Infant Mortality in England, 1538-2000

Chris Galley

Front cover: York Minster post-1840 nativity roof boss

Contents

List of figures

List of tables

Preface

This book brings together four articles about infant mortality that were originally published in the journal *Local Population Studies*. They are: C. Galley, 'Infant mortality in England, 1538-2000: Trends, sources and methods', *Local Population Studies*, 102 (2019), pp. 21-52; C. Galley, 'Infant mortality in England, 1538-2000: The parish register period, 1538-1837', *Local Population Studies*, 103 (2019), pp. 103-204; C. Galley, 'Infant mortality in England, 1538-2000: Stability and the beginnings of change, 1837-1910', *Local Population Studies*, 106 (2021), pp. 98-209; C. Galley, 'Infant mortality in England, 1538-2000: Decline in the twentieth century', *Local Population Studies*, 107 (2021), pp. 121-96. No substantial changes to the text have been made, other than those, such as the figures and tables being renumbered and references to other papers in series removed, needed to make a book out of four separate articles.

From the late nineteenth century much has been written about infant mortality and while changes in infant mortality from the introduction of parish registers in 1538 until the present can be described in great detail, the reasons why this happened are less well understood. This book does not provide a definitive account of why infant mortality varied between places and over time. Instead it seeks to examine these changes within a long-term perspective. It discusses how various socio-economic factors influence infant mortality, identifies what needs to be done to provide a better understanding of these changes and, via a series of simple case studies, shows how some unresolved issues can be addressed. The book is aimed at those amateur and professional historical demographers who want to know more about infant mortality and may also wish to undertake research on this topic. The main objective is to demonstrate that real progress can be made by combining in depth local studies with a long-term and even transnational perspective. A similar approach would also be useful in understanding historical trends in other age-specific mortality rates.

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1

Trends, sources and methods

> Francis the son of William Cockerell of Hackness fell into a sleep in his cradle on Monday the 23th November [1657] and after he awaked began to be very unquiet and so continued to be in great pain and laid very mournfully and in great anguish day and night; and a little before it died, which was on Thursday night after being the 26th day of the same, it gave a pretty smile and lifted up one of [its] hand and so departed into everlasting joy. I am persuaded he was a strong large child near a yard long when he died being about xiiii weeks old and was buried the next day.[1]

This rare description of an infant death was written by John Richardson, the parish clerk of Hackness, a small village in north Yorkshire. Richardson annotated some parish register entries that related to unusual phenomena or his family, in this case the death of his grandson, Francis.[2] It tells us much about Richardson's spiritual beliefs and the sorrow he felt when Francis died and, while we know the child's age at death, little can be gleaned about any cause of death. Similar stories are all too frequently replicated in any parish register of this period, although usually only the infant's name together with the dates of his or her baptism and burial are recorded. Other sources such as diaries sometimes include additional information relating to infant deaths, a famous example being that of Ralph Josselin, the Essex clergyman. Josselin's experience of childhood mortality was perhaps typical of a seventeenth-century family living in a rural area. He had ten children: the first Ralph died in infancy (under one year old), the second Ralph died aged just one, Mary died aged eight and the rest survived to be adults (Table 1.1). Josselin's diary entries relating to the first Ralph's life are telling, but difficult to interpret.[3] Ralph jnr. was born during a period when his father was ill, so ill indeed that 'I drew up my thoughts, and purposes concerning my estate in writing' (14 February 1648) and Ralph (senior) seemed more concerned about his health than that of his son. Ralph's birth on the 11th had been uneventful, 'I think the easiest and speediest that she ever had', but by the next mention of his son on the 17th, the child was 'ill, full of phlegm, we sent for the physician, he gave it syrup of roses it wrought well. My

1 C. Johnstone and E.J. Hart (trans.), *The Register of the Parish of Hackness Co. York*, Yorkshire Parish Registers Series, 25 (1906), p. 102. Francis Cockerell was born on 6 August 1657 and baptised on the 16th of the same month (p. 91). Spellings have been modernised.

2 See the discussion in D. Woodward, 'Some difficult confinements in seventeenth-century Yorkshire', *Medical History*, 18 (1974), pp. 349-53.

3 The quotations are taken from A. Macfarlane (ed.), *The Diary of Ralph Josselin 1616-1683* (Oxford, 1976), pp. 112-3. Spellings have been modernised.

Table 1.1 The children of Ralph Josselin (1617-1683)

Name	Date of birth	Date of death	Age at death
Mary	12 April 1642	27 May 1650	8 years
Thomas	30 December 1643	15 June 1673	29 years
Jane	25 November 1645	-	
Ralph	11 February 1648	21 February 1648	10 days
Ralph	5 May 1649	2 June 1650	1 year
John	19 September 1651	-	
Anne	20 June 1654	31 July 1673	19 years
Mary	14 January 1658	-	
Elizabeth	20 June 1660	-	
Rebecka	26 November 1663	-	

Source: A. Macfarlane, *The Family Life of Ralph Josselin* (Cambridge, 1970), p. 82.

wife persuaded it would die, it was a very sick child indeed'.[1] Ralph was baptised on the 18th in the hope that he would survive. The expectation however was that he would die, the sickness being 'very strong' (19th) and during the night 'he had a little froth in his mouth continually, in the morning there came some red mattery stuff out of his mouth, which made us apprehend his throat might be sore'. On the 20th Ralph reports that he and his wife are now feeling fine, little Ralph is 'not so tedious to us, because he does not shriek nor cry in his fits but lies quietly; we gave him breast milk at last, and little else'. This day was eventful in the Josselin household because his daughter Jane 'fell into the fire, and afterwards dagged a pair of scissors in Thom's eyebrow'. On the 21st 'my dear babe Ralph, quietly fell asleep, and is at rest with the lord'. Josselin's account is suffused with feeling and it is clear that he and his wife did what they could to prevent his son's death, but in effect this amounted to very little, with both him and us being at a loss to understand exactly what caused Ralph's death.[2] Important information relating to fertility, breastfeeding, weaning and miscarriages are contained within Josselin's diary, but there is nothing that helps us understand why Ralph died and the rest of his children survived infancy.[3]

Alice Thornton's devotional autobiography or series of 'remembrances' written for her family and friends tells us much about her family life and reveals a very different experience to that of Ralph Josselin.[4] Alice was a Yorkshire gentry woman who married to save the family estate and her autobiography, a reflection on her duty both to God and her family, attempts to make sense of the most important events in her life. Alice had nine children; six died in infancy, two on the day of their birth. She is more explicit than Ralph Josselin when it comes to discussing her pregnancies and children's deaths and for this reason it is worth looking at those sections of her autobiography that discuss these events in detail (Table 1.2).

1 Syrup of roses is a mild cathartic (purgative), see J. Worth Estes, *Dictionary of Protopharmacology. Therapeutic Practices, 1700-1850* (Canton MA, 1990), p. 167.

2 See R. Woods, 'Did Montaigne love his children? Demography and the hypothesis of parental indifference', *Journal of Interdisciplinary History*, 33 (2003), pp. 421-42 for a discussion of parental feelings towards their children.

3 See A. Macfarlane, The *Family Life of Ralph Josselin,* (Cambridge, 1970), pp. 50, 83, 86-88, 90, 199-204.

4 A. Thornton, *My First Booke of My Life*, edited by R.A. Anselement (Lincoln NE, 2014).

Table 1.2 Alice Thornton's (1626-1707) pregnancies and confinements

Name	Date of birth	Date of death	Age of death	Diary entry
1. Unnamed daughter	28-8-1652	28-8-1652	0 days	About seven weeks after I married, it pleased God to give me the blessing of conception. The first quarter I was exceedingly sickly in breeding, till I was with quick child; after which I was very strong & healthy … [on a visit to a friend] I passed down on foot a very steep hill … each step did me very much strain me being so big with child … I got down safe at last, though much tired & hot & weary, finding myself not well, but troubled with pains … This was the first occasion which brought me a great deal of misery & killed my sweet infant in my womb. … within a fortnight [I] fell into a desperate fever … The doctor stayed with me 7 days during my sickness. My poor infant within me was greatly forced with violent motions perpetually, till it grew so weak that it had left stirring & about the 27th of August I found myself in great pains as it were the colic, after which I began to be in travail. And about the next day I was delivered of a goodly daughter, who lived not so long as that we could get a minister to baptize it … This my sweet babe & first child departed this life half an hour after its birth … The effects of this fever remained by several distempers successively … lasting one quarter of a year [pp. 82-4]
2. Alice	3-1-1654	-		It pleased … God … to give me strength to conceive again about a quarter of a year after my recovery of that most desperate & dangerous sickness wherein I was brought so weak that my speech was taken from me, not being able to call for any help, but even as though I was expiring for many hours together & afterwards not able to turn my weary bones in bed nor help myself in the least. … Being about a 11 or 12 weeks gone, I perceived the child to be quick, … my child was very lively about 3 weeks, & about this time I found myself very feverish & hot, causing much sickness; at which time there was no motion in it, which made us fear further evil befall it or myself. Upon advice Mr Mahum let me blood 4 or 5 ounces. When lo immediately thereupon I found so great refreshment & cooling that the child sprang in my womb, and from thence forward I had much health & strength all the time of my being with child … At night [3-1-1654] I was in much pain, wakening so out of my first sleep so & continued very ill in strong labour … At which time, I was with great & excessive torment & peril of my life through the infinite & boundless mercy & goodness of God to me, who gave me a sweet & beautiful comely daughter which was well nigh choked with phlegm & the navel string which was twice about her neck & arms. So that when she was born she was without any breathing or appearance of life with the sore labour I had, she staying one full hour in birth at neck & shoulders. [pp. 87-8]
3. Elizabeth	14-2-1655	5-9-1656	18 months	I recovered not very well of the extreme weakness that followed for a quarter of a year after my child, in so much that my milk was taken from me, & so I was hindered from doing the natural duty incumbent upon us mothers, which troubled me much. … After some time my strength returned … I conceived another child, having a somewhat better time in breeding it … About a week before my full time I continued in much pain through the heaviness of my child … I was in great extremity till I was delivered … of a very sweet goodly daughter, & a delicate child. … After I was delivered … it fell out that my little daughter Naly, then newly weaned & being asleep in the cradle, fell into a desperate fit of the convolutions, as it was supposed to be, her breath stopping & grew blackish in her face, which did sore frighten her maid Jane Flower, who immediately took her up & with Jane Rimer the midwife made help to recover her life. … During this poor child's illness, I was almost at death's door myself by a great illness coming after I was in bed … This ill fit hindered my milk much, but yet afterwards I recruited fast & within a fortnight had gotten the milk again into my breast, & my dear babe Betty did suck every day of me … at the fortnight's end … an illness came in force on me … [which] did so discourage my dear mother that she would not let me give suck ... Daphne Lightfoot gave my Betty

				suck until she proved with child ... I put her to another at about three quarters of a year old, but she did not deal well with my child … It pleased God to take from me my dear child Betty, which had been long in the rickets & consumption gotten at first by an ague & much gone in the rickets, which I conceived was caused by ill milk at 2 nurses … she grew weaker & at last, in a most desperate cough that destroyed her lungs, she died [pp. 90-8]
4. Katherine	12-6-1656	-		After I was with quick child … I had pretty good health, considering my condition … till I was within a month of my time & then I grew very heavy, big, & weary, full of pain … I was one whole week in travail very strong [p. 94]
5. Unnamed son	10-12-1657	10-12-1657	0 days	I fell with child after my dear Betty's death, having my health very well after quick child, & so continued till I got a great fall over the threshold in the hall, at Hipswell, being then great with child of my fifth, wanting but ten weeks before my time. … Which fall cast me into an ill fit of distemper, and the jaundice followed, & about 3 weeks was very weak, & in great danger of death & miscarriage, with the continual pains & excessive motions of the child in me, which was turned wrong in the womb … It pleased God in much mercy to restore me to strength to go to my full time, my labour beginning 3 days … the midwife did believe I should be delivered soon. But lo it fell out contrary, for the child stayed in the birth & came cross with his feet first, & in this condition continued … I was upon the rack, in bearing my child with exquisite torment as if each time were divided from other, for the space of two hours, when at length, being speechless and breathless, I was by the infinite providence of God in great mercy delivered. … I having had such sore travail in danger of my life so long, and the child coming into the world with his feet first, caused the child to be almost strangled at birth, only living about half an hour [pp. 99-100]
6. William	17-4-1660	28-4-1660	11 days	I was delivered of a very goodly son after hard labour & hazardous, yet through great mercy I had my life spared & was blessed with a happy child … my pretty babe was in good health, sucking his poor mother … but it so pleased God to shorten this joy … for on the Friday week after he began to be very angry & forward [difficult to deal with] after his dressing in the morning, so that I perceived him not to be well, upon which I gave him Gascoyne powder. And having had 3 hours sleep, his face when he awakened was full of red round spots like the smallpox, being of the compass of a halfpenny, & whealed white over, these continuing on his face till night. But then, whether through cold upon his dressing, or what else was the cause the Lord knoweth, the spots struck in, and [he] grew very sick all night; and about 9 o'clock on Saturday morning he sweetly departed this life [pp. 120-1]
7. Robert	19-9-1662	4-6-1692	29 years	It still pleased the most high God to add this blessing when I was delivered, after great danger & peril of my life in travail … a little after my child was born, by a most violent & terrible flux of blood with such excessive floods all that night that it was terrible to behold to those about me, bringing me into a most desperate condition without hopes of life. Spirits, soul & strength seemed all gone from me. My dear husband & children & friends had taken their last farewell. In this deplorable condition I laid for several hours together, not being able to utter one word. After 5 hours torment it please my gracious Lord to have compassion on his languishing creature [p. 141]
8. Joyce	23-9-1665	26-1-1666	4 months	I was continued in much health & strength (after I had given suck to [Robert]) all along while I was with child … it pleased the Lord to make me happy in a goodly strong child, a daughter, after an exceedingly sharp & perilous time, being in the same condition of weakness after I came into bed & of my son Robert, which I escaped very narrowly the blow of death. But by the providence of God I was prepared with a remedy which prevented the extremity, & within 14 days I began to be in hopeful condition of recovery. … It pleased the Almighty to give me great comfort in the nursing of this sweet child … It was the pleasure of our God to visit my dear child Joyce Thornton with a great sickness … beginning as we thought with a cold which struck in many red spots all over her body & face, after which she mourned & cried exceedingly, being tormented with

				her sickness. We used all means that could be done to so young a child by the advice of Dr Wittie, yet nothing did prevail [pp. 144-9]
9. Christopher	11-11-1667	1-12-1667	20 days	Of my 9th child it was the pleasure of God to give me a weak & sickly time in breeding … The birth of my 9th child was very perilous to me, & I hardly escaped with my life falling into pangs of labour … continuing that week … I was, to my own apprehension & others never nearer death by the midwife's enforcement of my child so violently, which caused a great dislocation of the back & reins, [loin] by the inexpressible torments I endured. … After this comfort of my child, I recovered something of my weakness better, recovering my breasts & milk & giving suck, when he thrived very well & grew strong, being a lovely babe. … When he was about 14 days old, my pretty babe broke into red spots like the smallpox, and through cold … [he] fell into great looseness; & notwithstanding all the means I could use, it continued 4 days, having endured it patiently, [he] then fell into some little struggling; and at length it pleased his Saviour & mine after the 5th sick night & day to deliver [him] out of this miserable world. [pp. 163-5]

Note: Dates of death are given for all children who predeceased their parent. Spellings have been modernised.

Source: A. Thornton, *My First Booke of Life*, edited by R.A. Anselement (Lincoln NE, 2014).

Childbirth was a dangerous time for any mother and her child in this period, and this was especially so with Alice. Indeed, her autobiography reveals that Alice succumbed to, and survived, a number of life-threatening illnesses, which Raymond Anselement suggests were in some cases linked to periods in Alice's life when she was under stress.[1] Even allowing for some authorial exaggeration, there is no denying that Alice's pregnancies and deliveries were hazardous.

Alice became pregnant shortly after she married and was 'exceedingly sickly in breeding'. After this bout of what we would probably call morning sickness, she was 'very strong & healthy', but things took a turn for the worse when she overexerted herself going down a steep slope on a visit to a friend. This caused her pain and she subsequently fell into a fever which 'killed my sweet infant in my womb'. Her unnamed daughter died within an hour of being born and Alice's fever lasted for three months. Alice blames the death of her daughter on her over exertions, but we can be less certain. Her fever only developed a fortnight later and we might suspect that she contracted some form of infectious disease—whether this also affected her unborn child is of course impossible to determine. One thing is certain, however: this incident illustrates the fact that all infants were extremely vulnerable both during and immediately after birth.

Alice's account of her second pregnancy reveals how ill she had been following the death of her first child, yet she conceived soon after her recovery. She suffered a fever at 14 or 15 weeks for which she was bled, a dubious and sometimes harmful practice which Alice believed to be beneficial, and while she suspected her child was at risk, all turned out well. The birth itself was traumatic with the baby being born with the navel string around her neck and showing no signs of life. The child had been stuck during the delivery 'one full hour in birth at neck & shoulders', but it managed to survive. Alice took time to recover from her ordeal and was not able to breastfeed her child, 'my milk was taken from me', yet she conceived again only five months after giving birth.[2] This third pregnancy appears to have been less problematic and it was only after the birth that she succumbed to an illness, 'I was almost at death's door myself', which coincided with a similar life-threatening event that occurred to her second child Alice [Naly]. This illness caused Alice to stop breastfeeding her new daughter who, much to her regret, was given to a wet nurse and when that wet nurse became pregnant to another. The second wet nurse 'did not deal well with my child' and Elizabeth died at 18 months. It is well known that maternal breastfeeding is beneficial for infants and those put out to wet nurses had lower survival rates. It is not known if inadequate feeding caused the infant's death since Alice also revealed that her daughter:

> had been long in the rickets & consumption gotten at first by an ague & much gone in the rickets, which I conceived was caused by ill milk at 2 nurses.[3]

We might conclude that Elizabeth's death was indeed related to her insufficient diet, but given this mention of rickets and consumption, determining an exact cause of death remains difficult.

1 Thornton, *First Booke*, p. xxxvii, where Anselement writes: 'Of the many sicknesses Thornton records in her manuscript, a considerable number seem associated with emotional responses to stressful circumstances'.

2 Maternal breastfeeding tends to lengthen birth intervals.

3 The main cause of rickets is vitamin D deficiency, although a lack of calcium in the diet can also be a factor. Consumption is usually taken to mean pulmonary tuberculosis, although it was sometimes used as a synonym for a general wasting disease.

Alice's fourth pregnancy appears thankfully to have been largely incident free. She noted that her labour lasted a week, with mother and child appearing to do well. This was not the case with her next child. Her pregnancy was uneventful until she had a fall 'ten weeks before my time'. This cast her into an 'ill fit of distemper, and the jaundice followed' and whilst she feared for her child it was surely the birth, which was protracted and footling (delivered feet first), that caused his death. A more skilled midwife may have prevented this happening, but the child was 'almost strangled at birth, only living one hour'. This depressing series of events continued with her next birth which, while 'hard' and 'hazardous', was completed safely. Alice's joy at this birth was short lived because just over a week later William became 'full of red round spots like the smallpox' and he died soon afterwards.[1] The cause of William's death appears to have been an infectious disease, although probably not smallpox because Alice subsequently recounts how her three surviving children caught and survived this disease on 29 September 1666 (Katherine), 5 January 1667 (Robert) and 25 January 1667 (Alice).[2] Her description is, however, consistent with erysipelas, an acute streptococcal infection that sometimes affects infants, although at this distance of time it is impossible to be certain.

Alice's seventh delivery was accompanied with a 'most terrible flux of blood'. The child appeared unscathed, but once again the perils of childbirth are chillingly described. Haemorrhage is one of the most common causes of maternal death and was very difficult to treat during the seventeenth century. Alice writes that '[M]y dear husband & children & friends had taken their last farewell', but she somehow survived and was soon well enough to breastfeed her son. She continued breastfeeding during her eighth pregnancy which would make her son over two years old at this time. This pregnancy appeared to have been a healthy one and, after another difficult delivery which was also accompanied with haemorrhage, Alice recovered well and was able to breastfeed her daughter. All went well until it 'was the pleasure of our God to visit my dear child Joyce Thornton with a great sickness'. Joyce broke out in red spots and death followed shortly afterwards. A similar fate awaited Alice's last child. Alice had a 'weak & sickly time in breeding', the birth was 'very perilous' as labour continued for a week, and she was 'never nearer death' as the midwife's 'enforcement of my child so violently, which caused a great dislocation of the back & reins [loin], by the inexpressible torments I endured'. This is an eloquent testimony to the dangers all women faced when giving birth during this period. Alice did recover, but at about 14 days old Christopher also 'broke into red spots like the smallpox' and after five sick nights and days he died. This final, sad episode brought an end to Alice's childbearing history.

It is hard not to feel sympathy for Alice. She does all she can to safeguard her children; breastfeeding when possible and seeking medical advice where appropriate, but ultimately she had little influence over her children's survival. She, along with us, did not understand why so many of her children died, believing it to be a consequence of God's will. From a twenty-first century perspective, we might note the importance of maternal health, good midwifery practices and infectious disease in affecting the survival chances of infants, but

1 Note that William is given Gascoyne powder, a famous and expensive preparation introduced during the seventeenth century, which was made from the powdered liver and heart of snake, amber, hartshorn (stag antlers), coral, pearls and crab claws, see Worth Estes, *Dictionary of Protopharmacology*, p. 88. It would have had little beneficial effect.

2 Thornton, *First Booke*, pp. 155, 159-61.

we can be less certain of the extent to which each of these, or some other unknown factors, affected the survival of Alice's children.[1]

Alice Thornton's autobiography, along with Ralph Josselin's diary and John Richardson's parish register entries, are important documents that reveal unique insights into seventeenth-century life, albeit from the perspectives of individuals of relatively high social standing. In particular Alice Thornton's description of her childbearing history provides a vivid portrait of the hazards and joy of motherhood in this period. However, all three sources are limited by their authors' lack of understanding of the reasons why so many of their children or grandchildren were likely to die during infancy. Moreover, the sorts of documents discussed above, especially those written by women, only exist in very small quantities during this period. While the history of individual families is interesting, in order to gain a better understanding of the processes that affected infant mortality and the reasons why the infant mortality rate (hereafter IMR) declined over the long term, it will be necessary to adopt a different strategy, one that collates data from a much larger sample of events. The approach adopted here is that used by historical demographers and involves the examination of whole populations in order to establish patterns and trends and thereby determine the changing set of factors that influenced infant survival over the course of more than 400 years.

Changes in infant mortality over four centuries

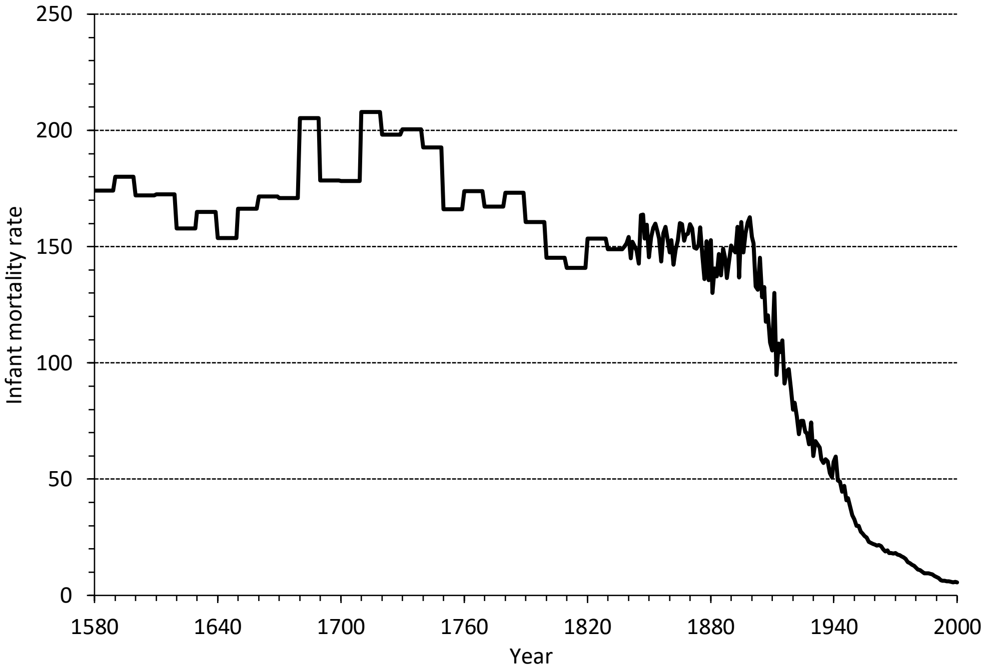
By the beginning of the twenty-first century, infant mortality had been virtually eliminated, in the developed world at least. Mothers now expect that their babies will be born healthy and survive into adulthood. They understand that a small number of infants will suffer rare congenital conditions and deaths from meningitis or Sudden Infant Death Syndrome (cot deaths) may still occur; however, few mothers factor a possible infant death into their calculations when they begin to plan their families. Indeed, in an age when women are starting families at ever increasing ages, the major issues surrounding birth have shifted away from the prevention of infant mortality towards achieving conception and successful pregnancies, thereby producing healthy babies who will then go on to lead rich, fulfilling lives. Even though the vast majority of infants now survive, in 2000 there were still 3,377 infant deaths in England and Wales. Each of these deaths represents a personal tragedy, but with 604,441 live births occurring in the same year, the IMR was 5.6 per 1,000 live births, the lowest figure then recorded.[2] Much of this residual infant mortality can to some extent be considered 'anthropogenic' in the sense that increasing age of motherhood and a higher proportion of multiple births due to fertility treatment means that a greater proportion of births occur to 'high risk' women. Moreover, the increasing sophistication of medical technology causes many infants, who otherwise would have died in the womb, to be born alive, even though some may not survive. A number of infant deaths are still preventable however; smoking while pregnant or within the immediate environment of an infant being one well-known risk factor associated with higher infant mortality. Many infant deaths are

1 We can also examine Alice's fertility by examining the intervals between her births. These are 16, 13, 15, 17, 28, 29, 36 and 25 months respectively and are consistent with natural fertility whereby there is no conscious choice to limit the number of children, see C. Wilson, 'Natural fertility in pre-industrial England, 1600-1799', *Population Studies*, 38 (1984), pp. 225-40.

2 Office for National Statistics, *Mortality Statistics DH2 27* (London, 2001), p. 2. Furthermore, miscarriages are still commonplace and relatively little is known about why late foetal deaths occur. In 2000 there were almost the same number of stillbirths (3,203) as infant deaths in England and Wales which gives a stillbirth rate of 5.3 per 1,000 births, Office for National Statistics, *Birth Statistics FM 1 29* (London, 2001), p. 1.

also concentrated into certain social subgroups and this has resulted in the persistence of distinct health inequalities throughout the population. Indeed, health authorities and researchers now focus much of their efforts on eliminating these inequalities as the principal means by which the IMR can be further reduced.

Figure 1.1 The infant mortality rate in England (and Wales), 1580-2000



Sources: England, 1580-1837, E.A. Wrigley, R.S. Davies, J.E. Oeppen and R.S. Schofield, *English Population History from Family Reconstitution 1580-1837* (Cambridge, 1997), Table 6.3, p. 224; England and Wales, 1838-45, Registrar General, *Eighth Annual Report of the Registrar General* (London, 1848), pp. 84, 254; England and Wales, 1846-1998, A. Macfarlane *et al*., *Birth Counts. Statistics of Pregnancy & Childbirth* (Norwich, 2000), pp. 1-4; England and Wales, 1999-2000, Office of National Statistics, *Mortality Statistics. Childhood, Infant and Perinatal DH3 37* (London, 2006), p. 1.

The age of almost universal infant survival is a relatively recent phenomenon and the easiest way to demonstrate this is to examine the national IMR. Figure 1.1 shows the IMR in England (and Wales from 1837) between 1581 and 2001. England is unique in that it has sources that enable estimates of infant mortality to be made from the sixteenth century when parish registers first began to record baptisms, burials and marriages. Parochial registration remained reliable in many places for three centuries, but was eventually superseded in 1837 when the present system of civil registration (of births, deaths and marriages) was introduced. Both systems allow a wide variety of demographic rates to be calculated at local and national levels and whilst there must be some debate about the accuracy of any pre-twentieth-century rate, those reported in Figure 1.1 are sufficiently robust to enable the general course of infant mortality to be charted for over 400 years. Thus, in 1581 about 175 out of every 1,000 live born babies failed to survive their first year. The rate increased a little during the early eighteenth century; it then fell, but as late as 1900 about 150 out of every 1,000 infants still died before their first birthday. Throughout the twentieth century the IMR declined steadily.

One problem with presenting information about infant mortality in terms of national averages is that it appears to suggest that the probability of dying was the same for each infant, but this was far from the case. Geographical variations in rates were considerable and infant mortality often appeared to strike at random with both rich and poor being affected. It was known by many, but not all, that maternal breastfeeding was beneficial for infant health and that the countryside was healthier than the towns, yet for much of the period most of the causes of infant mortality were little understood and it was not until the early twentieth century that systematic attempts were made to understand the subject. Indeed, the concept of infant mortality would have had little meaning throughout much of the period since it was not until the second half of the nineteenth century that the IMR first began to be calculated. Variations in rates were then identified and it became obvious that many infant deaths must be preventable. Consequently, towards the end of the nineteenth century health officials began to address the problem of infant health directly and whilst it took time to assimilate their ideas into the public's consciousness, there then began a century-long fight to reduce IMRs.

This book will seek to explain the course of infant mortality change between 1538 and 2000. The discussion will concentrate on England because for most of the period the sources for that country are better than those for other parts of the United Kingdom. Figure 1.1 has identified three distinct phases within England's infant mortality history: (1) high, but variable rates before the nineteenth century; (2) generally stable rates throughout the nineteenth century; and (3) almost continual decrease from 1900. The three subsequent chapters will be devoted to the most important periods revealed by Figure 1.1: chapter 2 will discuss the parish register period (1538-1837); chapter 3, stability during the nineteenth century and the turning point that occurred around 1900; and chapter 4 will examine why decline occurred throughout the twentieth century.[1] Each will adopt a similar format—sources will be introduced, trends established, issues discussed and finally some of the problems that remain to be resolved will be identified. While the main contours of change have been established, much still remains to be done to identify local variations and, perhaps more importantly, the reasons for these variations and why change occurred. Moreover, significant work on this topic may still be carried out by individuals or small research groups working with relatively small samples extracted from local or national sources.

By way of an introduction, it is necessary to do some groundwork and the rest of this chapter will discuss how the IMR is defined, the sources used to measure infant mortality, and the varying influences on infant mortality. Finally, an appropriate framework in which to examine the wide variety of influences on infant mortality will be established.

1 It might be thought that expending this amount of effort on infant mortality is excessive, but in 1900 infants comprised 24.3 per cent of all deaths in England and Wales (142,912 infant and 587,830 total deaths), Registrar General, *Sixty-third Annual Report of the Registrar General* (London, 1902), p. 122. This proportion was similar to that in previous centuries. For example, according to E.A. Wrigley and R.S. Schofield, *The Population History of England 1541-1871: a Reconstruction* (London, 1981), p. 499 there were 162,389 births and 140,165 deaths in England in 1700. Applying an IMR of 195.1 to these figures (E.A. Wrigley, R.S. Davies, J.E. Oeppen and R.S. Schofield, *English Population History from Family Reconstitution, 1580-1837* (Cambridge, 1997), p. 219) gives 31,682 infant deaths or 22.6 per cent of all deaths.

Definitions and measurement

The IMR is the most widely adopted means by which levels of infant mortality are measured. It is easy to calculate—usually by dividing the number of infant deaths (those aged under one year) by the number of live births in a given period—and as Figure 1.1 showed, this produces a value that is relatively easy to understand and use. The IMR is not a rate in the true sense of the word; rather it is the ratio of infant deaths to live births and it represents the probability that an infant will not survive to reach its first birthday. Thus, an IMR of 150 per 1,000 live births means that the probability of dying in the first year of life is 150 out of 1,000 or 0.15. Put another way, if there are 1,000 births on 1 January of a particular year only 850 infants will survive to reach 1 January of the following year. Most age specific mortality rates are calculated by dividing the number of deaths at a certain age by the population of that age at the mid-year point (2 July). This method is used in life table calculations and it works because usually it can be assumed that the probability of dying remains constant throughout the appropriate period of life (often single years).[1] In the case of infants however, this assumption is not valid because infants faced a much greater risk of dying shortly after birth than they did at older ages. For instance, in 1906, 31.6 per cent of infant deaths were aged under one month compared with only 4.1 per cent aged eleven months, and while the distribution of infant deaths varied over time, infants were always at their most vulnerable shortly after birth.[2] It is therefore more appropriate to use the number of births to represent the population at risk and the IMR can then be used to calculate the number of babies that survived to reach their first birthday.

The IMR, calculated by dividing the number of infant deaths (those aged under one year) by the number of live births in a given period, is sometimes referred to as the period IMR, since all the calculations are based on a specific period of time (usually one year). Alternatively, in some circumstances a cohort IMR may be calculated. In this case a group of babies (cohort) born within a certain period are traced over the course of one year to determine the proportion that failed to survive until their first birthday. Figure 1.2 illustrates both measures with births occurring along the horizontal axis and deaths along the vertical axis. Thus, in order to work out the IMR in 1900 it is necessary to start with the births that occurred in the first unit along the horizontal axis. The cohort IMR is then calculated by dividing the number of deaths in the parallelogram (B+C) by the births in 1900. Likewise, the period rate is calculated by dividing the number of deaths in the rectangle immediately above 1900 (A+B) by the births in 1900. Figure 1.2 could be extended vertically to include other age specific mortality rates and also horizontally to determine rates for longer cohorts. Note however, if an IMR for any unit of time under one year is needed it is appropriate to calculate a cohort rate and, if a period rate is calculated, then some consideration needs to be given to the seasonality of births and infant deaths.[3] In most instances period and cohort

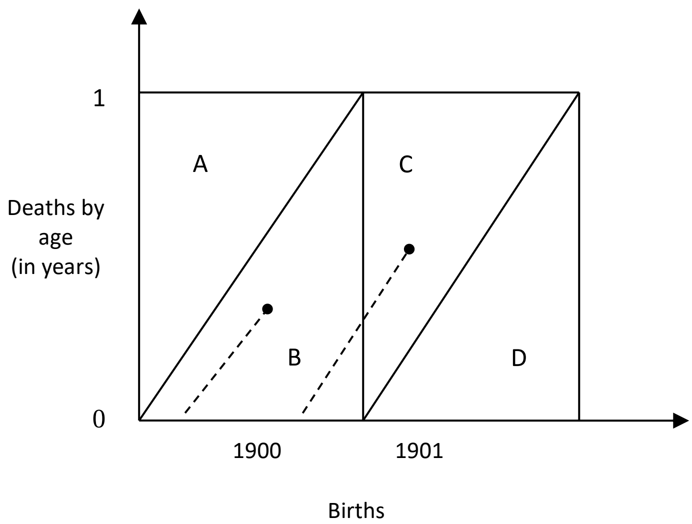
1 Life tables examine the experience of a hypothetical group of new born babies (cohort) that are subject to mortality rates at a specific period in time. The number of babies surviving to different ages can then be calculated and this allows the calculation of other measures such as expectation of life at birth (e_0).

2 Registrar General, *Sixty-ninth Annual Report of the Registrar General for 1906* (London, 1908), pp. cxviii-cxix.

3 See the discussion in Wrigley, *et al.*, *English Population History*, pp. 333-47. For example, the summer of 1911 was very hot throughout most of Europe and this caused a substantial increase in infant deaths from infantile diarrhoea. While calculating a period 'summer IMR' would be possible (summer infant deaths divided by summer births multiplied by 1,000), it would need to be acknowledged that many summer infant deaths were of older infants not born in the summer period. In extreme cases this may give rise to IMRs approaching or even exceeding 1,000 which of course is meaningless.

rates should be similar with their differing use being related to the sources available—a cohort IMR is usually calculated after some linking procedure has been undertaken while a period rate is used when aggregate data are available. A consequence of using period IMRs is that in many instances a baby born in one calendar year will die in the following one and hence its birth and death may appear in different parts of the infant mortality calculations in two subsequent years. To overcome this issue, it may sometimes be appropriate to employ a different formula—perhaps using the average number of births in both years. If the birth rate remains relatively constant then this will not be necessary; but if this is not the case, as occurred during both World Wars when births declined after many men had left home, some form of adjustment may be necessary.[1]

Figure 1.2 Cohort and period infant mortality rates



1 W.J. Martin, 'The estimation of infant mortality', *Journal of the Royal Statistical Society*, 96 (1933), pp. 481-6; S.W. Caffin, 'Infantile mortality rates', *Population Studies*, 6 (1952), pp. 106-9.

Despite its now universal acceptance as an important demographic tool, it was not until the 1870s that a precise definition of the IMR first appeared in print, and not until the early twentieth century before it was accepted into general use. Even during the late nineteenth century the term 'infant' was often employed as an imprecise description of any young child.[1] Indeed the word infant derives from the Latin *infans*, 'unable to speak', and as early as the seventeenth century John Graunt, the father of demography, acknowledged the imprecision of this term by criticising its use in the London bills of mortality: 'in the matter of Infants I would desire to know clearly, what the searchers mean by Infants, as whether children that cannot speak, as the word Infant seems to signify, or children under two or three years old'.[2] In part this imprecision stems from attempts to classify human development into various stages of the life course. Shakespeare's description of man's seven stages with the infant 'mewling and puking in the nurse's arms' is perhaps the most famous example, but there were others.[3] With no clear dividing line being evident between infancy and childhood, it is not surprising to learn that when T.R. Edmonds in 1836 claimed that, 'the very great diminution of the mortality of infants in England is one of the most remarkable phenomena of modern times', he was referring to the deaths of children under five years rather than just those under one year.[4]

It was only with the introduction of Civil Registration in 1837 that sufficient data about births and deaths became available in an accessible form to allow a full assessment of infant mortality at both local and national levels. William Farr, the first Statistical Superintendent to the General Registrar Office, was responsible for much of the content of the annual reports of the Registrar General between 1837 and 1878, and his main concern was with identifying preventable deaths and developing strategies by which sanitary improvements could be promoted. He used the crude death rate (deaths per 1,000 population) to identify excess deaths and while this statistic was by no means ideal, it quickly became adopted as a key demographic indicator.[5] Alternatives to this measure were discussed and Edwin Chadwick in his address to the National Association for the Promotion of Social Science stated that 'I have always held [an infant death rate] to be the single best test of the sanitary condition of a population'.[6] However, in a subsequent article in the same volume it becomes clear that Chadwick is referring to the infant death rate (infant deaths divided by the number of infants alive in a time period x 1,000) rather than the IMR.[7] Likewise, when John Simon,

1 H.R. Jones, 'The perils and protection of infant life', *Journal of the Royal Statistical Society*, 57 (1894), pp. 1-98, here at p. 6.

2 J. Graunt, 'Natural and political observations made upon the bills of mortality (1662)', reprinted in *Journal of the Institute of Actuaries*, 90 (1964), pp. 1-61, here at p. 21.

3 *As You Like It*, Act 2, Scene 7, lines 143-4; see also the discussion in H. Cunningham, *The Invention of Childhood* (London, 2006), pp. 13-4, 30-3.

4 T.R. Edmonds, 'On the mortality of infants in England', *The Lancet*, 25 (30 January 1836), pp. 690-4, here at p. 690. Likewise, A.A. Rusnock, 'Quantifying infant mortality in England and France, 1750-1800', in G. Jorland, A. Opinel and G. Weisz (eds), *Body Counts. Medical Quantification and Historical & Sociological Perspectives* (Montreal & Kingston, 2005), pp. 65-86 is essentially about early childhood rather than infant mortality.

5 J.M. Eyler, 'Mortality statistics and Victorian health policy: program and criticism', *Bulletin of the History of Medicine*, 50 (1976), pp. 335-55, here at pp. 340-3.

6 E. Chadwick, 'Address', *Transactions of the National Association for the Promotion of Social Science*, (1860), pp. 574-606, here at p. 580.

7 W.T. Gairdner, 'On infantile death rates, in their bearing on sanitary and social science', *Transactions of the National Association for the Promotion of Social Science*, (1860), pp. 632-48.

the first Medical Officer of Health for London and later Medical Officer to the Privy Council, commissioned three major investigations that focused on issues relating to infants, each employed a different definition of infant mortality.[1] William Farr had published the ratio of infant deaths to births in the second and third Annual Reports of the Registrar General to check the accuracy of registration and he had used the IMR to construct his English Life Table.[2] However, he did not use the term IMR and it was only after 1870 that Farr's interest in this topic awakened with the annual report of that year containing the first proper definition, 'real infant mortality may be satisfactorily measured by its proportion to births registered'.[3] The extent of variations in IMRs was published in an accessible form and a simple means was made available to make local comparisons possible. Further discussions appeared in subsequent years and the culmination of Farr's interest in infant mortality appeared in the 1875 report. The term 'infantile mortality' was formally defined and annual rates for the period 1870-1875 were given alongside a substantial discussion of the causes of, and influences on, infant mortality including age at death, illegitimacy, women's work and the special circumstances in individual large towns.[4]

Unfortunately, Farr's renewed interest in infant mortality coincided with the end of his career and his final three Annual Reports, those for 1876-1878, contain little about this subject. Farr's achievements in the field of infant health were nevertheless considerable, but his suggestions concerning the prevention of infant mortality fell largely on deaf ears and it would take a further 25 years before a concerted effort was made to reduce national IMRs. In the 1890s, a number of enlightened individuals such as Alfred Hill, Birmingham's Medical Officer of Health, began to realise that, in spite of widespread sanitary improvements, the IMR had failed to decline. Yet it was only from the beginning of the twentieth century that the rate began to be reported widely and local public health officials made concerted efforts to reduce infant mortality.[5] Thereafter, the IMR rapidly became adopted as a primary measure of a population's health and Sir Arthur Newsholme, whose pioneering work in the

1 In Edward Greenhow's (1860) study of the prevalence of diarrhoea, especially in infants, he used the proportion of diarrhoea deaths at age under one year to total diarrhoea deaths. In Greenhow's later report (1862) on excessive infant mortality in manufacturing places he calculated the proportion of deaths aged under one year to 1,000 living infants, but since he could not estimate the number of infants aged less than one, he used the average number of births instead—which meant that he had inadvertently calculated the IMR. Henry Hunter's investigation into high infant mortality in rural East Anglia (1864) used infant deaths per 100,000 persons living. These reports were published together with conclusions by Simon in *Second, Fourth and Sixth Reports of the Medical Officer of the Privy Council*. British Parliamentary Papers 1860 XXIX [C. 2736]; 1862 XXII [C. 179]; and 1864 XXVIII [C. 3416]). See R. Lambert, *Sir John Simon 1816-1904 and English Social Administration* (London, 1963), pp. 320-1, 336-7 for a discussion of these reports and M. Greenwood, *Some Pioneers of Social Medicine* (London, 1948), p. 93 for further criticism.

2 Registrar General, *Second Annual Report of the Registrar General* (London, 1840), p. 10; *Third Annual Report of the Registrar General* (London, 1841), p. 12. The first English Life Table appears in Registrar General, *Fifth Annual Report of the Registrar General* (London, 1843), p. xvii.

3 Registrar General, *Thirty-third Annual Report of the Registrar General* (London, 1872), p. xi.

4 Registrar General, *Thirty-eighth Annual Report of the Registrar General* (London, 1877), pp. xl-li; D. Armstrong, 'The invention of infant mortality', *Sociology of Health and Illness*, 8 (1986), pp. 211-32. It is no coincidence that Farr's increasing interest in infant mortality followed the implementation of the 1874 Births and Deaths Registration Act which shifted the responsibility for registering births to the parents and resulted in a tightening up of birth registration. The Act can be found at http://www.legislation.gov.uk/ukpga/1874/88/pdfs/ukpga_18740088_en.pdf (accessed April 2019).

5 C. Galley, 'Social intervention and the decline of infant mortality: Birmingham and Sheffield, *c.* 1870-1910', *Local Population Studies*, 73 (2004), pp. 29-50.

field of public health did much to publicise the problems of high infant mortality, famously called it 'the most sensitive index we possess of social welfare and of sanitary administration, especially under urban conditions'.[1] By the 1930s, it had even become sufficiently well established for Richard Titmuss to begin his chapter on infant mortality in *Poverty and Population* by quoting the then Prime Minister, Neville Chamberlain: 'sometimes we take the infant mortality rate as a sort of pointer to show how health is improving'.[2] More specifically, Charles McNeill in his study of child health stated explicitly that '[t]he infant death rate is the best measure of the standard of child health in a community: indeed, it is probably the best single measure of the general health standard of a population at all ages'.[3] In the twenty-first century, the IMR is still considered to be a primary indicator of demographic well-being, with most people recognising that rates are low throughout Britain.

Before the twentieth century, few people would have had any understanding of exactly how many infants died before their first birthday. Indeed, prior to the introduction of Civil Registration in 1837 accurate ages of death, especially for infants, were seldom recorded and, while infancy was well known to be a period of high risk, quantification was almost impossible (and when it was, there was no standardisation of terms). As large amounts of data became available towards the end of the nineteenth century, attention was slowly drawn to the fact that, while mortality within most age groups was in decline, this was not the case for infants. In a sense therefore, the IMR can be viewed as a social construct since its definition and introduction coincided with a period of growing concern about infants.[4] During the twentieth century as awareness about issues relating to infants increased, the various components of infant mortality began to be examined, and this led to the introduction and use of additional measures.[5] Some of the most important are:

(1) neonatal mortality—deaths in the first 28 days (or occasionally the first month);
(2) post-neonatal mortality—infant deaths aged over 28 days (or one month);
(3) stillbirth—the expulsion of a dead foetus that has reached the age that it is capable of independent survival (which is usually considered to be 28 weeks). The stillbirth rate is therefore the number of stillbirths divided by the total of live births plus stillbirths;
(4) early neonatal—deaths in the first week;
(5) perinatal mortality—the sum of stillbirths and early neonatal deaths.[6]

As with all measures relating to infant mortality it is important to refer back to the precise definition given in the text. Stillbirths are not strictly speaking a component of infant mortality, although many of the factors that affected the stillbirth rate had similar impacts on neonatal mortality. Also, there is not always agreement about exactly how a live birth may

1 A. Newsholme, *Supplement to the Thirty-ninth Annual Report of the Medical Officer of Health, of the Local Government Board, Containing a Report by the Medical Officer on Infant and Child Mortality*, BPP 1910 XXXIX [C. 5263], p. 74. See also A. Newsholme, 'The vital statistics of the Peabody Buildings and other artisans' and labourers' block dwellings', *Journal of the Royal Statistical Society,* 54 (1891), pp. 70-97, here at p. 79: '[i]nfants form a very delicate index of the character of the environment of the individual, and a high infantile mortality may rightly be regarded as indicating unfavourable sanitary or social conditions'.

2 R.M. Titmuss, *Poverty and Population* (London, 1938), p. 77.

3 C. McNeill, 'Child health in Holland, England, and Scotland: sixty years of progress', *British Medical Journal* (4 Apr 1942), pp. 429-33, here at p. 429.

4 P.W.G. Wright, 'Babyhood: the social construction of infant care as a medical problem in England in the years around 1900', in M. Lock and D. Gordon (eds), *Biomedicine Examined* (Dordrecht, 1988), pp. 299-329.

5 Armstrong, 'Invention of infant mortality', pp. 214-6.

6 S. Peller, 'Mortality, past and future', *Population Studies*, 1 (1948), pp. 405-56.

be distinguished from a stillbirth and, even by the late twentieth century, different countries had adopted slightly different definitions.[1] Despite these minor problems, the increasing sophistication of these additional measures reflect a growing awareness that the problems associated with infant mortality are complex and that different factors affect infants at different periods throughout their first year of life. They also reflect an active desire to reduce IMRs.

The period of infancy (birth to age one year) does not directly relate to the human development cycle; rather it is a consequence of how ages are recorded since an obvious way of processing large quantities of death certificates is to subdivide them by age at death, usually into single year or five year age groups.[2] Very young babies are subjected to a different set of hazards than older ones, but there is no clear dividing line at age one with older infants being exposed to similar risks to those that affected young children. Before the twentieth century the most important influence on an infant's survival was whether or not it was maternally breast-fed, since babies inherit some immunity via their mother's breast milk. Consequently, a more appropriate early age subdivision would be to consider the mortality of breastfed and weaned babies separately, but such a classification would be fraught with difficulties given differing infant feeding practices and the fact that weaning was not always a single event with many infants being given a mixed diet for a period of time. The immediate post-weaning period was dangerous for infants and since maternal breastfeeding could extend well into the second year, for some infants it may sometimes be better to view the first few years of life as a continuum, over which the risks faced by young children changed subtly. This means that research about infancy should not necessarily be confined to the first year and, in addition to analysing the established components of infant mortality, an examination of unconventional time periods may sometimes bring interesting results.[3] The fact that such a large proportion of all deaths were those of infants warrants that they receive special consideration; the first year of life covers the period when babies were exposed to a unique set of risks and since much comparative material is available, the IMR remains unrivalled as the most important measure of early age mortality.

To end this section some consideration of the representativeness of the IMR is needed. Historically the rate has been used in two similar, but inherently different ways: first, as a

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1 C. Gourbin, and G. Masuy-Stroobant, 'Registration of vital data: are live births and stillbirths comparable all over Europe?', *Bulletin of the World Health Organization*, 73 (1995), pp. 449-60. The World Health Organization, http://www.who.int/maternal_child_adolescent/epidemiology/stillbirth/en/ (accessed April 2019), recommends that in order to enable international comparison, deaths after 28 weeks gestation should be considered as stillborn, while United Kingdom National Health Service Choices gives 24 weeks, http://www.nhs.uk/Conditions/Stillbirth/ (accessed April 2019). According to a recent wide-ranging study published in *The Lancet*, 'stillbirth refers to all pregnancy losses after 22 weeks of gestation, but for comparable national estimates, we only present those beyond 28 weeks' gestation (third trimester)', 'Ending preventable stillbirths. an executive summary for *The Lancet*'s series', *The Lancet*, (January 2016), p. 2 available at http://www.thelancet.com/pb/assets/raw/Lancet/stories/series/stillbirths2016-execsumm.pdf, (accessed April 2019). Determining exactly when conception takes place is an approximate process and all gestational ages need to be treated with caution.

2 In pre-modern Japan ages were reported as calendar years lived through. Therefore, a baby born on 31 December would be considered as age 2 on 1 January when its actual age would only be two days, see T.C. Smith, *Native Sources of Japanese Industrialization, 1750-1920* (Berkeley, 1988), p. 105. Hence, IMRs in early modern Japan need to be estimated indirectly, see O. Saito, 'Infant mortality and pre-transition Japan: levels and trends', in A. Bideau, B. Desjardins and H. Pérez Brignoli (eds), *Infant and Child Mortality in the Past* (Oxford, 1997), pp. 135-53.

3 See, for example, Wrigley *et al.*, *English Population History*, pp. 248-54.

specific measure in a place over a given period; and, second, as a predictive measure of more general social or mortality conditions. In 1900 the IMR in England and Wales was 154 per 1,000 live births (based on 927,062 births), although there were considerable inter-county variations: from 91 in Rutland (456 births) and 106 in Hereford (2,620 births) to 175 in Warwickshire (28,035 births) and 180 in Lancashire (133,145 births).[1] Assuming that births and infant deaths have been accurately recorded, these rates are correct in the sense that they provide a simple retrospective measure of infant mortality in these places in 1900. They are independent of the number of births that occurred. If, however, any of these rates are used to infer something else, such as general health conditions in the counties or levels of sanitation, then some consideration of the significance of any resulting conclusions will be needed. This issue becomes increasingly important when smaller areas are considered. In 1900 England and Wales was divided into 631 Registration Districts (RDs), the smallest of which (in terms of the number of births registered) was the Scilly Islands with just 46 and the largest was West Ham, with 18,812 births.[2] An extra infant death in the Scilly Islands would therefore have increased its IMR by about 22 deaths per 1,000 live births, whilst a similar death in West Ham would have been insignificant. Overall, there were six RDs that registered fewer than 100 births and a further 36 that registered between 100 and 200 births.

Consider the following theoretical example. A large area with an IMR of 100 is subdivided into units each containing exactly 10 births. Assuming that the risk to each infant within the area is identical (and this may be far from the case) then within each unit it is possible that all 10 births will survive to reach age one year (quite likely), all 10 will die (much less likely, but possible) or any of between one and nine infants will die. Thus, the IMRs within the various units will vary from 0 to 1,000 and the likelihood of each IMR occurring is described by a binomial distribution.[3] To four decimal places, the chances of randomly selecting a unit with a given IMR are therefore: 0 – 0.3487; 100 – 0.3874; 200 – 0.1937; 300 – 0.0574; 400 – 0.0111; 500 – 0.0015; 600 – 0.001; and for rates greater than or equal to 700 effectively 0. The chance of finding a sample with 10 infant deaths is $(0.1)^{10}$ or 1 in 10 billion. This means is that if 100 units are selected then about 35 should have an IMR of 0, 39 an IMR of 100 (the actual rate in the area as a whole), 19 an IMR of 200, 5 an IMR of 300 and perhaps 2 with an IMR of 400 or over. Thus, if two or more of these units are selected and compared then their IMRs may well be very different (0 and 100 or 100 and 200 perhaps), yet we know that the overall rate in the whole area is 100. Of course, no one should give credence to any IMR based on just 10 births, but the preceding analysis suggests that some

1 Registrar General, *Sixty-third Annual Report of the Registrar-General of Births, Deaths and Marriages in England*, BPP 1901 XV [C. 761], pp. xv-xvi, 2-3, 122-30.

2 Registrar General, *Sixty-third Annual Report,* pp. 2-63.

3 A binomial distribution describes the distribution of events which can be considered as either positive or negative (in this case whether an infant survives or not), assuming that each event is independent of the others. The probability of achieving *k* positive outcomes out of *n* possibilities is given by the formula:

$$\frac{n!}{k!(n-k)!}p^k(1-p)^{n-k}$$

where p is the probability of the event taking place. In this example the formula is used to determine the probability of a certain number of infant deaths in a sample of 10 births. For example, if the true IMR is 100 per 1,000 (that is, $p = 0.1$), then the probability of getting an IMR of 200 in a sample of 10 births requires exactly 2 deaths ($k = 2$) in the sample of 10 births ($n = 10$) and from the formula above, this is $[(10 \times 9)/2] \times 0.1^2 \times 0.9^8 = 0.1937$. For a simple explanation see W.J. Reichmann, *Use and Abuse of Statistics*, (London, 1964), pp. 218-23.

variation within samples can be expected in any area. A consideration of sample size will therefore be needed if IMRs are used for anything other than simply recording infant survival chances.

Table 1.3 Samples sizes needed to have 95% confidence that the infant mortality rate is within specified ranges

'Real' IMR	95% of samples between	Sample size	95% of samples between	Sample size	95% of samples between	Sample size	95% of samples between	Sample size
300	260-340	504	280-320	2,016	290-310	8,067	295-305	32,269
250	210-290	450	230-270	1,801	240-260	7,203	245-255	28,812
200	160-240	384	180-220	1,537	190-210	6,147	195-205	24,586
150	110-190	306	130-170	1,225	140-160	4,898	145-155	19,592
125	85-165	263	85-145	1,050	115-135	4,202	120-130	16,807
100	60-140	216	80-120	864	90-110	3,457	95-105	13,830
75	35-115	167	55-95	666	65-85	2,665	70-80	10,660
50	10-90	114	30-70	456	40-60	1,824	45-55	7,299

Determining the size of the population at risk (number of births) that is needed to have confidence in the resulting IMRs is not an easy task. Many of the statistical models assume that single events such as infant deaths are independent of each other: that every infant faces the same set of risks and their chances of dying are identical.[1] However, in reality this is not usually the case. Epidemics of infectious diseases may occur amongst older infants resulting in clustering of deaths in certain areas. Likewise, it is well known that certain infants, such as illegitimates or twins, suffered much high rates of mortality than legitimate singletons. If we discount these concerns then an answer of sorts is possible. We wish to determine the sample size needed in order that there is a high probability that the IMR in our sample is within a certain amount of the 'real' IMR.[2] To do this we must first have an idea of the 'real' IMR (p), and this allows us to use the standard error formula $\sqrt{\left[\frac{p(1-p)}{n}\right]}$ which contains n, the sample size, thereby allowing its calculation. If n is sufficiently large to make the distribution of all samples approximately Normal then this means that 95 per cent of all samples will be within 1.96 standard errors (SEs) of the mean (our 'real' IMR). Put another way, our sample will have a 95 per cent chance of being close to the 'real' IMR.[3] If the real IMR is 100 per 1,000 live births ($p = 0.1$) and we wish to get within 4 percentage points (40 out of 1,000) of the real IMR (i.e. between 60 and 140, since the IMR is given per 1,000 births) then:

$$1.96\mathrm{SE}(p) = 1.96\sqrt{\left[\frac{p(1-p)}{n}\right]} = 1.96\sqrt{\left[\frac{0.1*0.9}{n}\right]} = 0.04.$$

1 Anyone using the IMR to infer other demographic measures or general social conditions in effect makes the same assumption.

2 This technique is described in H.A. Kahn and C.T. Sempos, *Statistical Methods in Epidemiology* (Oxford, 1989), pp. 24-7.

3 Substituting the 1.96 with 2.58 will achieve 99 per cent confidence. Normal distributions are discussed in Reichmann, *Use and Abuse*, pp. 211-8.

Solving this equation gives a value for *n* of 216. This means that if there are 216 births in our sample then with 95 per cent confidence we can say that the IMR should be between 60 (p = 0.1-0.04 = 0.06) and 140 (p = 0.1+0.04 = 0.14). Clearly to get a value closer to the 'real' IMR a larger sample will be required and this can be determined by replacing the 0.04 in the equation above with other values and solving for *n*. To get within 80-120 (i.e. 2 percentage points) the sample needs to increase to 864; 90-110 (1 percentage point) to 3,457 and 95-105 (0.5 percentage points) to 13,830 (Table 1.3). Three factors affect *n*: the 'real' IMR (the value of *p*), the closeness to the rate that is required and the degree of significance needed. To return to the situation in 1900; with an overall IMR of 154 in England and Wales, Table 1.3 suggests that around 5,000 births would be required before it would be safe to say that they were significant differences between two RDs recording rates of say 144 and 164. For the smaller RDs we must be much less certain that any apparent differences are indeed real.

Table 1.3 is merely illustrative of the possibilities of this type of analysis and will need extending to suit individual purposes. It should only be used as a guide, especially given the fundamental assumption that each infant faced identical risks does not strictly hold. Indeed, much of the analysis in the chapters that follow seek to distinguish between the risks that infants faced in order to determine why infant mortality varied so much both between individuals and communities. Provided an appropriate method has been used, the rate that is calculated will be correct irrespective of the sample size. It is only if the rate is used to infer something else, or it is compared to a different one, that some consideration should be given to the sample size. Table 1.3 does, however, show that a degree of caution needs to be expressed about any inferences that are made from IMRs that are based on a relatively small sample of births.

Sources

In order to have confidence in the accuracy of any IMR it is necessary that it is derived from reliable data. This means that, irrespective of the registration system that operated, all births and infant deaths that occurred within a given area need to have been recorded. If registration is incomplete then little confidence can be had in the calculated rate, although if certain groups consistently failed to register both births and deaths then the IMR may still be representative of the rest of the population. The data required to calculate IMRs for England can be found in the two types of registration systems that operated from the sixteenth century. The first was an ecclesiastical one based on local parish registers. Only baptism and burial church ceremonies were generally recorded, although a wealth of supplementary data was included in some registers at certain times. If infant baptism was universal and occurred shortly after birth then the baptisms and burials recorded in the register will provide an accurate reflection of the number of births and deaths that occurred. There was an inevitable gap between birth and baptism and a shorter one between death and burial, but this should not necessarily hamper the calculation of accurate IMRs if all infants who died unbaptised were identified as such in the burial register. By the late eighteenth century however, Anglican churchgoing was no longer universal and birth-baptism intervals had lengthened, which caused many children to die unbaptised and resulted in them being absent from parish registers. This meant that parochial registration in many places became unreliable. Eventually in 1837 the ecclesiastical system was replaced by national civil registration whereby births and deaths began to be registered directly. After 1837 both the quantity and quality of the data improved and from this date onwards a more sophisticated analysis of infant mortality is possible. For the researcher the advent of civil registration provides both advantages and disadvantages. While the data are more reliable, their sheer quantity, coupled with the increasing popularity of genealogy, created a huge demand for access to the original birth and death certificates and this led to restrictions being placed on the use of these sources. This means that most post-1837 research has to be carried out using published secondary material, although analyses of alternative sources, such as vaccination registers, which were created from the birth and death registers, have allowed investigations to be carried out, some of which have produced interesting results.[1] By contrast, most parish registers are open to individual inspection, either in their original or printed form, and this has allowed a range of demographic measures to be calculated for individual parishes using techniques such as family reconstitution.

Figure 1.3 Timeline of events useful to the student of infant mortality

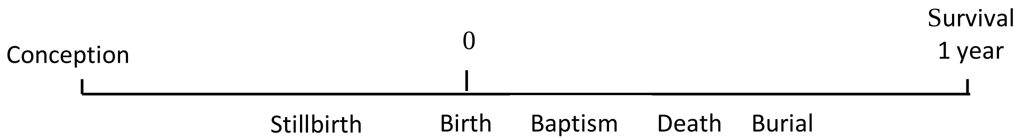

Figure 1.3 represents a timeline which shows five events (below the line) useful to the student of infant mortality. All these events may or may not occur, and their chances of being recorded were dependent on the registration system in use. Stillbirths are not strictly required for a study of infant mortality, although they are important in understanding prenatal influences on the mother and the success of the delivery techniques employed. A few parish registers recorded stillbirths for short periods, but when civil registration was introduced stillbirths were not recorded until 1927. Before 1837 it is likely that only baptisms and burials were recorded, although sometimes the associated dates of births and deaths were included. Civil registration data is often of a higher quality than nineteenth-century parish register data: credible estimates of IMRs have been derived for the 1840s, and following the tightening of regulations concerning the registration of births in 1874, coverage was virtually complete.[2]

With parish register data the situation is more complicated. Generally speaking, each Anglican parish was required by law to keep a register which contained a list of every baptism, burial and marriage that occurred in the parish, although there was little control over the details that individual parish clerks recorded. This means that some registers reported all the five events shown in Figure 1.3 at certain times. Many registers were kept badly, however, and some consideration of a register's accuracy is always needed before substantial analysis is undertaken. When only baptisms and burials are listed it is necessary to assume that each baptism can be used as a surrogate for a live birth, and the deaths of any infants who did not survive until they could be baptised need to be identifiable in the burial

1 L. Davies, 'Faith Street, South Kirby – "That troublesome place": Infant mortality in a Yorkshire coal-mining community, 1894-1911', *Family and Community History*, 6 (2003), pp. 121-7.

2 C. Galley and N. Shelton, 'Bridging the gap: determining long-term changes in infant mortality in pre-registration England and Wales', *Population Studies*, 55 (2001), pp. 65-77.

register. While the lack of consistency in parish registers clearly creates problems, it also provides opportunities for the student of infant mortality.

Table 1.4 The effects of under- and over-registration on the accuracy of the infant mortality rate (infant mortality rate = 100 if registration is perfect)

		Misreported deaths (%)										
		+25	+20	+15	+10	+5	0	-5	-10	-15	-20	-25
Misreported births (%)	+25	*100*	96	92	88	84	80	76	72	68	64	60
	+20	104	*100*	96	92	88	83	79	75	71	67	63
	+15	109	104	*100*	96	91	87	83	78	74	70	65
	+10	114	109	105	*100*	95	91	86	82	77	73	68
	+5	119	114	110	105	*100*	95	90	86	81	76	71
	0	125	120	115	110	105	***100***	95	90	85	80	75
	-5	132	126	121	116	111	105	*100*	95	89	84	79
	-10	139	133	128	122	117	111	106	*100*	94	89	83
	-15	147	141	135	129	124	118	112	106	*100*	94	88
	-20	156	150	144	138	131	125	119	113	106	*100*	94
	-25	167	160	153	147	140	133	127	120	113	107	*100*

Note: The table should be interpreted as follows. The centre column (headed 0) indicates a situation in which death registration is completely accurate. To the left of the centre column, deaths are over-registered by the percentages indicated, and to the right of the centre column deaths are under-registered by the percentages indicated. Similarly the rows indicate under- and over-registration of births. The figures in the main body of the table show the calculated infant mortality rate (IMR) for each combination of birth and death registration. Where the IMR is 100, in the centre of the table in bold, both birth and death registration are perfect, elsewhere an IMR of 100 in italics indicates that under- or over-registration of births and deaths is identical. So, for example, when there is 20 per cent over-registration of deaths and 10 per cent under-registration of births, the calculated IMR will be 133, or 33 per cent above the true rate.

For any registration system to be considered reliable all births and infant deaths within a given area need to have been recorded accurately. In the parish register period problems occurred due to the rise of non-conformity because increasing numbers of non-conformists refused to have their infants baptised in an Anglican church, and since there were few alternative burial grounds, they still had to bury their dead in the Anglican churchyard. The impact of this problem on registration in certain parishes could be substantial. For instance, during the 1790s non-conformist registers accounted for 47 per cent of all baptisms in Halifax, but only 16 per cent of burials.[1] Consequently, even though the Anglican registration system may itself have been reliable, the IMR calculated from the register may not reflect the real situation because it will contain some non-conformist infant deaths without the relevant baptisms. Other problems may still arise; for example, people living in one parish may have chosen to go elsewhere to have their infant baptised or buried. Likewise, the presence of a public institution, such as a hospital or poorhouse, may have caused a greater number of births or deaths than expected to have been recorded in a particular parish or registration district. Significant amounts of migration could also have created problems, since infants that moved out of an area would have affected the at risk population as did any infant that moved into an area. In practice for most places these effects counterbalanced

1 M. Slack, 'Non-conformist and Anglican registration in the Halifax area 1740-99', *Local Population Studies*, 38 (1987), pp. 44-5. Some non-conformist sects such as Baptists did not practise infant baptism.

each other, although this was not necessarily the case in rapidly expanding towns. Groups such as the mothers of illegitimate children were likely to have been highly mobile—some expectant mothers moved to certain areas to give birth, while others after giving birth left their baby in the care of others.[1] The effects on the IMR of differential recording rates can be seen in Table 1.4. If registration is accurate then the IMR will be 100 (centre of table). Note that equal amounts of both under- and over-registration should not theoretically be a problem, but if the groups that escaped registration experienced a different IMR from the rest of the population, then the true IMR will differ from the one that is calculated. Even quite small amounts of both under- and over-registration can lead to quite substantial errors in the IMR. Of particular significance is the combination of over-registration of one variable coupled with under-registration in the other. Thus, it is always important to devote some time to examining the quality of registration prior to any analysis.

A framework for understanding long-term changes in infant mortality

After over 50 years of concerted effort aimed at understanding pre-civil registration demography, there still seems to be many misnomers about levels of infant mortality amongst some historians who are not demographers. Here are just three examples.

> 'With 80% infant mortality being common and even higher rates of death for the babies of the poorest sections of British society a grim reality'.[2]

> 'Demographers estimate that infant mortality was 30 to 50 per cent in the premodern world'.[3]

> 'For all of England … the infant mortality rate – deaths during the first year of life – was about 250 to 300 per 1,000 live births, hence 25 to 30 per cent'.[4]

Very different rates are quoted and in each case no references are given to support these assertions. Hogan's rate is so high that any population suffering these levels of mortality would have quickly died out, while Hanawalt's are credible as estimates of infant *and* child mortality and Holmes' rates probably occurred in the towns of Stuart England, although mortality was much lower in the countryside. Summarising national patterns of any demographic measure over the course of three centuries in a single sentence is not easy, but it is clear that more needs to be done to make the levels of infant mortality shown in Figure 1.1 accessible to a wider public. When it comes to understanding and explaining the patterns described by Figure 1.1 the literature is vast and sometimes contradictory. In general terms, the process by which Britain underwent a transition from high to low IMRs is well understood and is related to modernisation: a complicated process that includes improvements in medicine, public and personal health, nutrition, material resources, housing, social welfare and technology, together with increasing levels of urbanisation and

1 During the nineteenth century some unmarried mothers entered workhouses with lying-in facilities thereby inflating both the illegitimacy ratio and the IMR in parishes with workhouses, since illegitimate infants experienced higher mortality rates than legitimates.

2 S. Hogan, 'Breasts & the beestings: rethinking breast-feeding practices, maternity rituals, & maternal attachment in Britain & Ireland', *Journal of International Women's Studies*, 10 (2008), pp. 141-60, here at p. 154. Earlier in the article, p. 152, Hogan makes explicit that she is referring to the first year of life: '[i]n historical periods in which infant mortality was often over 80% in the first year of life'.

3 B.A. Hanawalt, *Growing Up in Medieval London: the Experience of Childhood in History* (Oxford, 1995), p. 55.

4 F. Holmes, *The Sickly Stuarts: the Medical Downfall of a Dynasty* (Stroud, 2003), p. 14.

declining fertility. This list could be extended almost indefinitely. Whilst it is true to say that all the above affected the decline in infant mortality between 1850 and 1950 to some extent, the exact influence of each of these inter-connected variables has yet to be determined, and the processes that operated throughout the entire period covered by Figure 1.1 are still not fully understood.

One way of increasing our understanding about how and why IMRs varied and changed in the past is to develop a flexible framework, or schema, by which the causes of, and influences on, infant mortality can be examined.[1] For such a framework to be useful, it will need to take into account the different sources available throughout the period and it will also need to differentiate causes from influences. Causes of death are relatively easy to understand. For example, exposure to the smallpox virus often caused death even though some 'smallpox' deaths may have resulted from secondary infections. If the sources being used consistently and correctly give cause of death then it is relatively straightforward to provide a full analysis, although in practice it is only after the introduction of civil registration that large amounts of cause of death material becomes available and not until the twentieth century before infant causes of death become more detailed and reliable.[2]

By comparison, it is much more difficult to assess the various influences on infant mortality. Two factors that could influence whether or not an infant first contracted and then died from smallpox are place of residence and medical care. If an infant lived in a rural area with a low population density then it would be much less likely to be exposed to the smallpox virus than if it lived in a densely packed city such as London. Likewise, inoculation, vaccination or effective nursing may have meant that, once exposed to smallpox, an infant was more likely to survive. However, accessing appropriate medical care was probably easier in the towns and, in an era before universal free health care, the ability to pay for these medical interventions would have been crucial. Disentangling the influences on infant mortality remains difficult and—to complicate matters— relationships that existed at certain points in time and in certain places did not always exist in other times or places. For example, in the twentieth century there was generally an inverse relationship between social class and infant mortality: the higher the social class of a child or its parents, the lower the IMR.[3] This relationship operates because, with greater wealth, families are able to buy or access better medical care, education and social conditions. However, as far as it is possible tell, before

1 Many frameworks have been proposed, an influential one being W.H. Mosley and L. C. Chen, 'An analytical framework for the study of child survival in developing countries', *Supplement to Population and Development Review*, 10 (1984), pp. 25-45. See R.I. Woods, P. Watterson and J. Woodward, 'The causes of rapid infant mortality decline in England and Wales, 1861- 1921 part 2', *Population Studies*, 43 (1989), pp. 113-32 for one that is relevant to the late nineteenth century.

2 William Farr was prominent in establishing the scientific classification of causes of death and his work formed the basis of the International Classification of Diseases (ICD) system which was first adopted in 1900 and following subsequent revisions is still in use today, see http://www.who.int/classifications/icd/revision/en/ for the latest update (accessed April 2019). T. Devis and C. Rooney, 'Death certification and the epidemiologist', *Health Statistics Quarterly*, 1 (1999), pp. 21-33 provides a general discussion of how deaths are certificated by doctors and coroners. The analysis of causes of death is complicated because multiple causes are sometimes given on the death certificate and some causes are changed following post-mortem examination: see G. Maudsley and E.M.I. Williams, ' "Inaccuracy" in death certification - where are we now?', *Journal of Public Health Medicine*, 18 (1996), pp. 59-66.

3 A. Antonovsky and J. Bernstein, 'Social class and infant mortality', *Social Science and Medicine*, 11 (1977), pp. 453-70; E.R. Pamuk, 'Social class inequality in mortality from 1921 to 1972 in England and Wales', *Population Studies*, 39 (1985), pp. 17-31, here at p. 22.

1750 the peerage experienced IMRs similar to those of the nation as a whole.[1] While it is not known exactly where these elite infants were brought up (rates in London could be up to three times those in the countryside), or how they were cared for (wet nurses were often employed, although maternal breastfeeding appears to have become more common during the eighteenth century), wealth certainly brought about greater material comfort. However, before the advent of germ theory it did not always bring about a better understanding of how babies should be cared for and even though the rich could afford to buy the 'best' medical care, that care was often of little benefit and sometimes even dangerous. Establishing social influences on infant mortality in the pre-modern period is difficult, but explaining them is even more so.

To complicate matters the IMR has been, and continues to be, used both as a primary demographic indicator and as a surrogate measure for a whole range of social indicators. Thus, inferences about the disease environment have often been made from the IMR.[2] It has also been argued that the level of infant mortality still provides a very good indicator of general health levels within an entire population, and this is one reason why it continues to be employed to measure health inequalities.[3] Its significance therefore reaches far beyond a simple measurement of infant survival chances. Moreover, when influences on the IMR are discussed it is often necessary to use proxy variables when the influences we are interested in cannot be measured directly. For instance, in the absence of any absolute measure of mothers' health, Robert Millward and Frances Bell used the death rate of females aged 15-44 years from tuberculosis, arguing that 'it is accepted by some as reflecting primarily the mother's current resistance to disease (which will reflect her whole past health history) and is less sensitive to the current environment'.[4] While Millward and Bell found a strong correlation between female tuberculosis and infant mortality, it should be emphasised that mortality change is a complicated process affected by a wide range of factors and there could well be some intermediate variable that explains this correlation.[5] Undoubtedly, a mother's health has a powerful influence on her infant's survival, but measuring a variable such as health is far from straightforward.

Assumptions have also been made about the extent to which the level of infant mortality in a place is related to the health of those who survive.[6] Does an infant brought up in an area with an IMR of 200 suffer adverse health effects compared to one bought up in an area with an IMR of only 100? If the general conditions in the first area affected all infants—for example, all infants were exposed to dirty water causing one fifth of them to die with the rest suffering some form of illness—then the answer may well be yes. However, if a greater

1 See the discussion in R. Smith and J. Oeppen 'Place and status as determinants of infant mortality in England *c.* 1550-1937', in E. Garrett, C. Galley, N. Shelton and R. Woods (eds), *Infant Mortality: a Continuing Social Problem* (Aldershot, 2006), p. 76.

2 C. Bozzoli, A. Deaton and C. Quintana-Domeque, 'Adult height and childhood disease', *Demography*, 46 (2009), pp. 647–69. See also T.J. Hatton, 'Infant mortality and the health of survivors: Britain, 1910–50', *Economic History Review*, 64 (2011), pp. 951–97 and J. Brownlee, 'The relation of infantile mortality to mortality in subsequent life', *Journal of the Royal Statistical Society*, 80 (1917), pp. 222-48.

3 D.D. Reidpath and P. Allotey, 'Infant mortality rate as an indicator of population health', *Journal of Epidemiology and Community Health*, 17 (2003), pp. 344–6.

4 R. Millward and F. Bell, 'Infant mortality in Victorian Britain: the mother as medium', *Economic History Review*, 54 (2001), pp. 699-733, here at p. 714.

5 See the discussion on pp. 161-6.

6 D.J.P. Barker, *Mothers, Babies, and Disease in Later Life* (London, 1994) explores the wider links between infant health and subsequent disease.

proportion of infants in the first area were denied maternal breast milk and as a consequence succumbed more easily to the effects of dirty water then the answer could be no. A good example of the former assumption comes from the British Perinatal Survey (1958):

> [t]he perinatal death rate is also an index of the number of near deaths which may have occurred, and present with defects, acquired in pregnancy, at a later date. Like an iceberg, we see only a proportion of the ill-results, the deaths. But we must not forget the submerged and larger fraction, the near-deaths and the harm which they cause. The correlation is suggestive, because some causes of death—premature delivery, asphyxia during labour, Rhesus incompatibility—are known to be associated with the occurrence of mental and physical defects in some of the survivors. With the reduction in perinatal mortality there will also follow, *pari-passu*, a diminution in perinatal morbidity.[1]

Unfortunately, there is little quantitative evidence about illness before the twentieth century and it is difficult to judge the extent to which high infant mortality is also an indication of high infant sickness rates that may have serious repercussions in later life.

At the heart of these problems is the fact that we simply do not have sufficient data at the individual level about important influences on infant mortality, such as living conditions, mother's nutrition, infant feeding and environmental conditions, to determine the relative influence of each factor. Instead, we often have to rely on aggregate statistics, which are collected for much larger geographical and administrative units such as parishes or registration districts. The family unit is thought to be the most important influence on an individual infant's survival chances, since child rearing techniques and social circumstances varied considerably between individual mothers and this could result in infant deaths being clustered into certain families. For instance, the following entry occurs in the burial register of St Martin Coney Street, York, 'John, the new born Son of Absalom Bluitt, Dancing Master, being the 27th Child he has buried, all in Infancy, by two Wives Sep 11 1783'.[2] Robert Bland also discovered considerable differences in survival chances following his birth history survey of mothers before they left Westminster General Dispensary in the 1770s.[3] Of the 1,389 mothers surveyed, 310 had no living children, one woman had given birth to 34 children of which only five were still alive, but some mothers, albeit a minority, had been able to preserve the lives of all their children. Bland estimated that five out of every twelve babies died within two years, but one mother still had all her eleven children alive when she left the hospital. Such examples are interesting, although to what extent they are typical remains to be seen. Given such differences within individual families, some wider form of family linking process that is capable of adding social variables to individual family reconstitutions will be needed in order to understand many of the real influences on infant

1 W.C.W. Nixon, 'Foreword' to N.R. Butler and D.G. Bonham, *Perinatal Mortality. The First Report of the 1958 British Perinatal Mortality Survey under the Auspices of The National Birthday Trust Fund* (Edinburgh, 1963), p. iv. According to UNICEF, *The State of the World's Children, 2009* (New York, 2008), p. 20, similar problems affect the developing world: 'for every newborn baby who dies, another 20 suffer birth injury, complications arising from preterm birth or neonatal conditions'.

2 R. Beilby-Cook (ed.), *The Parish Registers of St Martin Coney Street, York, 1557-1812*, Yorkshire Parish Registers Series, 36 (1909), p. 230.

3 R. Bland, 'Some calculations of the number of accidents or deaths which happen in consequence of parturition; &c.', *Philosophical Transactions of the Royal Society*, 71 (1781), pp. 355-71, here at pp. 366-8.

mortality.[1] However, locating the sources needed to carry out this process would be difficult, time consuming and would probably result in relatively few families meeting all criteria for inclusion in the sample. This means that in the foreseeable future such a study would not appear to be feasible. It is therefore unlikely that a full assessment of the influences on infant mortality will be possible prior to the twentieth century and instead, we will proceed by providing a flexible framework within which the causes and influences on infant mortality can be examined.

Figure 1.4 Proximate determinants of infant mortality—a biological model

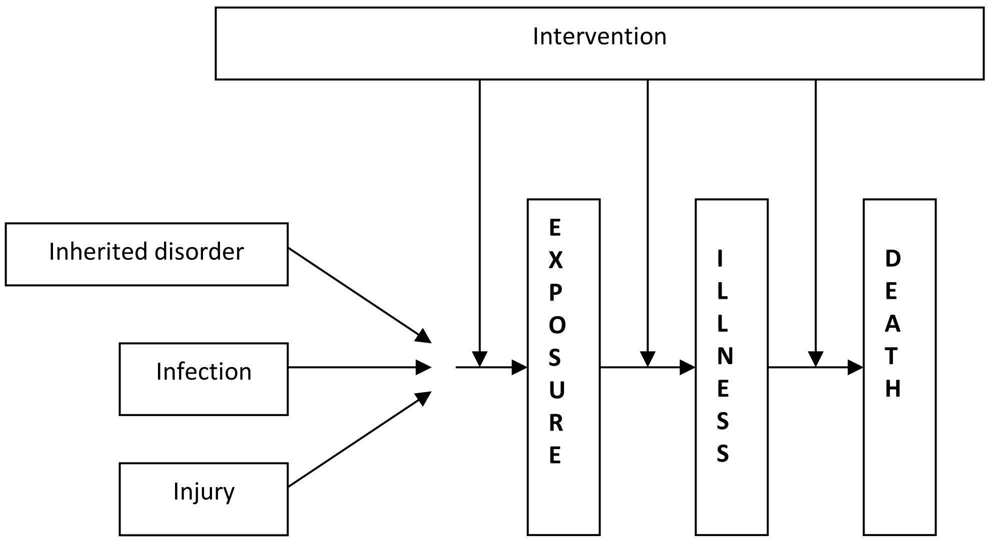

Figure 1.4 provides a first attempt at providing a suitable framework whereby infant mortality can be investigated. All deaths have a biological cause, although the quality of any cause of death data will be limited by available medical knowledge and the registration system in use at the time of death. For most of our period the causes of infant deaths, when they exist, were described using general terms such as premature birth, diarrhoea, and convulsions, the latter two being symptoms rather than true causes. Given such limitations it is appropriate to classify all causes of death under three broad headings: inherited disorder, infection and injury.[2] Exposure to some form of pathogen will have resulted in many infant deaths, but there were a number of conditions, inherited *in utero*, which caused a premature birth or congenital defect and thereby led to the infant's death. Accidents which included

1 See A. Macfarlane, *Reconstructing Historical Communities* (Cambridge, 1997) for an example of wider family reconstitution.

2 Figure 1.4 is, of course. an oversimplification. G. Masuy-Stroobant, 'The determinants of infant mortality: how far are conceptual frameworks really modelled?', in R. Frank (ed.), *The Power of Explanatory Frameworks: Bridging the Gap between Empirical and Theoretical Research in the Social Sciences* (Dordrecht, 2002), pp. 15-30, here at pp. 8-9, has argued that death is often the 'consequence of a cumulative series of biological insults rather than the outcome of a single biological event'. Detailed patient histories would be needed to test this thesis.

problems associated with a difficult birth could affect an infant, or indeed any individual, at any age.[1] The three boxes on the left-hand side of Figure 1.4 therefore represent the various threats to an infant's health, which eventually could lead its death. However, not every infant comes into contact with these threats and even if it does, death is not inevitable since, at each stage between infection, illness and death, some form of intervention may be possible. A healthy mother may mean that her infant is less likely to suffer an inherited disorder; living in a clean relatively isolated environment will reduce the risk of infection and the attendance of a competent midwife will reduce the likelihood of a birth injury. As we have seen, vaccination may result in exposed infants not succumbing to illness and good nursing practices may mean that ill infants are more likely to recover.

Figure 1.4 shows that effective intervention is possible at various stages: for example, dirty water poses a severe threat to infants since exposure may lead to the ingestion of harmful bacteria, which can cause infantile diarrhoea that is often fatal. The most effective means of combatting this problem is to use a clean water supply, but if this is not possible then boiling the dirty water should kill the bacteria. Maternal breastfeeding may lessen the likelihood of being exposed to dirty water and, if the infant does become ill, good nursing, or the use of oral rehydration therapies, may mean that the infant survives. Effective interventions often require learned specialist knowledge, although traditional childrearing practices such as maternal breastfeeding can reduce some of the risks. Social influences on infant mortality often act indirectly by both mitigating or increasing the risks and also by providing effective or ineffective intervention strategies. Thus, being poor may mean that parents had to live in areas where there were greater environmental risks; they may not have been able to afford medical care or they may have adopted different breastfeeding habits than their wealthier neighbours. The first two of these factors would have increased the chance of an infant death, while the last may have decreased the risks given that alternatives to breastfeeding were more expensive and perhaps less likely to be taken up by the poor. Therefore, it is important to determine exactly how a social variable such as wealth might influence both exposure and intervention in order for a full assessment of its impact to be made. In the following chapters Figure 1.4 will be modified both to reflect the story told by different data sources and the various socio-economic factors that influenced infant mortality.

Conclusion

In the first volume of *Population Studies* (1948) Sigismund Peller provided a wide-ranging study of past changes in mortality alongside his predictions for the future. With respect to infant mortality he wrote:

> [a] famous eighteenth-century author argued that tons of gold should be given to anyone who could show society how to eradicate infant mortality, and especially the then frequent and fatal convulsions. This goal has been largely

1 These groupings also reflect the fact that many historical demographers divide infant deaths into their endogenous (those associated with the mother and the birth process) and exogenous (those associated with the external environment) components, see E.A. Wrigley, 'Births and baptisms: the use of Anglican baptism registers as a source of information about the numbers of births in England before the beginning of Civil Registration', *Population Studies*, 31 (1977), pp. 281-312.

> achieved, except for mortality during the first days following birth. We should be at a loss, however, if we were asked to name the prize winners.[1]

As we have seen, the reasons why infant mortality declined between 1750 and 2000 are relatively easy to understand in general terms, but the role that direct human intervention played in that process has proved difficult to determine. This is hardly surprising given that efforts to eliminate modern inequalities in mortality have so far proved elusive. The most persuasive analysis of the health inequalities problem has been provided by Michael Marmot who argued that this health gap is a consequence of an individual's status, or position within the hierarchy, which 'is related to two fundamental human needs: to have control over your life and be a full social participant'.[2] The determinants of infant mortality are now well understood and in theory good quality free health care is available to all, but Marmot and others have still identified persistent social gradients in mortality. It is still proving difficult to change human behaviour even when the health benefits are obvious.[3] It is therefore not necessarily surprising to discover that the reasons for the secular decline in infant mortality in the past are not well understood, and that the role of human agency is particularly difficult to explain. Infant health is further complicated by the fact it is the infant's carers, usually their mothers, who are ultimately responsible for their welfare. Moreover, while it may be assumed that, like Alice Thornton, the vast majority of mothers did all in their power to ensure their infant's survival, for much of our period knowledge about the best methods of infant rearing were rudimentary to say the least. Thus, while many mothers may have believed that they had control over their lives—even if that was ultimately determined by 'God's will'—that control was often insufficient to ensure that their infants survived.

The rest of this book may not be able to identify who should have been awarded Peller's 'tons of gold', but hopefully it will to go some way towards providing a better understanding of the process of infant mortality change. It will seek to identify what we already know about infant mortality in the past and also set a research agenda, given the limitations of the available sources. Since infants were the most vulnerable group within society, the story of how infant mortality was gradually brought under control is a fascinating one with wider significance to our understanding of the demographic transition which has brought many benefits to the whole country.

1 Peller, 'Mortality, past and future', p. 424.

2 M. Marmot, 'Status syndrome', *Significance*, 1 (2004), p. 153; see also M. Marmot, *The Health Gap* (London, 2015).

3 More recently there has been a shift in focus from measuring health simply in terms of increasing life expectancy to ideas of well-being captured in measures such as healthy life expectancy, see www.gov.uk/government/publications/health-profile-for-england/chapter-1-life-expectancyandhealthy-life-expectancy (accessed April 2019).

2

The parish register period, 1538-1837

The starting date for any account of infant mortality in Britain must be 1538, the year when Thomas Cromwell instructed priests to keep a register in which every 'wedding, christening and burying' that took place in their parish was to be recorded. Not every parish register has survived; but from this date it is possible to provide reasonably accurate estimates of infant mortality for a wide variety of parishes over the course of three centuries.[1] In order to allow accurate IMRs to be calculated the following three conditions need to be satisfied: (1) the register must be accurate—it must list every baptism and burial that occurred within the parish; (2) sufficient information must be included to allow all infant deaths to be identified; and (3) the number of baptisms and burials needs to approximate to the number of births and deaths that occurred in the parish. Linking baptisms to infant burials will then allow series of IMRs to be created for parishes throughout the country. Of course only a few exceptional registers will yield accurate estimates of infant mortality for the entire period 1538-1837 and a number of technical difficulties may complicate the linking procedure; nevertheless, parish registers provide a wealth of information for the demographic historian and they exist in sufficient quality and quantity to ensure that their systematic exploitation allows the main patterns of infant mortality to emerge from the mid-sixteenth to the early nineteenth century.

Parish registers—a brief overview

Parish registers were documents of the state, even though they were administered at the local level, and their history in part reflects that of the country as a whole.[2] Of the approximately 11,000 English parishes fewer than 500 have surviving registers that date back to the 1530s and some of these lapsed during Queen Mary's reign (1553-8) when she attempted to reimpose Catholicism onto the country.[3] Many early registers have been lost, but it is likely that some parishes simply did not keep them and Cromwell's injunctions had to be repeated when both Edward VI (1546-53) and Elizabeth I (1558-1603) succeeded to the throne. In 1597 an attempt was made to improve registration when registers were ordered to be copied onto parchment and annual transcripts sent to the diocese (these documents are known as

1 See R. Wall, 'English population statistics before 1800', *The History of the Family*, 9 (2004), pp. 81-95 for a discussion of the quality and coverage of parish registers.

2 J.S. Burn, *The History of Parish Registers in England*, 2nd edn (London, 1862); J.C. Cox, *The Parish Registers of England* (London, 1910); D. Steel, *National Index of Parish Registers, Volume 1. Sources of Births, Marriages and Deaths before 1837* (London, 1968).

3 R. Finley, 'Parish registers. An introduction', *Historical Geography Research Series*, 7 (1981), p. 6.

Figure 2.1 A selection of entries from York's parish registers

(1) Holy Trinity Kings Court, 1663
Baptism—Elizabeth daughter of Christopher Stamper, April 21
Burial—Elizabeth daughter of Christopher Stamper, May 1

(2) St John Ousebridge, 1622
Baptism—Marie daughter of Trenton Myers, butcher, 26 May
Burial—Marie Myers a Crisome infant, daughter of Trenton Myers, butcher, 4 June

(3) Holy Trinity Goodramgate, 1656
Tobias, y^{e} Sonne of M^{r} Woodriffe, borne y^{e} 5th baptized the 14th of Januarii
Burial—Tobias, y^{e} Sonne of M^{r} Woodrife, the 26th June

(4) St Martin Coney Street, 1824
Baptism 14 March—John son of Jane Forth of this parish, Spinster, born February 29
Burial 19 March—John Forth of this parish, 18 days

(5) St John Ousebridge, 1622
Mr Richard Walker, grocer, had twoe children borne which were buried, 13 December

(6) Holy Trinity Micklegate, 1639
Burial—A childe of Willm Pattericks unbabtized 14 February

(7) St Michael le Belfrey, 1580
John tessymonde, sone to Anthony tessymonde, being not past one houre oulde, was baptized by the mydwyfe, at home, and buryed the xth day maye

(8) St Crux, 1674
Anne, ye daughter of John Willoughby, was presumptuously & irregularly baptized by a midwife, November ye 19th

(9) St Martin Coney Street, 1832
Burial—William Thackray of Coney Street, 7 months, 6 November

(10) St Michael le Belfrey, 1660
Roger And Janne, children of Mr Thomas Simpson, was borne And babtized And buried both in one Coffine, in ye hy end of ye North Alle, ye 16th day of October

(11) St John Ousebridge, 1622
Burial—A still borne childe of Mr William Robinson, marchant, 9 August

(12) St Martin cum Gregory, 1658
Burial—Ussaley wouddrop A nursed child dyed the 10th of Sept

Source: Original parish registers.

bishop's transcripts). During the seventeenth century increasing numbers of registers begin to survive, although a major period of disruption occurred as a consequence of Civil War and the imposition of the Commonwealth Government. Many registers are defective in this period, although others contain additional details. In 1644 births and deaths were ordered to be recorded alongside baptisms and burials and in 1653 a civil registration system, administered by laymen, was introduced. Ecclesiastical registration recommenced in 1660 with the Restoration of the Monarchy and it remained largely unaltered for the next 170 years. Two measures affected registration during this period: the Marriage Duty Act of 1694 taxed births, deaths and marriages and resulted in some registers listing births and deaths; and Rose's Act of 1812 which required the completion of specially printed registers where there were spaces for age at death and place of abode in the burial section. In some instances Rose's Act led to a decrease in the amount of information included in the register, since by the end of the eighteenth century it had become increasingly common to record cause of death and now there was no space for this in the new registers.

The foregoing short account illustrates how national government sought to impose standardisation onto some 11,000 parish clerks. The fact that this was never achieved, while being a weakness, is also one of the great strengths of parish registers as a source for demographic analysis. It means that alongside the usual information—name, parent's name, date of baptism and burial—interesting additional material is sometimes included. Figure 2.1 illustrates the range of material, useful for the study of infant mortality that can be found in York's parish registers. Example (1) provides the basic information required to calculate the IMR, an infant's baptism together with its subsequent burial before age 1. It should be noted that we are forced to assume that Elizabeth Stamper's age at death is 10 days, although we cannot know this for certain since dates for her birth and death are not given.[1] Examples (2-4) give similar information to (1). In addition, (2) provides information about occupation which allows assumptions to be made about the infant's social status, while example (3) also gives date of birth, and illustrates the fact that baptismal delay was generally short in this period. Example (2) also includes the term 'chrisom' which refers to the cloth in which the infant was baptised, but was also used as a shroud if it died shortly after birth.[2] Example (4) is typical of entries that followed Rose's Act. The burial entry does not give a parental name, although the age at death is sufficient to identify it as the same infant that was baptised five days earlier.

The major weakness with parish registers as a source for studying infant mortality is that any infant who died before it could be baptised will obviously not appear in the baptismal register. Unbaptised infant deaths may also be missing from the burial register, but this was not always the case, see (5) and (6). Examples (7) and (8) are particularly interesting in that they illustrate emergency baptism by a midwife.[3] If an infant was not likely to survive and a priest was unavailable then anyone could perform this rite, but while such practices may have been commonplace, they were rarely recorded in parish registers and, as example (8) shows,

1 We also need to assume that there are not two Christopher Stampers who both have daughters called Elizabeth living in this parish. In most cases this is highly unlikely, but in some large parishes additional information may be needed to confirm any links, especially if the family name is a common one.

2 W. Coster, 'Tokens of innocence: infant baptism, death and burial in early modern England', in B. Gordon and P. Marshall (eds), *The Place of the Dead. Death and Remembrance in Late Medieval and Early Modern Europe* (Cambridge, 2000), pp. 266-87.

3 B.M. Berry and R.S. Schofield, 'Age at baptism in pre-industrial England', *Population Studies*, 25 (1971), pp. 453-63, here at p. 454.

by the seventeenth century the church was actively discouraging this practice. Sometimes unbaptised infant burials were listed explicitly, but more often this information has to be inferred, as in the case of (9) where no corresponding baptism could be found. It may of course have been that (9) had been baptised in another parish or in an informal ceremony at home, but had no age at death been recorded it would not have been possible to identify this entry as an infant burial and consequently any IMR calculated from this register would underestimate the true rate. The inclusion of unbaptised infant burials is crucial to a register's overall accuracy and examples (7) and (10) are reassuring since they show infants who died shortly after birth being recorded in the register. The final examples in Figure 2.1 provide additional information useful to the study of infant mortality. Stillbirths, example (11), occur relatively infrequently in parish registers and are an important topic in themselves, being related to prevailing levels of mortality and the health of the mother.[1] They also provide an additional indication of the register's accuracy since they were not required to be recorded. Finally, a variety of interesting detail is also sometimes included. Example (12) provides information about nursing practices, while illegitimacy can be gleaned from example (4) and an indication of the higher mortality suffered by multiple births is given by examples (5) and (10).[2] Above all, Figure 2.1 reveals the rich variety of material included in parish registers and a careful search of existing ones, the vast majority of which have yet to be examined, will greatly enhance our knowledge of infant mortality in this period.

The extent and coverage of Anglican parochial registration

Parish registers are subject to both systematic and non-systematic omissions that may affect the accuracy of subsequent calculations of infant mortality. The potential researcher faces three main problems. First, some registers have been lost or they were kept sufficiently badly to preclude serious demographic analysis. Examples are easy to find. In 1746 on his appointment as vicar of Howden, east Yorkshire, James Godmond wrote in the parish register, 'Several Baptisms and Burials, being sent in irregularly, are to be found on p. 92, and some I am afraid never come to my Hand at all'.[3] Little can be done here, but such omissions are usually easy to identify and care must always be taken to ensure that registration is complete and sufficient details are included to allow any linking procedure to take place before analysis is attempted.[4] The fact that parish registers were administered under the auspices of the Church of England ensures that these documents have survived less well in Wales and Scotland. In 1538 Scotland was a separate country, and while all parishes were required to keep a register of baptisms from 1552 and a recommendation was issued in 1565 that burials should also be kept, early Scottish parish registers are generally of

1 R. Woods, 'The measurement of historical trends in fetal mortality in England and Wales', *Population Studies*, 59 (2005), pp. 147-62; C. Galley, 'The stillbirth rate in early modern England', *Local Population Studies*, 81 (2008), pp. 75-83.

2 C. Galley, ' "One face, one voice, one habit, and two persons!" The survival of twins in early modern society', *Local Population Studies*, 51 (1993), pp. 73-6.

3 G.E. Weddell (ed.), *The Parish Register of Howden 1725-1770*, Yorkshire Parish Registers Series, 48 (1913), p. 75. Godman obviously did not perform all the baptisms and burials in his parish. Another interesting example is from Dolbenmaen, Caernarfonshire, 'There has been a most shameful neglect for 20 years in this Parish without any account of Burials, Marriages & Christenings owing to a Drunken Curate Mr Davies lately Dead. Octbr. 9th 1790. Jeffry. Holland, rector', see http://northwalesmisc.blogspot.co.uk/ [accessed October 2019].

4 M. Drake (ed.), *Population Studies from Parish Registers* (Matlock, 1982), pp. x-xxv.

disappointing quality with few complete ones surviving over a sufficiently long period to make substantial demographic analysis feasible.[1] Welsh registers, when they survive, suffer from an additional problem because, with a relatively restricted name pool in use, establishing links between individuals is often difficult, if not impossible.[2] This has meant that most analyses have been undertaken on English registers, a situation that is unlikely to change. The chance survival of good quality registers will clearly limit enquiry, but sufficient exist to enable the main patterns to emerge over the course of three centuries.

Second, the vital events of only a certain proportion of the population were recorded in parish registers. During the sixteenth century when church attendance was compulsory,[3] registration was virtually complete, but during the seventeenth and eighteenth centuries the rise of nonconformity meant that some individuals refused to have their children baptised, although sometimes, the lack of an alternative, forced them to use the churchyard for their burials. Further problems occurred in some towns where there were insufficient churches to cope with expanding populations and as church attendance began to fall, ecclesiastical registration began to break down and this eventually led to the introduction of a civil registration system.

Third, while information about births and infant deaths is ideally required to investigate infant mortality, parish registers generally only recorded baptisms and burials. This creates problems since in some instances infants who died unbaptised were denied Christian burial and all trace of them may be absent from the burial register.[4] In medieval times it was thought that infants dying unbaptised entered limbo and consequently it was important to baptise all infants shortly after birth. Such was the importance of baptism that even a lay person, which was usually the midwife, was allowed to perform this rite if the infant was thought likely to die. This practice was discouraged after the Reformation and gradually baptism was turned into a public ceremony which ideally should take place on the Sunday following the infant's birth, unless it was in danger of dying.[5] One consequence of this was that, over time, average birth/baptism intervals gradually lengthened. Some infants were given an informal private baptism prior to the formal public ceremony and if for some reason, such as the infant's death, the church service did not take place, then under-registration may have occurred.[6]

Little can of course be done about the distribution of surviving registers, but the other two problems affected all registers to some extent. Early registers tend to have fewer problems than later ones and by the beginning of the nineteenth century the quality of registration had deteriorated in many places with the reasons being noted by John Rickman when he commented on results from the first national census in 1801:

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1 M. Flinn, (ed.), *Scottish Population History* (Cambridge, 1977).

2 R.W. Macdonald, 'The parish registers of Wales', *National Library of Wales Journal*, 19 (1976), pp. 399-429.

3 Following the Reformation and the succession of Queen Elizabeth, the Act of Uniformity (1559) made weekly church attendance compulsory subject to a substantial fine, see C.D. Field, 'A shilling for Queen Elizabeth: The era of state regulation of church attendance in England, 1552-1969', *Journal of State and Church*, 50 (2008), pp. 213-53.

4 C. Daniell, *Death and Burial in Medieval England* (London, 1997), pp. 127-8 suggests that there may have been special sections within some churchyards for the burial of unbaptised infants.

5 W. Coster, *Family and Kinship in England 1450-1800* (Harlow, 2001); R. Schofield, 'Monday's child is fair of face': favoured days for baptism, marriage and burial in pre-industrial England', *Continuity and Change*, 20 (2005), pp. 93-109, here at pp. 100-2.

6 By the eighteenth century questions were being raised about the role of infant baptism. See the discussion in R. Houlbrooke, *Death, Religion and the Family in England 1480-1750* (Oxford, 1998), pp. 49-53.

> Many Congregations of Dissenters, inhabiting Towns, have their own peculiar Burying Grouynds [and those that don't] bury in the Cemeteries of the established Church, but do not baptize in it. … some persons, from motives of Poverty or Convenience, inter their Dead without any religious Ceremony … Some irreligious Persons do not cause their Children to be baptized at all … Children who die before Baptism are interred without any religious Ceremony.[1]

These problems were serious and in 1837 a national civil registration system was introduced. To some extent Rickman's comments applied to the country as a whole, but certain areas, especially the towns, were more affected than others. In London there had always been some degree of choice over where an individual could be buried and as churchyards became overcrowded alternatives were always being sought.[2] Major problems occurred in the rapidly expanding industrial towns of the late eighteenth and early nineteenth centuries. Here population growth far outstripped new church building and the overall quality of registration was often poor. In Sheffield in addition to the original parish church, seven more Anglican churches were in use by 1830, but these could still hardly cope with a population of 91,692 in 1831.[3] Likewise, during the early nineteenth century Leeds had 17 Anglican churches while there were 30 in Manchester and Salford, but under-registration still occurred.[4] Consequently, few have attempted demographic analysis in such places, but what happened in the industrialising towns, where trends may have deviated significantly from national ones, is of such importance to the demographic history of Britain that urban registers need to be examined in much greater detail than has so far been the case. The examination of nonconformist registers may be able to overcome some of these difficulties, although it is important to establish that the population at risk for both births and deaths remained the same. With the exception of some notable studies using Quaker registers, as yet, nonconformist registers are a source that have remained largely untapped by historical demographers.[5]

Whether certain groups are excluded from parish registers, be it due to nonconformity, indifference or private baptism, is of crucial concern when attempting to assess overall population size, but it has less impact on the calculation of IMRs if such groups are absent from both baptism and burial registers.[6] The resulting IMRs will only of course be applicable to the Anglican population and it is possible that nonconformists adopted different approaches to child-rearing which would cause the calculated rates not to be representative of the population as a whole.[7] Likewise, those individuals that Rickman identified as

1 D.V. Glass (ed.), *The Development of Population Statistics* (Farnborough, 1973); C. Galley, *The Demography of Early Modern Towns. York in Sixteenth and Seventeenth Centuries* (Liverpool, 1998), pp. 153-5.

2 V. Harding, *The Dead and the Living in Paris and London, 1500-1670* (Cambridge, 2002), pp. 49-50.

3 R. Humphery-Smith, (ed.), *The Phillimore Atlas and Index of Parish Registers* (Chichester, 1984), pp. 41B, 266; A.D.H. Crook, 'Population and boundary changes, 1801-1981', in C. Binfield *et al.* (eds), *The History of the City of Sheffield 1854-1993* (Sheffield, 1956), pp. 482-3. The need for additional burial spaces also led to the opening of Sheffield General Cemetery in 1836.

4 Humphery-Smith, *Phillimore Atlas*, p. 41B.

5 J. Landers, *Death and the Metropolis. Studies in the Demographic History of London 1670-1830* (Cambridge, 1993); R.T. Vann and D. Eversley, *Friends in Life and Death: the British and Irish Quakers in the Demographic Transition* (Cambridge, 1992).

6 See Table 1.4.

7 See Vann and Eversley, *Friends in Life and Death*, pp. 192-203.

Table 2.1 Comparative birth-baptism intervals by period

		Interval in days by which stated per cent of infants were baptised		
		25	50	75
1650-1700	Earliest parish	1	1	4
	Median parish	2	8	14
	Latest parish	13	19	27
1771-1789	Earliest parish	2	6	11
	Median parish	16	26	38
	Latest parish	26	52	155
1791-1812	Earliest parish	1	3	6
	Median parish	22	30	64
	Latest parish	48	114	198

Note: This table is based on an analysis of 43 parish registers, although not every register recorded birth-baptism intervals in each of the three periods. The 'earliest parish' refers to the parish that recorded the shortest birth-baptism intervals and the 'latest parish' to the parish that recorded the longest birth-baptism intervals.

Source: B.M. Berry and R.S. Schofield, 'Age at baptism in pre-industrial England', *Population Studies*, 25 (1971), pp. 453-63, here at, p. 458.

'irreligious' or using home baptisms were likely to come from distinct social groups and their absence may also affect the calculated rates. There is relatively little evidence on both these subjects, but the most important issue to affect the calculation of IMRs concerns the possible non-registration of unbaptised infant burials. This problem tended to worsen during the eighteenth century as birth-baptism intervals lengthened (Table 2.1). During the sixteenth century birth-baptism intervals tended to be short and they gradually increased during the seventeenth and eighteenth centuries; however, Table 2.1 also shows that local baptismal customs varied considerably, as they probably did within different families.[1] Given that there was an inevitable delay between birth and baptism (and usually a much shorter one between death and burial), IMRs calculated from parish registers will always slightly overestimate the true rate as the period of observation should be exactly one year. With short intervals any discrepancies will be small, although it is clear from Berry and Schofield's sample that in every period birth-baptism intervals in some parishes could be substantial. Lengthening birth-baptism intervals will not affect the calculation of IMRs if unbaptised infant burials were consistently recorded and it is obvious that those parishes where intervals were short should have fewer of these burials than parishes where intervals were longer. Given the religious problems associated with dying unbaptised it is possible that greater efforts may

1 See also the examples given in D. Woodward, 'The impact of the Commonwealth Act on Yorkshire parish registers', *Local Population Studies*, 14 (1975), pp. 15-31; R.E. Jones, 'Infant mortality in rural north Shropshire, 1561-1810', *Population Studies*, 30 (1976), pp. 305-17; Drake, *Population Studies*, pp. 36-70; M.J. Saxby, 'Ages at baptism in the parish of All Saints, Sudbury, 1809-1828: a new approach to their interpretation', *Local Population Studies*, 70 (2003), pp. 49-56; A. Wright, 'Birth-baptism intervals in Whickham parish, Co. Durham c. 1770-1820', *Local Population Studies*, 77 (2003), pp. 81-7; S. Brush, 'When were babies baptised? Some Welsh evidence', *Local Population Studies*, 72 (2004), pp. 83-7; J. Perkins, 'Birth baptism intervals in 68 Lancashire parish registers, 1646-1917', *Local Population Studies*, 85 (2010), pp. 11-27.

have been made to baptise weak infants thought to be at risk of dying. However, by the eighteenth century R.E. Jones found that in North Shropshire, 'there seems to have been no relation between the probability of dying and probability of baptism'.[1] By contrast in St Martin in the Fields, London, Jeremy Boulton and Romola Davenport discovered that while birth-baptism intervals increased during the eighteenth century the number of infants dying unbaptised did not and this was due to many infants having been baptised at home in an informal ceremony which was not necessarily recorded in the parish register.[2] With birth-baptism intervals varying from parish to parish and the recording of unbaptised infant burials being by no means consistent, the selection of an appropriate register remains a crucial issue. While registration deteriorated in many parishes, even during the early nineteenth century some registers recorded short intervals and consequently a range of accurate IMRs have been calculated across the parish register period.[3]

To sum up: the wide variety of recording practices adopted by parish clerks, coupled with the fact that nonconformity had little impact in some places, ensures that, despite the various problems listed above, many registers remain excellent sources for the study of infant mortality. Much is still to be learnt about infant mortality in the parish register period, especially during the late eighteenth century when IMRs in some places were subject to change, and the sources needed to investigate this and other topics relating to how and why infant mortality changed are no doubt lying undisturbed in local archives around the country.

Before showing how parish registers can be used to estimate IMRs it is necessary to address those individuals who have questioned the general reliability of this source—the most prominent being Peter Razzell. His thesis is that sufficient individuals are absent from parish registers to make some forms of analysis meaningless. In addition to the possible omissions mentioned above, much under-registration occurred due to the negligence of parish clerks together with their refusal to register burials on account of non-payment of fees. According to Razzell, it was highly unusual for families to give identical Christian names to living siblings and, if such instances can be discovered after family reconstitution has been undertaken on a parish register, then this must be because the burial of the elder child has not been recorded in the register.[4] If under-registration has occurred, then appropriate correction rates can be applied by inflating the calculated IMR by the proportion of same-name infants missing from the burial register. Consequently, Razzell believes that most infant and other mortality rates calculated from parish registers seriously under-estimate the

1 Jones, 'Infant mortality', p. 316.

2 J. Boulton and R. Davenport, 'Few deaths before baptism: Clerical policy, private baptism and the registration of births in Georgian Westminster: a paradox resolved', *Local Population Studies*, 94 (2015), pp. 28-47.

3 E.A. Wrigley, R. Davies, J. Oeppen and R.S. Schofield, *English Population History from Family Reconstitution 1580-1837* (Cambridge, 1997), pp. 217-48, 268-80.

4 P. Razzell, 'The growth of population in eighteenth-century England: A critical reappraisal', *Journal of Economic History,* 54 (1993), pp. 743-71, here at pp. 752-6; P. Razzell, 'Evaluating the same-name technique as a way of measuring burial register reliability in England', *Local Population Studies,* 64 (2000), pp. 8-22, here at p. 8. There is a slight shift in emphasis between these two articles. Compare, '[i]t was extremely rare to give two living children identical Christian names' (1993, p. 752) with 'same-names were not given to living siblings in England after the middle of the seventeenth century, and the practice may never have existed even at an earlier period' (2000, pp. 10-11).

true rates.[1] The logic and internal consistency of Razzell's argument have been questioned by Wrigley and others working at The Cambridge Group for the History of Population and Social Structure.[2] The 'same name' technique was developed by Louis Henry as a means of assessing the quality of French parish reconstitutions, but rather than assuming that all same-name siblings were a consequence of burial under-registration, Henry noted that birth intervals could be divided into three categories according to the fate of the next youngest child of the same sex: (1) where there is definite evidence that the first-born child was living when the second one was named; (2) where there is evidence that the first-born child was dead when the second one was named and (3) where the fate of the first born was unknown.[3] For each category the proportion of cases can be established where the younger sibling was given the same name as the elder one. It then remains a simple procedure to estimate how many children in the third category would have died before their siblings were named. It is only *these* children that are missing from the registration system, rather than, as Razzell assumed, all those with the same name as their siblings (that is, there are no children in category (1)). Wrigley *et al.* concluded that, '[i]t is, indeed, more than likely that the improvement in the registration of burials, which Razzell believed that he detected, reflects the decreasing frequency with which parents used the same name twice for living children rather than a decline in under-registration'.[4] Evidence of any living same-name siblings will clearly prove problematic for Razzell's thesis.

While it remains difficult to quantify the extent of living same-name siblings, explicit examples are relatively easy to discover. A brief search of the secondary literature reveals that Thomas Tomkins (1573-1656), the Elizabethan composer, shared his Christian name with his brother who was a lay-clerk at Gloucester Cathedral.[5] Eamon Duffy's study of the Devon parish of Morebath showed that it was common practice to give the same name to living siblings; he even cited one example from 1534 of three unmarried brothers sharing the same name, John (maior, minor and minimus).[6] George Redmonds provides further examples including Thomas Adde of Kexbrough (died 1567), whose will showed him to be the father of Thomas Adde the elder and Thomas Adde the younger and that of William Wilkinson of Slaidburn who left 20 shillings to Margaret his eldest daughter, but only 8 shillings and 4 pence to Margaret the younger.[7] Similarly, the burial register of St Michael le Belfrey, York (1668) also gives an example, 'William, the second sonn of that name and sonn of William Peniman, esq., July the 24th'.[8] Strictly speaking it is possible that some of the

1 Razzell, 'Same-name technique', p. 17 argued that estimates of infant and childhood mortality rates derived from London parish registers need to be inflated by about 50 per cent to allow for the supposed deficiency in the recording of deaths exhibited by same-name siblings.

2 Wrigley, *et al.*, *English Population History*, pp. 98-108.

3 L. Henry, *Manuel de Démographie Historique* (Paris, 1967), pp. 22-5. This was not referred to by Razzell in his original 1993 article.

4 Wrigley *et al., English Population History*, pp. 100-1. Wrigley *et al.* then go on to provide a rigorous demonstration of the internal consistency of their findings. Henry's method is also discussed in R. Finlay, *Population and Metropolis: The Demography of London 1580-1650* (Cambridge, 1991), pp. 45-9.

5 P. Scholes, *The Oxford Companion to Music 10th edition* (Oxford, 1970), p. 1,027.

6 E. Duffy, *The Voices of Morebath* (New Haven, 2001), p. 14.

7 G. Redmonds, *Christian Names in Local and Family History* (Richmond, 2004), p. 48. Redmonds also discusses the use of the diminutive Jenkin for John 'Junior'—it was clearly necessary to employ some means of differentiating between living same-name siblings within the family.

8 F. Collins (ed.), *The Parish Register of St Michael le Belfrey, York part 2 1653-1778*, Yorkshire Parish Registers Series, 11 (1901), p. 129. Likewise, C. Drury and T. Walter Hall (eds), *The Parish Register of Sheffield in the*

above examples may have been half-siblings, or other family members residing in the household.[1] However, the following three extracts from parish registers refer to sets of twins and provide conclusive evidence:

> Blaby, Leics. (1559). John and John Sicke, the children of Christopher and Ann Sicke were baptized. *Item* 31 Aug John and John were buried;[2]
>
> Rothwell, Yorks. (Dec 1547). *Joh'es et Joh'es fil' gemelli Joh'nes Sayvell* bapt;[3]
>
> Kirkburton, Yorks. (April 1644). Richard sone of Mr Richard Horsfall bapt xxviith day. Richard sone of Mr Richard Horsfall and the latter borne being twindles bapt the same day.[4]

Other living same-name siblings can readily be discovered and a systematic search through similar sources will no doubt reveal other examples.[5]

All the above examples come from the sixteenth or seventeenth centuries, but remnants of this practice appear to have persisted into the eighteenth century. According to Steve King, in Calverley-cum-Farsley, a proto-industrial township in the West Riding of Yorkshire, 'recycling of names between live children seems to have been more common than Razzell allows with a clear tendency to re-use names once the first living child reached age ten'.[6] By the eighteenth century sibling name-sharing certainly appears to be in decline, but it could be argued that the main evidence for this practice is provided by parish registers—evidence which Razzell rejects. In at least one population, Isle of Skye in north-east Scotland, living same-name siblings persisted into the twentieth century (Table 2.2). Here there was a culture of sibling name sharing with at least 30 per cent of eligible families having living siblings with the same name during the period 1861-1901.[7] Moreover, by examining the birth and death registers it was possible to compare the mortality of infants who subsequently had a same-name sibling registered with those infants who did not. The same name IMRs were 295 for males and 311 for females compared with only 78 for males and 59 for females who did not have same name siblings.[8] Virtually half of all first born same-name siblings were dead

County of York, part 2, Yorkshire Parish Registers Series, 60 (1917), p. 32 records the following burial entry, 'Feb xxj° (1581) Jones & Jones fil' Willi Robinson'.

1 Redmonds, *Christian Names,* p. 49.

2 Burn, *History of Parish Registers*, p. 74.

3 Quoted in Steel, *National Index of Parish Registers, Volume 1*, p. 118.

4 F. Collins (ed.), *The Parish Register of Kirkburton, co. York Vol. 1, 1541-1654* (Exeter, 1887), p. 246.

5 Burn, *History of Parish Registers*, p. 74 gives the example of one John Barker who had three sons named John Barker and two daughters named Margaret Barker. For other examples, see R. Houlbrooke, *English Family Life 1576-1716* (Oxford, 1988), p. 131; Weddell, 'Parish Register of Howden', 33; Steel, *National Index of Parish Registers, Volume 1*, pp. 115-21. Also, see A. Imhof, *Lost Worlds. How our European Ancestors Coped with Everyday Life and why Life is so Hard Today* (Charlottesville, 1996), pp. 116-8 for similar German practices.

6 S. King, 'Dying with style: Infant death and its context in a rural industrial township 1650-1830', *Social History of Medicine,* 10 (1997), pp. 3-24, here at p. 15.

7 C. Galley, E. Garrett, R. Davies and A. Reid, 'Living same-name siblings and British demography', *Local Population Studies*, 86 (2011), pp. 15-36.

8 Galley*, et al.*, 'Living same-name siblings', p. 31. See also the subsequent debate, P. Razzell, 'Living same-name siblings in England, 1439-1851' *Local Population Studies*, 87 (2011), pp. 65-9; C. Galley, E. Garrett, R. Davies and A. Reid, 'Living same-name siblings and English demography', *Local Population Studies*, 87 (2011), pp. 70-7; P. Razzell, 'Living same-name siblings and English historical demography: a commentary', *Local Population Studies*, 88 (2012), pp. 76-81; C. Galley, E. Garrett, R. Davies and A. Reid, 'Living same-

Table 2.2 Examples of living same-name siblings, Isle of Skye 1871 and 1891

Name	Relationship to head of household	Marital status	Age	Occupation
James Steele*	Head	Widower	43	Farmer of 7 acres
Roderick do.	Son		16	Labourer, general
Ann do.	Daughter		14	Scholar
Catherine do.	***Daughter***		***12***	***Do.***
Donald do.	Son		9	Do.
Margaret do.	Daughter		7	Do.
Catherine do.	***Daughter***		***5***	
Catherine do.	***Daughter***		***3***	
William do.	Son		1	
Janet McInnes**	Wife	Married	36	Crofter's wife
Donald do.	***Son***		***14***	***Ag. Lab.***
John do.	Son		11	Scholar
Kate do.	Daughter		12	Do.
Christy do.	Daughter		9	Do.
Alexander do.	***Son***		***6***	
Donald do.	***Son***		***5***	
Alexander do.	***Son***		***3***	
Donald Lamond	Father-in-law		82	Crofter (retired)
Roderick McKinnon**	Head	Married	31	Fisherman
Margaret do.	Wife	Married	28	Do. Wife
John do.	***Son***		***4***	
John do.	***Son***		***2***	

Sources: * Census returns of Skye 1871; ** Census returns of Skye 1891.

before the next child of that name was born into the family, but this means that over half were not. Using Razzell's 'same-name' technique to inflate the IMRs of infants who did not have same-name siblings would in this case grossly exaggerate rates throughout the island and it would therefore appear inadvisable to infer general levels of infant mortality from those observed among same-name siblings.

Perhaps the best counter-argument to Razzell is the cumulative evidence that is emerging following the analysis of a wide variety of parish registers. The pattern of infant and other mortality rates appears consistent both with respect to geographical variations and those in the mid-nineteenth century.[1] Most impressive of all is the general stability of marital fertility, calculated through family reconstitution, that occurred throughout the parish register period.[2] If all parish registers were beset with lax recording practices, then surely it would be

name siblings and English historical demography: a final comment', *Local Population Studies*, 88 (2012), pp. 82-3.

1 C. Galley and N. Shelton, 'Bridging the gap: Determining long-term changes in infant mortality in pre-registration England and Wales', *Population Studies*, 55 (2001), pp. 65-77.

2 Wrigley *et al.*, *English Population History*, pp. 501-7.

virtually impossible for such results to occur across a range of parishes by chance alone? While Razzell is correct in pointing out that many parishes were affected by poor registration, with examples being easy to discover, the wide variety of registration practices adopted by individual parish clerks ensured that some at least maintained good registration. Parish registers are by no means ideal demographic sources, but the key to all successful demographic analysis is to select source material of the highest quality. The best parish registers represent a unique source whose careful exploitation has enabled the demographic history of the English population to be reconstructed back into the sixteenth century.

Other useful sources for estimating infant mortality

Three other types of source have the potential to add to our knowledge of infant mortality in the parish register period. The first is the wide variety of non-Anglican registers which as yet remain hardly used.[1] In some cases these registers may suffer from exactly the same problems as Anglican ones; they may even be worst since some nonconformist communities did not have their own graveyards and had to inter their dead in the parish churchyard. It is therefore important to determine the extent to which these problems affected the register under investigation before any analysis is undertaken. Quaker registers recorded births rather than baptisms and anyone marrying outside the faith was deemed to have left the church; they therefore have clear advantages over Anglican ones.[2] Nonconformist registers allow an alternative set of rates to be calculated to those from Anglican registers and more importantly, they may be more accurate during the crucial period 1750-1837 when the quality of many Anglican registers deteriorated. Furthermore, with many nonconformist communities being centred around towns, it may be possible to exploit these sources to estimate IMRs in rapidly growing industrial areas.

Bills of mortality have also been used to estimate IMRs. These sources usually present aggregated totals of baptisms, burials and marriages, sometimes with additional information such as age and cause of death. The causes of death tend to be rudimentary and often refer to symptomatic rather than actual causes, especially where infants are concerned. Bills of mortality were usually compiled from ecclesiastical sources so their accuracy is unlikely to surpass the Anglican registers themselves. The most famous set are from London and these have been shown to yield reasonable estimates of infant mortality, although deaths were only reported for those aged under two years from 1728 and, consequently, it is necessary to make assumptions about the ratio of infant to two-year-old deaths in order to estimate IMRs.[3] The large number of events recorded by the London bills have also allowed annual series of IMRs to be produced. More limited series for Carlisle, Chester, Northampton and Liverpool exist together with others for a variety of places.[4] The quality and usefulness of these sources vary

1 See for example A.A. Rollason, *The Old Non-parochial Registers of Dudley* (Dudley, 1899).

2 Landers, *Death and the Metropolis*; Vann and Eversley, *Friends in Life and Death*.

3 Compare R. Woods, 'Mortality in eighteenth-century London: a new look at the bills', *Local Population Studies*, 77 (2006), pp. 12-23 with P. Laxton and N. Williams, 'Urbanization and infant mortality in England: a long term perspective and review', in M. Nelson and J. Rogers (eds), *Urbanisation and the Epidemiological Transition, Reports from the Family History Group, Uppsala University*, 9 (1989), pp. 124-35 and Landers, *Death and the Metropolis*, pp. 169-70.

4 C. Galley, N. Williams and R. Woods, 'Detection without correction: problems in assessing the quality of English ecclesiastical and civil registration', *Annales de Démographie Historique*, (1991), pp. 161-83, here at pp. 168-9; J. Haygarth, 'Observations on the bill of mortality, in Chester, for the year 1772. By Doctor Haygarth', *Philosophical Transactions of the Royal Society*, 64 (1774), pp. 67-78; J. Haygarth, 'Bill of mortality for

considerably, as does the information they contain, and in some instances they merely present aggregated totals culled from parish registers.[1] Bills of mortality should essentially be treated as secondary sources; at the very least they provide a ready means of assessing the quality of registration within an area while the best can yield useful estimates of infant mortality.

The final type of source encompasses anything that recorded all the children who were born and died in a particular family. It includes genealogical material and diaries.[2] These sources have hardly been used for quantitative analysis and while socially selective, since those recording these events were literate, if they exist in sufficient quantities then it may be possible to assess trends over time. The most famous example of this type of analysis is Hollingsworth's study of the peerage.[3] Subsequent work using Hollingsworth's data and similar material from other elite groups has produced plausible estimates of measures such as life expectancy and maternal mortality.[4] Unfortunately, this genealogical material was created mainly to record potential male heirs and females and infants dying shortly after birth may have been under-recorded.[5] Likewise, since many of these groups often moved between town and countryside it is difficult to disentangle how the combination of social and economic factors may have influenced their IMRs. Despite these problems Hollingsworth's study reveals the potential of these and similar data sets.

All the sources so far discussed enable IMRs to be calculated, but once this has been achieved it is of equal if not of greater importance to seek to explain both how and why rates varied and changed. Here it is important to adopt a multidisciplinary approach and the examination of a range of non-quantitative sources relating to childbirth, child rearing practices and infant care (evidence that is often neglected by demographic historians) has been useful in explaining general patterns.[6] Work relating to medical practices such as obstetrics and midwifery allow issues affecting birth to be explored.[7] Likewise, sources relating to poverty, the poor law, the aristocracy and environmental conditions may also help to understand the circumstances in which certain groups of infants were raised.[8] Problems of interpretation remain with these types of sources since it is difficult to generalise from interesting, but sometimes unique, examples. Explaining patterns of infant mortality is difficult given the fragmentary nature of this type of evidence; however, progress can be

Chester for the year 1773', *Philosophical Transactions of the Royal Society*, 65 (1775), pp. 85-90; J. Haygarth, 'Observations on the population and diseases of Chester, in the year 1774. By J. Haygarth M. D.', *Philosophical Transactions of the Royal Society*, 68 (1778), pp. 131-54; J. Heysham, 'Collected bills of mortality for Carlisle, 1779-1787', reprinted in D.V. Glass (ed.), *The Development of Population Statistics* (Farnborough, 1973).

1 T. Short, *New Observations on City, Town and Country Bills of Mortality* (London, 1750).

2 See above, pp. 1-9.

3 T.H. Hollingsworth, *The Demography of the British Peerage*, Supplement to *Population Studies*, 18 (1964).

4 R. Smith and J. Oeppen, 'Place and status as determinants of infant mortality in England c. 1550-1937', in E. Garrett, C. Galley, N. Shelton and R. Woods (eds), *Infant Mortality: a Continuing Social Problem* (London, 2006), p. 71.

5 Smith and Oeppen, 'Place and status', p. 76.

6 V. Fildes, *Breast, Bottles and Babies* (Edinburgh, 1986); V. Fildes, *Wet Nursing* (Oxford, 1988). For a discussion of how literature and art can enhance our understanding of this subject see R. Woods, *Children Remembered. Responses to Untimely Deaths in the Past* (Liverpool, 2006).

7 See the discussion in R. Woods and C. Galley, *Mrs Stone & Dr Smellie. Eighteenth-century Midwives and their Patients* (Liverpool, 2014).

8 For example, see Houlbrooke, *English Family Life*.

made if such sources are viewed as a whole. These issues will be explored in greater depth later in this paper when an explanatory framework for understanding variations in infant mortality will be developed. First it is necessary to discuss how IMRs can be calculated.

Methods for calculating infant mortality rates from parish registers: reconstitution

The classic means of extracting age-specific demographic data from parish registers is via a technique known as family reconstitution. This method employs a data linking procedure devised by the French demographer Louis Henry and adapted for English registers by E.A. Wrigley in his classic study of the Devon parish, Colyton.[1] So far approximately 50 registers have been analysed in this way, many in conjunction with work at The Cambridge Group for the History of Population and Social Structure.[2] Family reconstitution involves the linking together of all events recorded in a parish register that relate to a particular marriage. Once sufficient families have been reconstituted, intergenerational links are made and a wide variety of representative demographic rates can then be calculated, although results often have to be combined into cohorts of 25 years or more to ensure a sufficiently high population at risk. The technique yields robust demographic data, although it is imperative to ensure that the register is complete and contains sufficient detail over a long period of time so that correct links can be established.

Figures 2.2 and 2.3 show how the procedure works. First, all entries that relate to a particular family name, in this case the 'Bachelors' who lived in the parish of St Martin Coney Street, York, are grouped together in chronological order under the headings marriages, baptisms and burials (Figure 2.2). Next individual family histories are constructed by linking baptisms and burials to marriages, or if no appropriate marriage entry can be found, then a 'dummy one' is created (Figure 2.3). In some cases it may not be possible to make links with certainty. For instance, if the heads of two families living in the same parish have identical names then it may not be possible to assign events to the correct family unless additional information is provided. However, the linking process is relatively straightforward in this example despite the inconsistency in spellings.

With the exception of three asterisked burials (B2, B5, B8) all the other entries listed in Figure 2.2 can be linked to a particular family. The procedure starts with the marriage of Charles Bacheler to Phalix Galloway on 15 December 1566 (M1). The next event from this family is the burial of their daughter, Jane (B1). With no corresponding baptism having been recorded, it is necessary to assume that this child died unbaptised and a 'dummy' baptism is created with the same date as its burial. There then follow four baptisms to this marriage (Bp1-4), although as the amount of detail included in the register decreased during the 1570s it is not possible to assign with absolute certainty the baptisms of ffrances (Bp3) and Elizabeth (Bp4) to this family. Elizabeth's burial is recorded (B3) and the family passes out of observation with Charles' burial on 29 December 1586 (B4). This last burial has been

1 The technique is described in E.A. Wrigley, 'Family reconstitution' in E.A. Wrigley (ed.), *An Introduction to English Historical Demography* (London, 1966), pp. 96-129. Results from the Colyton reconstitution are reported in E.A. Wrigley, 'Family limitation in pre-industrial England', *Economic History Review*, 19 (1966), pp. 82-109 and E.A. Wrigley, 'Mortality in pre-industrial England: the example of Colyton, Devon, over three centuries' in D.V. Glass and R. Revelle (eds), *Population and Social Change* (London, 1972), pp. 243-73. See also, G. Newton, 'Recent developments in making family reconstitutions', *Local Population Studies*, 87 (2011), pp. 84-9.

2 See Wrigley *et al.*, *English Population History*.

Figure 2.2 Parish register entries for the 'Bachelor' family, St Martin Coney Street, York, 1561-1700

Marriages	
(M1) Charles Bachelor married Phalix galloway	15-12-1566
(M2) Matthew Batcheler married Margaret Porter servant to Mr Claphamson	1-2-1624
(M3) Mathew Batchlour married Emott Harrison	21-4-1629
Baptisms	
(Bp1) Charles Bacheler sonne of Charles Bacheler	6-8-1570
(Bp2) Alice Bacheler doughter of Charles Bacheler, glasier	26-10-1572
(Bp3) ffrances Batchelor	3-7-1578
(Bp4) Elizabeth Bacheler	15-11-1579
(Bp5) Robert Batchelour son of Mathew Batchelor	7-11-1624
(Bp6) Jane Batchelour daughter of Matthew Batchelor	10-11-1626
(Bp7) Matthew Batchlour sonne of Matthew Batchlour, Carpenter	19-4-1631
(Bp8) Marie Batchlour Daughter of Mathew Batchlor	20-1-1633
(Bp9) Elizabeth Batchler Daughter of Mathew Batchler	2-2-1636
(Bp10) Mary Bacheler ye daughter of Mathew Bacheler	28-1-1638
(Bp11) Jo$^{n.}$ the sone of Mathew Batcheler	6-6-1669
(Bp12) Mathew son of Mathew Batcheller, joyner	11-5-1671
(Bp13) Rob$^{t.}$ son of Mathew Batcheller, joyner	11-5-1671
(Bp14) Jo$^{n.}$ the sonne of Matthew Batcheler	24-6-1673
Burials	
(B1) Jane Bacheler, the Doughter of Charles Bacheler	16-5-1568
(B2) Thomas Bacheler	*8-2-1578**
(B3) Elizabeth Bacheler	5-4-1581
(B4) Charles Bacheler	29-12-1586
(B5) Elizabeth Batchlor, wief of John Batchlor of Newcastle	*12-4-1608**
(B6) Margaret Batchelor, wife of Mathewe Batchelor, Carpenter	5-6-1628
(B7) An infant of Mathew Batchlor's, Carpenter	28-2-1630
(B8) Dorothie Batchlour, widdow	*19-1-1633**
(B9) A male infant of Mathew Batchlers	21-1-1635
(B10) Elizabeth, the daughter of Mathewe Batchler	20-3-1637
(B11) Mary Bacheller, ye daughter of Mathew Bacheler	10-12-1637
(B12) Mary Batchaller, fillia Mathew Bacheler, Carpenter	20-11-1639
(B13) An infant of Mathew Bacheler, male kind	21-7-1641
(B14) Rob^{t}, the sone of Mathew Bacheller	12-1-1653
(B15) Mathew Bacheller, Carpenter	18-9-1660
(B16) Emott Batcheler, the wife of Mathew Batchelor, vid.	1-4-1671
(B17) Mathew, the sonne of Mathew Batcheller	25-4-1672
(B18) John, the sonn of Mathew Batcheler	3-7-1672
(B19) Rob^{t}, the sonne to Mathew Batcheller	18-8-1672
(B20) Mary, the wife of Mathew Batcheller	27-6-1673
(B21) John, the sonne to Mathew Batcheler	28-1-1675
(B22) mathew batchler	25-3-1697

Note: Asterisked burials cannot be assigned to a family.

Figure 2.3 Family reconstitutions for the 'Bachelor' family, St Martin Coney Street, York, 1561-1700

1. (M1) 15-12-1566 - Charles Bachelor (d. 29-12-1586 (B4)) Phalix Galloway

Children	Name	Baptised	Buried
1	**Jane**	**(16-5-1568)**	**16-5-1568 (B1)**
2	Charles	6-8-1570 (Bp1)	
3	Alice	20-10-1572 (Bp2)	
4	ffrances	3-7-1578 (Bp3)	
5	Elizabeth	15-11-1579 (Bp4)	5-4-1581 (B3)

2. (M2) 1-2-1624 - Matthew Bacheler Margaret Porter (d. 5-6-1628 (B6))

Children	Name	Baptised	Buried
1	Robert	7-11-1624 (Bp5)	12-1-1653 (B14)
2	Jane	10-11-1626 (Bp6)	

3. (M3) 21-4-1629 - Mathew Batchlour (d. 18.9.1660 (B15)) Emott Harrison (d. 1-4-1671 (B16))

Children	Name	Baptised	Buried
1	**Infant**	**(28-2-1630)**	**28-2-1630 (B7)**
2	Matthew	19-4-1631 (Bp7)	25-3-1697 (B22)
3	Marie	20-1-1633 (Bp 8)	10-12-1637 (B11)
4	**Infant**	**(21-1-1635)**	**21-1-1635 (B9)**
5	Elizabeth	2-2-1636 (Bp9)	20-3-1637 (B10)
6	Mary	28-1-1638 (Bp10)	20-11-1639 (B12)
7	**Infant**	**(21-7-1641)**	**21-7-1641 (B13)**

4. Mathew Batchler (b. 19-4-1631 (Bp7); d. 25-3-1697 (B22)) Mary ? (d. 27-6-1673 (B20))

Children	Name	Baptised	Buried
1	Jo$^{n.}$	6-6-1669 (Bp11)	3-7-1672 (B18)
2	**Mathew**	**11-5-1671 (Bp12)**	**25-4-1672 (B17)**
3	Rob$^{t.}$	11-5-1671 (Bp13)	18-8-1672 (B19)
4	Jo$^{n.}$	24-6-1673 (Bp14)	28-1-1675 (B21)

Note: Entries in bold refer to infant deaths.

Source: R. Beilby-Cook (ed.), *The Parish Registers of St Martin Coney Street, York, 1557-1812*, Yorkshire Parish Registers Series, 36 (1909).

assigned to the father, rather than the son, since by this date the register was again recording relationships to the head of household—this means that if the son had been buried it should have been recorded as 'Charles son of Charles Bachelor'. Note that without any additional information it is not possible to assign the burial of Thomas Bacheler (B2) to this family. Whilst the register appears to be complete, the lack of detail provided in the 1570s means that it would be unwise to include this family in the calculation of any subsequent demographic rates, in spite of the effort expended.

Matters improve with the other families. With the exception of the burial of 'Elizabeth wife of John Batcheler of Newcastle' (B5) there is a gap of 40 years until the next marriage, that of Matthew Batcheler to Margaret Porter on 1 February 1624 (M2). They baptised their first child nine months after their marriage (Bp5) and a subsequent one two years later (Bp6). Margaret then died (B6) and just ten months later Matthew remarried on 21 April 1629 (M3). Four children were baptised from this second marriage (Bp7-10), but another three children only appear in the burial register recorded as 'an infant of Mathew Bacheler' (B7, B9, B13). For whatever reasons this family clearly had little success in rearing their children as three died in infancy and another three in early childhood. Their only surviving son, also called Matthew, reappears in the register when he baptised a son, John, in 1669 (Bp11). His marriage is not recorded in the register. It probably took place in a different parish and therefore a 'dummy' marriage, without a date, has been created. This second Matthew baptised a further three children (Bp12-14), including a set of twins, and three days after the last baptism was recorded his wife, who we learn was called Mary, was buried, presumably having died as a consequence of giving birth. All Mathew Bacheler's children died in infancy or early childhood (B18-21) and the final entry (B22) records Mathew Batcheler's burial in 1697. The exceptionally high infant and childhood rates experienced by the 'Bachelors' are not typical of this parish in this period, although they are indicative of death clustering—the fact that many infant deaths occurred within a relatively few high risk families.[1] Such high rates may have been caused by a genetic disorder or poor maternal and child care, but without further evidence we cannot be certain.

Figures 2.2 and 2.3 illustrate the relative ease with which the process of reconstitution is carried out, although clearly when a full reconstitution covering the entire parish register period is undertaken the number of entries and amount of data generated is far greater. Likewise, if a larger parish was chosen the amount of data and number of links to be made would increase proportionally and it becomes increasingly more difficult to ensure that correct matches are made. Again it needs to be stressed that it is important that all unbaptised infant burials are listed in the burial register since then, as in (M3), they can be correctly placed within the sequence of baptisms. The strict set of rules needed to establish links often means that large numbers of events remain unlinked or, as with the earliest Bachelor family, they subsequently have to be excluded from the calculation of demographic rates and this gives rise to concerns about the representativeness of the so-called 'reconstitutable minority'.[2]

Reconstitution is also unable to determine the demography of the more mobile parts of the population since by definition these individuals will have recorded events in different parish registers and hence it is often impossible to trace their full demographic history. Reconstitution is consequently more difficult to perform in places such as towns where population turnover was high, there were multiple parishes and greater choice over where

1 During this period IMRs in the city of York were in the region of 260, see Galley, *Demography of Early Modern Towns*, pp. 98-9.

2 D. Levine, 'The reliability of parochial registration and the representativeness of family reconstitution', *Population Studies,* 30 (1976), pp. 107-30.

couples could marry. It is also possible that migrants and residents exhibited different demographic characteristics, although whether this extended to infant mortality is not known and it is difficult to discover precise data on this issue.[1] A further problem arises due to the need to link to a marriage (or a specially created 'dummy' one) which means that reconstitution necessarily excludes the analysis of illegitimate infant mortality. While illegitimate fertility was generally low (often less than 5 per cent) throughout early modern England, although it was not so low in parts of Scotland, illegitimates generally suffered much higher rates of mortality than legitimates.[2] Consequently, when E.A. Wrigley and his colleagues attempted to provide national estimates of infant mortality they were forced to assume that, as with some nineteenth century data, the illegitimate IMR was double that of the legitimate rate and this led to their legitimate rates derived via reconstitution being inflated by between 1 and 6 per cent.[3]

In spite of these problems, family reconstitution provides the most accurate means of determining IMRs in the parish register period. In most parishes mobility rates were low, and since the period of observation for calculating IMRs is one year and much infant mortality was concentrated into the early months, most infant deaths should be captured by this technique. Indeed, of all the rates calculated from reconstitution the IMR should be amongst the most accurate, provided of course that an accurate register has been used. Reconstitution can also yield a wealth of demographic material relating to childhood and adult mortality, nuptiality and marital fertility—even a cursory glance at Figure 2.3 reveals birth intervals close to two years in most instances. For those whose interest lies primarily in the study of infant mortality however, family reconstitution is far too time consuming to be a feasible proposition. The Colyton reconstitution took approximately one year to complete and even with the aid of advanced computing technology the linking procedure is not always straightforward and considerable human input is still required.[4] Whilst we should be grateful to those individuals who have already undertaken reconstitution studies, clearly a much less time-consuming method is required if large numbers of new registers are to be investigated.

A simpler linking method

In order to speed up the calculation of IMRs a simplified method of data linkage can be adopted. In this case it is not necessary to link baptisms and burials directly to a marriage; instead, for each baptism the burial register is searched over the following year to determine if the infant died within one year. In practice the procedure is easier to carry out if the method is reversed. Then events that specifically refer to adults can be automatically excluded from the linking process which is just confined to those burials listed as 'son or daughter of'. This method works best if the register has been printed or digitised since as the burial register is searched relevant links can be noted onto a copy of the baptism register.[5] Once the linking

1 See the discussion in King, 'Dying with style'.

2 See R. Adair, *Courtship, Illegitimacy, and Marriage in Early Modern England* (Manchester, 1996) for a discussion of illegitimacy.

3 Wrigley *et al.*, *English Population History*, pp. 217-24.

4 Newton, 'Recent developments'; R. Davenport, 'Urban family reconstitution—a worked example', *Local Population Studies*, 96 (2016), pp. 28-49.

5 This could easily be accomplished using computer software packages such as Excel or Access. Likewise, if the register has been printed then any links could be noted onto a photocopy of the baptism register.

process has been completed, rates can then be calculated in the usual way. This method has a number of advantages over reconstitution. All baptisms are in observation, including those of illegitimates and migrants who may be omitted from a reconstitution study. Any short gap in the register, which would preclude a full reconstitution from taking place, will only result in a similar small gap in the series of calculated IMRs. Its major advantage over reconstitution is that it is much quicker to perform and thus it enables a far greater range of registers to be included in any study. It also provides a relatively simple means of identifying potential problems with a register. If during this process it suddenly becomes more difficult to make links, then the most likely reason is that the quality of registration has deteriorated and this part of the register can be excluded from subsequent calculations.

The simplified linking method has one major disadvantage, however. It is much more difficult to deal with unbaptised infant burials, unless they are specifically identified in the register (see Figure 2.1, examples (5)-(8)). In cases where these burials are included, but not identified, they would simply be fitted into appropriate gaps in the sequence of baptisms in a reconstitution study (for example (B1) in Figures 2.2 and 2.3). This of course cannot happen when this simpler method is employed. The selection of an appropriate register is therefore crucial and it would be unwise to embark on this process unless some indication of unbaptised burials is provided for at least part of the study period. Figure 2.4 illustrates how baptisms and burials are linked with all the entries that form the numerator in the infant mortality calculation being highlighted in bold. Note that unbaptised infant burials were specifically labeled during the 1610s, although there must be some uncertainty about whether the stranger's child buried that was buried on 27 November 1617 was an infant.[1] The inclusion of unbaptised infant burials in the register crucially affects any IMRs that are calculated. Without these burials, the overall IMR would be 300 per 1,000 baptisms (6 dying from 20 baptisms) while their inclusion produces a rate of 417 (10 out of 24). These very high rates are partly a consequence of the very small sample size and the fact that exceptional years were selected to illustrate how the linking process is carried out (this of course also applies to the Bachelor family in Figures 2.2 and 2.3). In general, it was unusual for parish registers to identify unbaptised infant burials, but an exhaustive examination of York's parish registers revealed that they were recorded in sufficient numbers to provide a good estimate of their level throughout the period. Approximately seven per cent of all infants died unbaptised in York between 1561 and 1700 and this result was then used to correct the rates calculated using this method and provide an estimate of an overall IMR for the city. Reassuringly when the corrected rates were compared to those calculated following family reconstitution any differences were only slight.[2] This correction rate is of course dependent on both the delay between birth and baptism and the level of infant mortality, so the one calculated for York may not be suitable for universal application as levels of urban infant mortality were high during the early modern period. Reconstitution is a far more powerful tool than the simple linking procedure, but this second method has the potential to add greatly to our knowledge of infant mortality in the parish register period.

1 Note that in this register unbaptised burials are described as 'a child of X unbapt'. Different descriptions were used in other registers.

2 Galley, *Demography of Early Modern Towns*, p. 96.

Figure 2.4 Calculating infant mortality rates using a simple linking method, a worked example: St Mary Bishophill Junior, York, 1616-1617

1616

Thomas sone of Wm. Eshebourne the xjth daye of Februarye; Buried 23 February

Richard sone of Robert Greeneburye the xxviijth of Februarye

Aylce daughter of Jesper Dobyson the xxiiijth daye of Marche

Wm. sone of Wm. Teshe the xvjth daye of Aprill

Frances dawghter of John Coweme' the xxtie daye of June

Buried—a man Child of Guye Thompson of Hoolegaite unbap. the xxvjth August

John sone of Wm. Bynes the Last Daye of August

Tho: sone of Roger Wannop the first daye of October

Anne Dawghter of Thomas Stockdayle the xxviijth day of October; Buried 25 April 1617

1617

John Bryane the xxiijth daye of January

George sone of John Accers the ixth of Februarye

Buried—A child of Wm. Blithes of Overpopleton unbapt. the vth daye of Marche

Marye Dawghter of Thomas Labourne of Hollgaite the xvjthe Daye of Mar

Buried—A Child of Thomas Halls unbapt. the xxiijth daye of Maye

John Sone of John Barron the vijth daye of August; Buried 11 August

John Sone of John Browne the ixth daye of August

Elizabeth Dawghter of James Slaiter the xxviijth daye of August

Margerye Daughter of Francis Blackbourne the xxth daye of September

George Sonne of George Wright the iijth Daye of October; Buried 3 December

Ann dawghter of John Randell the xijth Daye of October

Elizabeth Dawghter of John Barrabye the xxth daye of November; Buried 26 November

A child of stranger the xxvijth daye of November

Anne dawghter of John Coward the third daye of December; Buried 7 December

Jaine dawghter of Thomas Manners of Hoolegaite the xiiijth daye of Dec.

Note: Entries in bold refer to infant deaths. Burial dates have been added to relevant baptism entries and unbaptised infant burials (in italics) have been added to the baptism register.

Source: F. Collins (ed.), *The Parish Register of St Mary Bishophill Junior, York, 1602-1812*, Yorkshire Parish Registers Series 52 (1915).

Estimating infant mortality rates using aggregate methods

When age at death is recorded in the burial register, a practice that became increasingly common during the late eighteenth century and especially after Rose's Act of 1812, it is possible to estimate infant mortality by dividing the number of infant deaths by the number of baptisms within any period. In this case it is still important that all unbaptised infant burials are included in the register, but they need not be specifically identified (Figure 2.1, example (9) for instance). This method of calculating infant mortality is highly sensitive to deficiencies in registration and, for accurate rates to be calculated, it is important to ensure that both baptismal and burial registration are complete. If this is not the case, then it needs to be established that those groups who are absent from the baptism register did not bury their dead in the parish graveyard. It is instructive to consider an example when examining both the potential and pitfalls of employing this method, and the one considered here is by Paul Huck, who used it to calculate IMRs in a number of northern industrial parishes between 1813 and 1836.[1] He assumed that burial coverage was largely complete and while he acknowledged that some infants died before they could be baptised, any losses were deemed to be small and confined to neonates. In the large industrial parishes which Huck was

Table 2.3 The possible extent of baptismal under-registration in nine industrial parishes, 1813-1836

	Population		Total	Baptism	Birth Rate
Parish	**1813**	**1836**	**Baptisms**	**Rate**	**1839-1841**
Walsall	11,330	17,724	7,718	22.7	30.6
Handsworth	3,178	5,509	2,483	24.7	41.9
West Bromwich	7,851	20,009	6,650	22.1	41.9
Sedgeley	14,535	22,599	9,288	21.4	48.3
Armley	3,169	5,411	3,152	31.7	38.9
Wigan	32,743	48,091	19,762	20.8	37.1
Great Harwood	1,754	2,353	2,660	54.6	38.7
Denton	1,670	3,099	3,781	69.3	38.6
Ashton	20,269	39,442	27,746	40.9	38.6

Note: There was some under-registration of births in the early years of Civil Registration, but this was likely to have been lower than in the parochial registration system that it replaced. See the discussion in chapter 3.

Sources: P. Huck, 'Infant mortality in nine industrial parishes in northern England, 1813-1836', *Population Studies*, 48 (1994), pp. 513-26, here at p. 534; Census of Great Britain, 1851; Registrar General, *Eighth Annual Report of the Registrar General* (London, 1848), British Parliamentary Papers 1847-48 XXV.

1 P. Huck, 'Infant mortality in nine industrial parishes in northern England, 1813-1836', *Population Studies*, 48 (1994), pp. 513-26.

considering, such assumptions need to be questioned, however. An approximate test of baptismal coverage in these parishes can be given by comparing Huck's baptism rates for 1813-36 (which can be estimated by assuming constant population growth between censuses) with the birth rate in 1839-41 in the Registration District (RD) in which each parish was located (Table 2.3). There will no doubt have been some variation between the birth rate in the parish and the much larger RD, but both rates should be broadly similar. However, as Table 2.3 shows, only in Ashton are the two rates close to each other. In most parishes less than half the expected number of children were baptised, whilst in Great Harwood and Denton astonishingly high baptism rates occurred. The most likely reasons for any shortfalls are, as Rickman mentioned, that a large proportion of the population were nonconformists and used different churches, or simply that many parents did not bother to have their children baptised. The very high rates in Great Harwood and Denton suggest that people from outside these townships must have been baptising infants in the churches in these places. Before accepting Huck's estimates of infant mortality, therefore, it is necessary to ensure that the proportion of the population who baptised their infants was identical to that which used the churchyard for burials. It would also be useful to compare burial registration in the parish with civil death registration data.

In Ashton, which appears to have good baptismal coverage, problems occur when no attempt is made to discover the extent to which all births and baptisms that occurred within the parish were faithfully captured in the register. In 1821, as a result of population pressure, work began on a new church in that parish, St Peter's. The building was consecrated in 1824 and a new register was started.[1] This register appears to be accurate; it recorded the ages of infant burials in months, but the IMR, calculated using the simple aggregate method, was an astonishing 841 deaths per 1,000 baptisms between 1824 and 1836. Furthermore, only 6 per cent of infant burials were aged under one month which suggests that there must also have been significant under-registration of neonatal deaths. The explanation for this very high IMR has, of course, nothing to do with levels of mortality in Ashton: quite simply more people used this new church for burials than for baptisms.[2] Between 1831 and 1837, 24, 24, 29, 25, 35, 51 and 37 baptisms were recorded annually compared with 66, 76, 84, 115, 132, 148 and 176 burials. Presumably with plenty of space in its new churchyard, burial plots were easy to obtain and people from all over Ashton, including Denton township, used this burial ground.

Dividing infant burials by total baptisms is a crude method of determining IMRs, especially in parishes which were subject to considerable population increase. It will produce accurate rates if registration is complete or the population at risk remained the same for both baptisms and burials. When age at death is consistently stated this method provides an easy means by which infant mortality can be assessed. Moreover, in the early nineteenth century any rates calculated by this method can readily be compared with those in the early years of civil registration. The great advantage of this method is that it is easy to undertake and provided that a number of simple checks are made, it should, in many instances, produce reliable rates.

1 Huck, 'infant mortality', p. 521; Lancashire Parish Register Society, 'Registers of St Peter's, Ashton-under-Lyne, St Peter's Blackley and St Lawrence's Chorley', *Lancashire Parish Register Society*, 129 (1990), pp. 1-36.

2 This appears to be a good example of 'traffic in corpses', see J. Boulton, 'Traffic in corpses and the commodification of burial in Georgian London', *Continuity and Change*, 29 (2014), pp. 181-208.

Assessing the accuracy of parish registers

Given the above difficulties, it is essential to ensure that IMRs calculated from parish registers provide a true picture of demographic patterns in the area under study. In many cases it is relatively simple to demonstrate when registration is defective since gaps in the register, a sudden change in the level of detail provided or an inability to make links between baptisms and burials are obvious to detect. However, it will always be difficult to prove that registration was perfect and no absolute test of the accuracy of parish registers exists. Cross checking with sources such as bishop's transcripts may reveal missing entries, but with no definitive source recording births and deaths there is always the possibility that lax recording methods may cause rates calculated from any form of record linkage to be unreliable. Moreover, since the results can only be fully tested after the linking process has been completed, the researcher may then be reluctant to abandon their work given the amount of time and effort they have invested in it. When Wrigley and his colleagues set about assessing national population trends using reconstitution, they selected 26 from a total of 34 of the most reliable ones that had then been undertaken.[1] Yet even within this highly selective sample, demographic data from only eight parishes were deemed sufficiently accurate to yield IMRs for the period 1790-1837 and these parishes comprised only 0.18 per cent of the national population in 1801.[2] Moreover, no clear set of criteria was used to establish the reliability of their results. The process they adopted makes much of the 'feel' of the register in terms of whether overall patterns of registration, especially of baptisms and burials, appeared plausible and sometimes a substantial decline in infant mortality was used as an indication of deteriorating registration.[3] Wrigley and his colleagues acknowledged potential problems in adopting this approach, specifically that any outlier parish which does not conform with expected patterns may be excluded from the sample. Despite this problem, all aspects of a register need to be carefully inspected in order to have confidence in the resulting demographic data. It is also important to be able to identify those registers that are likely to yield the most accurate rates before any time-consuming analysis is undertaken, but this is not always possible.

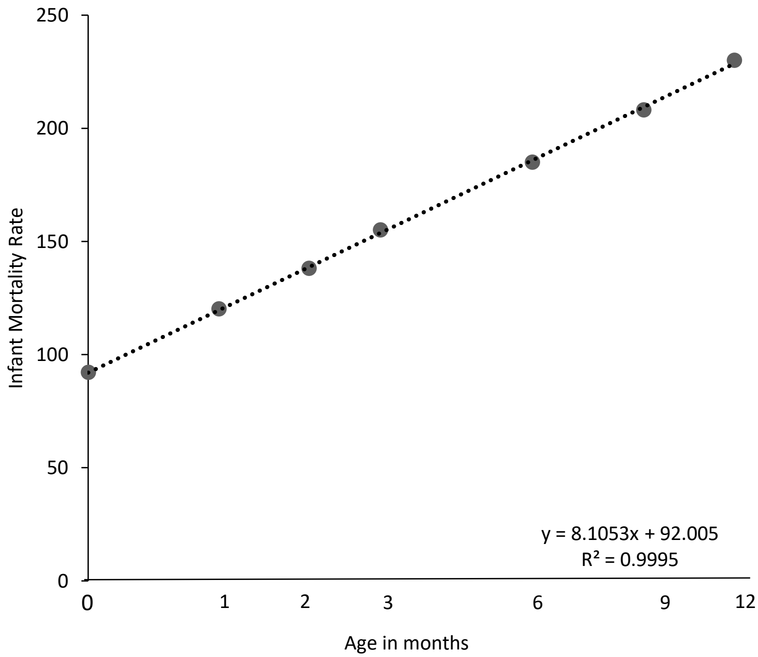
The only study that has sought to analyse patterns of infant mortality over a wide area in the parish register period was carried out by R.E. Jones who calculated IMRs in 60 mainly rural North Shropshire parishes.[4] Only those parishes with a printed register were chosen for analysis and the simple linking method was used to calculate IMRs. These registers yielded a range of rates for the period 1561-1810, but it was clear that many must have been affected by under-registration.[5] Jones showed that registration practices varied considerably within his sample and that the specific recording of unbaptised infant burials or stillbirths together with the fact that high infant burial rates were recorded by individual priests were useful indicators of a register's accuracy. Consequently, Jones identified a minority of 'good' registers and much of his subsequent analysis is based on these registers. Unfortunately, one consequence of Jones' methods was that those registers recording high IMRs were more likely to be deemed 'good' and it could not be established with certainty whether registers

1 Wrigley *et al.*, *English Population History*, pp. 20-3.
2 Wrigley *et al.*, *English Population History*, p. 26.
3 Wrigley *et al.*, *English Population History*, pp. 28-39.
4 R.E. Jones, 'Further evidence on the decline in infant mortality in pre-industrial England: north Shropshire, 1561-1810', *Population Studies*, 34 (1980), pp. 239-50 and Jones, 'Infant mortality'.
5 Jones, 'Infant mortality', pp. 309-11.

with lower rates were also accurate. Jones provides an interesting analysis of the problems of verifying the accuracy of parish registers and both of his articles provide rewarding reading.

In 1977 Wrigley, investigating the plausibility of IMRs produced via reconstitution, employed a more scientific approach to establish the accuracy of parochial registration, the so-called biometric analysis of infant mortality. This technique, devised by the French demographer Bourgeois-Pichat, examined the distribution of infant deaths and attempted to differentiate, in the absence of any cause of death data, exogenous deaths (those associated with the external environment) from endogenous deaths (those associated with disorders inherited from the mother and birth injuries).[1] Bourgeois-Pichat postulated that the cumulative IMR, and hence exogenous mortality, is proportional to the function $\log^3(n+1)$ where n = age at death in days. Thus, by drawing a graph of this relationship it should be possible to split endogenous from exogenous mortality since where the line of cumulative IMR crosses the y axis will give the endogenous rate (Figure 2.5). In this hypothetical

Figure 2.5 The relationship between the cumulative infant mortality rate and age at death



example the line of cumulative mortality is approximately straight and when the regression line is drawn it reveals an endogenous IMR of 92 compared to an overall IMR of 230. The neonatal IMR is 120 and consequently 28 (120-92) neonatal deaths per 1,000 live births must be due to exogenous causes. The relatively high level of endogenous mortality is reassuring

1 E.A. Wrigley, 'Births and baptisms: The use of Anglican registers as a source of information about the numbers of births in England before the beginning of Civil Registration', *Population Studies*, 31 (1977), pp. 281-312; J. Bourgeois-Pichat, 'An analysis of infant mortality', *Population Bulletin of the United Nations*, 2 (1952), pp. 1-14.

and implies that in this example registration is good; however, if the endogenous IMR is negative, implausibly low, or the line is far from straight, then questions need to be raised about the accuracy of the data. In many instances when IMRs calculated from parish registers are subjected to this examination the lines of cumulative infant mortality are straight and levels of endogenous mortality well above zero.[1]

As a greater amount of work has been undertaken on this technique a significant number of exceptions have been found to this so-called 'rule'. First, the line of cumulative IMR is not always straight. It can be affected by differing breastfeeding patterns,[2] and even two of the examples selected by Bourgeois-Pichat, Quebec (1944-7) and Sardinia (1948), were not straight.[3] Second, the regression line has been calculated in various ways. Different numbers of data points scattered over the first year of life have been used, and attempts have been made to use both linear and quadratic (curvilinear) regression.[4] Such seemingly subtle technical matters nevertheless can have a profound effect on the calculated levels of endogenous mortality. A quadratic regression will nearly always produce a better fit and usually lead to higher levels of endogenous mortality. Third, it is not known why Bourgeois-Pichat fixed upon the transformation $\log^3(n+1)$, and, with no accurate cause of death information being available in the parish register period that allows endogenous and exogenous infant mortality to be differentiated, it is not possible to provide an independent verification of this technique.[5] To illustrate these points Figure 2.6 uses early county-level civil registration data and compares endogenous and overall IMRs calculated using linear (a) and quadratic (b) regressions respectively. We might suppose that early nineteenth-century civil registration data are more accurate than those derived from many parish registers, but even here, very low or sometimes even negative endogenous IMRs can result when these regression methods are used.[6] The linear regression appears to provide a particularly bad fit with the three metropolitan counties having endogenous rates of 0.9, 8.7 and -2.3 and 20 of the 47 counties recording endogenous IMRs less than 20. Similar counties also recorded very different endogenous rates: compare rates of 32.7 in West Riding of Yorkshire with 12 in Lancashire and 10.6 in Devon with 37.3 in Lincolnshire.[7] Conventionally this would suggest that many areas experienced considerable under-registration, but, if this was the case, then variations in under-registration must have been far greater than those calculated by

1 Wrigley *et al.*, *English Population History*, p. 227; Galley, *Demography of Early Modern Towns*, p. 60. The straightness of the regression line is given by R^2 which should be 1 if the fit is perfect.

2 J. Knodel and H. Kintner, 'The impact of breast feeding patterns on the biometric analysis of infant mortality', *Demography*, 14 (1977), pp. 391-409.

3 Bourgeois-Pichat, 'analysis of infant mortality', p. 8.

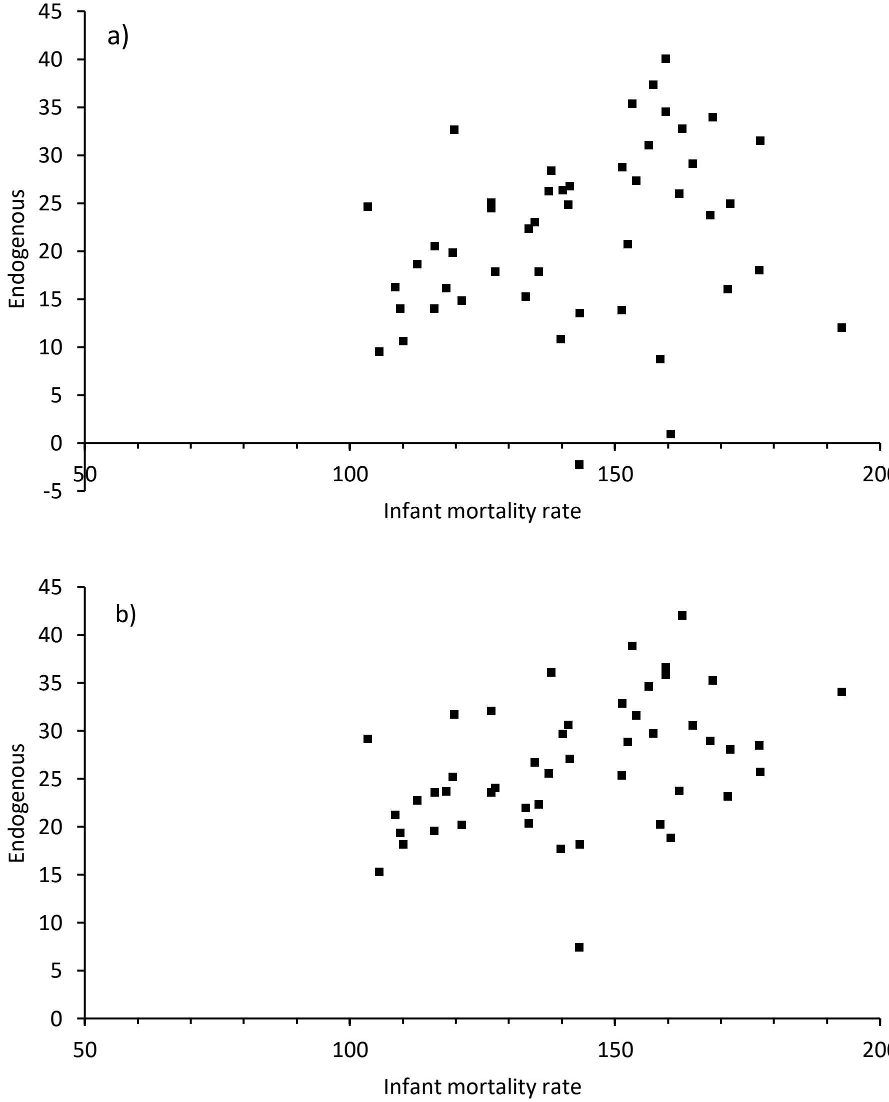
4 Compare Wrigley, 'Births and baptisms', pp. 283-4 which uses a linear regression with Wrigley *et al.*, *English Population History*, pp. 225, which uses a quadratic regression.

5 See the discussion in C. Galley and R. Woods, 'On the distribution of deaths during the first year of life', *Population: An English Selection*, 11 (1999), pp. 35-60 which argues that whilst this technique is still useful 'there is no one fixed law-like relationship' concerning the distribution of deaths over the first year of life (p. 57). Rather there are substantial variations both over time and space, and while it cannot as yet be demonstrated, this is also likely to be the case in the parish register period.

6 For a full discussion of these issues see Galley and Shelton, 'Bridging the gap'; Wrigley, 'Births and baptisms', pp. 299-304. For a discussion of some early resistance to civil registration see M. Nissell, *People Count. A History of the General Register Office* (London, 1987) pp. 20-4.

7 When a similar exercise was carried out using RD data 19 recorded negative endogenous rates, see Galley and Shelton, 'Bridging the gap', p. 72. One district, Great Yarmouth, even had a negative endogenous rate when a quadratic regression was used.

Figure 2.6 The relationship between endogenous and total infant mortality rate calculated by, a) linear regression and b) quadratic regression, English and Welsh registration counties, 1839-1846



Sources: Registrar General, *Eighth Annual Report of the Registrar General* (London, 1847), British Parliamentary Papers 1847-48 XXV; Registrar General, *Ninth Annual Report of the Registrar General* (London, 1848), British Parliamentary Papers 1847-48 XXV.

Teitelbaum given that many districts apparently experienced none.[1] The quadratic regression appears to provide better results, but endogenous rates still ranged from 7.4 in metropolitan

1 M.S. Teitlebaum, 'Birth underregistration in the constituent counties of England and Wales: 1841-1910', *Population Studies*, 28 (1973), pp. 329-43. Teitlebaum's Table 1 provides county correction rates to compensate for birth under-registration and these bear little relationship to the pattern revealed in Figure

Kent to 38.8 in Durham. Figure 2.6 therefore shows that levels of endogenous mortality varied considerably in the period 1839-46, in part due to the methods used. It also suggests that absolute levels of endogenous mortality cannot be calculated and appears to challenge the view 'that a low endogenous mortality of about 20-35 per 1,000 prevailed generally in England by the mid-nineteenth century, whatever the overall level of infant mortality'.[1] Indeed, only 53 per cent of counties experienced endogenous IMRs in the range 20-35, calculated using linear regression, although this increases to 76 per cent if a quadratic regression is used. It is therefore necessary to raise questions about whether this technique can be used to establish the accuracy of data compiled from parish registers.[2]

A final consequence of Bourgeois-Pichat's 'test' is that it assigns a large proportion of neonatal deaths to endogenous causes. This has led some who have examined changing levels of neonatal mortality in the parish register period to focus almost exclusively on the endogenous component, thereby downplaying the possible influence of neonatal infections which may have been of great significance during this period.[3] While examining the distribution of deaths in the first year of life is undoubtedly useful in assessing the accuracy of sources for infant mortality, with no independent assessment of the Bourgeois-Pichat 'test' being possible, the apparent mathematical precision of this technique may lead to some of the real changes becoming obscured.[4]

At this point it is worthwhile reiterating that no absolute test of a register's accuracy can exist. However, by employing a series of simple checks an assessment of parochial registration can be made, but throughout the process it is necessary to treat parish registers as qualitative as well as quantitative sources. The researcher needs to develop a 'feel' for the register's accuracy and as the analysis proceeds any problematic parts of the register can be excluded from subsequent analysis. Indeed, this process is similar to how an expert would establish the authenticity of an old master painting. Careful inspection of the register, preferably the original one, an understanding of how easily the various links can be established, together with an examination of the consistency of the resulting demographic data should enable the researcher to have confidence in their results. Of course, any process which includes a subjective element may be open to question, but a flexible approach is essential in order to make the maximum use of these valuable sources. The following series of checks on the accuracy of a parish register should therefore be used as a guide rather than as a rigorous series of tests.

2.6. For example, Lancashire with low endogenous mortality has a correction rate of 1.012 while West Riding with high endogenous mortality has a correction rate of 1.063. See also the discussion on pp. 122-5.

1 Wrigley *et al.*, *English Population History*, p. 233.

2 It would certainly appear unwise to use Bourgeois-Pichat's test to correct for under-registration. See Huck, 'Infant mortality in nine industrial parishes', p. 518 who corrects the IMRs calculated in his nine parishes by assuming that all under-registration takes place in the first month and endogenous mortality was 25 per 1,000 live births. In 1813-24 Huck calculated endogenous mortality rates ranging from 15 to -3 which conventionally would suggest that all his registers are defective.

3 N. Hart, 'Beyond infant mortality: Gender and stillbirth in reproductive mortality before the twentieth century', *Population Studies*, 52 (1998), pp. 215-29; E.A. Wrigley, 'Explaining the rise in marital fertility in England in the 'long' eighteenth century', *Economic History Review*, 51 (1998), pp. 435-64. V. Fildes, 'Neonatal feeding practices and infant mortality during the 18th century', *Journal of Biosocial Science*, 13 (1980), pp. 313-24.

4 Galley *et al.*, 'Detection without correction'.

(1) Before commencing any linking procedure, it is essential to ensure that the quality of registration is high. It is necessary to check that sufficient details, such as parental names or ages at death, which will allow infant deaths to be linked to baptisms, are consistently recorded in the burial register. Unless a full reconstitution is to be carried out, some indication of the recording of unbaptised infant burials is essential. It is also useful to carry out an aggregative analysis of annual totals of baptisms, burials and marriages in order to detect any obvious gaps or periods of deteriorating registration.[1] Some assessment of nonconformity should also be undertaken; this is especially important if for instance baptisms from such groups are not recorded, but burials are. Once linking is underway it is important to note any increase or decrease in the ease with which the process is carried out, especially if this coincides with a change in the parish clerk. Likewise, a sudden decrease in the IMR may also be indicative of deteriorating registration practices.

Table 2.4 Variations in registration district birth rates, 1841 and 1861

	Birth rates	
	1841	1861
Minimum	22	19
Maximum	48	46
Mean	31.7	33.0
Median	31	33
Standard Deviation	4.2	4.0

Sources: Registrar General, *Fifth Annual Report of the Registrar General* (London, 1843), British Parliamentary Papers 1843 XXI; Registrar General, *Twenty-fourth Annual Report of the Registrar General* (London, 1863), British Parliamentary Papers 1863 XIV.

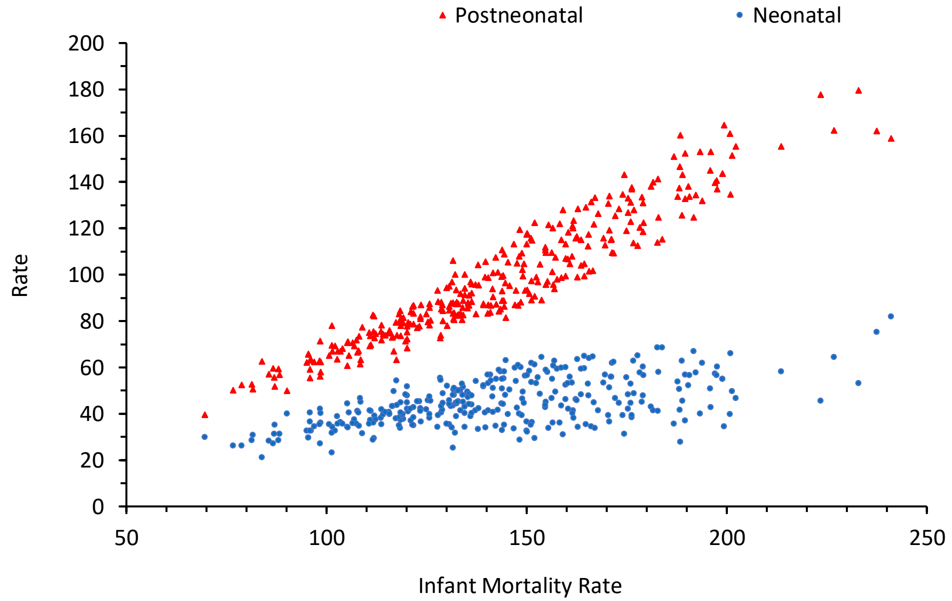
(2) If post-1800 parish registers are examined, or a rare local enumeration exists, then the baptism rate can be checked. Table 2.4 shows the extent of variations in birth rates for English and Welsh RDs in 1841 and 1861. By 1861 civil registration was working reasonably well and marital fertility had not begun to fall, so the main influences on birth rates would have been the age structure of the population and the proportion of women who were married.[2] It is likely that the pattern revealed in Table 2.4 would have been similar to that before 1837, although it should be remembered that parishes were much smaller units than RDs and therefore they might have been subject to greater variation. The national birth rate was 32.2 per 1,000 population in 1841 and 34.7 in 1861. Locally, birth rates varied considerably, from 19 to 46 in 1861, although about 96 per cent of RDs recorded birth rates between 25 and 40 (two standard deviations from the mean). Clearly any rates much beyond these limits will be suspicious and require further investigation (see Table 2.3). In a similar way the burial rate could be checked against the death rate in the early civil registration period, but even if the burial rate appears plausible it is still necessary to check that all infant burials have been recorded.

1 See E.A. Wrigley and R.S. Schofield, *The Population History of England 1541-1871. A Reconstruction* (London, 1981), pp. 16-30.

2 R. Woods, *The Demography of Victorian England and Wales* (Cambridge, 2000), p. 166.

(3) Next a comparison of neonatal and post-neonatal IMRs is useful. In the first instance any calculated rate can be compared with those from the early years of civil registration (Figure 2.7). In every case post-neonatal IMRs are greater than neonatal ones and they tend to increase steadily with respect to the overall IMR. Neonatal rates show less variation, with a range from 21 to 82, compared with 40 to 180 for post-neonatal IMRs.[1] However, both neonatal and post-neonatal mortality exhibit considerable variation. Figure 2.7 suggests that neonatal rates calculated from parish registers that are below 20 should lead one to suspect the register's accuracy, while rates greater than 80 indicate that a significant change in the age structure of infant deaths must have occurred before the mid-nineteenth century. Figure 2.7 also appears to tell a more consistent story than Figure 2.6 with much of the variation in post-neonatal rates probably being associated with differences in disease environments. By contrast, any similar association with neonatal mortality is much weaker. Moreover, given that endogenous factors accounted for much neonatal mortality and if, as many have assumed, endogenous mortality rates were broadly similar across the country, then endogenous mortality rates must have been low, perhaps less than 20, and neonatal exogenous mortality rates must have varied considerably between places experiencing very similar IMRs (see below for further discussion of these data).

Figure 2.7 Neonatal, post-neonatal and total infant mortality rates for Registration Districts, England and Wales, 1839-1844



Source: Registrar General, Eighth Annual Report of the Registrar General of Births, deaths and Marriages in England, British Parliamentary Papers 1847-48 XXV [C. 967].

1 The mean post-neonatal mortality rate was 97.5 (standard deviation 26.6) and the mean neonatal mortality rate 45 (standard deviation 10.2). Linear regression equations for associations with the IMR are: $y = 0.8103x - 17.963$, $R^2 = 0.9037$ (post-neonatal); $y = 0.1897x + 17.963$, $R^2 = 0.3397$ (neonatal).

(4) In an extension to (3), it is also instructive to examine the distribution of deaths during the first year of life. This allows those infant deaths most likely to be missing from any registration system—those that took place on the first day and during the first week—to be examined. Table 2.5 shows the distribution of burials and deaths in a variety of places. It is appropriate to start with St Michael le Belfrey, York in the two periods when age at death was recorded. The sixteenth-century register contains entries of exceptional detail (also see Figure 1.1, example (7)):

> 1580—John Franklande, sonne to Mr Richarde Frankelande, Register, aboute one hower oulde, buryed the xxviijth day of June; baptized at home because of weakness;[1]

> 1581—Agnes Stockdayle, daught'r to george stockdayle, seaven days ould, buried the iiijth day of February.[2]

The overall quality of this register suggests that the resulting estimates of infant mortality should be accurate. In this period the IMR was 247; 61 per cent of infant burials were neonatal and the numbers dying in the first week and on the first day were also very high.[3] It is possible that some stillbirths may have been recorded as though they were live born, although the individual entries do not support this since in every case explicit mention is made that the infant had lived, at least for a short time. By comparison, at the end of the parish register period when ages were again recorded in St Michael le Belfrey, only 24 per cent of infant burials were neonatal and only 2 per cent were first day burials. Indeed, it seems that it was burials, similar to those listed above, that are missing from the later register. While this result is in line with national patterns, it is likely that neonatal mortality in St Michael le Belfrey may have fallen between the sixteenth and late-eighteenth/early-nineteenth centuries, but suspicion must remain that it did not fall by over 100 per 1,000 live births (from 151 to 42), especially since most of the difference occurred within the first week, and especially on the first day, when registration was most likely to have been under greatest pressure. Between these two periods the overall recorded IMR also fell from 247 to 130, but by the beginning of civil registration the IMR in York RD was 180, with this figure probably underestimating the rate in the city itself.[4] The most likely explanation for

1 F. Collins (ed.), *The Register of St Michael le Belfrey, York part 1, 1565-1653*, *Yorkshire Parish Registers Series*, 1 (1899), p. 32.

2 Collins, *St Michael le Belfrey, part 1*, p. 33.

3 Similar high levels of early age deaths were found in parts of France. According to G.D. Sussman, 'Parisian infants and Norman wet nurses in the early nineteenth century: a statistical study', *Journal of Interdisciplinary History*, 7 (1977), pp. 637-53, here at pp. 643-4, '[i]n a group of nearly 2,000 infant deaths which occurred in nineteen parishes in the southern *banlieue* (suburbs) of Paris in the late eighteenth century among children who were born and died in the same parish, 13.2 percent of the infant deaths occurred in the first day of life and 28.7 percent in the first week; fewer deaths occurred in the last seven months of the first year (27.8 percent) than in the first seven days'.

4 See the discussion in Galley, *Demography of Early Modern Towns*, pp. 178-9. The neonatal mortality in York RD was 67 in 1839-44, compared to an IMR of 201 which means that 33.4 per cent of infant deaths were neonatal, Registrar General, *Eighth Annual Report*, p. 230.

Table 2.5 Percentage distribution of deaths during the first year of life, selected English examples

	Days		Weeks		Months					
Place and time	0	1-6	0	1-3	0	1	2	3-5	6-11	IMR
St Michael le Belfrey York, 1571-1586[a]	25	21	46	15	61	6	3	16	12	247
	(33)	*(27)*	*(60)*	*(19)*	*(79)*	*(8)*	*(6)*	*(21)*	*(16)*	*(135)*
St Michael le Belfrey York, 1779-1837[a]	2	7	10	14	24	18	8	20	29	130
	(10)	*(30)*	*(40)*	*(57)*	*(97)*	*(74)*	*(34)*	*(82)*	*(116)*	*(437)*
York Registration District, 1839-1846[b]					32.6	15.2	8.7	18.3	25.2	180
					(666)	*(310)*	*(177)*	*(374)*	*(513)*	*(2,040)*
English parish reconstitutions, 1813-1837[c]	4.1	10.5	14.6	18.7	33.3	11.5	8.1	17.4	29.6	*c.*140
Sheffield 1870-1871[d]	5	7	12	14	26	12	8	19 *(658)*	34	201
	(158)	*(238)*	*(196)*	*(473)*	*(869)*	*(415)*	*(289)*		*(1,172)*	*(4,468)*
England and Wales 1906[e]	8.9	10.0	18.9	12.7	31.6	10.8	8.6	20.3	28.7	133

Note: Figures in brackets refer to sample size.

Sources: a) F. Collins (ed.), *The Parish Register of St Michael le Belfrey, York*, 'part 1, 1565-1653', Yorkshire Parish Registers Series, 1 (1899), 'part 2 1653-1778', Yorkshire Parish Registers Series, 11 (1901); b) Registrar General, *Fifth Annual Report of the Registrar General* (London, 1843), British Parliamentary Papers 1843 XXI; Registrar General, *Twenty-fourth Annual Report of the Registrar General* (London, 1863), British Parliamentary Papers 1863 XIV; c) E.A. Wrigley R. Davies, J. Oeppen and R.S. Schofield, *English Population History from Family Reconstitution 1580-1837* (Cambridge, 1997), p. 241 (reported rates were: 1800-24, 136; 1825-37, 144); d) C. Galley, N. Williams and R. Woods, 'Detection without correction: problems in assessing the quality of English ecclesiastical and civil registration', *Annales de Démographie Historique*, (1991), pp. 161-83, here at p. 172; e) Registrar General, *Sixty-ninth Annual Report of the Registrar General* (London, 1908), pp. cxviii-cxix, British Parliamentary Papers 1908/XVII (Cd. 3833).

such differences was that many neonatal burials were missing from the parish register and that by the late eighteenth century registration in St Michael le Belfrey had deteriorated.

The sample drawn from parish reconstitutions provides similar evidence to suggest that by the early nineteenth century neonatal mortality had fallen. When parish register data are used the proportion of burials occurring on the first day is partly a construct since it is necessary to assume that all unbaptised infant burials died on the day they were born and any lengthening of birth-baptism intervals would consequently tend to shorten the calculated age at death. Wrigley and his colleagues found that nearly 15 per cent of burials occurred in the first week and 33 per cent in the first month. Levels significantly below these will cast doubt on the accuracy of a register, but, given the wide variation revealed in Figure 2.7, there was also probably some significant differences between the age structure of infant burials in urban parishes such as St Michael le Belfrey and the predominantly rural sample of Wrigley and his colleagues. The figures given in Table 2.5 should therefore only be used as a broad guide.

By the 1870s more robust civil registration evidence can be examined. The Sheffield data, which were extracted from a copy of the civil death register, also show significant numbers dying during the first day, week and month. They also reveal that slightly over half of all first day infant deaths were aged under two hours.[1] Clearly then, in order to have confidence in any registration system there needs to be significant numbers of very early age deaths. This conclusion is also supported by data published in the Registrar General's *Annual Report for 1906* (comparable breakdowns of neonatal infant deaths into days and weeks were not published by the Registrar General during the nineteenth century). A high proportion of neonatal deaths is again evident, although this result needs to be tempered by the fact that by 1906 post-neonatal mortality had begun to fall as the secular decline in infant mortality was underway. Nevertheless, nearly 19 per cent of deaths occurred in the first week with 8.9 per cent occurring on the first day. These results add further weight to the view that much infant mortality occurred within the first hours and days of life.[2]

Examining the distribution of infant deaths is an important way of determining a register's accuracy. However, more evidence is needed to establish whether the pattern in sixteenth-century York is typical of a high mortality parish in this period. Likewise, comparative distributions for the late eighteenth and early nineteenth centuries are needed to establish the extent to which neonatal mortality had declined between the two periods. It is also important to establish whether late-nineteenth- and early-twentieth-century data can provide a true comparison with parish register data. Thus, while this exercise has raised more questions than it has answered, one thing is certain: any new data must include a high number of early age deaths for us to have confidence in its accuracy.

1 Galley *et al.*, 'Detection without correction'.

2 See Woods and Galley, *Mrs Stone and Dr Smellie* for a discussion of the influence of midwifery practice on infant survival chances.

(5) It may also be useful to examine the mortality of two especially vulnerable groups of infants—multiple births and illegitimates. Both experienced very high levels of mortality, often at least twice that of other infants. Many twins had low birth weights and died close to their birth so consequently they may have experienced higher rates of under-registration than other infants. Most illegitimates were first births which brought additional risks to the infant and many of their mothers had access to fewer social supports so raising infants single-handedly proved especially difficult in the parish register period. The illegitimate IMR can of course only be examined if illegitimates are specifically identified in the register and this was not always the case. Twins will have been recorded, although given their vulnerability, it was not unusual for only one twin to survive until baptism, the other being stillborn or only surviving for a short period and dying unbaptised.[1] In such cases only a singleton may have been recorded in the register. In the first instance the twinning rate should be calculated since 'in most Western countries twins occur once in 80-100 births, so that one person in, say, 45 is a twin'.[2] Relatively few twin IMRs have been calculated, but Wrigley and his colleagues found rates to be 410 per 1,000 live births.[3] Rates below this figure should give cause for concern, as should illegitimate IMRs substantially lower than double the legitimate rate. An examination of these rates in late-eighteenth- and early-nineteenth-century registers may be rewarding and provide a simple way of assessing the reliability of registration in the period when under-registration was at its height.

There can be no hard and fast rules when attempting to verify the accuracy of a particular register, especially given that perhaps the most important indicator of the changing quality of registration is a change in the IMR. This causes special problems in a period such as the late eighteenth century when infant mortality in many places was in decline since it can never be certain the extent to which any recorded changes were real rather than a consequence of deteriorating registration. In such cases the researcher will need to rely on the 'feel' of the register, especially with respect to how links between infant burials and baptisms are established. Throughout the process it is important to remember that parish registers originated in an age with different notions of number and mathematical precision than today, and even when the so-called 'Dade' registers were introduced into some parishes during the late eighteenth century specifically to improve registration, such innovations did not necessarily extend to more accurate recording of infant mortality.[4] In this case, extra details were included in the register in order to identify individuals for legal purposes, but of course these were not needed if an infant died shortly after birth.

1 Twins were not always specifically labelled, but they can usually be identified because two infants with the same father's name were baptised on the same day. Care should be taken to ensure that multiple family baptisms, whereby previously unbaptised siblings are baptised alongside an infant, are excluded—these can usually be identified since the twin and triplet rates suddenly increases.

2 A.S. Parkes, *Patterns of Sexuality and Reproduction* (Oxford, 1976), p. 74. Triplets and quadruplets were rare with triplets occurring in about one in 8,000 births. The use of fertility treatments has altered these rates.

3 Wrigley *et al. English Population History*, p. 244. In early modern York the twin mortality rate was over 500, see Galley 'The survival of twins in early modern society'.

4 C. Galley, 'An exercise in Dade parish register demography: St Olave, York, 1771-1785', *Local Population Studies*, 74 (2005), pp. 75-83; A. Levene, 'What can Dade registers tell us about infant mortality in the later eighteenth century?', *Local Population Studies*, 76 (2006), pp. 31-42.

Above all the researcher needs to be sensitive as to how and why registration may be changing and whilst such 'feelings' are difficult to quantify and are bound to be subjective, they nevertheless remain important indicators of the overall accuracy of a register. It is also important to consider this issue when undertaking computer assisted linking since in this procedure the human element is minimised and it should prove useful to examine the original register together with carrying out the above five 'tests'. Despite the many problems relating to establishing the accuracy of parish registers, through the endeavours of a number of diligent parish clerks, many high-quality registers have survived, and issues relating to infants, about which contemporaries had little understanding, can now be quantified, analysed and discussed.

Calculating IMRs from parish registers

Once the accuracy of a parish register has been established, the process of deriving IMRs is relatively straightforward. The following exercises are intended to show how even small-scale analyses can provide interesting results. Three registers, from Rothwell, West Yorkshire, Hackness, North Yorkshire and Banbury, Oxfordshire have been selected and in each case some prior indication that the register would yield reliable material had been given.

Rothwell

The parish register of Rothwell was chosen because it had been published by the Yorkshire Parish Register Society and Michael Drake noted that unbaptised infant burials were recorded, '[i]n the parish of Rothwell (it lies between Leeds and Wakefield) 135 out of 1231 entries in the burial register for the years 1634-48 bear the description "infants not baptised"'.[1] The accuracy of any infant mortality calculation is dependent on all unbaptised infants being recorded and examination of this register showed that these events appear consistently throughout the period 1606-48. The following entries are typical:

(1) Filius Thomae Dobson non baptizus, sepulta fuit 9º de Julij (1620);
(2) Infans Dionisii Hodgson non bap' sepult' fuit decimo octavo die Maye (1627);
(3) Bap—Samuel fil. Antonij Dobson de Rodes nono die March (1633);
(4) Bur—Samuel fil. Antonij Dobson de Rodes decimo non die March (1633).[2]

While the register was written in Latin, only a slight knowledge of that language is needed to understand each entry. Examples (1) and (2) state explicitly that both infants were buried (*sepulta*) unbaptised, while (3) and (4) show that sufficient details were included to allow links between baptism and burial to be made. An aggregate analysis confirmed that there appeared to be no gaps in registration and detailed examination of the register suggested that sufficient information was included to enable links to be established with certainty throughout the period. There was also no indication that the accuracy of this register was affected by nonconformity and consequently it was decided to proceed with the calculation of IMRs using the simple linking method. Table 2.6 reports the necessary demographic data needed

1 M. Drake, 'An elementary exercise in parish register demography', *Economic History Review*, 14 (1962), pp. 427-45, here at p. 429; G.D. Lumb, *The Registers of the Parish Church of Rothwell c. York part 1 1538-1689*, Yorkshire Parish Registers Series, 27 (1906).

2 Lumb, *Registers of the Parish Church of Rothwell*, pp. 165, 172, 195 and 238.

Table 2.6 Demographic data from Rothwell parish register, 1606-1648

Year	Baptisms	Total burials	Infant burials	Non-baptised infant burials	Infant mortality rate per 1,000 live births
1606	59	51	8	5	203
1607	64	36	6	3	134
1608	55	38	11	1	214
1609	70	45	6	5	147
1610	62	43	5	6	162
1606-1610	**310**	**213**	**36**	**20**	**170**
1611	49	50	10	3	250
1612	59	53	10	4	222
1613	64	35	4	6	143
1614	64	44	8	2	152
1615	50	44	11	5	291
1616	55	68	8	8	254
1617	72	71	9	0	125
1618	68	79	10	5	205
1619	65	58	10	1	167
1620	70	59	9	8	218
1611-1620	**616**	**561**	**89**	**42**	**199**
1621	76	46	9	7	193
1622	52	38	6	3	164
1623	57	75	7	7	219
1624	52	68	9	12	328
1625	102	63	12	2	135
1626	70	44	11	5	213
1627	65	56	8	7	208
1628	90	71	16	3	204
1629	87	58	6	7	138
1630	88	55	13	3	176
1621-1630	**739**	**574**	**97**	**56**	**192**
1631	81	58	6	6	138
1632	99	81	10	6	152
1633	95	76	17	3	204
1634	83	88	14	12	274
1635	100	115	14	12	232
1636	80	101	11	18	296
1637	91	65	15	4	200
1638	81	71	9	6	172
1639	85	92	12	8	215
1640	98	79	15	5	194
1631-1640	**893**	**826**	**123**	**80**	**209**
1641	99	90	15	5	192
1642	104	63	17	9	230
1643	87	121	12	7	202
1644	92	73	15	14	274
1645	95	68	8	12	187
1646	95	38	7	5	120
1647	97	96	10	7	163
1648	78	67	8	13	231
1641-1648	**747**	**616**	**92**	**72**	**200**
1606-1648	**3,305**	**2,790**	**437**	**270**	**198**

Note: The infant mortality rate is calculated by adding together infant burials and unbaptised infant burials and then dividing by baptisms plus unbaptised infant burials.

Source: Original calculations from G.D. Lumb, *The Registers of the Parish Church of Rothwell c. York, part 1 1538-1689*, Yorkshire Parish Registers Series, 27 (1906).

to calculate IMRs in Rothwell. It shows that a high proportion of infant burials would have been lost had unbaptised burials not been recorded. Most of these burials were a consequence of birth-baptismal delay, about which nothing is known, and after 1622 every non-baptised burial is labeled *Infans* (example (2)). Had some of these burials been nonconformist ones they would have included some older children and the term *Infans* would have been inappropriate. Unbaptised burials amounted to 11.7 per cent of all burials and 8.8 per cent of births—had they been missing from the register then the overall IMR of 198 per 1,000 live births for 1606-48 would have been reduced to 123. Both rates are within the range recorded by parishes in this period (see Table 2.10), but without unbaptised burials being identified it would have been impossible to determine the extent of baptism under-registration in this parish and an inaccurate picture of infant mortality would have been given.

Further calculations using the Rothwell data suggest that the IMRs reported in Table 2.6 are credible. Between 1606 and 1648, 38 sets of twins could be identified, giving a twinning ratio of 93 per 1,000 birth events which sits favourably in the expected range of 80-100.[1] Of these 76 twins, 47 died within one year resulting in the very high IMR of 618, well above the 410 in Wrigley and his colleague's sample of parishes. In Rothwell illegitimates were identified between 1618 and 1646 with 67 recorded in the baptism register and a further 9 dying unbaptised. This produces an illegitimacy rate of 29.2 per 1,000 births ((76/2,607) x 1,000), which is low, but comparable to others in the parish register period.[2] Of the 76 illegitimates 31 died in their first year which gives an illegitimate IMR of 408 ((31+9)/(76+9) x 1,000). While relatively little is known about illegitimate mortality, reassuringly this was just over twice the overall rate of 198 which again might have been expected. It also means that the IMR for legitimates in Rothwell was 191.

As far as it is possible to tell, the above analysis has yielded accurate estimates of infant mortality. While the annual rate varied considerably, from 120 to 328, much of this was probably a consequence of the small number of events recorded in each year, although it may have been due to the prevalence of epidemics and varying weather patterns. The decadal rates of 170, 199, 192, 209 and 200 are relatively stable and probably more accurately reflect the general hazards to infant health encountered in Rothwell. The overall rate of 198 is high in comparison with legitimate rates that have been calculated for other West Riding parishes—Methley (134) and Birstall (128).[3] Of the 437 infant burials 199 were of neonates, and assuming that all the unbaptised burials were also neonatal ones, then the neonatal mortality rate was 131 and the post-neonatal rate 67, both of which are plausible. Note also that this high neonatal rate shows that a considerable decline must have occurred at some stage during the following two centuries since this rate is far greater than those shown in Figure 2.7. The neonatal and post-neonatal rates for twins were 500 and 118 which confirms that most, but not all, of the excess mortality of this group occurred within the neonatal period. By comparison neonatal and post-neonatal rates for illegitimates were 224 and 184 respectively which shows that the increased risks they faced were distributed more equally throughout the year. This brief analysis has shown the relative ease with which additional

1 The calculation is 3,537/38 = 93.08. The number of birth events is calculated by adding baptisms to unbaptised infant burials and then taking away the number of twin births; ie 3,305 + 270 – 38 = 3,537.

2 Adair, *Courtship, Illegitimacy and Marriage*, p. 50.

3 Wrigley, *et al.*, *English Population History*, pp. 270-1.

accurate estimates of infant mortality can be made in this period, provided of course that the register selected is of good quality.

Hackness

Hackness, a small village located between Scarborough and Whitby in North Yorkshire, was chosen because during the period 1630 to 1676, when John Richardson was parish clerk, 'he enlivened his entries with descriptions of terrible storms, strange deaths, and of the young lady who fainted during her wedding. He also noted the details of seven difficult confinements, during the years 1655-7'.[1] Further examination of the register, which has been printed, revealed the following entries:

(1) An abortive childe of Thomas Coulson buryed the 30 Novembr (1632);
(2) Mercy the daughter of Thomas Bewshawes bapt. 9 May (1652) And a child of his being a sonne buryed the same day;
(3) William Consetts wyffe was brought in bedd of two children the xiijth day of January (1656) the one was an abortive sonne born dead the other was a daughter and was Babtized the xiiijth day of the same and named Ann;
(4) A younge childe of William Pickeringes of Broxey dyed presently after it was borne the fifte Feb (1660) and was bur. same day;
(5) Two children of James Boyes of Hacknes beinge Boyes were borne the 23th of November (1669), unbaptized, he being a Papist.[2]

These show that unbaptised infants were recorded (2, 4, 5) and, more unusually, so were stillbirths (1, 3). Examples (2) and (3) are twin births where one child did not survive to be baptised and are reassuring since they show that every effort was made to include all vital events in the register. Indeed, in the case of (5), even births that did not result in an ecclesiastical ceremony taking place were included. The quality of this register in this period is exceptional and it therefore should provide the basis for reliable estimates of infant mortality to be given.

Table 2.7 shows data extracted from Hackness parish register for the period 1601-60. The period 1601-30 is used for comparative purposes, and a portion of the burial register from 1661 to 1667 has been lost, making 1660 a convenient place to stop this short analysis. An aggregative analysis showed that between 1601 and 1660 there were no obvious gaps in registration. The decadal baptism and burial totals are plausible, even though there is a much higher burial rate during 1656-1658. Although four stillbirths were recorded before 1630 it was only after Richardson became parish clerk that these events appeared consistently, with at least one stillbirth being recorded in 14 out of the next 30 years. This, together with the exceptional quality of the details contained in the register, suggest that very accurate estimates of IMRs should be forthcoming. Once the linking process was underway all links could be made relatively easily. The main interpretive problem concerned the Latin word *puer* (child) which was used in the description of some burials before 1630. Since no Christian name was given for these entries, they could refer to unbaptised burials (which is why a question mark has been placed next to the totals in Table 2.7) or they could just be an

1 D. Woodward, 'Some difficult confinements in seventeenth-century Yorkshire', *Medical History*, 18 (1974), pp. 349-53, here at p. 349.

2 C. Johnstone and E.J. Hart, *The Register of the Parish of Hackness co. York*, Yorkshire Parish Registers Series, 25 (1906), pp. 59, 72, 90, 97 and 105.

Table 2.7 Demographic data from Hackness parish register, 1601-1660

Period	Baptisms	Burials	Infant Deaths	Unbaptised infant deaths	Stillbirths	Infant mortality rate per 1,000 live births	Stillbirth Rate per 1,000 live and still births
1601-10	193	112	19	4?		117	
1611-20	184	149	13	16?	3	145	
1621-30	164	126	15	5?	1	118	
1601-30	541	387	47	25?	4	127	7
1631-40	156	92	22	5	8	168	37
1641-50	155	89	18	4	6	138	36
1651-60	154	140	17	4	11	133	65
1631-60	465	321	57	13	25	146	50

Source: Original calculations from C. Johnstone and E.J. Hart, *The Register of the Parish of Hackness co. York,* Yorkshire Parish Registers Series, 25 (1906).

indication of lax recording practices; it is impossible to tell. Assuming that all these entries refer to unbaptised burials then the overall IMR for 1601-30 is 127 per 1,000 live births, a reasonable estimate for a rural parish. After 1630 when unbaptised burials are specifically identified and we can be certain that registration is complete, their numbers decrease, but the overall IMR increases to 146 (neonatal rate = 71; post-neonatal rate = 75, assuming that all unbaptised burials are neonatal ones). This suggests that even though the pre-1630 register appears to be accurate, there may still have been some under-registration—perhaps of unbaptised infant burials—and by implication this means that in this instance it would be unwise to assume that the word *puer* always refers to unbaptised infants. The stillbirth rate (hereafter SBR) for 1631-60 is 50, an intriguing result since very few parish registers recorded stillbirths. Both the SBR and IMR for 1631-60 are plausible and fit in well with others calculated for early modern England (see Tables 2.10 and 2.14). It is unfortunate that the rest of the register does not include similar levels of detail, but for the period 1631-60 we can be confident that both the IMR and SBR are as accurate as any that can be calculated in the parish register era.[1]

Banbury

Banbury was one of the eight registers that formed the post-1789 sample used by Wrigley and his colleagues; indeed it was one of only four that was in observation for the whole of their study period, 1581-1837. Its register has also been published and the following analysis focuses on the period 1813-37, when ages at death were consistently provided in the burial register.[2] Since every infant burial was given an age at death, the period IMR is

1 Note there are not enough events to make an analysis of twin and illegitimate infant mortality worthwhile. For example, there were seven twins born in the period 1631-60 (three pairs plus one born alongside a stillbirth). Two of the seven died in infancy (IMR = 286) and a further two aged one.

2 J. Gibson and R. Couzens (trans.), *Baptism and Burial Registers of Banbury, Oxfordshire, Part Four 1813-1838*, Banbury Historical Society, 22 (1988).

Table 2. 8 Period and cohort infant mortality rates, Banbury 1813-1837

Year	Baptisms	Infant burials	Period infant mortality rate (per 1,000 births)	Linked infant burials	Unbaptised infant burials	Cohort infant mortality rate (per 1,000 births)
1813	169	27		18	3	
1814	204	25		24	3	
1815	179	21		14	3	
1816	189	16		19	3	
1817	196	21		17	5	
1818	177	23		17	3	
1819	197	24		28	4	
1820	177	36		26	9	
1813-1820	**1,488**	**193**	**130**	**163**	**33**	**129**
1821	179	30		24	5	
1822	223	27		21	5	
1823	184	24		23	3	
1824	201	28		21	5	
1825	199	36		32	8	
1826	207	26		23	7	
1827	199	30		26	4	
1828	202	26		28	6	
1829	203	29		22	3	
1830	216	20		26	0	
1821-1830	**2,013**	**276**	**137**	**246**	**46**	**142**
1831	222	32		33	5	
1832	193	29		19	4	
1833	204	40		33	8	
1834	244	36		31	8	
1835	201	36		27	3	
1836	217	22		28	1	
1837	219	32		19	9	
1831-1837	**1,500**	**227**	**151**	**190**	**38**	**148**
1813-1837	**5,001**	**696**	**137**	**599**	**117**	**140**

Source: Original calculations from J. Gibson and R. Couzens (trans.), *Baptism and Burial Registers of Banbury, Oxfordshire, Part Four 1813-1838*, Banbury Historical Society, 22 (1988).

straightforward to calculate, (696/5,001 = 137 per 1,000 live births) (Table 2.8). Likewise, with a little more effort the simple linking method was used to calculate the cohort IMR (((599+117)/(5,001+117)) x 1,000 = 140). During the linking process some links were established where the interval between baptism and burial was less than one year even though the stated age at death was given as one; for example:

1819 Bap—LANE Hannah d of Richard & Hannah, Neithrop, carpenter, Aug 1;

1820 Bur—LANE Hannah, castle Wharf, Neithrop, 1, June 9.[1]

It is probable that the delay between birth and baptism meant that Hannah was no longer an infant when she died, but if the only way that her age at death can be calculated is by

1 Gibson and Couzens, *Baptism and Burial Registers of Banbury*, pp. 21, 107.

subtracting her date of baptism from her date of burial then her true age at death will not be known. In this instance the problem does not appear to be significant since both the period and cohort estimates of infant mortality are similar.

A further problem arises because the printed register also includes nonconformist baptisms. There were Congregationalist, Quaker, Presbyterian and Wesleyan Methodist communities in Banbury during the early nineteenth century, all of which recorded births or baptisms; however, only the Quakers had a separate burial ground (although only four Quaker infant burials were recorded in this period) and all the other communities recorded at least some of their burials in the Anglican register. This means that if infant mortality is calculated using the Anglican register alone, an overestimate of the IMR will be produced since there were no compensating baptisms for the nonconformist infant burials in the register. In the printed register 445 nonconformist baptisms could be identified and these were linked to 46 infant burials producing a nonconformist IMR of 103 (46/445). The IMR for the Anglican population was therefore 143 (650/4,556), although if it were not known that nonconformist burials were included, this figure would increase to 153 (696/4,556). All these various estimates of infant mortality are plausible and there was no suggestion during the linking process to indicate that the register was inaccurate. These rates compare with 209 in the parish (1675-1749) and 139 in Banbury RD (1838-44).[1] However, the Banbury RD contained a much larger area than just Banbury parish (respective populations were 28,565 and 7,165 in 1841) and given that the rural hinterland might be expected to have experienced a lower IMR than the town itself, then the rate in Banbury itself was probably higher than 139. In 1821 and 1831 the baptism rate was 34 and 38 respectively, although these will be reduced if nonconformist baptisms are excluded. These rates compare favourably with a birth rate of 32 in the RD in 1841.[2] So far there is nothing to suspect that there are significant problems with this register.

Since ages at death are given, the distribution of infant deaths can be investigated (Table 2.9). When the figures for Banbury are compared with those in Table 2.5 it is immediately apparent that the proportion of neonatal burials is lower than might be expected. Indeed, it is low even by comparison with Wrigley and his colleagues, which of course includes the Banbury data (20.8 per cent compared with 33.8 per cent).[3] While some very early infant deaths are included in the register; for instance, '1825 BIRT William, Neithrop, about 4 hrs, Sep 26',[4] numbers are sufficiently low to suggest that many similar burials may have escaped

1 Wrigley *et al.*, *English Population History*, p. 270.

2 See Registrar General, *Eleventh Annual Report of the Registrar General* (London, 1850), p. 14 for births and p. 38 for the registration district population in 1841. For parish populations see Census of Great Britain, 1821, *Abstract of the Answers and Returns Made Pursuant to an Act, Passed in the First Year of the Reign of His Majesty King George IV, Intituled, 'An Act for Taking an Account of the Population of Great Britain, and of the Increase or Diminuation Thereof'. Preliminary Observations. Enumeration Abstract. Parish Register Abstract, 1821*, p. 254, BPP 1822 XXV, Census of Great Britain, 1831, *Abstract of the Answers and Returns made Pursuant to an Act, Passed in the Eleventh Year of the Reign of His Majesty King George IV. Intituled, 'An Act for Taking an Account of the Population of Great Britain, and of the Increase or Diminuation thereof.' Enumeration Abstract. Vol. 1 1831*, p. 490, BPP 1833 XXXVI. and Census of Great Britain, 1841, *Abstract of the Answers and Return Made Pursuant to Acts 3 & 4 Vic. c.99 and 4 Vic. c.7 Intituled Respectively 'An Act for Taking an Account of the population of Great Britain', and 'An Act to Amend the Acts of the Last Session for Taking an Account of the Population.',* BPP1843 XXII.

3 Wrigley *et al.*, *English Population History*, p. 226.

4 Gibson and Couzens, *Baptism and Burial Registers of Banbury,* p. 118. There were also occasional unbaptised burials from recent in-migrants, see pp. 110 and 120 for examples.

Table 2.9 Percentage distribution of deaths during the first year of life, Banbury, 1813-1837

	Days		Weeks		Months					
Type of infant	0	1-6	0	1-3	0	1	2	3-5	6-11	Infant mortality rate
All	0.6	6.3	6.9	13.9	20.8	14.4	10.3	19.3	35.2	137
	(4)	*(44)*	*(48)*	*(97)*	*(145)*	*(100)*	*(72)*	*(134)*	*(245)*	*(696)*
Not baptised	0.9	1.7	2.6	9.4	12.0	12.8	9.4	18.8	47.0	-
	(1)	*(2)*	*(3)*	*(11)*	*(14)*	*(15)*	*(11)*	*(22)*	*(55)*	*(117)*

Note: Figures in brackets are number of burials

Source: Original calculations from J. Gibson and R. Couzens (trans.), *Baptism and Burial Registers of Banbury, Oxfordshire, Part Four 1813-1838*, Banbury Historical Society, 22 (1988).

registration. It is likely that most of these 'missing burials' would have been because some very young infants escaped the registration system entirely and were buried as though they were stillbirths, but this issue is difficult to address. With the probability of dying close to birth being high then there should have been a greater proportion of neonatal deaths amongst the unbaptised burials, but Table 2.9 does not bear this out. Only 12 per cent of unbaptised burials were neonatal ones and only three burials were aged under one week. Indeed, throughout the entire register there appears to be very few early neonatal deaths and it is hard to escape the conclusion that registration in Banbury between 1813 and 1837 was not perfect.

Analysis of the register provides further evidence to suggest that not all baptisms were recorded. The parish priest clearly made a considerable effort to ensure that as many of his parishioners as possible had been baptised since it was common practice to baptise infants alongside their presumably older unbaptised siblings. There are even a few examples of adult baptisms:

> BAGLEY Matilda d. of Thomas & Susanna, Grimsbury, labr, Oct 16 1829;
>
> BAGLEY Tom Alfred (above a year) s. of Thomas and Susanna, Grimsbury, labr, Oct 16 1829;
>
> FRENCH Martha Ann (aged 18 yrs) d. of William & Hannah, Althorpe La. Labr., May 12 1830.[1]

Any baptisms of older children can be excluded from the infant mortality calculations, but not all such baptisms appear to have been labeled in this way. The proportion of twin baptisms was higher than expected, at 1 per 56 birth events, and there are even examples of older infants being baptised just before they died:

> Bap—CLARKE George s. of John & Charlotte, Calthorpe Lane carpenter, Jul 18, 1827;
>
> Bap—CLARKE Caroline d. of John and Charlotte, Calthorpe Lane, Carpenter, Jul 18, 1827;
>
> Bur—CLARKE Caroline Calthorpe Lane, 6 months (small pox), Jul 22, 1827.[2]

In this case it would appear that the smallpox epidemic, which was raging throughout the town, prompted the Clarkes to baptise Caroline, together with her brother, who may have been older although he could have been her twin, to ensure that she did not die unbaptised.

There is further evidence concerning those infants at greatest risk of dying under one to support the view that under-registration occurred in Banbury. Illegitimates appear to have been recorded consistently in the baptism, but not the burial register (34 per 1,000 baptisms, (171/5,001)). However, the illegitimate IMR was only 145, whereas we have already seen it might be expected to be about twice the legitimate IMR. Likewise, the twin IMR was only 210 which again is relatively low, although this may be partly due to the high incidence of 'apparent' twin baptisms which included some older siblings. Overall then, there is enough evidence to suggest that there must have been some under-recording of infant burials in Banbury with many of these likely to have been neonates. The extent to which certain

1 Gibson and Couzens, *Baptism and Burial Registers of Banbury*, pp. 57, 59.
2 Gibson and Couzens, *Baptism and Burial Registers of Banbury*, pp. 49, 124.

families adopted different recording practices is of course impossible to determine and it may have been the case that those families who qualified for inclusion under the rules of reconstitution always used the Anglican registration system which would then mean that their demographic rates are accurate; however, unidentified nonconformist burials, the baptism of older children alongside their younger siblings and especially the lack of early age burials, must throw some suspicion onto the post-1812 IMRs. In turn, this conclusion must also raise questions about the decline in neonatal mortality recorded by Wrigley and his colleagues.[1]

These three case studies have shown the rich diversity of registration practices that were adopted by individual parish priests. In the first two the addition of a few extra details, coupled with no obvious signs that large groups were missing from the register, suggested that registration is complete and accurate IMRs could be calculated. By contrast, a cursory examination of the Banbury parish register revealed no obvious problems, but further scrutiny suggested that in general nonconformists recorded their burials, but not their baptisms, in the register and it also seems that a number of infants escaped registration entirely. These conclusions have been arrived at by careful examination of the register or, in the case of Banbury, by cross checking with other sources and interpolation with other data. Not every one of the five 'tests' discussed above have been applied in each case; however, in the first two it can be stated confidently that registration appears virtually complete, even though the periods of observation are rather short. Together these three case studies have shown that with comparatively little effort our understanding of infant mortality in the parish register period has been enhanced as will, no doubt, similar studies on other registers.

Infant mortality patterns during the parish register period

The effort needed to determine the trend in infant mortality over the entire parish register period is considerable and the main achievement of those who have examined this problem has been in establishing levels for a variety of places. As we have seen, Wrigley and his colleagues used a sample of 26 parish reconstitutions, drawn from a range of environments, to produce national demographic rates.[2] When aggregated this sample was broadly representative of the adult male occupational structure of provincial England in 1831 and it mirrored demographic patterns in an earlier study of 404 parishes.[3] They also found that the 26 'reconstituted parishes shared many of the characteristics that would have been displayed by a group of parishes drawn by a random sampling procedure from the 10,000 ancient parishes of England'.[4] Moreover, circumstantial evidence relating to patterns of fertility within the 26 parishes suggested that the resulting IMRs were plausible. The proportion of long birth intervals (greater than 60 months) was low, levels of sterility matched models for populations experiencing natural fertility and there was no significant difference between birth intervals following those infants who were known to have survived their first birthday and those whose fate remained unknown.[5] It was also reassuring that all these patterns were evident during the period 1750-1837 when the registration system was under greatest

1 See also Wrigley 'rise in marital fertility'.
2 Wrigley *et al., English Population History*, pp. 40-72.
3 Wrigley and Schofield, *Population History of England.*
4 Wrigley *et al., English Population History*, p. 41.
5 Smith and Oeppen, 'Place and status', pp. 54-5. For patterns of childhood mortality see Wrigley *et al.*, *English Population History*, pp. 250-1.

pressure. However, as we have already seen, questions must be raised about the accuracy of at least one of the registers in the sample: Banbury during the period 1813-37. Despite this problem it is still instructive to examine the trend in infant mortality revealed by the 26 parishes.

Figure 2.8 shows national IMRs for the period 1580 to 1837 as revealed by the 26 family reconstitution parishes. Throughout this period the IMR remained relatively stable, mostly in the region *c*.170-180; there was a rise in the late seventeenth century, followed by decline from the mid-eighteenth century. Perhaps the most important feature of Figure 2.8 is that the IMR remained relatively low, especially by comparison with other European countries, where national rates often exceeded 200.[1] Wrigley and his colleagues showed that the decline after 1750 occurred within the endogenous component (calculated by Bourgeois-Pichat's method) while the late-seventeenth-century increase was caused by an increase in exogenous mortality.[2] Given the doubts expressed previously concerning the validity of the application of Bourgeois-Pichat's 'rule', it can be said that Figure 2.8 shows a largely stable rate that exhibited an increase in post-neonatal mortality after 1660, which mirrored a similar increase in early childhood mortality, followed by a decrease in neonatal mortality from 1740.[3] It is possible to speculate on what caused these changes; but first it is necessary to examine the extent to which the family reconstitution sample, which resulted from the cumulative efforts of many thousands of hours of painstaking work on individual parish registers, manages to capture the overall national trend in this period.

The method used to construct the infant mortality series raises a number of issues. The first concerns whether it is possible for any set of parishes to accurately reflect national patterns, given that IMRs in individual parishes could vary so much (from 311 to 92 between 1675 to 1749).[4] This problem is compounded because not every parish was in observation for the entire period 1580-1837 with only 8 of the 26 registers being considered reliable between 1779 and 1837. Moreover, while Figure 2.8 may accurately represent what happened in the 26 parishes, the sample is notable for the absence of any parish from a large urban centre such as London, Norwich or emerging industrial towns such as Birmingham or Manchester—exactly those parts of the country that made Britain unique during the eighteenth century. These omissions are not surprising given that registration was under great pressure in these types of places which makes it very difficult, if not impossible, to carry out family reconstitution on urban registers during the late eighteenth and early nineteenth centuries. Secondly, questions need to be raised about the late-eighteenth-century decline that occurred almost entirely in the neonatal or endogenous component. Such a phenomenon would usually be indicative of deteriorating registration, as perhaps happened to some extent in Banbury, although it is reassuring that the same data produced no corresponding decline in marital fertility. In spite of these difficulties, a large number of IMRs, calculated from a range of registers, have been published and a careful examination of these together with a certain amount of speculation will enable the main contours of change to be determined throughout the parish register period.

1 M. Flinn, *The European Demographic System 1500-1820* (Brighton, 1981); C. Corsini and P.P. Viazzo (eds.), *The Decline of Infant Mortality in Europe 1800-1950. Four National Case Studies* (Florence, 1993); *The Decline of Infant and Child Mortality. The European Experience: 1750-1990* (Dordrecht, 1997).

2 Wrigley *et al.*, *English Population History*, pp. 228-9.

3 Wrigley *et al.*, *English Population History*, p. 215.

4 Wrigley *et al.*, *English Population History*, pp. 270-1.

Figure 2.8 Infant mortality rates, England, 1580-1837

Source: E.A. Wrigley, R.S. Davies, J.E. Oeppen and R.S. Schofield, *English Population History from Family Reconstitution 1580-1837* (Cambridge*, 1997), Table 6.3, p. 224.*

Table 2.10 shows IMRs for the sample of parishes used by Wrigley and his colleagues during the period 1675-1749 together with a selection of some of the more reliable rates that have been published. Most were calculated from family reconstitutions, but others employed the simpler linking method. The places included in Table 2.10 should not be thought of as a representative sample of the various environments in which infants were raised since most were selected because their registers were considered accurate. Table 2.10 does however, as far as we know, illustrate the full range of experience before the civil registration era. London, the largest city in Britain with a population of *c*.575,000 in 1700, suffered the highest rates.[1] By contrast very low rates, under 100, occurred in a number of places and this was something that the national rate did not achieve until 1912. Bridford, Hartland, Odiham and Ulverston were all relatively remote rural parishes and they must have possessed conditions which were very favourable for infants in a pre-industrial context. Set against these extremes, most places in Table 2.10 experienced IMRs close to the 26 parish national rate with 20 out of the 36 recording rates between 100 and 200, 11 between 200 and 300 and, in addition to London, only March in Cambridgeshire experienced a rate in excess of 300. Rates in London had also declined significantly by the early nineteenth century.

Substantial urban-rural differences are apparent in many of the places included in Table 10. York was one of the largest and most important provincial cities with a population of *c*.12,000 during the seventeenth century and here rates were in the region of 260. However, there was no simple correlation between population size and infant mortality. Gainsborough (*c*.2,500 in 1700) had a much smaller population than York, but nevertheless experienced a similar IMR and even small towns such as Banbury and Lowestoft (*c*.2,000 and *c*.1,500

1 E.A. Wrigley, 'Urban growth and agricultural change: England and the continent in the early modern period', *Journal of Interdisciplinary History*, 15 (1985), pp. 683-728.

Table 2.10 Examples of infant mortality rates derived from parish registers

Infant mortality greater than 200 per 1,000 live births				Infant mortality rate between 100 and 200 per 1,000 live births				Infant mortality rate less than 100 per 1,000 live births			
Parish	County	Date	Rate	Parish	County	Date	Rate	Parish	County	Date	Rate
London (Quakers)[a]		1650-1674	251	Rothwell[f]	Yorks.	1606-1648	198	Odiham[b]	Hants.	1675-1749	96
London (Quakers)[a]		1700-1724	342	London (Quakers)[a]		1800-1824	194	Ulverston[h]	Cumb.	1690-1709	96
London (Quakers)[a]		1750-1774	327	Terling[b]	Essex	1675-1749	176	Hartland[b]	Devon	1675-1749	94
March[b]	Cambs.	1675-1749	311	Southill[b]	Beds.	1675-1749	172	Bridford[b]	Devon	1675-1749	92
Gainsborough[b]	Lincs.	1675-1749	270	Bottesford[b]	Leics.	1675-1749	167				
Great Oakley[b]	Essex	1675-1749	269	Earsden[b]	Northumb.	1675-1749	163				
Liverpool[c]	Lancs.	1701-1750	253	Reigate[b]	Surrey	1675-1749	147				
Wrangle[d]	Lincs.	1604-1703	250	Hackness[g]	Yorks.	1631-1660	146				
Wrangle[d]	Lincs.	1704-1803	222	Shepshed[b]	Leics.	1675-1749	139				
Leake[d]	Lincs.	1604-1703	248	Methley[b]	Yorks.	1675-1749	134				
Leake[d]	Lincs.	1704-1803	211	Morchard Bishop[b]	Devon	1675-1749	131				
Lowestoft[b]	Suffolk	1675-1749	246	Aldenham[b]	Herts.	1675-1749	130				
Alcester[b]	Warwick	1675-1749	236	Birstall[b]	Yorks.	1675-1749	128				
York[e]	Yorks.	1561-1600	225	Colyton[b]	Devon	1675-1749	125				
York[e]	Yorks.	1601-1650	261	Ipplepen[b]	Devon	1675-1749	125				
York[e]	Yorks.	1651-1700	266	Ash[b]	Kent	1675-1749	121				
Willingham[b]	Cambs.	1675-1749	222	Austrey[b]	Warwick	1675-1749	118				
Banbury[b]	Oxford	1675-1749	209	Hawkshead[h]	Cumb.	1690-1709	113				
				Gedling[b]	Notts.	1675-1749	112				
				Dawlish[b]	Devon	1675-1749	108				
				Cartmel[h]	Cumb.	1690-1709	103				

Note: E.A. Wrigley R.S Davies, J.E. Oeppen and R.S. Schofield, *English Population History from Family Reconstitution 1580-1837* (Cambridge, 1997, pp. 270-1 report infant mortality rates for each of their 26 parishes for the period 1675-1750, but on pp. 22-3 they show that in four cases registration had deteriorated by the end of this period. The final limits for when these parishes were in observation are: Alcester, 1744; Lowestoft, 1730; Reigate, 1729; and Willingham, 1729.

Sources: These are denoted by superscript letters as follows: a) J. Landers, *Death and the Metropolis. Studies in the Demographic History of London 1670-1830* (Cambridge, 1993), p. 136; b) Wrigley *et al*., *English Population History from Family Reconstitution*, pp. 270-1; c) D.E. Ascott, F. Lewis and M. Power, *Liverpool 1660-1750. People, Prosperity and Power* (Liverpool, 2006), p. 41; d) F. West, 'Infant mortality in the East Fen parishes of Leake and Wrangle', *Local Population Studies*, 13 (1974), pp. 41-4, here at pp. 43-4; e) C. Galley, 'A never-ending succession of epidemics? Mortality in early-modern York', *Social History of Medicine*, 7 (1994), pp. 29-57, here at p. 45; f) Original calculations from G.D. Lumb*, The Registers of the Parish Church of Rothwell c. York, part 1 1538-1689*, Yorkshire Parish Registers Series, 27 (1906); g) Original calculations from C. Johnstone and E.J. Hart, *The Register of the Parish of Hackness co. York,* Yorkshire Parish Registers Series, 25 (1906); h) R. Finlay, 'Distance to church and registration experience', *Local Population Studies*, 24 (1980), pp. 26-37, here at p. 35.

respectively in 1700) experienced rates greater than 200.[1] Conditions that were detrimental to infant health must therefore have occurred in all urban places and even in many of the parishes included in the central column of Table 2.10, such as Colyton, some degree of nucleation existed. While an 'urban penalty' clearly operated throughout Table 2.10, a group of rural parishes: March, Willingham, Great Oakley, Leake and Wrangle, all located in eastern England, also experienced very high rates which matched or even exceeded those in the towns. Above all, Table 2.10 demonstrates that considerable variations in IMRs occurred throughout early modern England. Indeed, an examination of the central column of Table 2.10 reveals no straightforward explanation for the often considerable differences in rates (compare Rothwell with Methley for instance). It is therefore hard to escape the conclusion that the risks faced by infants varied considerably and these were determined by the peculiar combination of factors that operated within local environments.

Table 2.11 London's contribution to national infant mortality rates, 1650-1849

Period	Infant mortality rate: Non-metropolitan England	Infant mortality rate: London	Per cent of national population in London	'National' infant mortality rate	Difference between non-metropolitan and 'national' infant mortality rate
1650-1674	169	251	9.5	177	+8
1675-1699	189	263	10.5	197	+8
1700-1724	195	342	11.5	212	+17
1725-1749	196	341	11.5	213	+17
1750-1774	170	327	11.5	188	+18
1775-1799	166	231	11.5	173	+7
1800-1824	144	194	11.5	150	+6
1825-1849	*152	151	12.0	152	0

Note: It has been assumed that birth rates in London and non-metropolitan England were identical; i.e. the proportion of births occurring in London was the same as its share of the national population. This seems a reasonable assumption to make, but further research will need to be undertaken to demonstrate whether this was indeed the case.
* Rate for 1825-37 given.

Sources: Non-metropolitan England, E.A. Wrigley R. Davies, J. Oeppen and R.S. Schofield, *English Population History from Family Reconstitution 1580-1837* (Cambridge, 1997), p. 219; London, J. Landers, *Death and the Metropolis. Studies in the Demographic History of London 1670-1830* (Cambridge, 1993), p. 136; London's contribution to the national population (1650-1800), E.A. Wrigley, 'Urban growth and agricultural change: England and the continent in the early modern period', *Journal of Interdisciplinary History*, 15 (1985), pp. 683-728, here at p. 688; (1800-1849), R. Woods, 'The effects of population redistribution on the level of mortality in nineteenth-century England and Wales', *Journal of Economic History*, 45 (1985), pp. 645-51, here at p. 648.

Given the range of experience highlighted in Table 2.10 it is possible that the national trend revealed in Figure 2.8 merely reflects the changing distribution of the English population living in various diverse environments. To illustrate this possibility, Table 2.11 shows the effect of combining Landers' London IMRs with Wrigley and his colleagues'

1 P. Clark, and J. Hosking, 'Population estimates of English small towns', *Centre for Urban History, University of Leicester Working* Paper, (1993), pp. 118, 142.

provincial rates to provide an overall national rate. Even though London's population more than doubled between 1650 and 1801, and by 1851 it had quintupled, the proportion living in the capital hardly changed; nevertheless, London's infant mortality was sufficiently high, especially between 1700 and 1775, to inflate the 'national' rate by up to 12 per cent.[1] This 'London effect' was also far from constant and by the 1840s it was much smaller as its IMR had converged with the national rate.[2] Throughout this period England experienced significant urbanisation. Thus, while the proportion of the population living in London remained relatively constant, the proportion living in towns increased steadily (Table 2.12).

Table 2.12 The urban population of England and Wales, c.1520-1911

Year	Per cent urban	Urban population (millions)	National population (millions)
c.1520	5.3	0.1	2.4
c.1600	8.3	0.3	4.1
c.1670	13.5	0.7	5.0
c.1700	17.0	0.9	5.1
c.1750	21.0	1.2	5.8
1801	27.5	2.4	8.7
1801	33.8	2.9	8.7
1811	36.6	3.7	10.2
1821	40.0	4.8	12.0
1831	44.3	6.2	13.9
1841	48.3	7.7	15.9
1851	54.0	9.7	17.9

Note: Rows 1-6 are based on a benchmark of 5,000 in defining a town whereas rows 7-12 are based on a minimum size of 2,500, population density of over one person per acre and some degree of nucleation determined by inspection of a map; hence their estimates for the urban populations in 1801 differ.

Sources: Rows 1-6: E.A. Wrigley, 'Urban growth and agricultural change: England and the continent in the early modern period', *Journal of Interdisciplinary History*, 15 (1985), pp. 683-728, here at p. 688; rows 7-12, C.M. Law, 'The growth of urban population in England and Wales, 1801-1911', *Transactions of the Institute of British Geographers*, 49 (1967), pp. 125-43, here at p. 130.

For example, the population of Norwich increased from *c*.15,000 in 1600 to *c*.36,000 in 1801; Bristol increased from *c*.12,000 to *c*.60,000 in the same period while Birmingham and Manchester had only reached *c*.8-9,000 in 1700, but were *c*.74,000 and *c*.89,000 respectively in 1801.[3] Table 2.10 showed that without exception the towns experienced higher IMRs than the national rate; therefore, given the operation of an urban 'infant mortality penalty', the five-fold increase in the proportion living in an urban environment between 1600 and 1831

1 The population of London was 958,863 in 1801 and 2,362,236 in 1851, see *1851 Census, Population Tables I, Volume 1. England and Wales, Divisions I-VII*, p. 2.

2 Figures from the Registrar General show that the IMR in London was 163 between 1839 and 1844 compared with a national rate of 149, see Registrar General, *Eighth Annual Report*, p. 57. This London figure is slightly higher than Lander's Quaker estimate.

3 Wrigley, 'urban growth', p. 686.

will have had a substantial impact on the national IMR.[1] For instance, assuming that urban and non-urban IMRs and birth rates remained constant throughout the period (which of course they did not) then if the urban rate was 250 and the non-urban rate 150 then this would mean that the national rate would have been 158 in 1600, 167 in 1700, 178 in 1800 and 196 in 1841. There can be no way of determining representative IMRs for urban and non-urban England, especially given that Table 2.10 has already emphasised the variety of experience and the substantial decline that occurred post-1750; however, these theoretical calculations illustrate that excess urban infant mortality coupled with increasing urbanisation will have created upwards pressure on the national IMR.[2] They have also reinforced how difficult it is to construct a representative sample using only 26 parishes, especially when that sample excludes any parish from a large urban centre.

Calculating IMRs in towns is far from straightforward since residential urban turnover rates were high; there was often greater choice over where to register events than in rural parishes and urban burial grounds quickly became full. This means that demographic analysis using urban registers is often not feasible, although careful analysis of York's surviving parish registers allowed IMRs for that city to be calculated between 1570 and 1700. An attempt to extend the analysis to 1837 proved disappointing due to the increasing unreliability of the eighteenth and early nineteenth-century registers. Deriving a representative rate for London is much more difficult and involves solving similar problems to those encountered by Wrigley and his colleagues when they constructed their national series. Table 2.13 shows selected IMRs from London. The four sets of data in the first column seek to establish both levels and trends. They all show a decline from the late seventeenth and early eighteent centuries to the early nineteenth century even though they differ in terms of absolute levels. By the 1840s civil registration data confirm that in London the IMR had declined to around 160 per 1,000 live births and this suggests that there must have been considerable improvement in rates at some point during the century from 1750.[3] It is reassuring, therefore, that all the series in Table 2.13 reflect this convergence. Landers' and Vann and Eversley's estimates use Quaker registers, which recorded births and deaths directly, and should theoretically produce accurate rates. Both reveal very high IMRs between 1650 and 1750 (in excess of 300), although there is considerable disagreement between the two in terms of levels within each period and this in part may be due to both sets of estimates being based on relatively small 'at risk' populations. The estimates based on the bills of mortality present both opportunities and challenges. They provide city-wide rates, although it is clear that the reliability of these estimates is dependent on the quality of the bills and these are unlikely to surpass those of the registers themselves with Jeremy Boulton estimating that around 20 per cent of baptisms were missing from London's Anglican registers around 1700.[4] Consequently, any deficiencies in the original registers are likely to be repeated in the bills and there may also be problems arising from the process of aggregating figures from more than 100 parishes. The bills also did not report infant deaths directly. Instead from 1728 only children under two years of age were distinguished and in order to determine the proportion

1 For a wider discussion of these issues see R. Woods, 'The effects of population redistribution on the level of mortality in nineteenth-century England and Wales', *Journal of Economic History*, 45 (1985), pp. 645-51.

2 For urban mortality more generally see E.A. Wrigley, *The Path to Sustained Growth. England's Transition from an Organic Economy to an Industrial Revolution* (Cambridge, 2016), pp. 92-5.

3 Registrar General, *Eighth Annual Report*, pp. 57, 62-3.

4 J. Boulton, 'The Marriage Duty Act and parochial registration in London, 1695-1706', in K. Schürer and T. Arkell (eds), *Surveying the People* (Oxford, 1992), pp. 222-52, here at p. 239.

Table 2.13 Infant mortality rates in London, 1650-1849

Source	Date	IMR	Parish	Date	IMR	Parish	Date	IMR
Quakers (L)[a]	1650-1699	260	Allhallows Bread Street[e]	1538-1653	111	Aldgate[h]	1550-1574	150
	1700-1749	342	Allhallows London Wall[e]	1570-1636	225		1575-1599	226
	1750-1799	276	St Botolph Bishopgate[e]	1600-1650	211		1600-1624	285
	1800-1824	194	St Christopher le Stocks[e]	1580-1653	88		1625-1649	266
			St Dunstan in the East[e]	1605-1653	255		1650-1674	255
Quakers (V&E)[b]	1650-1699	353	St Mary Somerset[e]	1605-1653	272		1675-1699	244
	1700-1749	277	St Michael Cornhill[e]	1580-1650	135		1700-1724	248
	1750-1799	155	St Peter Cornhill[e]	1580-1650	129			
	1800-1849	111				Clerkenwell[i]	1600-1624	266
			St Benet Paul's Wharf[f]	1690-1709	216		1625-1649	270
Bills of mortality (W)[c]	1730-1739	263	St Mary Aldermary[f]	1690-1709	193		1650-1674	250
	1760-1769	232	St Mary Woolnoth[f]	1690-1709	136		1675-1699	322
	1790-1799	211	St Peter Paul's Wharf[f]	1690-1709	191		1711-1714	268
	1820-1829	177	St Vedast Foster Lane[f]	1690-1709	223		1735-1753	338
Bills of mortality (L&W)[d]	1730-1739	*c*.400	St Botolph without Aldgate[g]	1583-1599	298	Cheapside parishes[i]	1600-1624	148
	1760-1769	*c*.300					1625-1649	201
	1790-1799	*c*.200					1650-1674	207
	1820-1829	*c*.150					1674-1699	271
							1700-1724	333

Note: The Cheapside parishes comprise: All Hallows Honey Lane; St Mary Le Bow; St Pancras Soper Lane; St Martin Ironmonger Lane; and St Mary Colechurch.

Sources: a. J. Landers, *Death and the Metropolis. Studies in the Demographic History of London 1670-1830* (Cambridge, 1993), p. 136.
b. R.T. Vann and D. Eversley, *Friends in Life and Death* (Cambridge, 1992), p. 194.
c. R. Woods, 'Mortality in eighteenth-century London: a new look at the bills', *Local Population Studies*, 77 (2006), pp. 12-23, here at p. 17.
d. P. Laxton and N. Williams, 'Urbanization and infant mortality in England: a long term perspective and review', in M. Nelson and J. Rogers (eds), *Urbanisation and the Epidemiological Transition, Reports from the Family History Group, Uppsala University*, 9 (1989), pp. 124-35, here at p. 126.
e. R. Finlay, *Population and Metropolis: The Demography of London 1580-1650* (Cambridge, 1991), p. 30.
f. Landers, *Death and the Metropolis*, p. 185.
g. T. Forbes, *Chronicle from Aldgate* (New Haven, 1971), p. 65.
h. G. Newton and R. Smith, 'Convergence or divergence? Mortality in London, its suburbs and its hinterland between 1550 and 1700', *Annales de Démographie Historique*, 2013, pp. 17-49, here at p. 46;
i) G. Newton, 'Infant mortality variations, feeding practices and social status in London between 1550 and 1750', *Social History of Medicine*, 24 (2011), pp. 260-80, here at p. 270.

of infants in the under two deaths it is necessary to make assumptions based on model life tables. The considerable differences in Table 2.13 therefore reflect the models chosen—Robert Woods used model North of the Princeton Life Tables, while Paul Laxton and Naomi Williams assumed that infants comprised between 66 and 72 per cent of under two deaths.[1] If Laxton and Williams' estimates are accepted then it would imply that most parishes would have experienced rates in excess of 300 before 1750. By contrast Woods argued that his lower estimates are plausible since they are more consistent with other urban centres in this period and, as London expanded westwards, its incorporation of more healthy suburbs will have helped the overall rate to decline.

When the estimates based on analyses of individual registers are examined a different picture begins to emerge with the most striking feature of Table 2.13 being the considerable range that was recorded (from 88 to 338 per 1,000 live births). It seems likely however that the low rates recorded by some parishes in John Landers' and Roger Finlay's samples (calculated by the simple linking method) were a consequence of substantial under-registration. It does not appear tenable that seventeenth-century IMRs in London could have been lower than those in 1841 where the mean IMR in the 30 London RDs was 160 and rates within individual districts varied from 123 in St Luke to 208 in Holborn, (standard deviation 18.3).[2] Finlay's sample was used to test the quality of registration in London. He found that registration practices varied considerably, especially with respect to the recording of unbaptised infant burials, and he made no systematic attempt to correct for possible under-registration.[3] The practice of sending many London infants out to be nursed, both in other parts of London and more commonly in the rural parishes surrounding London, will also have affected the recorded IMR in many parishes since a considerable number of these infants were baptised in their parish of birth, but were buried elsewhere.[4] Landers used a similar method to Finlay to assess IMRs at the turn of the eighteenth century and despite attempts at correction he concluded that his parish register rates 'still underestimates the prevailing level of infant mortality to some degree' and 'it seems safe to conclude that the level of infant mortality prevailing around 1700 was in excess of 300 per 1,000 and had thus risen steeply since the period studied by Finlay'.[5] If nothing else this conclusion demonstrates the unreliability of registration in a number of London parishes. The most accurate rate in this period would appear to be that recorded in St Botolph without Aldgate between 1583 and 1599. This parish register was exceptionally detailed which should have resulted in accurate rates having been calculated. The Clerkenwell and Cheapside series, based on family reconstitutions carried out at the Cambridge Group for the History of Population and Social Structure, also reflect a late-seventeenth-/early-eighteenth-century increase in infant mortality, while the Aldgate series is more stable. Gill Newton argues that the late

1 Woods, 'a new look at the bills', p. 14; Laxton and Williams, 'Urbanization and infant mortality in Britain', p. 125; also see Landers, *Death and the Metropolis*, pp. 169-70.

2 Registrar General, *Eighth Annual Report*, pp. 110-9.

3 Finlay, *Population and Metropolis*, pp. 27-33.

4 The extent of this practice and its effects on infant mortality remains unknown, see Fildes, *Wet Nursing*, p. 79; G. Clark, 'A study of nurse children, 1550-1750', *Local Population Studies*, 39 (1987), pp. 8-23; G. Newton, 'Infant mortality variations, feeding practices and social status in London between 1550 and 1750', *Social History of Medicine*, 24 (2011), pp. 260-80. The opening of the foundling hospital in 1741 will likewise have affected rates to some extent, see A. Levene, 'The estimation of mortality at the London Foundling Hospital, 1741-99', *Population Studies*, 59 (2005), pp. 87-97 and C. Cunningham, 'Christ's Hospital: Infant and child mortality in the sixteenth century', *Local Population Studies*, 18 (1977), pp. 37-40.

5 Landers, *Death and the Metropolis*, pp. 189-90.

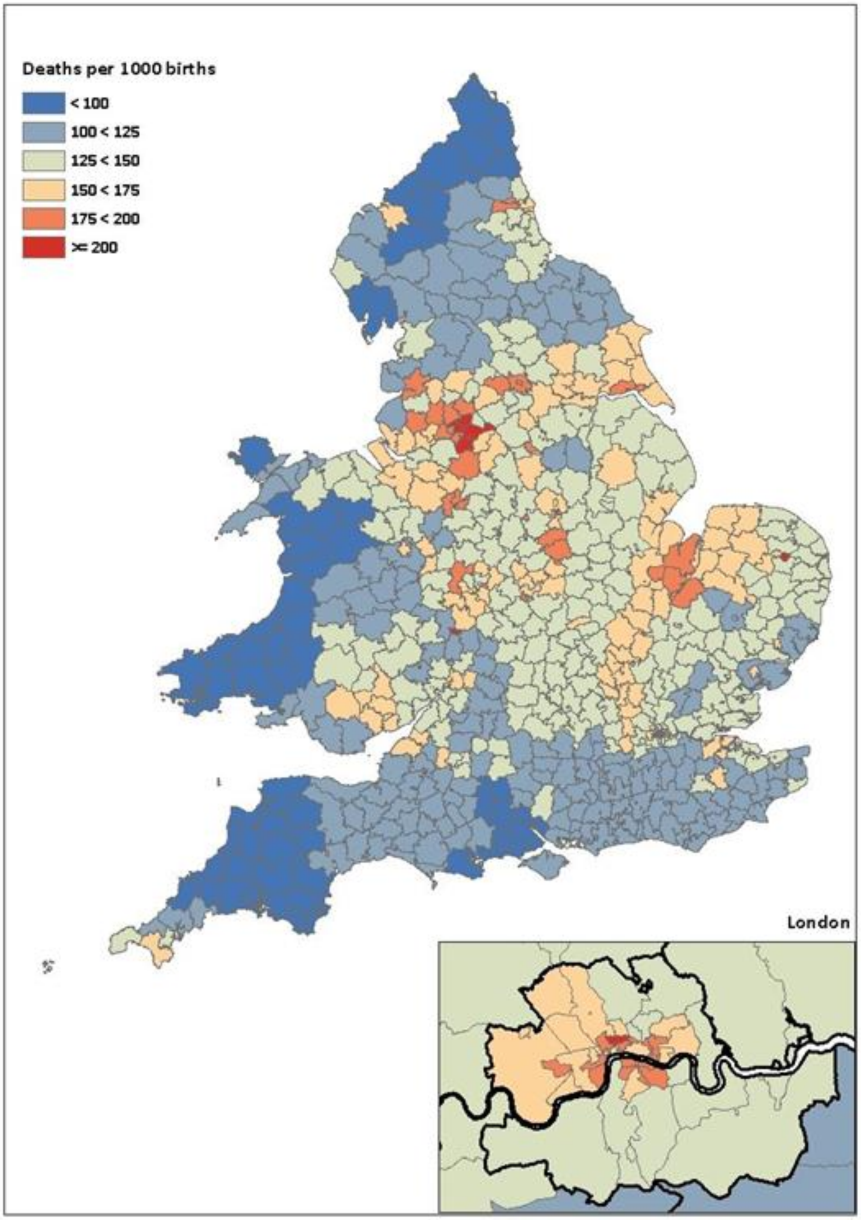
seventeenth century increase was due to more infants being nursed at home rather than being sent into the countryside and this meant that their burials were more likely to be recorded in the London registers. There was also an intensification of the epidemiological regime as London's population increased and this made infants more likely to catch and succumb to a host of diseases common in the city.[1]

Whatever the true level of infant mortality in London, there was clearly considerable under-registration in some of the city's parishes and this, again, must throw suspicion onto the overall accuracy of the bills of mortality. We probably need to be skeptical about the accuracy of any urban rate below 200 per 1,000 live births and, while rates over 300 have been recorded within individual parishes, especially during the early eighteenth century, it has not been possible to establish the extent of spatial variations, with the lower level remaining as yet unknown. It is also impossible to judge whether Woods' estimates based on the bills of mortality are more plausible than those produced by Laxton and Williams or Landers. Rates over 300 in some parishes together with rates in the region of 200 in others could easily have combined to produce Woods' estimates, while Laxton and Williams' rates imply that rates were much higher throughout the capital in the early eighteenth century. The evidence provided by Table 2.13 is inconclusive and more work needs to be undertaken to establish the full extent of variations in infant mortality within London. One thing seems certain, however: from the sixteenth to the early eighteenth century IMRs in London were very high, perhaps the highest in the country between 1700 and 1750. By 1841 the IMR had fallen to match the national rate and spatial variations throughout the capital were relatively low which means that at some stage during the eighteenth century a substantial decline must have taken place. This may partly be explained by the incorporation of healthier suburbs, but over the course of the century from 1740, IMRs in parishes such as Clerkenwell must have halved since Clerkenwell RD had an IMR of 158 in 1841.[2] While a definitive assessment of infant mortality in London has not been possible, the analysis of Table 2.11 has been confirmed and, while the general direction of change in the capital may have mirrored that of Figure 2.8 it did so in a more exaggerated form.

Unfortunately, Wrigley and his colleagues did not publish infant mortality time series for individual parishes, but sufficient data can be gleaned from other publications to show that in those parishes where rates were already low, any decline during the eighteenth century was at best only slight. For instance, E.A. Wrigley has published the following rates for Colyton: 130 (1550-99); 92 (1600-49); 109 (1650-99); 109 (1700-49); 94 (1750-99) and 92 (1800-49), although after subsequent analysis it was considered that the Colyton data was only sufficiently reliable to be included in the national series for the period 1578-1789.[3] Likewise in Hartland rates hardly changed between 1550 and 1840.[4] A more extensive analysis is needed to confirm such patterns, but it seems reasonable to assume that conditions must have existed in these parishes and others, such as the ones in column 3 of Table 2.10, that were as favourable for infants as any that existed until the secular decline in infant mortality began at the beginning of the twentieth century. The pattern in places such as Alcester, Banbury and Aldenham mirrored the national trend, as did those in the east fen

1 Newton, 'feeding practices and social status in London between 1550 and 1750', pp. 277-8.
2 Registrar General, *Seventh Annual Report of the Registrar General* (London, 1846), pp. 114-5.
3 Wrigley, 'Births and baptisms', p. 286; Wrigley, *et al.*, *English Population History*, p. 22.
4 R. Schofield and E.A. Wrigley, 'Infant and child mortality in England in the late Tudor and early Stuart period' in C. Webster (ed.), *Health Medicine and Mortality in the Sixteenth Century* (Cambridge, 1979), p. 66; Wrigley *et al.*, *English Population History*, p. 271.

Figure 2.9 **Infant mortality rates in Registration Districts, England and Wales (with London inset), 1839-1844**



Note: The rates have been mapped onto the 1851 boundaries. The boundaries were created by Joe Day for the research project, *An Atlas of Victorian Fertility Decline*, see J.D. Day, *Registration sub-district boundaries for England and Wales 1851-1911* (2016). Full details can be found on the Populations Past website, www.populationspast.org [accessed October 2019]. I am grateful to Eilidh Garrett for drawing this map.

Source: Registrar General, Eighth Annual Report of the Registrar General (London, 1848), BPP 1847-48 XXV.

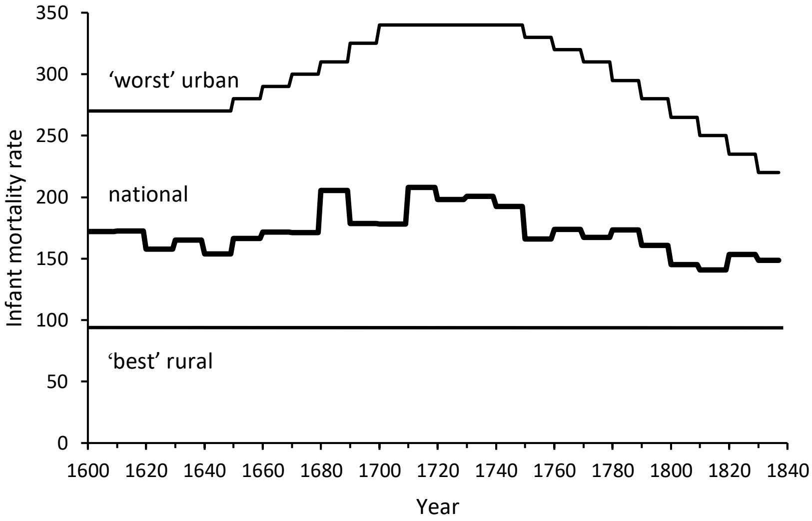
rural parishes of Leake and Wrangle where rates were in excess of twice those in Harland and Colyton.[1]

Infant mortality trends during the parish register period can also be inferred by working backwards from early civil registration data. Figure 2.9 shows spatial variations in IMRs in England and Wales between 1839 and 1844, the earliest date that it is possible to provide this information.[2] It is immediately apparent that in the early 1840s many parts of the country experienced rates similar to those during the preceding two centuries. Rates in mid-nineteenth-century RDs, some of which contained many parishes, will of course have tended to average out; nevertheless, there is considerable agreement between Figure 2.9 and Table 2.10. In the 1840s relatively few districts experienced high IMRs (greater than 150) and not surprisingly most of these were urban, with the industrial towns of Yorkshire, Lancashire, The Midlands and South Wales being prominent. Smaller towns such as Great Yarmouth, Brighton and Exeter also experienced high mortality, as did a number of rural industrial districts. In addition a group of mainly rural districts arching from The Wash and almost reaching London suffered IMRs over 150. Thus, the excess mortality experienced by the Eastern rural parishes of Table 2.9 extended well into the nineteenth century.[3] It is also apparent that by the 1840s London was no longer recording the highest IMRs thereby confirming that significant decline must have occurred during the eighteenth century. By contrast, four areas—much of Devon, large parts of Wales, where intriguingly we have no parish register estimates of infant mortality, and the northern and southern extremes of England—experienced low rates comparable to the parishes in the third column of Table 2.10. Most of the districts represented in Figure 2.9 remained close to the national rate, although there is some evidence to suggest that in many, but not all, places there had been a general decline in rates. Figure 2.9 also masks the considerable population redistribution that was occurring as many of the districts experiencing the highest IMRs were also being subject to substantial population increase.

Given the diversity of trends identified above what happened to the national rate could in a sense be considered irrelevant and it may be more useful to examine the trend within specific environments. Figure 2.10 therefore presents a stylised view of the changing range of infant mortality between 1600 and 1840.[4] At first glance it looks as though the range can be explained simply by urbanisation—the lowest rates were found in rural parishes and the highest in urban areas, especially London. However, the experience of the vast majority of places would have been closer to the national rate produced by Wrigley and his colleagues and, of course, some eastern rural parishes suffered rates as high as the worst urban ones. Thus, while the pattern of late-seventeenth-century increase followed by substantial decline from the mid eighteenth century may have been replicated in many places where rates were already low, there is little evidence of change throughout the entire parish period. In summary, and with a certain degree of speculation, the following five trends in IMRs can be identified:

1 Wrigley, 'Births and baptisms', 286.
2 The accuracy of these data will be discussed in chapter 3
3 A. Hinde and V. Fairhurst, 'Why was infant mortality so high in eastern England in the mid nineteenth century?', *Local Population Studies*, 94 (2015), pp. 48-66.
4 During the sixteenth century the range was likely to have been similar to that in 1600, although we can be less certain.

Figure 2.10 A stylised view of infant mortality change, 1600-1840



(1) In many remote rural areas IMRs were low and they hardly changed throughout the period 1580-1840.

(2) In London and the large towns IMRs increased during the late seventeenth century and then steadily declined from some point during the eighteenth century. In the case of London, the very high rates recorded by some parishes were no longer evident by the 1840s, although as the capital expanded it probably began to absorb areas that were more favourable for raising infants. However, even modestly sized towns such as York experienced some decline during the eighteenth century.

(3) In many Eastern rural parishes, IMRs were also high, but substantial decline also occurred in parishes such as March from the late seventeenth and early eighteenth centuries. Nevertheless, even in the mid nineteenth century conditions in these parishes were still detrimental to infant health.

(4) In those parishes that developed into industrial centres, it seems likely that during the eighteenth and nineteenth centuries IMRs remained relatively stable. They may have increased slightly, but it is unlikely that they decreased significantly, since deteriorating environmental conditions probably offset the generally declining rates experienced in other parts of the country. The rising population in these places meant that their contribution towards the national IMR increased proportionally.

(5) Throughout much of the country, while spatial variations in IMRs could be substantial, over the longer term, rates within most parishes remained relatively stable and it is likely that the broad national trends revealed by the Wrigley and his colleagues would have been repeated in many, but not all, parishes.

Given these five distinct trends, selecting a sample of registers that encompasses these various environments remains difficult and is reliant on the survival of good quality source material within each of the five environments. Crucially it has not been possible as yet to produce a convincing infant mortality series for an emerging industrial town. In a sense though, what happened to the national IMR, which is a composite measure resulting from the changing proportion of infants born within each of the five environments, is less important than seeking explanations for each of these distinct trends. While the addition of estimates from new registers and further analysis of existing data is still needed to confirm and perhaps add detail to the above trends, the most striking feature of infant mortality in the parish register period is the fact that where an infant was born had such a profound impact on whether or not it would survive.

Evidence to Explain Variation and Change

Figure 1.4 can be used as a framework for understanding patterns of infant mortality in the parish register period, especially with respect to the five trends identified above. Whilst at present data limitations ensure that it is not possible to provide a definitive account of these trends, with a certain amount of informed speculation a consistent explanation can be given and further research targeted at specific issues can be identified. Reading Figure 1.4 from left to right, in the first instance we need to discover evidence relating to inherited disorders, infections (differential levels of exposure to disease), and injuries, either at birth or later by accident or intention. This can then be supplemented by an examination of differing child care practices which may or may not have been effective in enabling the infant to survive.

Ideally causes of death for infants would be useful in explaining any differences, but unfortunately early parish registers rarely give this information. Epidemics such as plague were sometimes noted, but generally it was not until the eighteenth century that some registers began to record cause of death and those given for infants are often difficult to interpret. The following two entries from the register of St Lawrence, York are typical:

> 1781—Maria 5th Daughter William Armit, of Poolbridge, Farmer, Died April 22nd buried in the Churchyard 24th, Aged 4 months, Fits.
>
> 1792—John Lumley Son of Matthew Lumley, Gardener, without the Bar, died 27th February buried Feby 28th in the Church yd, 1 month, Decay.[1]

In both cases it is impossible to provide a modern interpretation of how these infants died. Fits, convulsive fits or convulsions were given as causes of death for about 80 per cent of infant deaths in this register and they could refer to the final stages of a host of conditions or diseases. Likewise, 'decay' provides little information of real value and the only causes of death for infants that are informative are infectious diseases such as smallpox, measles and whooping cough and these mainly killed older children.[2] An analysis of infant causes of death taken from parish registers is therefore likely to prove unrewarding. The same is also true with bills of mortality which sometimes provide causes of death for infants. The following are taken from the Chester bill for 1773 with the number of deaths given in brackets: fever (1), quinsey (1), teething (1), thrush (1), consumption (2), convulsions (50), chinkcough (whooping cough) (3), looseness (1), weakness of infancy (4) and unknown (1).[3] Convulsions are again by far the most common cause of death (50 out of 65), and apart from whooping cough, the other causes are difficult to interpret. This is also the case with the best set of bills to have survived, those for London. In 1837 John Marshall published time series of

1 E.C. Hudson (ed.), *The Registers of St Lawrence, York 1606-1812*, *Yorkshire Parish Registers Series*, 97 (1935), pp. 106, 139.

2 See Hudson, *Registers of St Lawrence*, p. 110 for an example.

3 Haygarth, 'Bills of mortality for Chester bill for the year 1773'.

causes of death from the bills and he grouped together certain 'diseases incident to infancy'.[1] Between 1629 and 1689 he classified 'abortive and stillborn', 'chrisomes and infants', convulsions, teething, worms, rickets, 'overlaid and starved at nurse', mouldshothed and canker as infant diseases, although after 1690 childbed was added and from 1701 so were cancer and thrush.[2] 'Childbed' usually refers to a maternal death and will only be a cause of death for infants if it means that the infant died at birth. Again, most of the other infant causes of death are too imprecise for a modern understanding to be given. In part this lack of accuracy in allocating causes of death reflects prevailing levels of knowledge amongst medical practitioners, the searchers who were responsible for collecting this information and throughout the population as a whole. It also probably reflects how little could be done to prevent many infant deaths since if it was not known exactly how an infant died, it was difficult to develop an effective intervention strategy. To make matters worse, there were also significant changes in how some of the causes in the bills were allocated over time. For example, 2,596 'chrisomes and infants' were recorded in 1629, 1,123 in 1660 but only 70 in 1700 whilst, at the same dates, the number of convulsion deaths increased from 52 to 1,031 and then 4,452.[3] It was not necessarily the case that one cause of death was transferred into another category, rather there seems to have been little consistency in how causes were allocated with some causes of death appearing to drift in or out of fashion over time. Moreover, with ages not being given alongside the causes and all the under two deaths being grouped together from 1728, it is likely that many of the so-called 'infant' deaths would have been those of young children. We cannot however be certain so, frustratingly, with respect to infant causes of death the London bills are of only limited value.[4]

In the early years of civil registration a more detailed death classification system was used, but frustratingly, many infant deaths were still assigned imprecise causes. In an attempt to determine the main causes of death detailed causes were given and discussed for a number of places, including Liverpool, which in 1839 had the very high IMR of 239 per 1,000 live births. For the 1,839 infant deaths registered in Liverpool that year the six most important causes were: 'convulsions' (729), 'pneumonia' (216), 'consumption' (125), 'teething' (123), 'hydrocephalus' (85) and 'debility' (77) which together represented 74 per cent of all deaths.[5] Again we cannot be sure exactly what is meant by convulsions or debility and even though teething appears to be an infection associated with the eruption of teeth it is difficult to be certain. Ideally, if these causes were broken down by age within the first year then we would be able to speculate on their true nature, but the original death certificates are not at present open for inspection and this is not possible. Infectious diseases were certainly important, and with a total of 325 so-called zymotic diseases such as smallpox, measles and whooping

1 J. Marshall, *Mortality of the Metropolis* (London, 1837), p. 79; see also T. Birch, *A Collection of the Yearly Bills of Mortality, from 1657 to 1758 inclusive* (London, 1759).

2 In this sense 'chrisom' refers to a dead infant. 'Moldshoted' refers at a condition of the skull, in which the bones ride, or are shot, over each other at the sutures. Marshall, *Mortality of the Metropolis*, p. 79 provides the following note: 'column 12 is reported under the head of Headmouldshot, Horseshoehead and Water in the head, and probably partook both of PHRENITIS (inflammation of the brain) and HYDROCEPHALUS'.

3 Marshall, *Mortality of the Metropolis*, p. 76.

4 See the discussion in Landers, *Death and the Metropolis*, pp. 94-8.

5 Appendix to Registrar General, *Third Annual Report of The Registrar General* (London, 1841), pp. 74-7, BPP 1841 Session 2/VI. The IMR is given on p. 20 of the report and refers to Liverpool as a whole whereas the figures in the appendix refer to Liverpool RD. There were 2,376 infant deaths in the whole of Liverpool compared to 1,839 in Liverpool RD, although the total reported in the Appendix table is only 1,830.

cough, plus lung diseases (355), together these account for 37 per cent of all the deaths. Many 'hydrocephalus' deaths probably had a pre-natal cause and only four violent deaths were recorded.[1] Deaths assigned to 'debility' may have resulted from an inability to breastfeed due to some pre-natal condition, a lingering illness or an injury acquired at birth and could therefore easily be assigned to any of the three categories in Figure 1.4. Thus, whilst it seems safe to conclude that most infant deaths can be placed within the infection category and fewest within injury, exactly how the less easily interpreted causes should be distributed remains difficult to determine. With the possible exception of some infectious diseases, analysis of causes of death in the parish register period is of only limited value and also gives little insight into change over time. Given these limitations the way forward is to turn to other demographic material such as stillbirths, the distribution of infant and childhood deaths, seasonality, social class variations and maternal mortality, each of which can provide additional insights into the changing patterns of infant mortality.

Stillbirths

A stillbirth is a baby that is born dead and while not consistently recorded in parish registers, some parish priests occasionally noted them, albeit for short periods only.[2] There must always be some doubt about exactly what constituted a still, rather than a live, birth during the parish register period. It was only during the twentieth century that a precise definition was used and even then different countries employed different definitions making international comparisons difficult.[3] There is the possibility that some live born infants who did not survive for long would have been buried as though they were stillborn because it was cheaper to do so and there is some evidence to suggest that this happened. Memorandum books kept by clerks in the parish of St Botolph without Aldgate, London contain the following entry: a child, '[d]yed and was buried the ix[th] day of May Anno 1596. Which chyld was borne alyve the day before and for that he was not cristned he was accompted a stilborne'.[4] Another child was recorded stillborn even though it was seven days old and during the period 1584-98, Forbes showed that the stillbirth rate (SBR) was 96.6 per 1,000

1 Incidences of infanticide are easy to discover, but they were relatively rare and mainly confined to illegitimates. K. Wrightson, 'Infanticide in earlier seventeenth-century England', *Local Population Studies*, 15 (1975), pp. 10-22, here at p.11, found only 60 cases in 53 Essex parishes during the period 1601-65 and he concluded, '[i]t seems most unlikely, however, that infanticide has a distinct role … as a means of population control' (p. 19). This was in marked contrast to early modern Japan, see F. Drixler*, Mabiki. Infanticide and Population Growth in Eastern Japan, 1660-1950* (Berkeley, 2013).

2 Formally a stillbirth is defined as a baby born dead after 24 completed weeks of pregnancy. If the baby dies before 24 weeks it is known as a miscarriage. In the parish register period there would not have been this precision. For examples of midwifery case notes describing the deliveries of stillbirths and miscarriages see Woods and Galley, *Mrs Stone & Dr Smellie*, pp. 233, 317-8, 321-6, 329-30, 342-3, 351-4, 391-7.

3 According to T. Percival, *Medical Ethics: Or, a Code of Institutes and Precepts: Adapted to the Professional Conduct of Physicians and Surgeons* (London, 1803), p. 86 'much observation is required to discriminate between a child stillborn, and one that has lived after birth only a short period of time', quoted in J.M. Lloyd, 'The "languid child" and the eighteenth-century man-midwife', *Bulletin of the History of Medicine*, 75 (2001), pp. 641-79. here at p. 645. Also see M. Fraser, 'New Zealand – infant mortality rates and still-births', *Journal of the Royal Statistical Society*, 92 (1929), pp. 428-44 and the discussion in C. Gourbin and G. Masuy-Stroobant, 'Registration of vital data: are live births and stillbirths comparable all over Europe?', *Bulletin of the World Health Organization*, 73 (1995), pp. 449-60. The age at which a miscarriage becomes a stillbirth has always been the subject of controversy and debate since the exact time when conception occurred cannot be determined with absolute certainty and the age that foetuses are capable of independent survival varies.

4 Forbes, *Chronicle from Aldgate*, p. 63.

Table 2.14 Stillbirth rates, 1578-1850

(a) from parish registers

Parish	County	Date	Baptisms	Stillbirths	Stillbirth rate
St Vedast & St Michael le Quern	London	1578-1700	3,755	219	55
St Michael Cornhill	London	1580-1650	2,261	75	32
St Peter Cornhill	London	1580-1650	1,769	88	47
St Helen's Bishopgate	London	1595-1680	1,521	76	48
St Dunstan in the East	London	1605-1653	3,103	103	32
St Mary Somerset	London	1605-1653	2,079	62	29
St Boltoph Bishopgate	London	1617-1650	2,101	112	51
St Martin-in-the-Fields	London	1620-1636	5,142	275	51
St Mildred & St Margaret Moses	London	1670-1700	509	23	43
All Hallows Bread Street	London	1671-1700	301	17	53
All London registers			**22,541**	**1,050**	**45**
Hawkshead	Lancs.	1581-1700	4,606	218	45
Terling	Essex	1601-1640	1,309	58	42
Ercall Magna	Salop	1611-1640	601	29	46
York (four parishes)	Yorks.	1614-1700	4,624	220	45
Hackness	Yorks.	1631-1660	478	25	50
Stretford	Lancs.	1650-1663	191	15	73
Bolton	Lancs.	1666-1712	6,094	365	57
Oswestry	Salop	1668-1717	5,342	211	38
Chorley	Lancs.	1684-1708	725	27	36
Childwell	Lancs.	1701-1753	2,053	114	53
Leigh	Lancs.	1701-1750	5,790	191	32
Prescott	Lancs.	1731-1795	9,848	405	40
Balderstone	Lancs	1787-1812	949	47	47
Blackburn	Lancs.	1793-1812	11,593	759	61
Dewsbury	Yorks.	1813-1837	12,495	715	54
All non-metropolitan registers			**66,698**	**3,399**	**48**

(b) from other sources

Source	Place	Date	Births	Stillbirths	Stillbirth rate
Midwife delivery records					
Katherine Manley	Whitby	1730-1754	2,179	86	38
Thomas Higgins	Wem	1781-1803	1,078	49-75	43-65
John Green Crosse	Norfolk	1820s-1830s	1,323	71	51
All midwife records			**4,580**	**206-232**	**43-48**
Lying-in hospitals					
British Lying-in Hospital	London	1750-1759	3,693	113	30
		1760-1769	4,787	132	27
		1770-1779	5,465	232	41
		1780-1789	5,327	293	52
		1790-1799	5.762	285	47
		1750-1799	25,034	1,055	40
Dublin Lying-in Hospital	Dublin	1757-1786	21,681	1,131	50

Table 2.14b continued

Dublin Lying-in Hospital	Dublin	1787-1793	10,294	580	53
		1826-1833	15,533	1,121	67
		1822-1844	6,377	325	49
Westminster General	London	1774-1781	1,839	84	44
Dispensary		1818	629	20	31
		1818-1828	12,460	302	24
Royal Maternity Charity	London	1828-1850	47,715	1,823	37
Liverpool Lying-in Hospital	Liverpool	1842-1845	323	18	53
All hospitals			**161,163**	**7,514**	**45**

Note: The stillbirth rate is calculated per 1,000 stillbirths and live births, ie (stillbirths / (stillbirths + births)) * 1,000. The stillbirth rate calculated from Thomas Higgins' case notes is 43, but there is a serious imbalance in the sex ratio of live births, 116 males to 100 females, which can be reduced to 106 (close to the biological norm) if all those live born infants without a reported sex are taken to be female. The sex-ratio of dead-born foetuses was 245, or 145 if all those dead-born foetuses without a reported sex are assumed to be female. Higgins' stillbirth rate rises to 65 if all cases with unstated outcomes are taken to be dead-born fetuses. See A. Tomkins, 'Demography and the midwives: deliveries and their dénouments in north Shropshire, 1781-1803', *Continuity and Change*, 25 (2010), pp. 199-232, here at pp. 219-21, for a different interpretation of these data.

Source: R. Woods and C. Galley, *Mrs Stone & Dr Smellie. Eighteenth-century Midwives and their Patients* (Liverpool, 2014), Table 1.1, pp. 25-6.

stillbirths and live births.[1] However, between 1609 and 1623, when stillbirths were again reported, the rate had fallen to 39.8 with the most likely explanation for this decline being that at this later date only true stillbirths were recorded.[2] Roger Finlay also discovered that in the large parish of Hawkshead stillbirths were more likely to be reported from the outlying parts of the parish and he argued that some of these must have been live-born.[3] We have already seen that in Hackness John Richardson went to considerable effort to differentiate stillbirths from live births and there is no reason to suggest that other clerks did not do likewise.[4] Since stillbirths were not required to be recorded by the Anglican registration system, it is likely that those registers that did so were amongst the most accurate and it is therefore worthwhile to consider evidence of stillbirths in the parish register period.

Table 2.14a presents a range of SBRs calculated from parish registers and this is complemented by Table 2.14b which includes rates calculated from midwife delivery and hospital records. Any problems affecting parish registers will not of course have affected the rates derived from these latter two sources. Perhaps the most striking feature of Table 2.14 is the consistency of the rates both over time and across space. Individual parish rates vary from 29 to 73, but much of this variation will have been due to the small numbers of

1 Forbes, *Chronicle from Aldgate*, p. 65, although only four examples were noted by the clerk. There were also instances of what we would term miscarriages being recorded as stillbirths, 'A woman chylde beinge so Yonge that it was skant to be decerned', p. 67.

2 There had been a change in the parish clerk between the two periods. Thomas Harridance was parish clerk between 1582 and his death in 1601 and the aptly named John Clerke was clerk by 1616, see Forbes, *Chronicle from Aldgate*, pp. 34-5.

3 Finlay, 'Distance to church'.

4 The case notes of James Hamilton illustrate the difficulty of differentiating a stillbirth from a live birth when he set out a procedure for resuscitating an apparent 'stillbirth', see Galley and Woods, *Mrs Stone & Dr Smellie*, pp. 427-30.

stillbirths recorded in each parish and the aggregated rates for both London and non-metropolitan parishes are very similar, 45 compared with 48.[1] Table 2.14a also shows little variation between parishes and certainly nothing approaching the differences in IMRs revealed by Table 2.9. Indeed, these rates are also consistent with SBRs during the early part of the twentieth century.[2] When Wrigley speculated on the cause of the rise in marital fertility rise during the eighteenth century he suggested that this phenomenon could have been due to a decline in the SBR thereby confirming the link between endogenous and maternal mortality which had both declined at the same time.[3] In order for this to have occurred the SBR needed to have been high during the seventeenth century (greater than 100), but Table 2.14 suggests that rates did not approach these levels.[4] Instead SBRs were relatively low and showed little variation or change throughout the parish register period. Both the midwife and hospital records, Table 2.14b, should be accurate in their identification of stillbirths and rates calculated from these sources are remarkably similar to the parish register ones. Since most were from the eighteenth century they also reveal little evidence of change over time. It is likely that both these types of records are biased in that they do not cover the whole population with private patients needing to pay the doctor his fees and the hospitals probably taking a greater proportion of poorer patients. In both cases however they probably dealt with some of the more difficult deliveries which may have resulted in a greater proportion of stillbirths. However, there is little in the figures to suggest that this occurred—perhaps better delivery techniques offset some of these additional risks? Table 2.14 is remarkable for its overall uniformity especially when compared to Table 2.9 and while further evidence would be welcomed, at present it seems safe to conclude that the SBR remained relatively stable throughout the parish register period. Given that the most important factor in determining whether a stillbirth occurs is the health of the mother, and in particular her nutritional status which affects foetal development, this suggests that these must have changed little throughout the period. Given that stillbirths and endogenous deaths will have shared many characteristics,[5] with most being subsumed under the headings inherited deficiency or accidents (birth injuries) in Figure 1.4, we must therefore conclude, albeit tentatively, that much of the variation in IMRs during the parish register period was due to differences in exposure to disease.

1 J. Graunt, 'Natural and political observations made upon the bills of mortality' reprinted in *Journal of the Institute of Actuaries*, 90 (1964), pp. 1-61, here at p. 29, noted that '[t]he *Abortive* and *Stillborn* are about the twentieth part of those that are christened, and the numbers seemed the same thirty years ago as now'. This would give a SBR of 48, although there must have been some under registration of baptisms in the bills which would have lowered the rate.

2 The Register General only began to report stillbirths from 1928. Between 1928 and 1939 the national rate was 40 with the range being from 27 to 70 within individual districts, see Registrar General's *Annual Reports* and *Statistical Reviews* for the relevant years and Woods and Galley, *Mrs Stone and Dr Smellie*, pp. 26-7.

3 Wrigley, 'rise in marital fertility'.

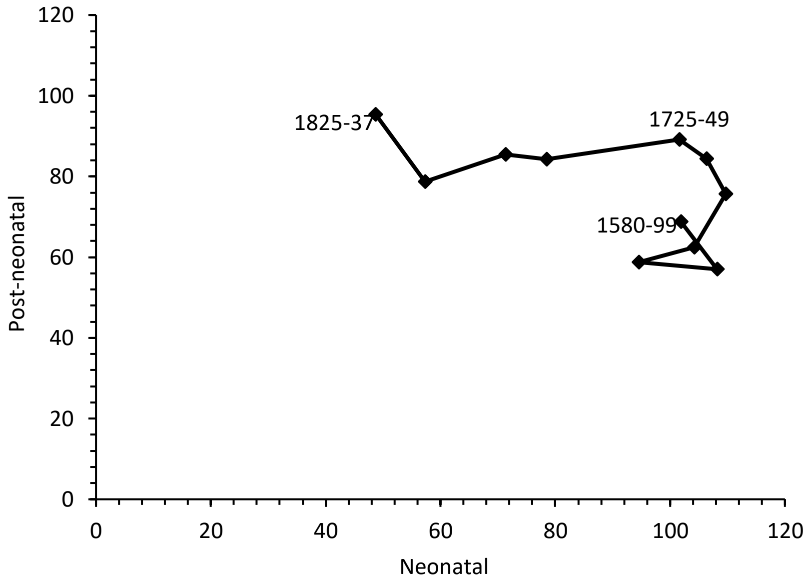
4 It is possible that miscarriages rather than late foetal deaths (stillbirths) were very high, but these of course would not have been recorded. Also see Hart, 'Beyond infant mortality' who estimated SBRs from early neonatal mortality and suggested that they were consistently in excess of 100 before 1750. By contrast Woods, 'historical trends in fetal mortality' has shown that there is nothing in the historical record to show that SBRs approached these levels. He concluded that the SBR was unlikely to exceed 60 in northern Europe (p. 159).

5 The introduction of the perinatal mortality rate (stillbirths and deaths within the first week) acknowledged this link and attempted to resolve any blurring between still and live births. See S. Peller, 'Mortality, past and future' *Population Studies*, 1 (1948), pp. 405-456, here at pp. 408-23.

The distribution of deaths throughout the first year of life

Much of what we know about infant mortality in the parish register period is a result of the Cambridge Group for the History of Population and Social Structure's extensive work on 26 English registers and while this sample can be criticised for the extent to which it represents national trends, anyone who has carried out a family reconstitution will appreciate their remarkable achievement in establishing levels, trends and patterns between 1580 and 1837.[1] Their work is a benchmark against which others must be judged. Perhaps the most important and intriguing result to emerge from their analysis was that the post-1750 decline in infant mortality occurred almost exclusively within the endogenous component while at the same time there was a similar decline in maternal mortality.[2] Indeed, without this fall 'there would have been almost no change in mortality under the age of 15 between the beginning and end of the last 150 years of the parish register period'.[3] They also showed

Figure 2.11 Relationship between neonatal and post-neonatal infant mortality rates, 1580-1837



Source: E.A. Wrigley R. Davies, J. Oeppen and R.S. Schofield, *English Population History from Family Reconstitution 1580-1837* (Cambridge, 1997), p. 226.

1 Wrigley *et al.*, *English Population History*, pp. 198-248.

2 Wrigley *et al.*, *English Population History*, p. 236. Maternal mortality is difficult to calculate in the parish register period because many maternal deaths were associated with stillbirths, and without causes of death, those mothers who died undelivered will not have been identified as such. For an exception see G.W.G.L. Gower, *A Register of all Christenings, Burials & Weddings within the Parish of Saint Peters upon Cornhill* (London, Publications of the Harleian Society Registers Volume 1, 1877), p. 161, '27 Dec 1605 'Luce Anderson Widd': she died in Childbed and her Child stilborne she was servant to Mrs Walker in Corbetes Court gra' street'. For a discussion of the issues involved in calculating the maternal mortality rate see C. Galley and A. Reid, 'Maternal mortality', *Local Population Studies*, 93 (2014), pp. 68-78.

3 Wrigley *et al.*, *English Population History*, p. 268.

that most of the increase in infant mortality between 1675 and 1750 occurred within the post-neonatal component. Figure 2.11 illustrates this pattern and put simply a post-neonatal increase was followed by a neonatal decline. Wrigley and his colleagues compared infant with childhood mortality and they also had sufficient data to allow infant deaths to be broken down into finer units.[1] They discovered that childhood mortality increased in the same period, but was 'much more strongly marked between 6 and 15 months than at younger or older ages' with mortality in this age group increasing by about two thirds between 1580-1674 and the peak period 1700-1749 compared with one third amongst the age group two to six months, one fifth for those aged 18 months to five years and one tenth for five to ten year olds.[2]

Unfortunately, few have attempted to replicate the Cambridge Group's analysis and little comparative data exists. Table 2.15 sets the 26 parish neonatal and post-neonatal rates against those for York and London. Landers' neonatal rates for London Quakers mirror the national rates quite closely with decline occurring after 1750; however post-neonatal mortality was much higher, the early eighteenth-century increase greater and there was also some decline after 1775.[3] This suggests that there may have been urban-rural differences in the age structure of infant deaths and is confirmed by the evidence from York even though at first sight the York neonatal rates seem at odds with the others. In part this is because the simple linking process was used to calculate IMRs and the rates then corrected to account for the inconsistent recording of unbaptised infant burials throughout the sample of registers. This correction process necessarily assumes that all unbaptised infant burials occurred on the day of their birth when in fact the infant was likely to have been older. Indeed, unless dates for birth and death are given, age at death must be calculated by subtracting the date of burial from the date of baptism which will lead to the neonatal component being inflated to some extent.[4] The uncorrected neonatal rates for York were 105, 132 and 117 respectively while neonatal rates in the two parishes where reconstitutions had been undertaken were 143 (St Martin Coney St, 1561-1700) and 142 (St Michael le Belfrey, 1560-1602).[5] Hence the York neonatal rates given in Table 2.15 appear plausible and it is unfortunate that the city's registers are not sufficiently accurate to allow reliable rates to be calculated much beyond 1700. One of the first signs of poor registration is a decrease

1 Wrigley *et al.*, *English Population History*, Table 6.6, p. 239; Table 6.11, p. 252.

2 Wrigley *et al.*, *English Population History*, pp. 253, 350. If possible, it would be better to divide infants into pre- and post-weaned since it might be expected that after weaning infants were susceptible to a host of new infections that had been mitigated by maternal breastfeeding. Such a division would be of course impossible since the age of weaning was unknown in most cases and it also assumes that weaning was a single event rather than a gradual process. See P. Crawford, *Blood, Bodies and Families in Early Modern England* (Harlow, 2004), p. 152 who argues that weaning represents a major change in the child's life.

3 Vann and Eversley, *Friends in Life and Death*, do not provide neonatal and post-neonatal rates for London. Their London IMRs are different to those of Landers and do not reveal any increase during the early eighteenth century. This may be due to the fact that their at risk populations are small. Likewise, the rates they report for the rest of the country are lower than those in Table 2.14 and they also suggest that the Quaker registers may not have captured all infant deaths (pp. 193-4, 199-202).

4 Wrigley *et al.*, *English Population History*, pp. 239-40 noted a considerable decline in first day mortality after the implementation of Rose's Act (1812) which required age at death to be given on specially prepared forms. Prior to this if the infant died without being baptised dummy births were created with the same date as their burial and hence the first day mortality rate declined from 41.8 in the 1800s to only 4.8 in the 1830s. All neonatal rates calculated from parish registers will necessarily include some post-neonatal deaths, although Quaker rates should not be affected in this way because their registers recorded births and deaths directly.

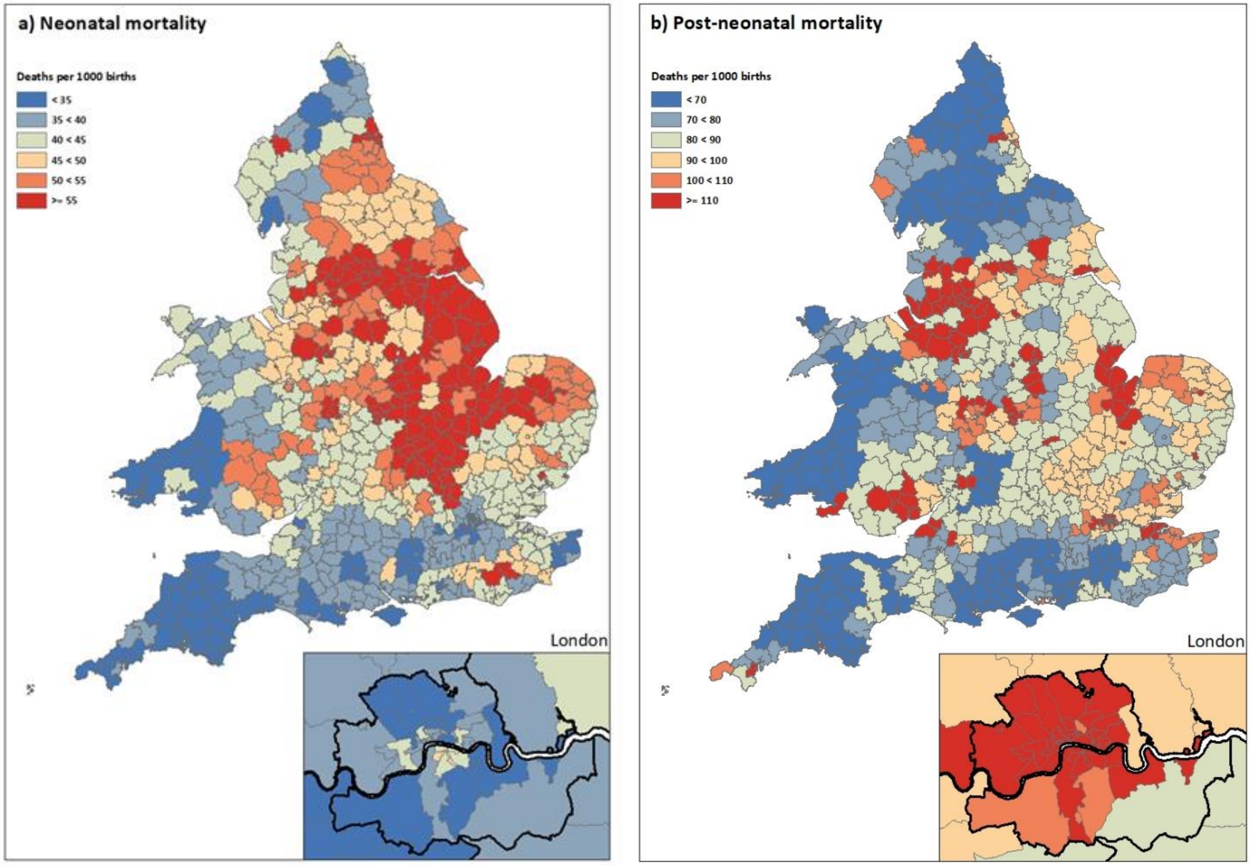
5 Galley, *Growth, Stagnation and Crisis*, pp. 99, 112.

Table 2.15 Neonatal and post-neonatal infant mortality rates in the parish register period

Date	Neonatal mortality rate	Post-neonatal mortality rate	Infant mortality rate	Date	Neonatal mortality rate	Post-neonatal mortality rate	Infant mortality rate
	England				York		
1580-99	101.9	68.8	170.7	1561-1600	144	81	225
1600-24	108.2	57.0	165.2	1601-40	174	87	261
1625-49	94.5	58.8	153.3	1641-1700	161	119	266
					London Quakers		
1650-74	104.2	62.5	166.7	1650-74	108	143	251
1675-99	109.7	75.7	185.4	1675-99	115	148	263
1700-24	106.3	84.4	190.7	1700-24	125	217	342
1725-49	101.6	89.2	190.8	1725-49	112	229	341
1750-74	78.5	84.3	162.8	1750-74	96	231	327
1775-99	71.3	85.4	156.7	1775-99	81	150	231
1800-24	57.3	78.7	136.0	1800-24	40	154	194
1825-37	48.7	95.4	144.1	1825-37	33	118	151

Sources: England data taken from E.A. Wrigley R. Davies, J. Oeppen and R.S. Schofield, *English Population History from Family Reconstitution 1580-1837* (Cambridge, 1997), p. 226; York data for 13 parishes from C. Galley, 'Growth, stagnation and crisis: The demography of York, 1561-1700', (unpublished PhD. thesis, University of Sheffield, 1991), p. 125; London Quaker data from J. Landers, *Death and the Metropolis. Studies in the Demographic History of London 1670*-1830 (Cambridge, 1993), p. 136.

Figure 2.12 Neonatal and post-neonatal mortality rates in Registration Districts, England and Wales (with London inset), 1839-1844



Source: see Figure 2.9.

in the proportion of early age deaths and consequently it is necessary to verify that any decline in neonatal mortality is real rather than a consequence of changes in registration practices. We have already seen that circumstantial evidence relating to birth intervals suggests that the Cambridge Group's rates are reliable, but with very few analyses of the distribution of deaths during the first year of life in the parish register period having been carried out, especially during the period between 1750 and 1837 when registration was under the greatest pressure, a wider range of evidence, especially for the towns and cities, is needed to confirm and clarify these changes. Short of replicating the Cambridge Group's analysis on a new set of registers, the only way of assessing national patterns is to examine what happened during the early years of civil registration.

Figure 2.7 compared neonatal and post-neonatal mortality rates with overall IMRs in English and Welsh RDs between 1839 and 1844. There was a close, almost linear relationship between post-neonatal and overall infant mortality with much of the variation in overall IMRs being due to the post-neonatal component. The relationship between neonatal and overall infant mortality was much weaker. Figure 2.12 explores these relationships further by mapping neonatal and post-neonatal mortality rates by RD for the same period. Generally speaking, the areas experiencing the highest IMRs also experienced the highest post-neonatal rates, with the urban mortality penalty being prominent. Thus, the RDs suffering the highest IMRs—Norwich (241.0 per 1,000 live births), Liverpool (232.9), Hull (237.5), Nottingham (226.7) and Manchester (223.4)—also suffered some of the highest post-neonatal rates: 158.9, 179.7, 162.1, 162.3 and 177.8 respectively. The distribution of post-neonatal mortality was similar to Figure 2.9 with the towns and some eastern rural districts experiencing the highest rates while the lowest rates were to be found in parts of Wales and the northern and southern extremes of England.[1] The neonatal map is more complicated. Many districts that experienced high post-neonatal rates also experienced high neonatal rates and the reverse was also true with neonatal rates being low throughout much of southern England, most of Wales and the very north. However, Durham, most of Yorkshire and large swathes of eastern England, including the whole of Lincolnshire, experienced high neonatal rates. It is also interesting to see that Norfolk experienced higher neonatal rates than its neighbour Suffolk. By contrast, Cornwall, South Wales and parts of Lancashire had lower rates than might be expected from their IMRs. The highest neonatal rates were found in Norwich (82.1) and Hull (75.4), but Liverpool, which had the second highest IMR and the highest post-neonatal rate, had a neonatal rate that was only 53.2, exactly the same as Wycombe, Buckinghamshire and Loddon, Norfolk and lower than Foleshill, Warwickshire (62.9) and Ticehurst, Sussex (61.9). It is also striking that most of London experienced relatively low neonatal rates compared with its high post-neonatal rates. It could be that part of the reason for these discrepancies is that there were as yet undetected regional differences in under-registration since we know that registration was not perfect in this period.[2] There could also have been considerable regional differences in child care practices; however it is difficult to be certain and Figure 2.12 identifies many areas where the relationship between neonatal and post-

1 Galley and Shelton, 'Bridging the gap', p. 75, Figure 9.

2 See the discussion in Chapter 3. Teitlebaum, 'Birth underregistration', p. 333 provides estimates of birth under-registration by county for the 1840s. The effects of birth under-registration on neonatal mortality rates depends largely on whether this was also accompanied by an under-registration of young infant deaths which seems likely. According to Teitlebaum Norfolk had an under-registration rate of 6.5 per cent compared with 3.5 per cent for Suffolk which would appear to be the wrong way around if these differences can be accounted for purely by under-registration. This issue is clearly complicated.

neonatal mortality needs to be investigated further. Figure 2.12 adds considerable weight to the view that a general decline in neonatal mortality must have occurred at some point during the eighteenth century.[1] Moreover, if levels of endogenous mortality were broadly similar throughout the country then, even if we accept some differences in under-registration, there must also have been substantial variations in exogenous neonatal mortality which probably had some regional components. This result coupled with the variations in post-neonatal mortality noted above means that local disease environments must have played an important role in explaining overall differences in IMRs.

The results reported in this section suggest many fruitful areas for further research, especially with respect to identifying geographical variations in neonatal mortality. The link between maternal and endogenous mortality may be crucial here, but little is known about geographical variations in maternal mortality in this period. In terms of explaining the various patterns, we need to seek causes for both the late-seventeenth-century increase in post-neonatal mortality and the mid-eighteenth-century decline in neonatal mortality.

Seasonality of infant deaths

By comparison with the nineteenth century, where it is well known that urban infants were especially vulnerable to diarrhoea in the hot summer months, relatively little is known about the seasonality of infant deaths in the parish register period. In part this is because for results to have significance, large numbers of infant deaths are required as the total number of deaths need to be broken down into seasonal or monthly components. Once again most of our knowledge of seasonality is based on the work of Wrigley and his colleagues who discovered that 'cold weather brought higher mortality, while in the summer months rates were significantly lower'.[2] When different ages were considered separately, a winter peak was discovered amongst those aged 5-11 months.[3] What is interesting about this analysis is the absence of any evidence of the summer excess that features in much discussion of infant mortality in the late nineteenth century.

Working out the seasonality of infant deaths is by no means a straightforward process. It is highly influenced by the seasonality of births and the risks that infants faced were dependent on their age, with the first three months being especially dangerous.[4] Hence it is appropriate to examine period and cohort rates separately, although this is only feasible if large amounts of data are available for analysis. Other studies that have examined seasonality have not matched the level of sophistication achieved by Wrigley and his colleagues, but Creighton believed infantile diarrhoea to be 'one of the most important causes of London mortality from the Restoration onwards'.[5] This conclusion was based on his analysis of weekly numbers of deaths in the bills of mortality from 'griping in the guts' which clearly

1 Galley and Shelton, 'Bridging the gap', pp. 74-5, discusses geographical variations in neonatal and post-neonatal mortality.

2 Wrigley *et al.*, *English Population History*, p. 338. This resulted in April being 'the least dangerous month in which to be born while July and September were the most dangerous' with 'the four months from June to September being 'consistently unfavourable to infant life' (p. 335). Note the difference between the risks faced by infants being born in a particular month compared with living through that month. For a full discussion of these issues see Wrigley *et al.*, *English Population History*, pp. 333-40.

3 Wrigley *et al.*, *English Population History*, p. 334.

4 For difficulties in measuring seasonality mortality see J.-P. Sardon, 'Le mouvement saisonnier de la mortalite infantile: une mesure impossible?', *Population*, 38 (1983), pp. 763-79.

5 C. Creighton, *A History of Epidemics in Britain, Volume 2* (Cambridge, 1894), p. 748.

show a summer peak, although it should be tempered against the reservations about the quality of information contained in the bills mentioned above and the fact that not all deaths in this category would have been infant ones.[1] Likewise, Landers' analysis of the bills of mortality from the 1730s identified both winter and late summer peaks in infant mortality, but during the eighteenth century as infant mortality worsened the autumn and winter months became increasingly hazardous.[2] This winter peak was also observable in a sample of rural Shropshire parishes examined by Jones and moreover it was also evident within neonatal deaths.[3] By contrast, in sixteenth- and seventeenth-century York a slight summer excess was discovered. However, when neonatal and post-neonatal mortality was investigated separately there was a slight winter excess within the post-neonatal component while for neonates there was a very strong summer excess.[4] This summer excess in neonatal mortality has also been discovered in London with Landers noting 'a strong seasonal peak in the summer months (June-August)' in the age group 0-29 days.[5] More recently, an extensive study by Romola Davenport of the parish of St Martin-in-the-Fields has discovered similar patterns. She found that:

> [n]eonatal mortality displayed a prominent summer peak throughout the period 1752–1812 … As was the case amongst London Quakers, this summer peak in neonatal mortality persisted in St. Martin in the Fields despite lengthening birth intervals and significant falls in neonatal mortality … In common with London Quakers, there was also a summer peak amongst slightly older infants, aged 1–5 months, but no summer peak at older ages. This summer peak in mortality of the youngest post-neonates disappeared after c.1795.[6]

Making sense of these contrasting patterns remains difficult and is not helped by the fact that different methods have been employed to measure seasonality, different periods analysed and the analysis carried out by Wrigley and his colleague has not been replicated on other registers. Seasonality is therefore a topic worthy of further investigation with two issues being especially important given the overall pattern of change in the IMR discussed above. The first relates to the extent to which the seasonality identified in the largely rural sample

1 Creighton *History of Epidemics in Britain, Volume 2*, p. 750 records that in the first four weeks of July 1670 there were 245 deaths from 'griping in the guts' compared to 867 in the first four weeks of September, 1670. Also see Landers, *Death in the Metropolis*, p. 208.

2 Landers, *Death in the Metropolis*, pp. 214, 231. See also Vann and Eversley, *Friends in Life and Death*, p. 224.

3 Jones, 'Further evidence on the decline of infant mortality', pp. 246-7. Jones calculated seasonal IMRs (infant burials / baptisms within each season) which did not take into account birth seasonality. Despite this, his conclusions still hold up. P. Huck, 'Shifts in the seasonality of infant deaths in nine English towns during the 19th century: a case for reduced breast feeding?', *Explorations in Economic History*, 34 (1997), pp. 368-86, here at p. 372, found that a similar winter peak in infant mortality persisted into the early nineteenth century in his sample of industrialising parishes. Likewise, S. Peller, 'Studies on mortality since the renaissance', *Bulletin of the History of Medicine*, 13 (1943), pp. 427-61, here at p. 453, found a winter excess amongst European ruling families and E. Vilquin, 'La mortalité infantile selon le mois de naissance. Le cas de la Belgique au XIXe siècle', *Population*, 33 (1978), pp. 1137-53 found both winter and summer peaks in Belgium during the 1840s.

4 Galley, *Growth, Stagnation and Crisis*, p. 140.

5 Landers, *Death in the metropolis*, p. 143.

6 R.J. Davenport, 'Infant-feeding practices and infant survival by familial wealth in London, 1752–1812', *The History of the Family,* 24 (2019), pp. 174-206, here at p. 187-8. Note that Davenport considers summer to be July-September while Landers uses June-August. In York the three months with the highest seasonal indexes were July, August and September, Galley, *Growth, Stagnation and Crisis*, p. 140.

of Wrigley and his colleagues also appeared in the towns with their much higher IMRs, and the second to the extent to which seasonality changed over time as IMRs declined in many places. Other issues worthy of further consideration such as seasonal differences within individual infant age groups and the effects of climate change have hardly been discussed.[1] We can at least identify three patterns, albeit tentatively, that may help us explain the overall direction of change in IMRs: (1) the late autumn/winter excess that is particularly evident amongst older infants; (2) the fact that this excess also appears to have increased, especially in London during the eighteenth century, and (3) the marked seasonality in neonatal mortality that may have differed between rural and urban areas and suggests that neonatal infections must have had a significant impact on neonatal deaths.

Other demographic data

It is well known that infant mortality was higher among boys than girls, that twins suffered higher rates than singletons, as did illegitimates compared with legitimates. Boys suffered an IMR about 14 per cent higher than that of girls, which was probably related to differing levels of foetal development and it did not change significantly over time.[2] Similar reasons also explain much of the higher rates amongst twins.[3] By comparison, the reasons why illegitimates suffered such high mortality rates must be related to the social conditions in which they were raised, although a greater proportion of illegitimates would have been first births and these suffered higher mortality rates than higher order births. The impact of birth order on mortality has been little studied in the parish register period, but there is no evidence to suggest that the 'normal' pattern of high mortality amongst first births, which declined to reach a low amongst third births and increased thereafter in a tick-shaped distribution, did not occur. Katherine Lynch and Joel Greenhouse confirmed this pattern for nineteenth-century Sweden, but more interestingly they discovered that family factors were an important influence on an infant's survival.[4] Individual examples of death clustering within families are relatively easy to discover (see Table 2.3 for examples), but the impact of this phenomenon on overall IMRs and change over time is difficult to assess, in part because relatively few large families have been reconstituted. However, it is clear that the clustering of deaths into a relatively small number of families can have a disproportionate effect on the overall IMR in an area.

Likewise, relatively little work has been carried out on social class variations in infant mortality during the parish register era.[5] However, it would be wrong to assume that the

1 The effects of the 'little ice age' which lasted perhaps until 1850 ensured that much of the parish register period was one of gradual warming. Hence it may not be appropriate to compare seasonality during the early eighteenth century with that in the warmer late nineteenth century. For a general discussion of this phenomenon see A.B. Appleby, 'Epidemics and famine in the little ice age', *Journal of Interdisciplinary History*, 10 (1980), pp. 643-63.

2 Wrigley *et al.*, *English Population History*, pp. 298-301. Foetal loss was also greater amongst males.

3 Wrigley *et al.*, *English Population History*, p. 247. Twin mortality rates were over three times higher than singletons in the first month and whilst this difference declined as twins grew older, they still suffered a disadvantage in their first two years.

4 K.A. Lynch and J.B. Greenhouse, 'Risk factors for infant mortality in nineteenth-century Sweden', *Population Studies*, 48 (1994), pp. 117-33, here at p. 121.

5 P. Razzell, *Mortality, Marriage and Population Growth in England, 1550-1850* (London, 2016), pp. 38-9 has suggested that a wealth gradient in infant mortality exists, but this conclusion is based on a relatively small sample of infants. A recent study by H. Jaadla, E. Potter, S. Keibek and R. Davenport, 'Infant and child mortality by socio-economic status in early nineteenth-century England' *Economic History Review*, 73 (2020),

sorts of relationships that can be found in the twentieth century necessarily held true during earlier periods. In part this is because the most important influence on an infant's survival chances was whether or not it was breastfed and those sections of the populations employing wetnurses came necessarily from the better off sections of society. Furthermore, given the great differences in geographical variations in infant mortality, being poor and living in a remote rural area could easily bring greater health benefits that being rich and living in an unhealthy environment such as London. Hollingsworth's important study of the British peerage should therefore provide an initial indication of social class variations in mortality.[1] We have already seen that he used genealogical data conceived to verify male primogeniture so that some female births and infant deaths are missing from his data set, especially before 1750. Hollingsworth made corrections to his data and his inflated estimates are similar to the Cambridge Group's national series, although the late-eighteenth-century decline amongst the peerage was much greater.[2] Explaining these differentials is difficult because in most cases it is not known where these infants lived or what type of care they received. For example, any benefits from maternal breastfeeding could easily have been offset by a move to germ-ridden London.[3]

At the opposite ends of the social spectrum we also know something about the survival rates of foundlings admitted to the London Foundling Hospital. This vulnerable group suffered extremely high levels of mortality. During the late 1750s a parliamentary grant allowed the Hospital to accept most infants it was offered. IMRs were probably in excess of 600 and, with childhood mortality also being high, the chances of a foundling surviving his or her hospital experience were not good.[4] Up to 4,000 infants per year were admitted during this short 'general reception' period, but when in 1760 the parliamentary grant was withdrawn due to the increasing costs associated with supporting the foundlings, admission rates declined to little more than 100 per year and sometimes much less. After 1760 IMRs also declined so that by 1800 they were probably only slightly higher than those prevailing in the rest of the population. There are considerable problems in both calculating and interpreting IMRs for foundling populations since relatively few foundlings entered the hospital on the day of their birth, it is not known how they were treated prior to admission and outside of the 'general reception' period, sick infants may have been refused entry. A significant proportion of infants also originated from outside of London. On admission, infants would have been sent to a suitable wetnurse as soon as possible, or if they were sick, treated within the hospital. Foundlings, therefore, were an exceptional group who, for a variety of reasons, were deprived of many of the basic necessities to ensure their survival. While the hospital did its best, these vulnerable infants still faced considerable hazards throughout their (often short) lives. Despite the smaller number of admissions in the late

pp. 991–1,022, here at p. 991, which analysed the 8 Cambridge Group parishes in the period 1813-1837 showed that 'wealth conferred no clear survival advantage in infancy'.

1 Hollingsworth, 'demography of the British peerage', p. 66 and T.H. Hollingsworth, 'Mortality in the British peerage families since 1600', *Population*, 32 (1977), pp. 323-52, here at p. 327.

2 See the discussion in Smith and Oeppen, 'place and status', p. 76.

3 See also R. Finlay, Differential child mortality in pre-industrial England: The example of Cartmel, Cumbria, 1600-1750', *Annales de Demographie Historique*, 17 (1981), pp. 67-80, here at p. 75, who managed to link probate records to individual family reconstitutions. He discovered that the families of those leaving £60 or more had an IMR of 95 compared with 117 for those leaving less than that amount. This result is based on only 162 infant deaths.

4 A. Levene, *Childcare, Health and Mortality at the London Foundling Hospital, 1741-1800* (Manchester, 2007), p. 54.

eighteenth century it is significant that by then the proportion surviving had increased.[1] Levene also discovered that being illegitimate conferred an additional risk for foundlings as their IMRs exceeded the already extremely high rates of their legitimate peers.[2]

The only population-wide study of social differences in infant mortality was undertaken by Romola Davenport on eighteenth- and early-nineteenth-century St Martin-in-the-Fields.[3] While there were technical issues concerning infants who had presumably been sent out to nurse and the possible export of burials to other parishes, Davenport showed that neonatal mortality was much higher amongst wealthier residents during the period 1752-1774.[4] By the turn of the century, neonatal mortality had declined within all sections of the population, rates had converged and during the early nineteenth century little difference remained. Since birth intervals amongst the wealthy also increased during this period, Davenport concluded that this was most likely due to greater maternal nursing and less reliance on wet nurses. By comparison, there was little social differences in post-neonatal during the period 1752-1774, but by the end of the century the expected social gradient of lower mortality amongst the wealthy had emerged. A possible explanation for this change posited by Davenport was that the wealthy were increasingly being able to access better health care during this period, especially with respect to inoculation against smallpox. The emergence of social class differences in mortality helps explain part, but by no means all, of the decline in infant mortality during the late eighteenth century. Further research is needed to discover whether the changes that occurred in London also affected other towns and rural areas. Likewise, the extent to which the changes that affected the wealthy also affected those lower down the social scale, perhaps to a lesser degree, is not known.

The final set of demographic data relevant to the study of infant mortality is maternal mortality. In the absence of information on cause of death, the maternal mortality rate (hereafter MMR) is difficult to determine in the parish register period because many maternal deaths were associated with stillbirths, which were not usually recorded, and the deaths of those mothers who died undelivered were obviously not recorded alongside a birth.[5] Instead, maternal deaths have to be inferred by working out how many mothers died up to 42 days after giving birth and then correcting for undelivered deaths and those associated with stillbirths. Since the MMR was relatively low, especially by comparison with the IMR, large numbers of baptisms and burials need to be searched before a representative rate can be calculated. Notwithstanding this problem, the general course of maternal mortality has been determined and generally speaking the MMR declined from about 15 to 5 during the

1 See Levene, *London Foundling Hospital*, pp. 1-89 for a full discussion of these issues.

2 A. Levene, 'The mortality penalty of illegitimate foundlings and poor children in eighteenth-century England' in A. Levene, T. Nutt and S. Williams (eds), *Illegitimacy in Britain, 1700-1920* (Basingstoke, 2005), pp. 34-49.

3 Davenport, 'Infant-feeding practices'.

4 Davenport, 'Infant-feeding practices', pp. 190-4.

5 Galley and Reid, 'Maternal mortality'. William Hunter dissected a number of women who died undelivered. Drawings of these women were used in his famous anatomical atlas, see C. Grigson, ' "A universal language" William Hunter and the production of *The anatomy of the human gravid uterus*', in E.G. Hancock, N. Pearce and M. Campbell (eds), *William Hunter's World. The Art and Science of Eighteenth-century Collecting* (Farnham, 2015), pp. 59-80. For examples of women being buried alongside their foetuses see C. Roberts and M. Cox, *Health & Disease in Britain from Prehistory to the Present Day* (Stroud, 2003), pp. 252-4; Daniell, *Death*, pp. 125-6.

eighteenth century and it then stayed at this level until the 1930s.[1] Wrigley and his colleagues noticed that endogenous and maternal mortality declined at the same time and they speculated that this may have had a similar or related cause. While the loss of its mother would undoubtedly have had a detrimental effect on an infant's survival chances (all the sets of twins in the Cambridge Group's 26 parishes whose mothers died, also died), it is not certain whether the relationship between infant and maternal mortality holds in the other direction.[2] Put simply, if every maternal death resulted in an infant death, then a decline in the MMR from 15 to 5 would cause an extra 10 infants to survive which means that an IMR of 200 would only decline to 190.[3] However, safer and less traumatic childbirth would also have resulted in fewer injuries to both mother and child; fewer infants would therefore have died as a consequence of the birth process and healthier mothers might have been better able to care for their infants, especially during their important first few days.

Explaining variations and change

It has been possible to establish the extent of variations and change in infant mortality during the parish register period with some degree of certainty, but providing an explanation for these patterns is much more difficult. The reason being that while there is sufficient demographic data to determine broad trends, little good quality quantitative material exists about the causes of infant mortality or the various child rearing methods, in particular breastfeeding rates, which influenced infant survival chances. Instead it will be necessary to rely on qualitative evidence culled from a range of sources in order to form a convincing explanation, even if this will necessarily involve some degree of speculation.

The preceding analysis of the cumulative demographic data has suggested that most of the differences in IMRs can be accounted for by differential exposure to disease. The fact that most of the variations in IMR occurred within the post-neonatal component supports this view, notwithstanding that variations in neonatal mortality were significant. The general stability of the stillbirth rate (Table 2.13) across both time and space implied that so-called endogenous infant mortality did not vary sufficiently to account for the major changes in infant mortality highlighted above. Thus, factors such as changes in maternal nutrition or standards of living which affected maternal health, were not significant enough to account for the variations evident in the five environments identified above.[4] What follows will seek to provide an explanation of the course of infant mortality change in the parish register period using all the available data. While all attempts at 'squaring this circle' will ultimately prove inconclusive, this process will at least identify gaps in our knowledge and enable an agenda for further research to be set.

We begin with those rural, relatively isolated areas that experienced the lowest IMRs. Rates between 80 and 100 were once thought to be beyond the bounds of possibility for a preindustrial population, but they must have occurred because in these areas there was less

1 See the discussion in Woods and Galley, *Mrs Stone and Dr Smellie*, pp. 21-2. These estimates are subject to some margin of error.

2 This point was made by I. Loudon, 'On maternal and infant mortality', *Social History of Medicine*, 4 (1991), pp. 29-73, here at p. 72.

3 U. Högberg and G. Broström, 'The demography of maternal mortality – seven Swedish parishes in the nineteenth century', *International Journal of Gynaecology and Obstetrics*, 23 (1985), pp. 489-97 showed that in seven nineteenth-century Swedish parishes infants whose mothers died at birth suffered a nine-fold decrease in their survival chances. This increased risk persisted until age five.

4 S. Scott and C.J. Duncan, *Demography & Nutrition* (Oxford, 2002), p. 332.

likelihood of coming into contact with a whole range of pathogens common in urban environments and, more importantly perhaps, the child care methods that were employed were effective. In order to achieve these rates, almost universal maternal breastfeeding must have been the norm with weaning occurring relatively late.[1] Maternal breastfeeding, especially the first milk, colostrum, which contains immunity boosting antibodies and has a mild laxative effect that helps in passing the meconium, confers some immunity to the infant and in the period before germ theory was accepted all alternative sources of nutrition such as 'dry' or wet nursing posed significant additional risks to the infant.[2] It does not appear tenable that standards of cleanliness or of living in general were higher in these rural parishes compared to elsewhere. Likewise, given the relatively small size of these parishes most births would have been supervised by, at best, a local midwife who had attended relatively few births. Access to more specialised medical assistance would have been limited or nonexistant.[3] Thus, while direct evidence is lacking, these 'traditional' birthing practices, infant feeding and childrearing methods were clearly effective, at least within the confines of early modern medical practice. Moreover, IMRs in these parishes hardly changed until the secular decline in infant mortality occurred at the beginning of the twentieth century, so it seems unlikely that child rearing methods changed either. The evidence for levels of infant mortality in these places is based on data grouped into long cohorts so any small short-term variations will tend to be smoothed out.[4] Notwithstanding such issues, as far as it is possible to tell, there were a number of populations that consciously did little to ensure the survival of their infants, but still managed to achieve low IMRs. Writing about one of these places at the end of the nineteenth century, Hartland in Devon, Waller noted:

> a study published in 1891 advertised its anachronistic queerness. There was surviving belief in sorcery, the practice of ancient civil ritual and of communal sanctions against unsocial activity, and evidence that cruel sports were only lately extinct. But many places could claim as much or more. The significant point is that to be held remote in late-nineteenth-century England meant in the case of Hartland being merely thirteen miles from Bideford and sixteen miles from Holsworthy, the nearest market towns and railway connections.[5]

While allowing for some exaggeration, the 'modern' advances associated with urbanisation together with its additional threats to infant life had clearly not reached 'backward' Hartland even by 1891. In the parish register period being remote meant that there was less chance of coming into contact with disease and perhaps also less chance of coming into contact with alternative, less natural, ideas about childrearing, ones that were also more hazardous for

1 Populations where maternal breastfeeding was not the norm, even rural ones, suffered very high IMRs. In parts of northern Sweden, infants were fed milk via a cow's horn and IMRs were in the region of 350, see A. Brändström, 'The impact of female labour conditions on infant mortality: A case study of the parishes of Nedertorneå and Jokkmokk, 1800-96', *Social History of Medicine*, 1 (1988), pp. 329-58. Also see J.E. Knodel, *Demographic Behavior in the Past* (Cambridge, 1988), pp. 44-5, 542-9.

2 For an overview of infant feeding in this period see V. Fildes, 'The culture and biology of breastfeeding: an historical review of western Europe', in P. Stuart-Macadam and K.A. Dettwyler (eds), *Breastfeeding: Biocultural Perspectives* (New York, 1995), pp. 101-26.

3 See the general discussion in Woods and Galley, *Mrs Stone & Dr Smellie*.

4 A decline in the IMR from 100 to 90 would be significant, but may not be identified when the data are presented in this way.

5 P.J. Waller, *Town, City and Nation. England 1850-1914* (Oxford, 1983), p. 201.

infant survival. In places where IMRs were higher than these rural 'ideals' we might therefore expect some deviation from the practices adopted in Hartland and elsewhere.

IMRs in the towns could be up to three or four times greater than in the healthiest environments and even small towns such as Gainsborough experienced a considerable urban penalty. All towns would have suffered an increased disease load as the close proximity of people ensured that infants were likely encounter gastrointestinal diseases and, perhaps more importantly given the seasonality of infant deaths, winter respiratory diseases together with a number of typical childhood infectious diseases such as smallpox and measles.[1] As populations increased, so would the disease burden and infants would have been more likely to be exposed to infectious diseases at younger ages causing the IMR to increase. However, there does not appear to be a simple correlation between infant mortality and population size, rather once a threshold had been reached IMRs were raised accordingly, although London appears to have been exceptional, both in its overall size and the rates experienced by individual parishes. With respect to the late-seventeenth-/early-eighteenth-century increase in post-neonatal IMR witnessed in London and the Cambridge Group's sample of parishes, one disease, smallpox, can account for at least part of that increase. According to Ann Carmichael and Arthur Silverstein, before the seventeenth century, evidence of smallpox causing substantial numbers of death is rare and they argue convincingly that after 1600 *variola major* (with case fatality rates up to 30 per cent) replaced *variola minor* (with case fatality rates of about one per cent) as the main agent responsible for causing smallpox deaths.[2] This meant that, increasingly during the seventeenth and eighteenth centuries, successive epidemics of smallpox resulted in increased mortality especially in the towns.[3] The effects of such an epidemic on infants can be seen in Chester where, as we have seen, John Haygarth published comments on mortality in the town for the three years 1772-1774. In 1772 there were 16 smallpox deaths, four of which were infants; in 1773 there was one non-infant smallpox death, but in 1774 there were 202 smallpox deaths, 51 were infants, none of which were neonates and 44 were aged over six months.[4] Assuming that Haygarth's figures are accurate, IMRs in the three years were 192, 164 and 249 which gives an overall IMR of 203 with infant smallpox deaths accounting for 44 deaths per 1,000 baptisms during 1772-1774.[5] Haygarth also showed that the overall case fatality rate in 1774 was 15 per cent (202 deaths out of 1,385 cases), but with the 'smallpox' IMR being 130 (51/421) then either most infants must have been exposed to the disease or case fatality rates for infants were much higher.[6] With Duncan and his colleagues arguing that smallpox affected Chester every two to four years from the seventeenth century onwards and that the gap between epidemics narrowed during the eighteenth century, this means that it is not inconceivable that

1 Landers, *Death and the Metropolis*, pp. 89-126.

2 A.G. Carmichael and A.M. Silverstein, 'Smallpox in Europe before the 17th century: virulent killer or benign disease?', *Journal of the History of Medicine and Allied Sciences*, 42 (1987), pp. 147–68.

3 These became especially noticeable in York after 1650. See Galley, *Demography*, p. 104 and pp. 103-8 for a wider discussion of childhood epidemics.

4 Haygarth, 'Chester bill, 1772', p. 77; 'Chester bill, 1773', p. 89; 'Chester bill, 1774', pp. 148, 150.

5 Haygarth reported 81 infant deaths and 421 baptisms in 1772, 66 infant deaths and 402 baptisms in 1773 and 105 infant deaths and 421 baptisms in 1774 which gives 252 infant deaths and 1,244 baptisms for the three years combined. There were 55 infant smallpox deaths in the three years.

6 R.A. Leadbetter, 'Smallpox in Oxfordshire, 1700-99, and the implications of familial transmission routes', *Local Population Studies*, 98 (2017), pp. 12-29, here at pp. 23-4, found that 60 per cent of infants in traceable families died from smallpox during two eighteenth-century epidemics in Banbury.

Haygarth's figures could be representative of the impact of smallpox on eighteenth-century Chester.[1] In 1784 Haygarth published a proposal which advocated a combination of isolation and infant inoculation to control the disease.[2] A society was founded to carry out Haygarth's scheme and limited success in reducing mortality rates was achieved during the 1778 epidemic.[3] Similar schemes were set up in Leeds, Newcastle and Carlisle; however, the charity that oversaw Haygarth's work soon floundered and it was not until vaccination began to be practiced widely, at the beginning of the nineteenth century, that infant smallpox began to decline steadily.

Table 2.16 Decadal smallpox deaths, London bills of mortality, 1629-1837

Date	Smallpox deaths	Total deaths	Smallpox deaths (per cent)
1629-36	2,547	90,195	2.8
1661-70	9,950	241,317	4.1
1671-80	12,660	191,168	6.6
1681-90	16,640	223,606	7.4
1691-1700	11,028	207,698	5.3
1701-10	12,043	214,638	5.6
1711-20	19,532	239,115	8.2
1721-30	23,044	274,933	8.4
1731-40	20,592	264,925	7.8
1741-50	18,533	252,717	7.3
1751-60	20,611	204,597	10.1
1761-70	24,234	234,412	10.3
1771-80	20,923	214,605	9.7
1781-90	17,867	192,690	9.3
1791-1800	18,477	196,798	9.4
1801-10	12,534	185,823	6.7
1811-20	7,858	190,768	4.1
1821-30	6,990	209,094	3.3
1831-7	3,858	162,906	2.4

Note: The bills for 1637-46 are lost and Creighton only gives smallpox, not total, deaths for 1647-60.

Source: C. Creighton, *A History of Epidemics in Britain, Volume 2* (Cambridge, 1894), pp. 436-7, 456, 461, 531, 535, 568.

1 S.R. Duncan, S. Scott and C.J. Duncan 'Smallpox epidemics in cities in Britain', *Journal of Interdisciplinary History,* 25 (1994), pp. 255-71, here at pp. 260-5. This conclusion assumes that Haygarth's figures were not affected by under-registration, other diseases did not cause childhood mortality to increase, the 1774 epidemic was typical of others in this period and that all those infants that succumbed to smallpox would have survived infancy. All these assumptions must of course be open to question. For the possible effects of other childhood diseases see, A. Dyer, 'Epidemics of measles in a seventeenth-century English town', *Local Population Studies*, 34 (1985), pp. 35-45.

2 J. Haygarth, *An Inquiry How to Prevent the Small-pox. And Proceedings of a Society for Promoting General Inoculation at Stated Periods, and Preventing the Natural Small-pox in Chester* (London, 1784). See also, A.A. Rusnock, *Vital Accounts. Quantifying Health and Population in Eighteenth-century England and France* (Cambridge, 2002), p. 103.

3 A. Boylston, 'John Haygarth's 18th-century 'rules of prevention' for eradicating smallpox', *Journal of the Royal Society of Medicine*, 107 (2014), pp. 464-9, here at p. 496.

The impact of smallpox on London's mortality regime can be seen by examining the proportion of smallpox deaths reported in the London bills of mortality (see Table 2.16). Given the reservations expressed above about the quality of these data and the fact that only total smallpox deaths, not infant ones, were reported, they do show the importance of this disease to London's mortality regime. They also infer that smallpox infant mortality must have increased substantially during the eighteenth century and then fell quickly from the beginning of the nineteenth century after the introduction of vaccination. Moreover, Romola Davenport, Leonard Swartz and Jeremy Boulton showed that in the parish of St Martin-in-the-Fields there was a similar trend and deaths were increasingly concentrated within infants and young children during the late eighteenth century.[1] The smallpox IMR doubled between 1770 and 1800, although the 1800 figure (*c*.30) was still lower than that calculated for Chester.[2] Davenport and her colleagues conclude that inoculation had little impact on infant mortality in St Martin-in-the-Fields, although it may have done so on other populations within London such as the Quakers who experienced declining IMRs during the second half of the eighteenth century.[3] In a subsequent paper, Davenport and two other colleagues have shown that in northern England smallpox was an endemic disease that mainly affected children, whilst in the south it was more of an epidemic disease which could also affect adults and this may explain the difference in smallpox IMRs between Chester and London.[4] Smallpox clearly had an important impact on the IMR and in part can explain both the eighteenth-century increase in post-neonatal mortality and the subsequent early-nineteenth-century decline. Its effects would have been felt especially within the towns with many isolated villages, particularly in the south, being hardly affected. By itself, smallpox cannot explain all of the changes noted in Figures 2.8-2.10.

The smallpox IMR has yet to be determined with any degree of accuracy and the effects of inoculation are still a matter of debate; nevertheless, the importance of infectious diseases to changing levels of infant mortality appears paramount and it seems likely that other 'childhood' diseases, notably measles, whooping cough and scarlet fever together with winter respiratory diseases, about which little is known, were equally important in explaining the changing patterns of post-neonatal mortality from the late seventeenth century. As urbanisation continued apace, the chances of encountering all these diseases at an early age would have increased. Thus, in a period where once an infant had been exposed to a disease

1 R. Davenport, L. Schwartz and J. Boulton, 'The decline of adult smallpox in eighteenth-century London', *Economic History Review*, 64 (2011), pp. 1,289-1,314, here at p. 1,304.

2 Davenport, *et al.*, 'decline of adult smallpox' also suggest that there was an under-registration of baptisms which may make these IMRs unreliable. See also, W.A. Guy, 'Two hundred and fifty years of small pox in London', *Journal of the Statistical Society of London*, 45 (1882), pp. 399-443; Landers, *Death and the Metropolis*, especially pp. 120, 160 and 192. Landers argued that all young children would have come into contact with the smallpox virus which resulted in most adult smallpox deaths being those of recently arrived migrants. Indeed, Ralph Josselin's daughter Anne caught smallpox shortly after arriving in London, see A. Macfarlane, *The Family Life of Ralph Josselin* (Cambridge, 1970), p. 112.

3 Davenport, *et al.*, 'decline of adult smallpox', p. 1,311. See also P. Razzell, 'The decline of adult smallpox in eighteenth-century London: a commentary', *Economic History Review*, 64 (2011), pp. 1315-35 for an alternative view of urban inoculation and R. Davenport, J. Boulton and L. Swartz, 'Urban inoculation and the decline of smallpox mortality in eighteenth-century cities—a reply to Razzell', *Economic History Review*, 69 (2016), pp. 188–214 which provides further evidence from London and Manchester to support their case. Note that Davenport, 'Infant-feeding practices' allows for the possibility that inoculation improved the chances of wealthier infants.

4 R. Davenport, M. Satchell and L. Shaw-Taylor, 'The geography of smallpox before vaccination: a conundrum resolved', *Social Science & Medicine*, 206 (2018), pp. 75-85.

little could be done other than to let 'nature take its course', some alternative intervention strategies must have been employed to account for the dramatic decline in infant mortality that mainly occurred within the neonatal component. There would appear to be three candidates worthy of investigation: birthing practices, infant feeding and general child care methods, although all three are linked to some extent.

With respect to birthing practices, most women would have been attended by a combination of family, friends and perhaps a local untrained midwife whose skill levels may have varied considerably. In the vast majority of births, a natural presentation would have resulted in a relatively safe, straightforward birth and there would have been little for the midwife to do other than provide reassurance to the mother. Problems arose if the presentation was not natural, the foetus became obstructed (or the midwife believed this to be the case), there was severe bleeding or a puerperal infection occurred. In such cases attendance by a more specialist midwife or man-midwife could in some cases save the lives of both the mother and her infant and as new techniques were developed and disseminated more lives appear to have been saved.[1] Thus, as far as it is possible to say, the MMR declined from about 15 per 1,000 birth events in about 1650 to around 10 by the mid eighteenth century and 5 by the end of the parish register period.[2] As we have seen, the death of the mother could have a profound impact on an infant's survival chances with many succumbing within the first few hours or days. Data from nineteenth-century Sweden show that an infant's chance of dying following a maternal death were very high (684 per 1,000 live births); consequently, the decline in maternal mortality will have had a positive, although small, impact on infant mortality.[3] While most midwifery case notes record in often considerable detail individual deliveries and report immediate outcomes for the mother and her infant, they are usually silent about the subsequent fate of their patients. Not surprisingly, midwives were primarily concerned with ensuring a safe delivery and their publications contain relatively little information about infant care (William Smellie's midwifery treatise in the version edited by Alfred McClintock contains 361 pages of which only 22 pages are concerned with infant health).[4] Josephine Lloyd notes that midwives paid increasing attention towards infant care in the immediate period after birth and this caused some 'languid' infants to be resuscitated, most notably by William Smellie's advocation of a female catheter to inflate the lungs of any infant experiencing breathing difficulties.[5] However, most remedies advocated by eighteenth-century doctors, including those for infants, involved some form of bleeding or purging, and these would have been detrimental to the infant's

1 Woods and Galley, *Mrs Stone & Dr Smellie*. For example, the discovery of how the infant turned during delivery would have allowed midwives to replicate this process in obstructed deliveries thereby reducing the likelihood that the infant was harmed. See also A. Løkke, 'Mrs Stone and Dr Smellie: British eighteenth-century birth attendance and long-run levels and trends in maternal mortality discussed in a north European context', *Population Studies*, 72 (2018), pp. 123-36.

2 Woods and Galley, *Mrs Stone & Dr Smellie*, p. 22. Relatively few maternal mortality rates have been calculated and any rural-urban or social variations in maternal mortality have yet to be determined.

3 Högberg and Broström, 'demography of maternal mortality', p. 493.

4 A.H. McClintock (ed.), *Smellie's Treatise on the Theory and Practice of Midwifery, Vol. 1* (London, 1876), pp. 225-7, 434-6 and 417-29. McClintock includes a lengthy introduction to Smellie's work and often annotates individual case notes.

5 Lloyd, 'The "languid child"'; McClintock, *Smellie's Treatise*, p. 226. See also Woods and Galley, *Mrs Stone & Dr Smellie*, p. 428 for an account of James Hamilton performing a similar procedure.

survival.[1] A greater involvement in infant care by doctors would not necessarily have resulted in a significant reduction in infant mortality and other factors such as how the umbilical cord was treated, about which little is known, probably had a much greater influence on an infant's survival.[2]

The impact of improvements in birthing practices on infant mortality is difficult to judge. Wrigley and his colleagues suggest that the two were linked, although early age deaths, especially first day ones, are difficult to identify with certainty from parish reconstitutions.[3] It is plausible that better delivery techniques ensured that more infants were born uninjured meaning that more would have survived. However, MMRs were sufficiently low to suggest that any effects on the overall IMR would have been modest and the scale of geographical variations in IMRs were such that, while important, birthing practices can have accounted for little of the overall pattern of change. A more plausible explanation would be that improvements in midwifery meant that fewer mothers were injured during the birthing process and this resulted in them being better able to look after their infants. The greatest improvements should have occurred amongst the rich and in the towns where the latest innovations in midwifery techniques were more readily available. Infant mortality decline was greater amongst the peerage and in the towns, although further research is needed to confirm this link.[4] Infectious disease was also important since women in the third trimester of pregnancy have greater susceptibility to a range of diseases and the changes in smallpox outlined above will also have affected maternal mortality to some extent. Likewise, the number of deaths associated with puerperal fever or neonatal syphilis have hardly been investigated in this period. To sum up: the declines in maternal and infant mortality were linked, but improvements in obstetric practice had only a modest impact on the IMR.[5]

Most of what we know about infant feeding practices derives from the work of Valerie Fildes.[6] Essentially there were three methods that could be employed to feed infants: maternal breastfeeding, wetnursing or artificial feeding. By far the most common was maternal breastfeeding, especially amongst the poor who would not have been able to afford alternatives. Evidence for infant feeding is primarily qualitative and derived mainly from health manuals or diaries. Thus, we know that where possible Alice Thornton attempted to breastfeed her children, although in the case of her third child, Elizabeth, illness forced her

1 We know from midwifery case notes that purges were sometimes prescribed for the new born and bleeding from the umbilical cord was also undertaken on occasion, see Woods and Galley, *Mrs Stone & Dr Smellie*, pp. 367, 428 for examples.

2 J. Sharp, *The Midwives Book*, edited by Elaine Hobby (Oxford, 1999), p. 166 wisely recommended that 'when the navel string is cut off, apply a little cotton or lint to the place to keep it warm', but if something less hygienic was applied to the cord then this could cause neonatal tetanus. See P. Stride, 'St Kilda, the neonatal tetanus tragedy of the nineteenth century and some twenty-first century answers', *Journal of the Royal College of Physicians Edinburgh*, 38 (2008), pp. 70–7 for a discussion of how devastating this disease could be.

3 Wrigley *et al.*, *English Population History*, p. 239 show that first day mortality declined from about 50 at the end of the seventeenth century to less than 5 in the 1830s, although this is partly a consequence of parish registers including unbaptised infant deaths which for purposes of reconstitution have to be allocated a birth on the same day as their death. Following Rose's Act of 1812 age at death should have been provided and first day mortality should no longer be overestimated. By comparison the first day mortality rate in Sheffield during the 1870s was about 10 (Table 2.5).

4 See also the discussion in Smith and Oeppen, 'Place and status', pp. 72-6 who suggest that obstetric progress had little impact on maternal mortality. This issue is complicated because access to specialised midwifery was easier in the towns where maternal mortality rates might have been higher.

5 See the general discussion in Loudon, 'On maternal and infant mortality'.

6 Fildes, *Breasts, Bottles and Babies*; Fildes, *Wet Nursing*; Fildes, 'The culture and biology of breastfeeding'.

to employ wetnurses, who Alice believed, gave her daughter 'ill milk' which ultimately was responsible for her death.[1] How most mothers fed their infants has to be inferred since it is only from the late nineteenth century that data on the extent of maternal breastfeeding practices began to be collected.[2] Both wetnursing and artificial feeding were likely to pose additional risks to the infant. The employment of a wetnurse would have been mainly confined to the richer members of society, and whilst in general, wetnursing should supply the infant with good levels of nutrition, the absence of the first milk, colostrum, and the possible lower levels of care provided by a substitute mother could pose additional risks to the infant. More detrimental to the infant's health would have been 'dry' or artificial feeding which usually consisted of ground cereal combined with cow's milk. This food was often unsuitable and not easily digested, but perhaps more importantly levels of hygiene at the food preparation stage and in the quality of the milk were such that the infant ingested large amounts of bacteria along with their food. As we have seen, in populations where combinations of artificial and/or wetnursing were employed, IMRs could be in excess of 500 per 1,000 live births.[3] Clearly, even if a fraction of the population adopted such feeding methods then rates would be high.

The extent to which the higher IMRs, especially in the towns, were caused by lower maternal breastfeeding rates cannot be ascertained. The combined effects of an increased disease load together with lower breastfeeding rates and earlier weaning could easily account for the wide variations noted above. It is possible that it was more socially acceptable to feed an infant artificially in the towns where there would have been many recent in-migrants who may have escaped the accepted cultural norms of their birthplaces, although it is equally possible that rapid urbanisation and an influx of 'rural' mothers meant that a greater proportion of urban infants were maternally breastfed.[4] Most of the evidence for these practices comes from London, where we know that wetnurses were often employed by the rich and many infants were sent into healthy rural parishes to be raised and then returned home, if they survived, after they had been weaned.[5] We also know that during the eighteenth century, as London expanded, this practice appears to have declined because it became less fashionable to do so, the benefits of maternal care became more obvious or the rapid increase of London's population meant that the demand for rural nurses quickly out stripped supply.[6]

1 See Table 1.2.

2 Marital fertility was largely invariant throughout the country which suggests that there were no significant variations in maternal breastfeeding, see Wrigley *et al.*, *English Population History*, p. 510 who noted 'the remarkable homogeneity of the patterns [of marital fertility] to be observed in the data for individual parishes'.

3 Levene, *London Foundling Hospital*, pp. 51-9.

4 For a discussion of possible cultural exchanges see E.A. Wrigley, 'The general and the particular', *Local Population Studies*, 100 (2018), pp. 25-32.

5 Clark, 'study of nurse children'. Little evidence for this practice could be found in seventeenth-century York. The immediate effects of this phenomenon probably increased the IMR to a certain degree since those infants who died at nurse were often buried in the nurses' rural parishes and hence their mortality did not count towards London's IMR.

6 P. Razzell, 'Infant mortality in London, 1538-1850: a methodological study', *Local Population Studies*, 87 (2011), pp. 45-64, here at p. 52, quoting G. Clark, *The Nurse Children of London, 1540-1750: a Population Study* (unpublished D.Phil. thesis, University of Reading, 1988), pp. 110-3. See also, Newton, 'Infant feeding practices'.

The age at weaning can also affect the IMR. Fildes discovered that many infants were breastfed, as were all of Ralph Josselin's children, for over a year which would have meant that this sometimes hazardous event was delayed beyond the infant mortality period.[1] Writers of child care texts generally recommended that breastfeeding should be extended into the second year, although after 1750 that period appeared to have declined to between 8 and 12 months which Fildes suggests could have been facilitated by better access to food substitutes and feeding vessels. These figures are supported by contemporary reports of stated common ages at weaning and the few actual ages at weaning that she was able to collect.[2] Any lowering of the mean age at weaning to below age one may tend to increase the IMR given that that the introduction of solid food was often associated with an increase in gastrointestinal disorders; however, Fildes' conclusions are based on a very small sample (42) which also has a middle/upper class bias. Likewise, Fildes was able to discover little about the ages at which supplementary feeding was introduced; it was usually associated with the irruption of the child's first incisor teeth and it appears that medical authors were not too concerned about this topic, 'possibly because it was assumed that women would give additional foods either when a child appeared to be ready for them, or according to the custom of family and friends'.[3]

The prevalence of wetnursing may also mean that some form of artificial feeding was also practiced, although exactly how many infants were fed in this way is not known, nor are survival rates. Given the high mortality rates of artificially fed infants, here we have the potential for explaining large variations in infant mortality. A further practice highlighted by Fildes which could account for a large part of the variations was that many advice books suggested that infants should be deprived of breastmilk during its first few days which meant that they would not receive the beneficial effects of colostrum.[4] It was argued that since this first milk was a different colour and consistency it should be discarded and instead a purge or some other medicine should be administered at periods throughout the first few days until the meconium had been passed and the mother's milk became white. Exactly why these highly dangerous practices developed is not known; it can only be assumed that milk that was not white was thought to be tainted in some way. The extent to which individual families acted on this advice cannot be known, but if some did, especially in the towns where such views could circulate more easily, it could easily account for part of the very high neonatal rates witnessed there. During the second half of the eighteenth century, following the publication of William Cadogan's influential essay on childcare, authors generally recommended breastfeeding from birth.[5] Here then we have a thesis that could account for at least some of the changes in neonatal mortality outlined above. A lack of colostrum coupled with some form of purge could potentially have devastating effects and the

1 V. Fildes, 'The age of weaning in Britain 1500-1800', *Journal of Biosocial Science*, 14 (1982), pp. 223-40.

2 Fildes, 'age of weaning'. E.K. Nitsch, L.T. Humphrey and R.E.M. Hedges, 'Using stable isotope analysis to examine the effects of economic change on breastfeeding practices in Spitalfields, London, UK', *American Journal of Physical Anthropology*, 146 (2011), pp. 619-28 argue that there was no single uniformly practiced weaning schedule. Their findings are however based on the analysis of only a few infant skeletons.

3 See Fildes, *Breasts, Bottles and Babies*, p. 245.

4 V. Fildes, 'Neonatal feeding practices'; 'age of weaning '. For an example of another culture that developed this dangerous practice see P.L.G. Odent, 'Early infant feeding and neonatal survival in Nepal: Breastfeeding, colostrum and discarding of the first milk', (unpublished University College London PhD thesis, 2011), especially pp. 358-9.

5 W. Cadogan, *An Essay upon Nursing and the Management of Children, from their Birth to Three Years of Age* (London, 1749).

subsequent substitution of maternal breastfeeding could account for a large part of the decline in infant mortality that occurred during the second half of eighteenth century. It could also account for the summer peak in neonatal mortality witnessed in London and York. With the stillbirth rate being relatively stable this suggests that neonatal infections were perhaps the most important factor in explaining trends. However, evidence from the early years of civil registration suggests that neonatal infections by themselves cannot account for all of the variations given that very different places experienced essentially the same neonatal IMRs. We also know that giving purges to some infants persisted well into the nineteenth century with William Farr complaining as late as 1870 that:

> [i]n country districts the custom of giving some aperient shortly after its birth still appears to be very prevalent, less so in the large towns, still less in London. The aperient varies much in kind. Butter and sugar, gruel, and castor oil are the most common; but in Chelmsford a favourite dose would appear to be milk and sugar; in Sheffield treacle; and in Altringham, a teaspoon of cold water.[1]

Note again that there were significant urban-rural differences and Farr adds that '[n]o report has been received of any great delay being common in putting the child to the breast' which suggests that by this date most infants would also have received colostrum.

Infant feeding patterns in the parish register period were clearly complex and the extent to which an increase in maternal breastfeeding caused IMRs to decline during the eighteenth century is a matter of debate. Some unhealthy practices persisted into the nineteenth century, but if a greater proportion of infants were maternally breastfed, and fewer mothers denied their infants colostrum, then despite the persistent administration of purges, the overall effect would still have been beneficial and the impact would have been greater in the towns and cities.

As well as advocating breastfeeding from birth, William Cadogan he also made other more general recommendations about childcare and an examination of his work is the best means of assessing child rearing methods during the eighteenth century.[2] Cadogan's influential essay, addressed as a letter to the governors of the Foundling Hospital and subsequently published, advocated improvements in child care which were intended to ensure that those infants entering that institution had better chances of survival. His recommendations were the result of, 'observing and following nature more closely' and there is little in them that would concern a modern child care expert.[3] By implication it can also be inferred that those practices that Cadogan objected to must have been in common use. We have already seen that he endorsed maternal breastfeeding from birth:

> The general practice is, as soon as a child is born, to cram a dab of butter and sugar down its throat, a little oil, panada, caudle, or some unwholesome mess. So that they set out wrong, and the child stands a fair chance of being made sick from the first hour. It is the custom of some to give a little roast pig to an infant; which, it seems, is to cure it of all the mother's longings. I wish these matters were a little more enquired into, for the honour of the sex; to which many imperfections of this kind are imputed, which I am sure it does not lie

1 Registrar General, *Thirty-fourth Annual Report of the Registrar General* (London, 1873), p. 226; BPP 1873/XX.
2 Cadogan, *Essay*; M. and J. Rendle-Short, *The Father of Child Care. Life of William Cadogan (1711-1797)* (Bristol, 1966).
3 Cadogan, *Essay*, p. 4.

> under. When a child sucks its own mother, which, with a very few exceptions, would be best for every child, and every mother, nature has provided it with such wholesome and suitable nourishment; supposing her a temperate woman, that makes some use of her limbs; it can hardly do amiss;
>
> The mother's first milk is purgative, and cleanses the child of its long hoarded excrements; no child therefore can be deprived of it without manifest injury;
>
> I am quite at a loss to account for the general practice of sending infants out of doors, to be suckled, or dry-nursed by another woman, who has not so much understanding, nor can have so much affection for it, as the parents; and how it comes to pass, that people of good sense and easy circumstances will not give themselves the pains to watch over the health and welfare of their children;
>
> To breed a child in this artificial manner, requires more knowledge of nature, and the animal oeconomy, than the best nurse was ever mistress of, as well as more care and attention than is generally bestow'd on children.[1]

Cadogan is clear in stating that maternal breastfeeding (including colostrum) is the best way to feed an infant. He also suggested that any supplementary feeding should take place with simple broths that were not fortified with sugar, spice or wine, '[l]et this method be observed about a twelvemonth, when, and not before, they may be weaned; not all at once, but by insensible degrees; that they neither feel nor fret at the want of the breast'.[2] If Cadogan's beneficial recommendations were widely adopted then they would have helped to reduce IMRs, especially neonatal ones.

Cadogan also made sensible suggestions about infant care:

> Children in general are over-cloath'd and overfed;
>
> besides the mischief arising from the weight and heat of the swaddling-cloaths, they are put on so tight and the child is so cramp'd by them, that its bowels have not room, nor the limbs any liberty, to act and exert themselves in the free easy manner they ought;
>
> I think that they (clean linen and fresh cloaths) cannot be changed too often and would have them clean every Day; as it would free them from stinks and sournesses, which are not only offensive, but very prejudicial to the tender state of infancy.[3]

Above all Cadogan's motto is, '[i]f we follow nature, instead of leading or driving it, we cannot err'.[4] Fildes notes that, after the publication of Cadogan's letter nearly all later authorities adopted his recommendations wholeheartedly, and also from this date it appears that maternal breastfeeding became more popular amongst the higher classes, although much of the evidence for this is anecdotal.[5] Cadogan's letter was clearly influential; by 1772

1 Cadogan, *Essay*, pp. 13-5, 24-5.
2 Cadogan, *Essay*, p. 21.
3 Cadogan, *Essay*, pp. 9-10, 12.
4 Cadogan, *Essay*, p. 13.
5 R. Trumbach, *The Rise of the Egalitarian Family* (New York, 1978), p. 208; R. Perry, 'Colonizing the breast: Sexuality and maternity in eighteenth-century England', *Journal of the History of Sexuality*, 2 (1991), pp. 204-34, here at pp. 216-24.

it was in its tenth edition and amongst the medical profession William Smellie referred to it as early as 1751 while Michael Underwood who, in 1784 when discussing swaddling, was greatly indebted to the views of Cadogan.[1] From the mid eighteenth century advice books began to encourage maternal breastfeeding in part because it was also understood that it would help to space out births which would result in healthier mothers who in turn would be able to take greater care of their infants.[2]

Advice about keeping the infant as clean as possible is of course sensible and if Cadogan recommended that tailclouts (nappies) and other soiled clothing should be changed at least once a day then we can assume that in many instances this happened less frequently. As for swaddling, this topic is all but absent from the demographic literature. According to Carole Rawcliffe:

> [t]he practice of swaddling, or wrapping up a newborn baby in cloth bands was not, as might be supposed, a traditional folk custom, but yet another example of the ubiquitous influence of humoral theory. Since human life appeared to be a continuous, inelectable process of dessication from the fluidity of the womb to the dust of the grave, it was necessary to prevent premature loss of moisture after birth by protecting all or part of the recently exposed body. Unformed, malleable limbs also needed support, lest they became misshapen, although the midwife had to be very careful in case she caused deformity by binding too tightly.[3]

The effects of swaddling on the new born are hard to discern, but it may cause overheating and would certainly be detrimental if put on too tightly.[4] It would also make changing and cleaning the infant a more onerous task. By the second half of the eighteenth century swaddling appears to be in decline with authorities such as William Buchan railing against the practice, although Clark argued that by the 1760s 'the practice of wrapping children in

1 McClintock, *Smellie's Treatise*, p. 436; M. Underwood, *A Treatise on the Diseases of Children* (London, 1784), p. 230: 'for many years past the very ancient tight mode of dressing infants has been discontinued, for which we are perhaps greatly indebted to Dr CADOGAN. It is certain also, that for the last twenty years, the fashion recommended by him has been improving; but there is yet room to go forward'. On infant feeding Underwood wrote, '[i]t would be unpardonable, however, in a work of this sort not to insist how inadequate every substitute for the breast has been universally found' (p. 214).

2 Anon, 'Some account of a small volume, just published, under the title of, A comparative view of the state and faculties of man, with those of the animal world', *Gentleman's Magazine*, 35 (1765), p. 418, 'A woman who does not suckle, may expect a child every year, this quickly exhausts the constitution, and brings on the infirmities of old age before their time: But a woman who suckles has an interval of a year and a half or two years, which gives time for the constitution to recover its vigour'. The book's author is John Gregory. For similar advice in Germany see A. Imhof, 'The amazing simultaneousness of the big differences and the boom in the 19th century – some facts and hypotheses about infant and maternal mortality in Germany, 18th to 20th century?' in T. Bengtsson, G. Fridlizius and R. Ohlsson (eds), *Pre-industrial Population Change* (Stockholm, 1984), p. 203.

3 C. Rawcliffe, *Medicine & Society in Later Medieval England* (Stroud, 1995), p. 201. Also see J.S. Chisholm, 'Swaddling, cradleboards and the development of children', *Early Human Development*, 2/3 (1978), pp. 255-75; P. Crawford, ' "The sucking child": Adult attitudes to child care in the first year of life in seventeenth-century England', *Continuity and Change*, 1 (1986), pp. 23-51, here at pp. 37-8; A. Buck, *Clothes and the Child* (Bedford, 1996), pp. 24-32; J. Huggett and N. Mikhaila, *The Tudor Child. Clothing and Culture 1485 to 1625* (Lightwater, 2013), pp. 15-9, 70-1; S. Laurence, *The Hand that Rocked the Cradle. The Art of Birth and Infancy* (Norwich, 2018), pp. 132-4.

4 J.C. Bacon, 'Overheating in infancy', *Archives of Diseases in Childhood*, 58 (1983), pp. 673-4.

bands of some kind still had a strong hold'.[1] Cadogan's letter therefore marks a watershed in childcare and its appearance certainly fits in well with the changes in infant mortality outlined above. Trumbach is in general agreement with this thesis, at least amongst the aristocracy: 'it is certain that aristocratic children after 1750 survived in unprecedented numbers and that they were better loved and cared for by their mothers'.[2]

If better childcare was responsible for most of the decline in infant mortality it needs to be demonstrated that a significant proportion of urban mothers both accepted and acted upon this advice—it is after all one thing to have written advocacy for innovations in childcare and another to show that such innovations were disseminated amongst, and acted upon by, the wider population. Some theoretical calculations can demonstrate the extent of the changes required to bring about a decline in infant mortality in an early modern city. If we take the IMR of breastfed infants to be 200 per 1,000 live infants and that of non-breastfed infants to be 500 (both of which are plausible) then if the overall IMR is 300, two thirds of infants must have been breastfed and one third non-breastfed (200*(2/3) + 500*(1/3) = 300). If the proportion of non-breastfed infants declines to one fifth or one tenth then the IMR would decline to 260 (200*(4/5) + 500*(1/5)) and 230 (200*9/10 + 500*1/10)). These figures suggest that if nothing else changes then for the IMR to decline from 300 to 230 an additional 20 per cent of mothers would needed to have breastfed their infants.[3] Such changes would seem to infer that a major revolution in child care practices needed to have taken place, but given the highly fluid nature of urban populations this may have been possible if increasing numbers of 'rural' in-migrant mothers had simply followed the practices of their place of birth rather than adopting those of their place of residence. The advice offered by midwives and those in the birthing chamber was an important influence on the child care regime adopted and this 'revolution' in child care needed to have taken place amongst the relatively small number of midwives rather than the much larger number of mothers. Given the evidence for declining levels of wet nursing, increasing maternal breastfeeding rates and improvements in midwifery practice it is also possible that such changes could have occurred over a period of 50 years or so.[4] Any improvement in child care would have helped to reduce the IMR and in the smaller towns and cities where IMRs were lower than in London, the proportion of women needing to have changed their childcare regimes would have been correspondingly lower. The suggested IMRs for

1 G. Clark, 'Infant clothing in the eighteenth century: a new insight', *Costume*, 28 (1984), pp. 47-59, here at 57; W. Buchan, *Domestic Medicine* (Edinburgh, 1769), pp. 13-9; H. Cunningham, *The Invention of Childhood* (London, 2006), pp. 119-20; Buck, *Clothes and the Child*, p. 32.

2 Trumbach, *Rise of the Egalitarian Family*, p. 235. W. White, 'Observations on the Bills of Mortality at York', Philosophical *Transactions of the Royal Society of London*, 72 (1782), pp. 35-43, here at p. 42, also noted that there had been 'a general improvement and greater attention to nature in the management of infants'.

3 Clearly changes in breastfeeding alone cannot account for IMRs witnessed by Landers' Quaker sample (see Table 2.13) which declined from 342 (1700-49) to 194 (1800-24). An IMR of 350 would suggest that half the population breastfed and half did not (200*1/2 + 500*1/2 = 350), while an IMR below 200 would suggest that by the nineteenth century virtually all Quaker women were breastfeeding and that other improvements in childcare must have occurred.

4 The population of London increased from *c.*55,000 in the early 1500s to *c.*200,000 in 1600, *c.*575,000 in 1700 and *c.*959,000 in 1800, Wrigley 'Urban growth', p. 686. Consequently, many London mothers would have been born in a more advantageous demographic environment where better birthing and child care practices were perhaps in use. Many other towns also experience substantial population growth, especially during the eighteenth century. For slightly different estimates of London's population see R. Finlay, 'Population growth and suburban expansion', in A.L. Beier and R. Finlay (eds), *The Making of the Metropolis. London 1500-1700* (Harlow, 1986), pp. 37-59.

breastfed and non-breastfed infants are of course crude 'guestimates' and were chosen to illustrate the scale of change necessary to account for the patterns visible in Tables 2.10, 2.13 and Figure 2.10—they do however illustrate the potential of changes in breastfeeding and childcare regimes to account for at least some of these changes.

With reference to Figure 1.4, it would appear that much of the decline in infant mortality can be explained in terms of more effective intervention. We also have a tenable thesis for the decline of neonatal mortality which involves certain groups changing their child rearing habits. Following the publication of Cadogan's letter the medical profession was almost universal in their promotion of maternal breastfeeding and more enlightened childcare, although further work needs to be undertaken to verify the extent to which Cadogan's recommendations were disseminated and accepted.[1] Given the paucity of supporting data, the above conclusions must remain tentative, but at least we have a thesis that further research can test. Infant mortality decline was a multi-layered process and it should also be remembered that the main cause of rural/urban differences in mortality was due to threats posed by the urban environment. It is also plausible that as London and some of the larger towns expanded an increasing proportion of the population were living in better, cleaner homes as the built environment improved.

Given the changes witnessed in the towns we might assume that the causes of the decline within the national sample were similar, although much less pronounced. This seems tenable because the Cambridge Group's sample consists mainly of rural parishes and any of the changes outlined above would consequently have less impact in these environments. Likewise, in the rapidly expanding industrial towns, where IMRs appear to have hardly changed, any improvements in childcare were probably offset by a deteriorating environment. In such places with large numbers of in-migrants cultural exchanges with respect to child care regimes were no doubt important.

The final environment which comprised a group of eastern rural parishes is more difficult to explain since instead of the low levels of mortality that might be expected in such places, IMRs were amongst the highest recorded and in spite of some decline during the eighteenth century these high rates persisted well into the nineteenth century.[2] We might assume that similar improvements in child care occurred during the eighteenth century, but this must remain a matter of speculation because the causes of these high rates have yet to be investigated with any degree of thoroughness. Mary Dobson provided a wide ranging analysis of the population of south-east England from the sixteenth to the eighteenth centuries and she identified considerable local variations in mortality, which she largely explained by the height of the parish above sea level with low lying marshy parishes suffering very high rates.[3] Dobson only calculated IMRs for a small sample of 21 parishes between the 1780s and 1812 whose registers gave exact infant ages at death using the simple aggregative method. This method is of course highly dependent on the quality of the registers, but she found considerable differences within her sample. Inland rural parishes experienced rates in the range 62-149 while coastal and estuarine marshland parishes ranged

1 Even during the twentieth century health initiatives such as warnings against tobacco smoking were only gradually accepted and acted upon.

2 Hinde and Fairhurst, 'Why was infant mortality so high?'.

3 M. Dobson, *Contours of Death and Disease in Early Modern England* (Cambridge, 1997).

from 240 to 377.[1] She explained much of the high mortality rates in eastern England as a consequence of the presence of marshland fevers (malaria) and while this disease was unlikely to have been responsible for all the excess infant deaths, the general level of illness prevalent in these parishes probably led to a number of poor childcare practices being adopted. It would appear that doping with opiates was commonplace and in an environment in which it was difficult to survive, high IMRs were tacitly accepted. Andrew Hinde and Victoria Fairhurst writing about the persistent high infant mortality in these places during the mid-nineteenth century concluded that:

> [a]lthough the prevalence of malaria and other fevers diminished markedly by the early nineteenth century with the draining of the fens, the agriculture which was carried out on the drained lands involved the use of large amounts of … [female labour] … While their mothers were working in the fields, infants would be cared for by older siblings or by child minders who were prone to neglect them, feed them inadequately, and from time to time to use the opium drugs which were prevalent in the region to keep them quiet. The crowding together of many infants into the houses of each child-minder also promoted the spread of infection.[2]

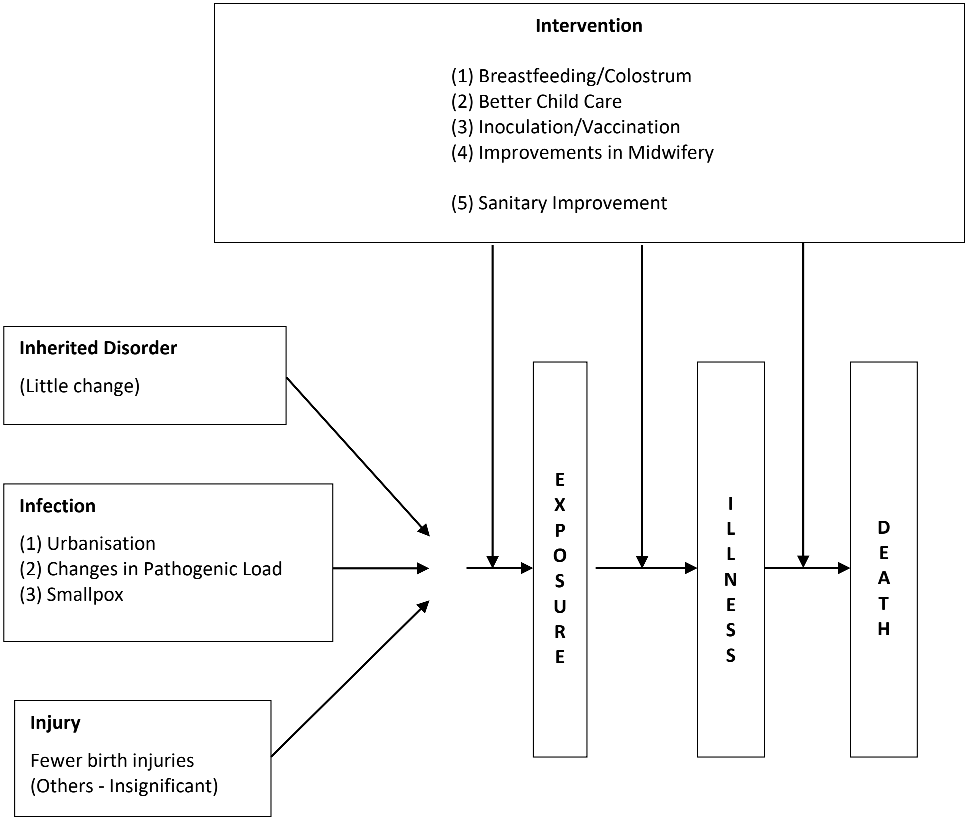
If Hinde and Fairhurst are correct then it is likely that a combination of environmental improvements coupled with some changes in child care were responsible for the decline in IMRs in these parishes.

While much remains to be done both to fully delineate, and explain, patterns of infant mortality during the parish period, Figure 2.13 seeks to identify the factors influencing the overall course of change. As far as it is possible to discern there is little evidence to suggest that deaths associated with inherited disorders varied throughout the country or changed significantly over time. Deaths caused by injury were low throughout the period and, whilst birth injuries may have declined because of better midwifery practices, the overall impact of these types of death was not significant. Thus, with inherited disorders and injuries remaining largely invariant, it would seem safe to conclude that endogenous mortality varied little and was responsible for at best only a small fraction of the overall change in infant mortality during the period. Instead, by far the most important factor in explaining patterns of infant mortality was exposure to a range of infections which affected infants of all ages. It was the likelihood of being exposed to these diseases, coupled with the various interventions that could be made to mitigate them, which ultimately determined whether infants survived. Thus, certain environments posed additional threats to the infant, most notably the towns where the disease load was greater than in the countryside and, as urbanisation intensified, this meant that urban infants were increasingly likely to be exposed to diseases at younger ages. Generally speaking, there was less chance of coming into contact with disease in rural areas, although in some places malaria was rife and this had a detrimental impact on infant health. One disease, smallpox, by itself had a major impact on IMRs, although its full effects has not yet been fully ascertained. Smallpox caused IMRs to increase from the late seventeenth century and then, following the adoption of inoculation and, more importantly,

1 Dobson, *Contours*, Table 4.1, p. 168, also see pp. 175-8. Note that Figure 2.9 does not show that south-eastern coastal and estuarine RDs experienced particularly high IMRs during the early 1840s. This could be because the very high IMRs that Dobson discovered were confined to a relatively few parishes.

2 Hinde and Fairhurst, 'Why was infant mortality so high?', p. 65.

Figure 2.13 Determinants of infant mortality in the parish register period



vaccination from the beginning of the nineteenth century, rates declined, especially in the towns. There was also likely to have been changes in other diseases, although these have as yet not been identified.

Standards of hygiene were unlikely to have been significantly better in those rural parishes that experienced the lowest IMRs. Instead it was the child care methods that they adopted, especially almost universal maternal breastfeeding which could extend into the second year, that enabled so many of their infants to survive. In the towns the higher disease load was difficult to avoid and caused many deaths from respiratory infections, infantile diarrhoea and typical childhood diseases such as measles, scarlet fever and whooping cough. Once an infant was exposed to a disease, limited medical knowledge meant that most treatments were at best ineffective and few interventions were possible between exposure, illness and in some cases death. It was unlikely that calling a doctor in such circumstances would help many infants survive. Improvements in infant mortality could best be achieved by adopting better child care practices, or not adopting these poor practices in the first place. This would have ensured that some infants were prevented from being exposed to disease and hence more would have survived. The main means by which this could be achieved was by maternal breastfeeding, especially during the infant's first days so that it could receive the beneficial effects of colostrum. A high disease load combined with unhealthy child care practices could result in very high IMRs. However, intervention in terms of adopting more natural, traditional child rearing methods could lower rates to some extent, although with many of the true causes of infant mortality remaining unknown there were limits to how low IMRs could fall, especially in unhealthy urban environments. Inoculation and later vaccination had some impact on IMRs, as did improvements in midwifery to a lesser extent. There may also have been some sanitary improvements during the eighteenth century which would have mitigated some environmental threats. Whilst the literature on nineteenth-century urban demography is dominated by the hazards caused by a poor environment, this does not mean that conditions within Tudor and Stuart towns could not have been worse—there is after all much evidence to suggest that there were improvements in the built environment of Georgian towns. The framework presented in Figure 2.13 can only provide a partial understanding of the influences on IMRs in the parish register period since it is limited by the sources available for analysis and in part it should be viewed as a means by which further research may identified. No doubt socio-economic factors such as wealth, occupation, housing and education had major impacts on infant mortality, but evidence about their effects in this period is scanty to say the least.

An IMR of about 100 per 1,000 live births would appear to be the minimum achievable in the parish register period given prevailing medical expertise; rates above these levels can, therefore, be viewed as the ability of individuals and communities to mitigate the additional threats posed by the environments in which they lived. Some did this successfully, others less so, but when behaviour changed and better child care methods were adopted then IMRs could decline.[1] Moreover with town populations being fluid and relying on in-migration for much of their growth it is possible that Cadogan's 'old fashioned', but beneficial, ideas about child care were more likely to be followed by these 'rural' in-migrants. The 'backwardness' of rural areas brought distinct advantages to the infants who lived there and if in-migrants brought such 'backward' ideas to the city then change was possible.

Much of this last section has necessarily involved some degree of speculation, both in determining the pattern of change and especially in providing an explanation of these changes. Whether or not this speculation proves right will depend on further research which should fill gaps in our knowledge and address the more contentious issues discussed above.

Issues in Infant Mortality in the Parish Register Period

A number of issues relating to infant mortality during the parish register period can be identified as a consequence of the preceding discussion. First, it is again appropriate to acknowledge the contribution made by E.A. Wrigley and the Cambridge Group for the History of Population and Social Structure in assembling and disseminating large amounts of data relating to infant mortality and historical demography more generally. While certain aspects of their analysis may be challenged, their undoubted success in establishing the main contours of change remains unrivalled. Indeed, it is unlikely that a similar database of demographic rates will be compiled until there are significant advances in automated computer-assisted linkage and this does not seem likely in the foreseeable future. Individuals

1 Individual families often exhibited considerable differences with respect to their ability to raise infants. Likewise, illegitimates were born into the same environments as legitimates, but they faced additional risks. A greater proportion of illegitimates were first births which were more hazardous than higher order births, but the mothers of illegitimates had fewer resources at their disposal and it is likely that this would have forced them to adopt poorer child care methods which resulted in illegitimate IMRs being about twice those of legitimates.

working on single registers can still however make significant advances in our understanding of infant mortality in this period. The following list of issues, which is by no means exhaustive, remain unresolved and many could easily be addressed by a single researcher working on a single register. Some are more complex and will require further analysis of existing sources, while others may require the exploitation of new ones.

(1) Only a relatively small number of registers from more than 11,000 parishes have been examined with a view to establishing levels of infant mortality. As the three examples discussed above have illustrated, new estimates of IMRs using high quality registers are easy to calculate and with most registers lying untouched by demographic historians, there is considerable scope for exciting discoveries to be made. No estimates of infant mortality have been made for large parts of the country. In Wales, Scotland and Ireland this may be due to the relatively poor quality of the source material, but there may be exceptions and until a comprehensive trawl through existing registers is made, we will not know whether reliable demographic rates will be forthcoming. In counties such as Cornwall and Lancashire the rich vein of published registers has yet to be fully exploited. The larger towns and cities have also been overlooked, although results from London and York reported in Tables 2.9 and 2.10 have shown that demographic analysis is feasible in urban centres. An understanding of what happened in the emerging industrial towns remains crucial for a full analysis of national trends during the eighteenth and nineteenth centuries to be given, but with registration being under such strain it may not be possible to calculate accurate IMRs for these places.

(2) One of the advantages of parish registers as a demographic source is that they are by no means uniform, with some reflecting the personality and interests of the person who compiled them. Consequently, if registers can be discovered that contain similar details to those recorded by John Richardson in Hackness, then further insights may be gained. As a first step in this process it would be useful to identify more registers that recorded stillbirths since these are more likely to contain a complete record of all the baptisms and burials that took place in the parish. Their examination would also complement the SBRs reported in Table 2.14.

(3) With the exception of Quaker registers, little work has been carried out on nonconformist and non-Anglican registers. In many instances these documents may only record events from a small community, the death register may never have been kept because the church did not have their own burial ground or they may only exist for a short period. However, good quality registers worthy of demographic analysis may exist and a systematic search through local and national archives may prove fruitful.

(4) Other sources which have remained untapped by demographic historians may also prove useful. In particular, the vast number of family genealogies carefully compiled by numerous family historians are yet to be fully exploited. Problems with verifying the accuracy of such data will occur, but these may not be insurmountable and such

data could be collated by cooperating with societies such as the Guild of One-name Studies.[1]

(5) Family reconstitution employs a precise set of rules that enables any demographic rate that is calculated to be representative of the population at risk. By linking individual reconstituted families to other sources such as the Hearth Tax, Marriage Duty Act or Poor Law records it should be possible to shed light on a range of issues including social class variations in infant mortality. This process will be time-consuming and inevitably lead to further losses of data as it will be impossible to link some families to these additional sources. Critics of reconstitution have argued that while the calculated rates may be accurate, they are not representative of the whole population and any additional linking will intensify these arguments. Nevertheless, this process could lead to a fuller understanding of many issues relating to infant health. Reconstitution enables a wide range of family histories to be compiled and, in some instances, it may be useful to examine individual family histories as though they were qualitative historical sources in order to set their demographic history within a broader social context.[2]

(6) There is the possibility that in periods where registration is known to be under pressure, especially from the late eighteenth century onwards, some limited form of reconstitution which focusses on those families known to attend church and who consistently recorded their vital events in the parish register will yield accurate demographic rates. Under-registration was likely to occur within specific families rather than being spread evenly throughout the whole population and while qualifying families may be socially selective, the resulting analysis should nevertheless prove interesting. This process may also be possible in the emerging industrial towns, and while there will always remain questions concerning whether or not such families can be considered representative of such a dynamic population, it may be the only way of deriving reasonably accurate rates in these places. However, until such a study is carried out, we will not know if this process is feasible.

(7) The most important issue in the parish register period concerns the relationship between declining IMRs and deteriorating registration. With the conclusions of Wrigley and his colleagues in *English Population History from Family Reconstitution* being based on only eight registers between 1779 and 1837 it is important to calculate more accurate rates during this period. The discovery of more registers that listed stillbirths during this period would be a useful first step in identifying potentially accurate registers and an initial analysis of twin and illegitimate mortality should provide evidence as to whether further work on the register would be appropriate.[3]

1 Similar sources about elite families have been analysed by N. Cummins, 'Lifespans of the European elites, 800-1800', *Journal of Economic History*, 77 (2017), pp. 406-39. These sources do not however include information about infants. Knodel, *Demographic Behavior in the Past*, used family genealogies from fourteen German villages which were created in part to confirm the Aryan ancestry of these families.

2 P. Sharpe, *Population and Society in an East Devon Parish. Reproducing Colyton 1540-1840* (Exeter, 2002) places the results from a family reconstitution within the wider social history of the parish.

3 The accuracy of baptismal registers at the very end of the parish register period could be tested by examining the under 5s in the 1841 census and seeing whether they could be traced in the parish register.

(8) Following on from (7), further examination of the age-structure of infant deaths is needed to confirm the late-eighteenth-century decline in neonatal mortality. The full extent of variations in neonatal and post-neonatal mortality has yet to be determined with any degree of certainty and the addition of further details to Table 2.7 would help to judge whether the high rate of neonatal mortality in St Michael Le Belfrey is representative of other parishes. More data would also help to determine whether the variations in neonatal and post-neonatal mortality identified in Figure 2.12 also occurred earlier.

(9) Much remains to be discovered about the seasonality of infant deaths during the parish register period. Most of what we know is derived from a relatively small number of parishes and further evidence is required to confirm these patterns. It has not been possible to demonstrate if there was a late summer peak in infant deaths, similar to that caused by infantile diarrhoea in nineteenth century cities, and it would be useful to know more about the winter excess which presumably was caused by lung diseases of one form or another. Further work is also needed to confirm the summer excess in neonatal mortality—this is important because if this was an urban phenomenon mainly affecting very young infants it would reinforce Fildes' thesis about infants being denied colostrum which resulted in very high neonatal mortality rates.

(10) Little work has been carried out about variations in demographic behaviour within families, in part because when demographic data is subdivided into smaller units any conclusions have wider margins of error.[1] However, the extent to which infant mortality was concentrated into particular families is important since significant improvements could have been made if a relatively small number of high mortality families were able to alter their behaviour.

(11) A large-scale project that focusses on high risk infants such as twins and illegitimates would also be very useful. Any improvements in health should show up better within these high mortality populations, although the sample would need to be large in order to examine spatial variations and change over time. This would mean that a wide range of registers would need to be examined, but if digitised registers are available then this could be achieved relatively easily and this type of project could be readily carried out by a local history group. Such a study could shed light on a range of issues since each group was subject to a different set of risks, with twins being more affected by the birth process and neonatal factors, while illegitimates were more affected by the social conditions in which they were raised.

(12) Given that much of the variation and change in infant mortality appears to be due to differences and possible changes in disease environments it is worth while exploring further the link between infant and early childhood mortality. This will open up the possibility of exploring less conventional age breakdowns. This type of analysis may also be needed to examine Fildes' contention that the age of weaning declined to less than one year during the eighteenth century.

1 See S. Edvinsson, and A. Janssens, 'Clustering of deaths in families: infant and child mortality in historical perspective', *Biodemography and Social Biology*, 58 (2012), pp. 75-86. See also the other articles in this volume.

(13) More work also needs to be carried out on maternal mortality both in confirming the eighteenth-century pattern of decline and in establishing whether urban/rural differences in rates existed.

(14) Further exploration of non-demographic sources, particularly those that deal with child-rearing practices or birthing techniques, is needed. An examination of midwifery case notes and textbooks may provide further evidence of how infants were treated in the period immediately after birth and the examination of personal accounts and diary-like documents may provide further evidence of breastfeeding practices, wetnursing and weaning. Although Fildes examined a wide range of sources, most of her research was carried out over thirty years ago and further sources should now have come to light.[1]

(15) Any additional evidence relating to child care practices should be useful and with greater interest being shown towards gender studies and social history there will no doubt be many avenues worthy of further investigation.

Great strides have been made towards understanding the changing patterns of infant mortality during the parish register period. Much however remains unresolved and as the above discussion has shown, further work targeted at specific issues is easily within the reach of any local population historian working on their own or as part of a group.

1 See L. Astbury, '"Ordering the infant": caring for newborns in early modern England', in S. Cavallo and T. Storey (eds), *Conserving Health in Early Modern culture* (Manchester, 2017), pp. 80-103 for a discussion of some of these issues, although she only mentions infant feeding briefly in her conclusion.

3

Stability and the beginnings of change, 1837-1910

As part of the first census in 1801, in addition to counts of persons, families and houses being taken, annual totals of baptisms, burials and marriages were collected from every parish for certain years during the eighteenth century.[1] John Rickman, the chief architect of the early censuses, did this as a means of resolving the long- standing debate about whether the British population had been in decline during the eighteenth century.[2] While these returns were sufficient to show that there had been considerable increase in population during the eighteenth century, Rickman was well aware that parochial registration was far from perfect, especially in the towns. Many nonconformists did not record their vital events in parish registers, unbaptised infant burials were often missing and some individuals simply did not have their infants baptised. Sir George Rose's Parochial Registration Act of 1812 attempted to tighten up registration as additional details were required to be recorded on specially prepared forms, but registration did not improve and, with respect to the calculation of IMRs, even though age at death was now recorded, there was no place for parental names on the new forms and sometimes this lack of information makes inter-generational linking difficult.[3] Parish registers were also increasingly wanting for legal purposes particularly with respect to establishing property rights. Only Church of England records could be used in court proceedings and, if births did not appear in the parish register, this could have serious

1 The Act requested that returns should be provided for 'every parish, township or place' (including non-parochial ones) by the 'Rector, Vicar, Curate, or Officiating Minister, and Overseers of the Poor or (in Default thereof) by some other substantial Householder', see Registrar General, *Census of Great Britain, 1801, Parish Register Abstract* (London, 1801), p. iii, British Parliamentary Papers (hereafter BPP) 1801-1802 VI. In the main these data would have been culled from parish registers. Baptisms and burials were collected every ten years from 1700 to 1780 and then annually from 1781. Annual marriage totals were collected from 1754, the date of Hardwicke's Marriage Act which sought to prevent clandestine marriages and required that legal marriages should take place in church preceded by the reading of banns or by license. See R.B. Outhwaite, *Clandestine Marriage in England 1500-1850* (London, 1995), pp. 75-97 for a discussion of Hardwicke's Act.

2 D.V. Glass, *Numbering the People: the Eighteenth-century Population Controversy and the Development of Census and Vital Statistics in Britain* (Farnborough, 1973) and its companion volume, D.V. Glass, *The Population Controversy: a Collective Reprint of Material Concerning the 18th Century Controversy on the Trend of Population in England and Wales* (Farnborough, 1973) reproduce papers relevant to this debate.

3 Deteriorating registration during the eighteenth and early nineteenth centuries is reflected in the fact that only 7 out of the sample of 26 parish reconstitutions used by E.A. Wrigley, R.S. Davies, J.E. Oeppen and R.S. Schofield, *English Population History from Family Reconstitution 1580-1837* (Cambridge, 1997) were deemed sufficiently reliable after 1812 to be included in their analysis, see pp. 22-3, 109, 115.

legal consequences, especially with respect to the validity of property transfers.[1] This situation, compounded by nonconformists being effectively excluded from parts of the legal process, led to growing agitation for change and resulted in the 1836 Registration Act which introduced the civil registration of births, deaths and marriages into England and Wales.[2]

Thus, from 1 July 1837, every birth, death and marriage should have been recorded and a certificate of that event could be requested. Civil registration in its early years was not however perfect. It was thought that births were under-reported, deaths less so, but since stillbirths were not required to be registered until 1927 some infants who died shortly after birth were still buried as though they were stillborn.[3] One thing is certain though—whatever its shortcomings, civil registration was far superior to the parochial system it replaced and virtually all demographic studies of the post-1837 period employ sources created by this system and published under the auspices of the General Register Office (GRO).

Civil registration—reliability and sources

The recording of births and deaths, rather than baptisms and burials, has obvious benefits for the student of infant mortality, although accurate rates will only be forthcoming if all events are captured. In the early years of civil registration this was not the case. The first Annual Report of the Registrar General acknowledged this problem: '[w]ith respect to the Registration of Deaths … the deficiency is probably very small. … There is undoubtedly some deficiency in the Registration of Births … but the deficiency is much less than that which has long existed in the Registration of Baptisms'.[4] Reassuringly the same report showed that an improvement had been made over the course of the first year of registration. The second Annual Report noted similar problems, and in commenting on a table which gave the proportion of infant deaths per 1,000 births for groups of counties, suggested that under-registration had caused the rates to be 'a little higher than the truth'.[5] By the seventh Annual Report, which dealt with 1843 and 1844, an explanation of these deficiencies was given:

> Many births have escaped notice, particularly in the first years of registration, as parents are not bound to give information of a birth unless 'requested to do so' by the Registrar: latterly by increased vigilance and better arrangements, the defects have much diminished, and the zeal and exertions of the officers employed under the Act, will, I confidently expect, render this branch of registration as complete as is possible in the present state of the law.[6]

In most cases parents would register a birth, but there was no legal obligation for them to do so. Some did not do this and, since stillbirths were not registered, if an infant died shortly

1 See the discussion in E. Higgs, *Life, Death and Statistics: Civil Registration, Censuses and the Work of the General Register Office, 1836-1952* (Hatfield, 2004), pp. 1-21.

2 Glass, *Numbering the People*, pp. 118-32; M.J. Cullen, 'The making of the Civil Registration Act of 1836', *Journal of Ecclesiastical History*, 25 (1974), pp. 39-59. Scotland followed suit in 1855 and Ireland in 1864.

3 For examples of this practice see E. Ross, *Love and Toil: Motherhood in Outcast London, 1870-1918* (Oxford, 1993), p. 97.

4 Registrar General, *First Annual Report of the Registrar General* (London, 1839), pp. 12-3, BPP 1839 XVI.

5 Registrar General, *Second Annual Report of the Registrar General* (London, 1840), p. 10, BPP 1840 XVII.

6 Registrar General, *Seventh Annual Report of the Registrar General* (London, 1846), p. 4, BPP 1846 XIX. The law stated that parents *may* give notice of a birth to the Registrar, but this information was only *required* if requested by the Registrar.

after birth there were economic benefits in burying it as though it was stillborn as a funeral was not necessarily required.[1] There was also considerable scope for birth under-registration since births had to be registered within 42 days compared with only 5 days for deaths. In his sixth Annual Report the Registrar General offered a solution to this problem:

> in my opinion, all the births will not be registered until by law it be made compulsory on the father or mother, or some qualified informant, to give notice, within a fixed period, to the Registrar of a birth having occurred, under a small penalty, to be inflicted on default of giving such notice.[2]

His advice clearly fell on deaf ears and nearly 30 years later in the Annual Report for 1872 similar concerns were expressed and estimates of birth under-registration provided:

> The probable annual deficiency in the ten years 1841-50 was 38,036, in the next ten years 19,323, and in the last ten years … 13,614. The deficiency thus rapidly declined: calculated on 1,000 births occurring, it was in the three decades, 65 in the first, 29 in the second and 18 in the third. … I have reason to believe that a certain number of children born alive are buried as stillborn, and that of deaths buried without a Registrar's certificate a few are never registered.[3]

By the 1860s, therefore, just under two per cent of births were thought to be missing, although the method used to derive these estimates is not described. In 1871 registrars were required to send a return of every birth and infant death to the local smallpox vaccination officer as a means of enforcing infant vaccination, which had been made compulsory in 1853. Some groups actively resisted vaccination and, since it was difficult to ensure that any births missing from the register could be vaccinated, there were calls for improvements in registration. These concerns, together with those raised by the Registrar General, resulted in the 1874 Births and Deaths Registration Act which placed the onus for birth registration—subject to a penalty— on to the parents, the occupier of the house where the birth had taken place, others present at the birth or those having responsibility for the child.[4] Furthermore, some form of certification was required before a stillbirth could be buried. It is no coincidence, therefore, that in the Registrar General's Annual Report for 1875, the first year that the Act had been in force, an extensive discussion of infant mortality appears. A comparison of IMRs was published for various places by cause of death together with a discussion of the deaths of illegitimate children, the group thought to be at greatest risk of going unregistered.[5] In the following year the Registrar General thought that, 'the administration of the new Act has operated in a satisfactory manner'.[6] While no registration system can be perfect, it is generally thought that by the end of the nineteenth century very few vital events escaped capture.

1 See Glass, *Numbering the People*, p. 128 for an example of a prosecution for burying a live born infant as a stillbirth.

2 Registrar General, *Sixth Annual Report of the Registrar General* (London, 1845), pp. xiii-xiv, BPP 1844 XIX.

3 Registrar General, *Thirty-Fifth Annual Report of the Registrar General* (London, 1874), pp. v-vi, BPP 1875 XVIII, Part 1.

4 Glass, *Numbering the People*, p. 181; Higgs, *Life, Death and Statistics*, pp. 85-7. This wording followed closely that of the 1854 Scottish Registration Act.

5 Registrar General, *Thirty-Eighth Annual Report of the Registrar General* (London, 1877), pp. xl-li, BPP 1877 XXV.

6 Registrar General, *Thirty-Ninth Annual Report of the Registrar General* (London, 1878), p. 23, BPP 1878 XXII.

Identifying under-registration is relatively easy, but establishing the degree to which events were missed proves far more difficult. Robert Woods has provided the best overall discussion of under-registration in the early years of civil registration, in part by reworking earlier attempts by David Glass and Michael Teitelbaum who, using slightly different methods, compared the number of births registered, adjusted by survival rates, with census counts at later dates.[1] Their estimates of birth under-registration were not significantly different to those reported in the 1874 Registrar General's Annual Report and varied from 6 to 8 per cent during the 1840s, 2 to 3 per cent during the 1850s, 2 per cent during the 1860s and 0.4 to 0.7 per cent during the 1870s.[2] However, after a lengthy discussion of the various problems associated with under-registration during the Victorian period, Woods concluded that, while under-registration certainly existed, attempts at correction are likely to prove fruitless since 'there is no clear consensus on what the correction factors should be, although there is a view that by the 1880s the accuracy of civil registration was acceptable'.[3] Woods argued that all attempts at correction must rely on the assumed quality of other data, notably reported ages in censuses, and since these are also subject to error this inevitably leads to circularity in any argument.[4] His definitive analysis of Victorian demography was therefore undertaken using the raw data published by the GRO.

When IMRs are calculated, problems associated with under-registration are compounded because, in addition to an under count of births, it is likely that an unknown number of early infant deaths also escaped registration and the combined effects are difficult to judge. Glass provided 'corrected' IMRs based on his estimates of birth under-registration, but he found that his rates for 1841-1845 were too low, so after assuming a deficiency of deaths of between two and three per cent which occurred largely amongst infants, he produced a revised rate which was similar to the original one calculated using the registered data and published by the GRO; 147-152 per 1,000 live births (corrected) compared with 148 (registered).[5] It is clearly difficult to provide estimates of the number of very early infant deaths that escaped registration; however, an analysis of neonatal and post-neonatal mortality in the years immediately following the introduction of civil registration has allowed comparisons to be made with the parish register period, notwithstanding that some margin of error needs to be applied to these data.[6] Between 1839 and 1844 the proportion of neonatal to infant deaths increased steadily from 16.91 per cent in 1839 to 18.97 per cent in 1844 which probably suggests a general improvement in registration rather than deteriorating neonatal mortality.[7] The variations in neonatal mortality within registration

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1 R. Woods, *The Demography of Victorian England and Wales* (Cambridge, 2000), pp. 38-70; D.V. Glass, 'A note on the under-registration of births in Britain in the nineteenth century', *Population Studies*, 5 (1951), pp. 70-88; M.S. Teitelbaum, 'Birth underregistration in the constituent counties of England and Wales: 1841-1910', *Population Studies*, 28 (1974), pp. 329-43.

2 Teitelbaum, 'Birth underregistration', Table 2, p. 334.

3 Woods, *Demography of Victorian England and Wales*, p. 69.

4 Woods, *Demography of Victorian England and Wales* pp. 47-70 labelled this 'detection without correction'. See also R.D. Lee and D. Lam, 'Age distribution adjustments for English censuses, 1821 to 1931', *Population Studies*, 37 (1983), pp. 445-64.

5 Glass, 'Note on the under-registration of births', Tables 10 and 11, pp. 84-5.

6 See Figures 2.6 and 2.7.

7 Registrar General, *Eighth Annual Report of the Registrar General* (London, 1849), pp. 214, 240-1, BPP 1847-1848 XXV; *Ninth Annual Report of the Registrar General* (London, 1849), p. 119, BPP 1847-1848 XXV, Appendix BPP 1849 XXI. The percentages for each year from 1839 to 1846 were 16.91, 17.28, 17.30, 18.00, 18.28, 18.51, 18.04 and 18.97.

counties and districts may partly reflect regional differences in under-registration; however these issues will only be resolved once early age deaths are disaggregated and, whilst it would be interesting to examine infant deaths within the first week and especially on the first day during this period, at present this is not possible.[1] While under-registration occurred, it seems safe to conclude that the IMRs calculated using Victorian civil registration data are sufficiently robust to allow the most important trends to emerge throughout the period.

In addition to problems caused by under-registration, the original birth, death and marriage registers are not at present available for inspection in England and Wales. Individual certificates can be purchased, but the prohibitive cost associated with accessing large numbers of births and deaths precludes large-scale demographic analysis.[2] This means that most studies of infant mortality in the Victorian period have to be based on the various publications of the GRO or secondary material that is often derived from these data. During the nineteenth and early twentieth centuries the most important GRO publications were the annual reports, decennial supplements which provide decadal summaries, and quarterly returns which give short reports on registration for three month periods.[3] The annual reports published discussions of the most important issues of the day followed by detailed tables of births, deaths and marriages at the national, county, registration district (hereafter RD) and sometimes registration sub-district (hereafter RSD) level. IMRs for various units can therefore be easily calculated by dividing the registered number of infant deaths by the number of births within a certain period and then multiplying by 1,000.[4] Most annual reports contained a letter to the Registrar General from the Statistical Superintendent, the most prominent being William Farr who helped shape the reports and used them as a platform to promote and disseminate sanitary reform.[5] In part the annual reports were used to frame discussions of pertinent demographic issues and this means that their content changed over time, both with respect to the issues discussed and how the basic data were presented. The various GRO publications, therefore, both shape and limit our view of infant mortality in the Victorian period. For example, we have already discussed the age structure of infant mortality during the early years of civil registration, but we are unable to replicate this type of analysis for other periods because similar data were not published for the rest of the

1 See pp. 58-60.

2 For the potential of using original birth and death registers see D. Kemmer, 'Investigating infant mortality in early twentieth century Scotland using civil registers: Aberdeen and Dundee compared', *Scottish Economic and Social History*, 17 (1997), pp. 1-19.

3 GRO publications report the number of events *registered* within a particular time period, not the number of events that *occurred* within that period. Since births could be registered up to 42 days after the event took place this means that some births that occurred in November or December would have been registered in the following year. The delay between birth and registration is not at present known for England and Wales, but according to J.F.J. Sykes, *Fiftieth Annual Report of Medical Officer of Health for St Pancras* (St Pancras, n.d.), p. 26 'one to two months delay occurs in eighty per cent of the returns from the Registrars'. Around 60 per cent of births were registered close to the 42-day deadline and over 10 per cent were registered after 42 days (p. 25). This phenomenon will clearly affect attempts to measure birth seasonality, especially over short periods of time.

4 To calculate the 'real' IMR for a particular year, access to birth and death dates would be needed, although any differences from the published rates are likely to be slight. This is not necessarily the case if IMRs are calculated for periods of less than one year since both births and infant deaths were not spread evenly throughout the year.

5 See Higgs, *Life, Death and Statistics* for a general discussion of the GRO and its various publications and J.M. Eyler, *Victorian Social Medicine: the Ideas and Methods of William Farr* (Baltimore, 1979) for a discussion of the work of William Farr.

nineteenth century. Infant deaths, broken down by age (0, 1, 2, 3-5, 6-8 and 9-11 months), were given for 1839-1846, but for 1847 and 1849 a different age breakdown was provided (0-2, 3-5 and 6-11 months).[1] In 1848 no age breakdown was given, and it was not until 1888 that this information was repeated—and then only for England and Wales as a whole and London, not by RD.[2] This means that all analyses of the age structure of infant deaths in the Victorian and Edwardian periods are necessarily fragmented, although sources such as local medical officer of health (hereafter MOH) reports occasionally published these data.[3]

The annual reports sometimes give special consideration to infant mortality. As we have seen, the first substantial discussion of the subject occurred in the Annual Report for 1875, although shorter notes had appeared in the reports of the early 1870s.[4] After 1875 the IMR was usually reported, but few details were given and this is reflective of the reports as a whole under the tenure of Brydges Henniker as Registrar General (1880-1900).[5] It was only during the early twentieth century that greater emphasis was given to this topic with the 1901 Annual Report noting that the 'mortality among infants and young children has always been regarded as a valuable test of salubrity'.[6] Infant deaths were given by cause for each county together with a comparison of rates in urban and rural counties. The space given to infant mortality increased during the first decade of the twentieth century and, by the 1906 Annual Report, ten pages were devoted to this topic with graphs of IMRs being included together with discussions of county and urban variations, change over time and seasonality.[7] By using the various GRO publications it is possible to calculate IMRs by RD for the whole of the Victorian and Edwardian periods. Causes of death for infants by RD were also published in the decennial supplements, but a large number of deaths were assigned to the 'other causes' category and this can make their interpretation difficult.[8] The annual reports, decennial supplements and quarterly returns therefore provide the basic data needed to assess patterns of infant mortality throughout the country between 1837 and 1910. They also contain additional data of great interest for certain periods, but in order to provide a full picture of infant mortality, they must be used creatively and supplemented with other material.[9]

The GRO published data for various geographical areas decreasing in size from the whole of England and Wales to regions, counties, RDs and RSDs, although not every measure was consistently reported for each of these units. There are two types of problem associated with using GRO units. The first concerns how accurately they reflect the places they appear to represent. The basic units of civil registration were RDs and these were initially based on Poor Law Unions, groups of parishes chosen for administrating the New Poor Law. RDs

1 Registrar General, *Tenth Annual Report of the Registrar General* (London, 1852), pp. 247-87, BPP 1849 XXI; Registrar General, *Twelfth Annual Report of the Registrar General* (London, 1853), pp. 211-51, BPP 1851 XXII.

2 Registrar General, *Fifty-First Annual Report of the Registrar General* (London, 1889), pp. 106-33, BPP 1889 XXV. Causes of death were also given for England and Wales and London from 1888.

3 See below for a discussion of how some of these sources can be used.

4 See p. 14.

5 Higgs, *Life, Death and Statistics*, pp. 90-128 describes this period as 'an age of inertia'.

6 Registrar General, *Sixty-Fourth Annual Report of the Registrar General* (London, 1903), pp. lxix, BPP 1902 XVIII.

7 Registrar General, *Sixty-Ninth Annual Report of the Registrar General* (London, 1908), pp. xxxvi-xliv, BPP 1908 XVII.

8 See R. Woods and N. Shelton, *An Atlas of Victorian Mortality* (Liverpool, 1997), pp. 47-64 for a discussion of infant mortality that uses these sources.

9 GRO publications can sometimes be frustrating to use especially when trying to construct time series of certain measures.

were then divided into sub-districts or grouped together to form counties and then regions. In 1861 RD 428, Lincoln, was 158,920 acres in area and had a population of 47,063.[1] With a population density of slightly under 0.3 persons per acre this would appear to be a typical rural district, but since the city of Lincoln had a population of 20,999 (44.6 per cent of RD), the RD comprised a substantial city centrally located within a sparsely populated rural hinterland. By 1901 there were 74,670 persons living in the slightly enlarged RD (159,761 acres, population density 0.47 persons per acre), 48,784 (65.3 per cent) of whom lived in the city of Lincoln. Thus, between 1861 and 1901 the ancient city more than doubled in population while the rural population remained virtually static, 26,064 in 1861 compared with 25,886 in 1901. This means that by the turn of the twentieth century this apparently low density 'rural' RD was indeed more urban than rural. From the 1850s to the 1900s decadal IMRs in Lincoln RD were 154, 165, 162, 148, 151 and 126 and it appears therefore that the IMR remained relatively stable until about 1900.[2] However, there were urban-rural differences in mortality within the RD. Lincoln RD comprised three RSDs: Lincoln South-West, Lincoln Home (which contained the city) and Lincoln North-East. In 1861 IMRs for each RSD were 143, 181 and 122 while in 1901 they were 125, 181 and 122. Thus, rates in part of the district had decreased and this caused the overall IMR in the district to remain stable, despite the city of Lincoln more than doubling in size.[3] It would therefore seem unwise to assume that the overall IMR of the RD was representative of all parts of the district. Most 'rural' RDs included some urban components, and while disaggregating RDs into RSDs can address this problem to some extent, it is often not possible to replicate the same types of analysis at different levels of aggregation. Any study that classifies RDs into urban and rural or correlates RD IMRs with other socio-economic variables assumes some uniformity across the RD and this was not always the case. Likewise, 'urban' RDs were rarely coterminous with town and city boundaries. Sometimes it is possible to combine neighbouring districts to produce 'registration cities', but these are rarely perfect.[4]

1 Registrar General, *Twenty-Fourth Annual Report of the Registrar General* (London 1863), p. 67, BPP 1863 XIV. For the population of the city of Lincoln, see Registrar General, *1861 Census of England and Wales, Volume 1, Population Tables* (London, 1862), p. 69, BPP 1861 L.

2 Decadal IMRs can be calculated from Registrar General, *Supplement to the Twenty-Fifth Annual Report of the Registrar General* (London, 1864), pp. 302-3, BPP 1865 XIII; Registrar General *Supplement to the Thirty-Fifth Annual Report of the Registrar General* (London, 1875), pp. 308-9, BPP 1875 XVIII, Part 2; Registrar General, *Supplement to the Forty-Fifth Annual Report of the Registrar General* (London, 1885), p. 260, BPP 1884-1885 XVII; Registrar General, *Supplement to the Fifty-Fifth Annual Report of the Registrar General, Part I* (London, 1895), p. 517, BPP 1897 XXI; Registrar General, *Supplement to the Sixty-Fifth Annual Report of the Registrar General, Part I* (London, 1907), p. 516, BPP 1905 XVIII Parts 1 and 2; Registrar General, *Supplement to the Seventy-Fifth Annual Report of the Registrar General, Part III Registration Summary Tables (1901-1910)* (London, 1919), p. 531, BPP 1914-1916 VIII. Tables 2-5 discuss changes in IMRs by RD at the national level within this period.

3 See A. Reid, H. Jaadla and E. Garrett, *Demographic and Socio-Economic Data for Registration Sub-Districts of England and Wales, 1851-1911*. [data collection]. (UK Data Service, 2020). SN: 8613 who have calculated IMRs for RSDs.

4 P. Laxton and N. Williams, 'Urbanisation and infant mortality in England: a long term perspective and review', in M.C. Nelson and J. Rogers (eds), *Urbanisation and the Epidemiological Transition*, Department of History, Uppsala University: Reports from the Family History Group 9 (Uppsala, Sweden, 1989), pp. 124-35.

Table 3.1 Population of Sheffield compared with Ecclesall Bierlow and Sheffield Registration Districts (RDs), 1841-1911

Date (1)	Sheffield City (2)	Ecclesall Bierlow RD (3)	Sheffield RD (4)	(3) + (4) (5)	(5) – (2) (6)	Percentage difference (7)
1841	111,091	31,625	85,293	116,918	5,827	4.98
1851	135,310	37,914	103,626	141,540	6,230	4.38
1861	185,172	63,618	128,951	192,569	7,397	3.84
1871	239,946	87,432	162,271	249,703	9,757	4.07
1881	284,508	114,418	183,135	297,553	13,045	4.38
1891	324,243	137,905	204,677	342,582	18,339	5.35
1901	380,793	179,676	229,454	409,130	28,337	6.93
1911	454,632	205,617	267,132	472,749	18,117	3.62

Notes: Percentage difference calculated as ((6) / (2))*100. A boundary change on 31 October 1901 incorporated parts of Wortley and Rotherham RDs into the city of Sheffield, together with parts of sub-districts in Sheffield and Ecclesall Bierlow RDs not previously included, see Registrar General, *1901 Census of England and Wales, County of York* (London, 1903), Table 12, p. 96, British Parliamentary Papers 1903 LXXXIV-LXXXVI.

Sources: Sheffield city, A.D.H. Crook, 'Population and boundary changes, 1801-1981' in C. Binfield, D. Martin, R. Childs, R. Harper, D. Hey, G. Tweedale and R. Harman (eds), *The History of the City of Sheffield 1854-1993* (Sheffield, 1956), pp. 482-3; Ecclesall Bierlow and Sheffield RDs, Census of Great Britain, 1851, *Population Tables, Vol. 2* (London, 1852), p. 26, BPP 1852 LXXXVI; Census of England and Wales 1871, *Population Tables: Area, Houses and Inhabitants, Vol. II: Registration or Union Counties* (London, 1872), p. 428, BPP 1872 LXVI Volumes 1 & 2; Census of England and Wales 1891, *Area, Houses and Population, Vol II: Registration Areas and Sanitary Districts* (London, 1893-4), pp. 879-80, BPP 1893-1894 CV; Census of England and Wales 1911*, Areas, Families or Separate Occupiers, and Population, Vol. II: Registration Areas* (London, 1912), pp. 289-90, BPP 1912-1913 CXI Volumes 1, 2 and 3.

The town, and from 1893, the city of Sheffield was contained within two RDs, Ecclesall Bierlow and Sheffield. As Table 3.1 shows, if these two RDs are combined to form a 'registration city' then the population of Sheffield 'registration city' is increased by between four and seven per cent compared to the city itself. Any analysis of demographic change within these two districts should therefore provide a reasonably good approximation to that occurring within the city. In terms of area though, the two RDs were much larger than the city of Sheffield—33,904 acres compared with 19,651 acres—which means that the RDs contained large tracts of sparsely populated areas surrounding a relatively small compact urban centre. Indeed, even within the city of Sheffield most of the land could be considered rural (Figure 3.1). For example, in 1841 the town of Sheffield comprised six townships, the largest of which was Upper Hallam—5,870 acres with a population density of 0.2 persons per acre—which compares with Sheffield township, which was 3,100 acres and had a population density of 21.9 persons per acre. As the city expanded the urban core moved outwards but, even today, large swathes of moorland are still contained within the city's boundary. By excluding those RSDs in Ecclesall Bierlow and Sheffield not in the city it is

Figure 3.1 Sheffield from Skye Edge by H.B. Parker, 1844

Note: The town of Sheffield is pictured framed within a rural idyll.

Source: Sheffield Local Studies Library: Picture Sheffield Collection w02073.

possible to produce a 'registration city' that is a much closer, but not a perfect, match to the city itself.[1]

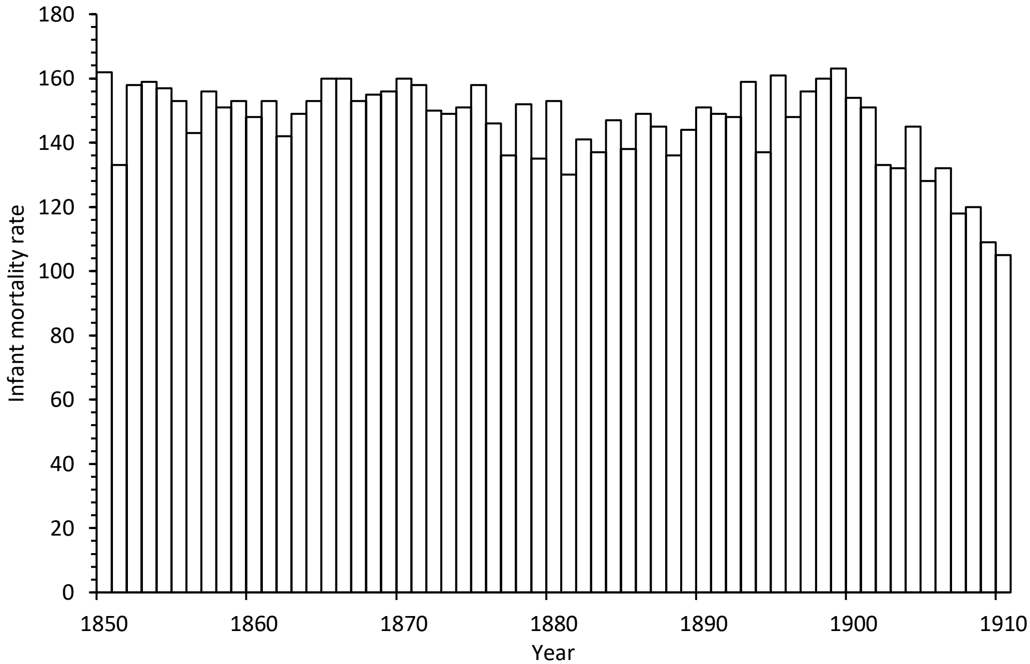
The second problem associated with using RDs is that, as was the case with Lincoln, many experienced boundary changes at some point during the nineteenth century. New ones were created as the considerable population redistribution that occurred throughout England and Wales affected many places, especially those parts of the country subject to industrialisation. At the commencement of civil registration England and Wales was split into 324 RDs, but these areas clearly proved too large since by 1851 most had been subdivided to create 623 districts and by 1910 that number had increased to 634.[2] This means that compiling time series of IMRs for some places, particularly those subject to rapid population increase, proves difficult since, strictly speaking, like is not being compared with like. In an attempt to overcome these difficulties Woods and Shelton created 614 districts 'by combining contemporary districts in order to permit comparison over six decades', although they noted that 'in some cases it has also been necessary to estimate the relevant

1 Between 1841 and 1901 the areas outside the city's boundaries were Norton RSD in Ecclesall Bierlow, Handsworth RSD in Sheffield and the parishes of Dore and Totley in Upper Hallam RSD (Ecclesall Bierlow). All these areas became part of the city during the twentieth century.

2 Registrar General, *Fifth Annual Report of the Registrar General* (London, 1843), p. 169, BPP 1843 XXI; Registrar General, *Fourteenth Annual Report of the Registrar General* (London, 1853), p. 82, BPP 1854-1855 XL; Registrar General, *Seventy-Third Annual Report of the Registrar General* (London, 1912), p. 205, BPP 1911 XI. From 1911 onwards local authority districts became the preferred unit of reporting.

statistics using those for surrounding districts' and they concede that these units 'do not represent a perfect solution' since 'fewer and larger units would be required to preserve complete integrity'.[1] Using RSD data can provide a better solution, although this will necessarily involve a greater amount of effort. Despite the problems associated with RDs, the wide range of data published for the various GRO units, many of which were important influences on infant survival, ensures that the principal means by which researchers seek to understand variation and change in infant mortality is through an analysis of RD data, notwithstanding that others sources also have the potential to add greatly to our knowledge of this subject.

Figure 3.2 Infant mortality rates, England and Wales, 1850-1910



Source: Registrar General's *Annual Reports* for the years 1850-1910.

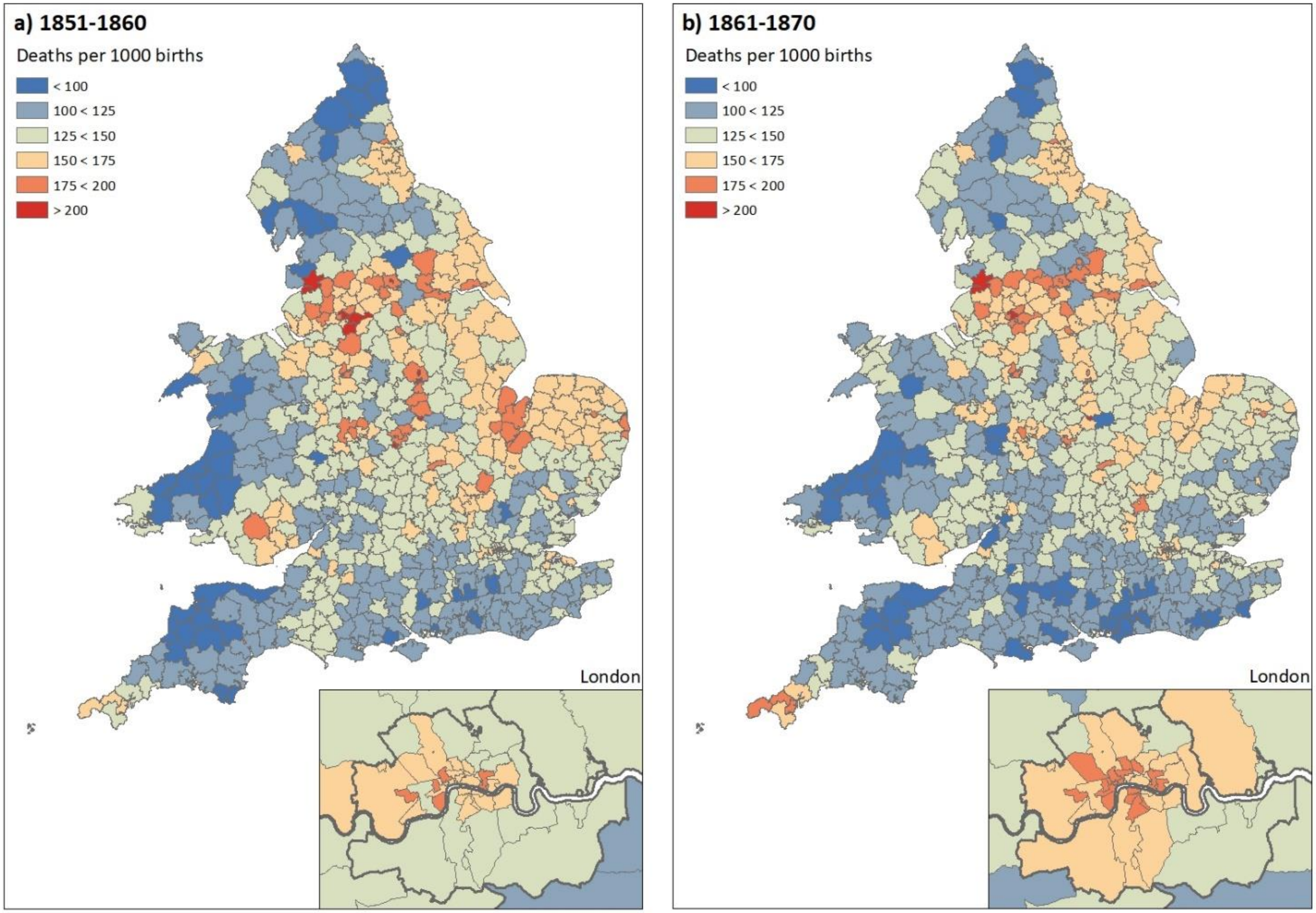
Patterns of infant mortality in the Victorian and Edwardian periods

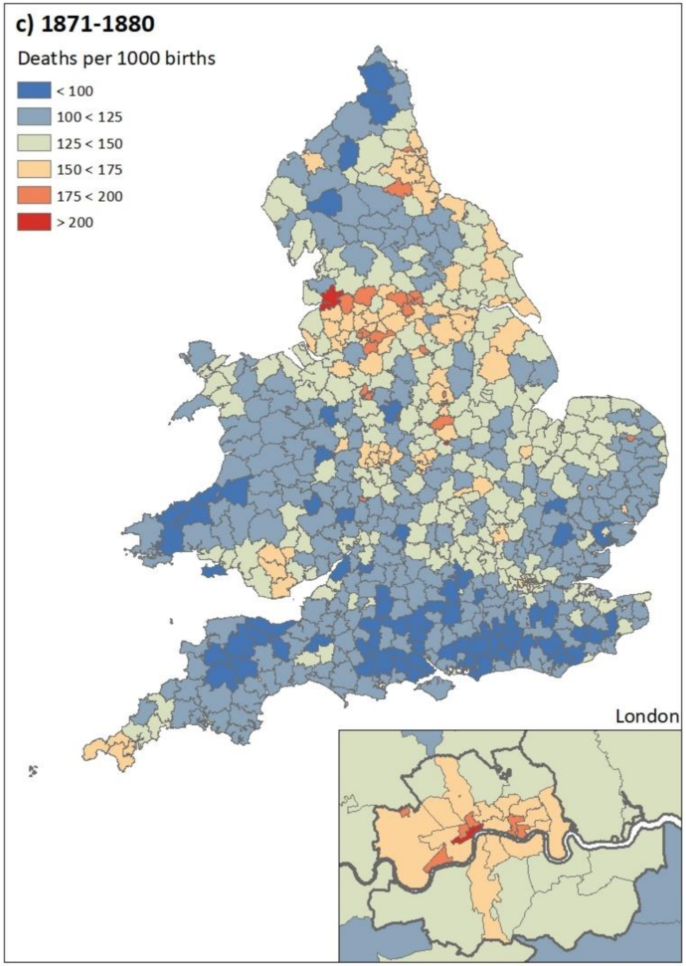
It is appropriate to begin with the national trend before examining finer scale variations. Figure 3.2 shows national IMRs between 1850 and 1910 presented in a form that an Edwardian demographer would recognise.[2] It reveals a rate that fluctuated, but was generally

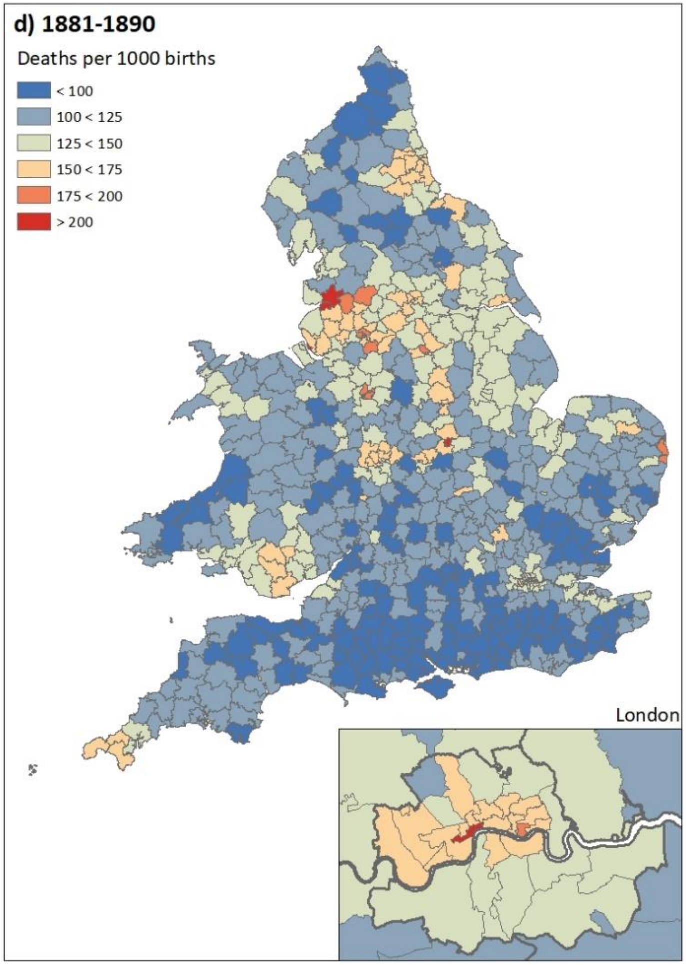
1 Woods and Shelton, *Atlas of Victorian Mortality*, p. 16. A. Hinde and B. Harris, 'Mortality decline by cause in urban and rural England and Wales, 1851-1910', *The History of the Family*, 24 (2019), pp. 377-403, describe a set of 588 geographical units based on registration districts which 'achieve a broadly consistent geography' over the five six decades from 1851-1860 to 1901-1910 (pp. 384-5).

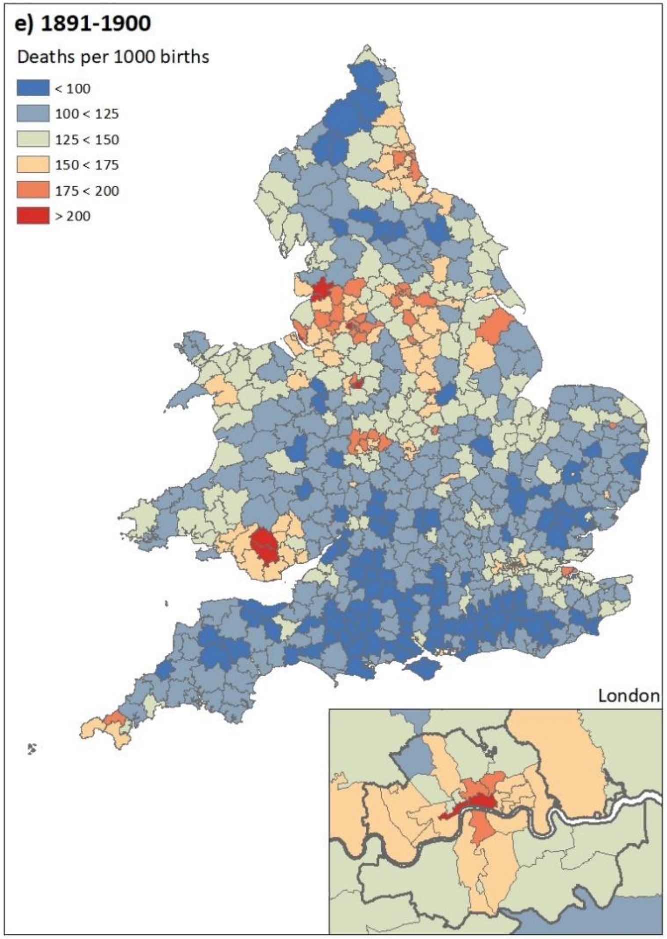
2 A graph in this form was first published in Registrar General, *Sixty-Ninth Annual Report of the Registrar General* (London, 1908), p. xxxix, BPP 1908 XVII. This appeared alongside similar ones showing changes in birth and death rates.

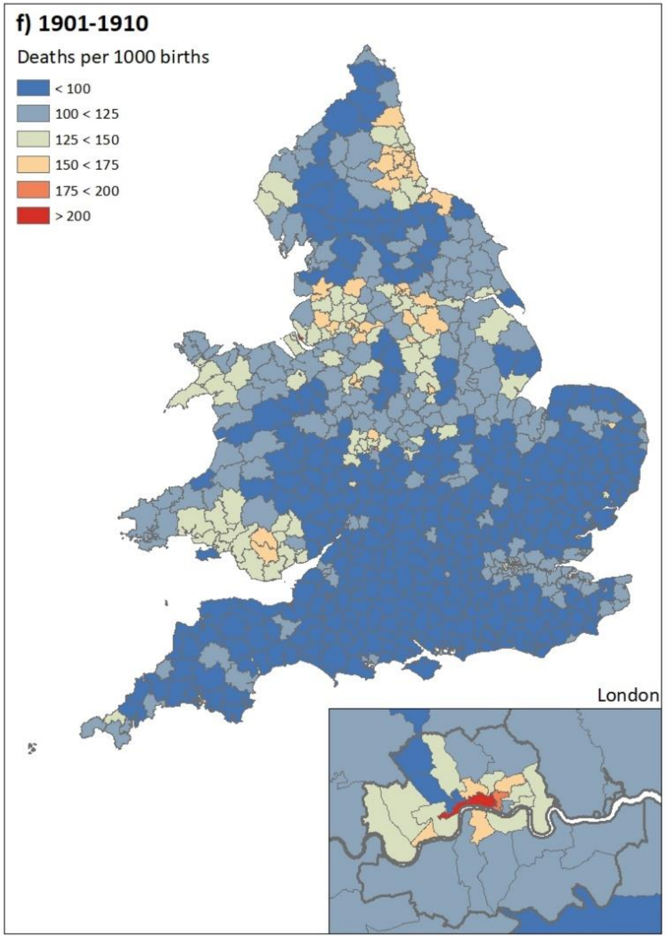
Figure 3.3 Decadal infant mortality rates by registration district, England and Wales, 1851-1910




c) 1871-1880
Deaths per 1000 births
< 100
100 < 125
125 < 150
150 < 175
175 < 200
> 200
London


d) 1881-1890
Deaths per 1000 births
< 100
100 < 125
125 < 150
150 < 175
175 < 200
> 200
London


e) 1891-1900
Deaths per 1000 births
< 100
100 < 125
125 < 150
150 < 175
175 < 200
> 200
London


f) 1901-1910
Deaths per 1000 births
< 100
100 < 125
125 < 150
150 < 175
175 < 200
> 200
London

Notes: The registration districts in this Figure are the 614 standardised districts used in R. Woods and N. Shelton, *An Atlas of Victorian Mortality* (Liverpool, 1997), pp. 15-20. I wish to thank the authors for allowing me access to these data. I am grateful to Eilidh Garrett for drawing these maps.

Sources: Figures 3b, d, e, f are the same as Maps 7a and 7b in R. Woods and N. Shelton, *An Atlas of Victorian Mortality* (Liverpool, 1997), although different intervals and colouring have been used. The boundaries were created by Joe Day for the research project, 'An Atlas of Victorian Fertility Decline', see J.D. Day, *Registration Sub-District Boundaries for England and Wales 1851-1911* (Cambridge, 2016). Full details can be found on the PopulationsPast website, www.populationspast.org [accessed 1 January 2021]. The original data have been deposited at the United Kingdom Data Service, University of Essex, see R. Woods, *Causes of Death in England and Wales, 1851-60 to 1891-1900: the Decennial Supplements* [computer files] Colchester, England, United Kingdom Data Archive [distributor], 1997. SN 3552, https://doi.org/10.5255/UKDA-SN-3552-1.

stable until 1900, followed by the beginnings of secular decline. Indeed, it was only once the data had been presented in this way that such patterns could be identified and as the Registrar General's Annual Report for 1906 noted:

> In the course of the forty years ending in 1900, the corrected death rate at all ages had fallen by about 15 per cent, but no such corresponding reduction could be recorded in the proportion of deaths of children under one year of age; since the close of the century, however, the subject of the waste of infant life, formally treated with apathy, has received close and increasing attention from all classes of the community, and to this awakening may fairly be ascribed some portion of the decline in the rate of infantile mortality that has taken place during the past few years.[1]

Figure 3.2 clearly shows that a significant turning point occurred at or around the turn of the century, although whether the Registrar General was correct in his assessment of its causes will be discussed later. The apparent stability of the national rate before 1900 masks a key feature of infant mortality in the Victorian period; the persistent and substantial geographical variations that occurred throughout the country. For instance, between 1891 and 1900 the national rate was 153.3 per thousand births, but rates in individual RDs ranged from 223.0 in Liverpool to 78.3 in Reeth, North Yorkshire.[2]

Figure 3.3 shows a sequence of maps of decadal IMRs for RDs from the 1850s until the 1900s. Starting in the 1850s, not surprisingly perhaps, Figure 3a is similar to Figure 2.9, with large parts of southern England, Wales and the very north of England recording the lowest rates (shaded blue). These districts were predominantly rural, often sparsely populated, and relatively remote. By contrast, the highest rates were to be found in the towns, especially those undergoing industrialisation, in Yorkshire, Lancashire and the Midlands. These urban districts were densely populated and their relatively small areas belie their impact on the national IMR. In London rates were generally high with the highest being found in the centre and the western suburbs and the lowest in the southern and north-eastern suburban districts. High IMRs were also found in a group of rural eastern districts centred around the Wash and expanding outwards into Lincolnshire, Norfolk and towards London. It is also noticeable that the map for the 1850s shows that only nine districts recorded IMRs in excess of 200.

Moving through the sequence of maps, it is clear that over time the number of blue districts increases so that, by the 1880s, the vast majority of districts south of a line drawn from the Severn to the Wash are shaded blue. The excess IMRs in the eastern districts persisted into the 1860s, but by the 1870s many were near to the national average and by the 1880s and 1890s most of these districts had turned blue. The urban and industrial districts in Lancashire, Yorkshire and the Midlands continued to record the highest rates, as did parts of south Wales and the area around Tyneside. In London the highest rates still tended to be found in the central districts, but while the overall IMR in London remained near to the national average individual RDs exhibited considerable variation, in part because institutional deaths and high levels of migration in the capital distorted rates in some RDs.[3]

1 Registrar General, *Sixty-Ninth Annual Report*, p. xxxvii.

2 Registrar General, *Supplement to the Sixty-Fifth Annual Report, Part 1*, pp. 97-731.

3 For example, the London RDs recording the highest and lowest IMRs during the 1900s were London City (354) and St Giles (67). The reason why London City's IMR was so high was that a large hospital, St

Figures 3a-e therefore provide evidence of both continuity and change—the persistence of high infant mortality in urban and industrial environments together with a gradual improvement in many districts. The final map, Figure 3f, is dominated by blue and the intervals chosen to illustrate the level of variation in the Victorian period no longer appear adequate. The north-east, south Wales, the very centre of London and the towns of Yorkshire, Lancashire and the Midlands just about stand out as places of high mortality, but as the Registrar General in 1906 noted, the secular decline in infant mortality had begun and moreover it appears to have affected nearly all places.

Table 3.2 Number of registration districts recording specific infant mortality rates in each decade, England and Wales (excluding London), 1851-1910

IMR	1851-1860	1861-1870	1871-1880	1881-1890	1891-1900	1901-1910
40-59						1
60-79	4	3	3	9	3	76
80-99	37	46	67	127	98	238
100-119	128	151	194	216	200	137
120-139	174	172	155	127	138	77
140-159	135	118	99	71	73	44
160-179	76	68	54	33	56	15
180-199	26	26	14	3	16	
200-219	8	4	3	3	4	1
220-239		1			1	
240-	1					

Note: The 25 London RDs have been excluded from the table.

Sources: R. Woods, *Causes of Death in England and Wales, 1851-60 to 1891-1900: the Decennial Supplements* [computer files] Colchester, England, United Kingdom Data Archive [distributor], 1997. SN 3552, https://doi.org/10.5255/UKDA-SN-3552-1. Full details can be found on the PopulationsPast website, www.populationspast.org [accessed January 2021].

The patterns shown in Figure 3.3 become clearer if the numbers of RDs recording specific IMRs within each decade are examined (Table 3.2). While decadal rates smooth out annual variations, they enable longer-term trends to emerge. The range of rates shown in Table 3.2 is considerable at all times, although between 1851 and 1900 over two thirds of the 589 RDs recorded rates between 100 and 160. Table 3.2 also reveals a downward drift in IMRs until 1890, an increase in the 1890s, followed by substantial decline in the 1900s. This pattern becomes further apparent if RDs are placed into larger groups: thus, the number of RDs recording IMRs below 100 was 41, 49, 70, 136, 101 and 315 for each decade while the number of RDs recording IMRs greater than 160 was 111, 99, 71, 39, 75 and 16.

Bartholomew's, was located in that district and there was no attempt to reallocate patient deaths to their district of residence. This means that relatively few births were recorded in this district, but there were many infant deaths from the hospital, hence its seemingly very high IMR, see Registrar General, *Supplement to the Seventy-Fifth Annual Report*, pp. 1, 18, 748-9. For further discussion of this question, see S.L. Rafferty, 'Can indirect estimation methods and the medical officer of health reports "correct" distorted infant mortality rates reported by the Registrar General? The case of London, 1896-1911', *Local Population Studies*, 106 (2021), pp. 57-81; G. Mooney, 'Did London pass the "sanitary test"? Seasonal infant mortality in London, 1870-1914', *Journal of Historical Geography*, 20 (1994), pp. 158-74; and T.A. Welton, 'The effects of migration in disturbing local rates of mortality as exemplified in the statistics of London and the surrounding country for the years 1851-60', *Journal of the Institute of Actuaries*, 16 (1872), pp. 153-86.

This suggests that most RDs must have experienced decline between 1851 and 1890, even though Figure 3.2 showed that the national rate remained relatively stable. Table 3.3 extends the analysis by ranking each RD according to its IMR and then reporting rates at certain percentiles. Thus, IMRs for the median (50th percentile) RD were 134, 131, 123, 114, 119 and 98 for each decade which means that, compared with the 1850s, there had been a 15 per cent decline by the 1880s and a nearly 27 per cent decline by the 1900s. Similar trends are apparent at each percentile, the only exception being at the 90th percentile where levels of decline were about five percentage points lower between the 1850s and 1880s and seven percentage points lower than the general trend between the 1850s and 1900s. Thus, decline appears to have been virtually uniform and, while it would be unwise to assume that these trends occurred in every RD, the evidence seems sufficiently consistent to suggest that strong national forces must have influenced IMRs throughout the period.

Table 3.3 Percentile infant mortality rates, registration districts in England and Wales (excluding London), 1851-1910

Percentile	1851 -1860	1861 -1870	1871 -1880	1881 -1890	1891 -1900	1901 -1910	Percentage decline 1850s to 1880s	Percentage decline 1850s to 1900s
90	171	169	163	154	165	140	10.0	18.1
75	155	150	142	132	141	117	14.8	24.5
50	134	131	123	114	119	98	14.9	26.9
25	118	114	110	101	105	86	14.4	27.1
10	105	102	98	92	95	78	12.4	25.7

Note: Registration districts are ranked from low to high (100th percentile). The 25 London RDs have been excluded from the table.

Source: R. Woods, *Causes of Death in England and Wales, 1851-60 to 1891-1900: the Decennial Supplements* [computer files] Colchester, England, United Kingdom Data Archive [distributor], 1997. SN 3552, https://doi.org/10.5255/UKDA-SN-3552-1. Full details can be found on the PopulationsPast website, www.populationspast.org [accessed January 2021].

Table 3.4 examines what happened in the relatively few RDs suffering the highest IMRs. It shows every RD that recorded an IMR greater than or equal to 180 for each decade between 1851 and 1910. Most are large northern towns or districts adjacent to them, although Norwich and Yarmouth are prominent on the list and some rural fenland districts such as Ely, Whittlesey and Holbeach appear during the 1850s. Districts such as Stoke-upon-Trent and Burnley did not experience decline until 1900 which shows that here local factors must have been important; however, decline occurred everywhere after 1900 with only Liverpool still recording a rate above 180. Most districts repeated the pattern outlined above and this is perhaps best illustrated by the total number of RDs that appear in each decade: there were 35 in the 1850s, only 6 in the 1880s and 21 in the 1890s. Most of these high mortality districts had experienced significant decline by the 1880s and the 1890s are once again highlighted as a problem, with only Leicester reporting a lower IMR during the 1890s than in the 1880s.

As has already been mentioned, all analyses of infant mortality using RDs need certain caveats placing upon them, especially the fact many urban districts experienced boundary

Table 3.4 Registration districts recording infant mortality rates greater than 180 in each decade, England and Wales (excluding London), 1851-1910

Registration district	1851-1860	1861-1870	1871-1880	1881-1890	1891-1900	1901-1910
Liverpool	241	236	217	219	223	204
Manchester	216	212	188		190	
Coventry	211					
Ashton-under-Lyme	209	188			188	
Nottingham	206	197	187		186	
Leicester	202	220	214	203	195	
Preston	202	207	212	203	220	
Stockport	201	190	182		194	
Leeds	200	187	188			
Norwich	197	188	188		181	
Wolverhampton	197				188	
Yarmouth	196	204	199			
Bradford	196	196				
Hull	195	192			189	
Wolstanton	195	189	183		188	
Whittlesey	195					
Oldham	194	188				
Salford	193	183	184	184	206	
Blackburn	192	195	191		186	
Wisbeach	192					
Stoke-upon-Trent	190	190	189	190	210	
Newcastle-upon-Tyne	190	188				
Sheffield	188	198	183		195	
Wigan	188	187				
Northampton	188	186				
Foleshill	186	180				
Sculcoates	185	180				
Bolton	184					
Nuneaton	184					
Selby	184					
Goole	182	186				
Macclesfield	182					
Holbeach	181					
Ely	180					
Loughborough	180					
Dewsbury		196	181			
Hunslet		194	185			
Luton		184				
Burnley		181	183	184	186	
Barnsley		181				
York		181				
Birmingham		180			200	

Table 3.4 continued

Merthyr Tydfil					202	
East Stonehouse					186	
Redruth					185	
Walsall					184	
Number of districts	35	31	17	6	21	1

Note: The 25 London RDs have been excluded from the table.

Sources: R. Woods, *Causes of Death in England and Wales, 1851-60 to 1891-1900: the Decennial Supplements* [computer files] Colchester, England, United Kingdom Data Archive [distributor], 1997. SN 3552, https://doi.org/10.5255/UKDA-SN-3552-1. Full details can be found on the PopulationsPast website www.populationspast.org [accessed 1 January 2021].

changes which makes comparison over time difficult.[1] Spatial variations in infant mortality in the large towns could also be substantial. For instance, in 1900 the city of Sheffield's IMR was 200, but rates in individual sub-districts varied from 112 in Upper Hallam to 234 in Sheffield North.[2] In spite of such issues, Table 3.4 shows that, even in the worst environments, some decline is evident before the 1890s and that after 1900 decline had occurred everywhere.

Table 3.5 shows IMRs in England and Wales and London alongside groups of RDs selected to illustrate the best and worst environments to raise infants. It is apparent that, when the data are presented in this way, decline occurred throughout England and Wales between 1851 and 1890 with the possible exception of London. Indeed, if Figure 3.3d is scrutinised carefully then the 1880s emerge as one of relatively low mortality. The substantial post-1900 decline is evident in all places and—generally speaking—the patterns shown in Tables 3.2-3.4 are repeated notwithstanding that an infant born in the unhealthiest RD, Liverpool, was up to four times more likely to die in its first year than one born in the healthiest RD. More generally, throughout the whole period the mainly urban, 'unhealthy' districts experienced levels of infant mortality twice as high as the mainly rural, 'healthy' districts. It is also noteworthy that Farr's 'healthy districts', which were originally selected for their low crude death rates, whilst experiencing low IMRs, were never the healthiest places to raise infants. These districts also recorded a slight increase during the 1890s which was not repeated in the 60 RDs recording the lowest IMRs. London proves a major exception to the general rural-urban gradient in IMRs since rates in the capital were close to the national average. London accounted for around ten per cent of the total population of England and Wales and, while individual London RDs varied greatly, their combined effect averaged out and the overall London rate remained close to the national one.

Given the limitations of this type of analysis, Tables 3.2-3.5 reveal a remarkable uniformity in describing long-term trends in infant mortality in Victorian England and Wales; in nearly every instance the downward drift in rates between 1850 and 1890 is

1 See the discussion in N. Williams and C. Galley, 'Urban-rural differentials in infant mortality in Victorian England', *Population Studies*, 49 (1995), pp. 401-20, here at pp. 404-7.

2 J. Robertson, *Annual Report of the Medical Officer of Health for Sheffield, 1900* (Sheffield, 1901), pp. 20-1.

Table 3.5 Infant mortality rates for selected groups of registration districts, 1851-1910

Place	1851-1860	1861-1870	1871-1880	1881-1890	1891-1900	1901-1910	Percentage decline 1850s-1880s	Percentage decline 1850s-1900s
England and Wales	154	154	149	142	153	128	8.0	16.9
London	155	162	158	152	160	128	2.1	17.4
Highest RD	241	236	217	219	223	204	8.8	15.4
60 RDs with highest IMRs	189	185	178	167	181	153	11.7	19.0
RDs included in Table 4	195	191	181	172	185	155	11.5	20.5
Farr's Healthy RDs	111	111	109	106	114	94	4.4	15.3
60 RDs with lowest IMRs	96	95	92	87	90	74	9.2	22.9
Lowest RD	67	73	74	70	78	47	-3.3	29.1

Notes: For the composition of Farr's healthy registration districts, see W. Farr, 'On the construction of life-tables, illustrated by a new life-table of the healthy districts of England', *Transactions of the Royal Society*, 149 (1859), pp. 837-78, here at p. 862. The districts of Hendon, Lewisham and Bromley have been excluded since all are close to London and, in contrast to most of the other districts, they experienced substantial population increase during the period. Their inclusion would have meant that in 1891-1900 31 per cent of infant deaths in the healthy districts would have been concentrated into these three districts. The healthy districts were chosen because they had a low death rate that did not exceed 17 per 1,000 living. For a discussion of the representativeness of Farr's healthy districts see E. Lewis-Fanning, 'A survey of the mortality in Dr Farr's 63 healthy districts of England and Wales during the period 1851-1925', *Journal of Hygiene*, 30 (1930), pp. 121-53.

Sources: R. Woods, *Causes of Death in England and Wales, 1851-60 to 1891-1900: the Decennial Supplements* [computer files] Colchester, England, United Kingdom Data Archive [distributor], 1997. SN 3552, https://doi.org/10.5255/UKDA-SN-3552-1. Full details can be found on the PopulationsPast website, www.populationspast.org [accessed January 2021].

apparent, as is the 1890s increase and the subsequent post-1900 decline. Three questions emerge from this analysis: the first relates to the reasons why the national rate remained stable despite underlying decline almost everywhere; the second to the causes of the increase in the 1890s and the third to the causes of the underlying decline and the accelerated decline post-1900. The first two questions can be dealt with relatively easily while the third will require further discussion.

Table 3.6 shows the percentage of infant deaths recorded in RDs ranked according to their IMRs. Thus, the 10 per cent of RDs recording the lowest IMRs, which roughly correspond to the seventh row of Table 5, contributed only 2.9 per cent of infant deaths in the 1850s and this percentage steadily declined so that after 1890 they contributed only about a half of this figure. By contrast, the 10 per cent of RDs recording the highest IMRs, which roughly corresponds to the fourth row of Table 3.5, were responsible for over 35 per cent of infant deaths in the 1850s and this figure steadily increased throughout the period so that by the 1900s over 47 per cent of infant deaths occurred in these districts. Indeed, the 25 per cent of RDs recording the highest IMRs were responsible for nearly 56

Table 3.6 Percentage of infant deaths in registration districts ranked by infant mortality rate, England and Wales (excluding London), 1851-1910

Percentiles	1851-1860	1861-1870	1871-1880	1881-1890	1891-1900	1901-1910
90-100	35.5	38.1	37.8	43.8	45.4	47.5
75-89	20.3	22.7	25.9	24.3	26.3	24.0
50-74	22.2	19.5	19.3	17.2	16.4	16.9
25-49	13.5	12.3	10.6	8.7	7.7	7.0
10-24	5.7	5.1	4.5	4.2	2.9	3.1
0-9	2.9	2.3	1.9	1.9	1.4	1.5

Note: Registration districts (RDs) are ranked from low to high (100th percentile). The 25 London RDs have been excluded from the table.

Sources: R. Woods, *Causes of Death in England and Wales, 1851-60 to 1891-1900: the Decennial Supplements* [computer files] Colchester, England, United Kingdom Data Archive [distributor], 1997. SN 3552, https://doi.org/10.5255/UKDA-SN-3552-1. Full details can be found on the PopulationsPast website, www.populationspast.org [accessed January 2021].

per cent of infant deaths in the 1850s and over 71 per cent in the 1900s while the 50 per cent of RDs recording the lowest rates contributed only 22 per cent of infant deaths in the 1850s and 12 per cent in the 1900s. Thus, even though IMRs in most places were declining, large-scale population redistribution and urbanisation meant that an increasing proportion of infants were being born in the unhealthy towns. In 1851, 54 per cent of the population of England and Wales could be considered urban with 31 per cent living in large towns (over 50,000) but, by 1901, 78 per cent were living in urban areas with 51 per cent in large towns.[1] Given the rural-urban gradient in IMRs, increasing levels of urbanisation counterbalanced the generally improving IMRs, even in the towns, and consequently the overall national rate remained relatively stable.

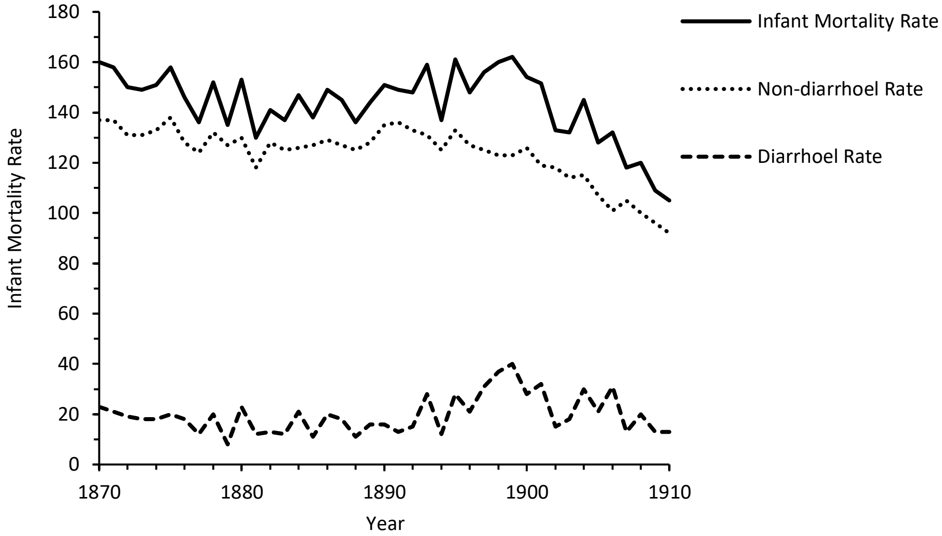
The second question can be answered by reference to the complex group of gastro-intestinal diseases that caused infantile diarrhoea.[2] Figure 3.4 shows the national IMR between 1870 and 1910 alongside diarrhoeal and non-diarrhoeal IMRs and it reveals that most of the increase during the 1890s can be attributed to an increase in diarrhoea deaths.[3] During the 1890s a series of hot, dry summers occurred which exacerbated unhealthy, environmental conditions, especially in the cities, creating ideal conditions for this disease to flourish.

1 P.J. Waller, *Town, City and Nation: England 1850-1914* (Oxford, 1983) pp. 8-9, based on R. Lawton (ed.), *The Census and Social Structure: an Interpretative Guide to Nineteenth Century Censuses for England and Wales* (London, 1978), p. 97 and C.M. Law, 'The growth of urban population in England and Wales, 1801-1911', *Transactions of the Institute of British Geographers*, 41 (1967), pp. 125-43. See also R. Woods, 'The effects of population redistribution on the level of mortality in nineteenth-century England and Wales', *Journal of Economic History*, 45 (1985), pp. 645-51; Williams and Galley, 'Urban-rural differentials', pp. 409-12; and E. Garrett, A. Reid, K. Schürer and S. Szreter, *Changing Family Size in England and Wales. Place, Class and Demography, 1891-1911* (Cambridge, 2001), p. 424, who used the term 'compositional demography' to describe these effects.

2 See the discussion in R. Woods, P.A. Watterson and J.H. Woodward, 'The causes of rapid infant mortality decline in England and Wales, 1861-1921, part 1', *Population Studies*, 42 (1988), pp. 343-66. See D. Dwork, *War is Good for Babies and Other Young Children* (London, 1987), pp. 22-51 for a discussion of contemporary attempts to understand the causes of diarrhoea deaths.

3 Figure 4 is basically the same as Registrar General, *Seventy-Second Annual Report of the Registrar General for 1909* (London, 1911), Diagram IV, p. xliv, BPP 1911 X; and Woods, *Demography of Victorian England and Wales*, Figure 7.12, p. 275.

Figure 3.4 Infant, non-diarrhoeal and diarrhoeal mortality rates, England and Wales, 1870-1910



Source: Registrar General, *Seventy-Fourth Annual Report of the Registrar General* (London, 1913), Table XXII, p. xxxiv, British Parliamentary Papers 1912-1913 XII.

Woods, Watterson and Woodward, following their extensive analysis of infant mortality in this period concluded:

> climatic conditions, especially during the third quarter of the year, interacted with poor urban sanitary environments which resulted in high levels of diarrhoea and dysentery among infants, particularly those aged between 1 and 11 months. … There seems little doubt that the increase in infant mortality during the 1890s, especially the late 1890s, was, indeed, caused by an increase in mortality from diarrhoeal diseases. Up to one-quarter of all infant deaths in England and Wales in 1899 were ascribed to this group of diseases.[1]

Without these adverse climatic conditions, the second half of the nineteenth century would therefore be viewed as one of continual decline in infant mortality.

While climate certainly played its part in explaining the increase in diarrhoeal deaths, the interaction between high summer temperatures, low rainfall and infantile diarrhoea was complex.[2] For example, according to Table XXII of the Registrar General's Annual Report for 1911, the summer of 1897 was warm (average temperature in the third quarter was 62.2°F (16.8°C)), rainfall was slightly above average for the decade (6.3 inches compared with an average of 6.03 inches) and the diarrhoeal IMR was high at 31.[3] The average temperature in

1 Woods, *et al.*, 'Causes of rapid infant mortality decline, part 1', p. 360.

2 For a wide-ranging contemporary discussion see O.H. Peters, 'Observations upon the natural history of epidemic diarrhoea', *Journal of Hygiene*, 10 (1910), pp. 602-777.

3 Registrar General, *Seventy-Fourth Annual Report of the Registrar General* (London, 1913), Table XXII, p. xxxiv, BPP 1912-1913 XII.

1896 was the same as in 1897, but rainfall was higher (8.7 inches) and diarrhoeal mortality a third lower at 21.[1] By comparison, the summer of 1874 was virtually identical to 1897 (62.2°F and 6.2 inches), but the IMR from diarrhoea was only 18. Part, but not all, of this difference may have been due to increased levels of urbanisation during the nineteenth century, but the exact relationship between climate and diarrhoea deaths is difficult to explain.[2] Table 3.7 shows the ten years with the highest diarrhoeal mortality, highest mean temperature in the third quarter of the year, and lowest rainfall, for the period 1870-1910. The combination of high temperature and low rainfall could have devastating consequences, but only 1899 appears on all three lists.[3] Only three out of the years with the highest temperatures also had the greatest diarrhoeal mortality, while six of the years with the lowest rainfall had the greatest mortality. Indeed, for the whole of the period 1870-1910 there is a stronger correlation between infant diarrhoea deaths and low rainfall than between infant diarrhoea deaths and high temperature.[4] The exact interplay between these three variables has yet to be determined. Moreover, the temperatures and rainfall reported by the Registrar General

Table 3.7 Years with greatest diarrhoeal mortality, highest mean third quarter temperature and lowest rainfall, England and Wales, 1870-1910

Highest diarrhoeal mortality	Highest mean third quarter temperature	Lowest rainfall
1=1899	1=1899	1=1898
2=1898	2=1878	2=1907
3=1901	2=1884	3=1906
4=1897	2=1893	4=1899
4=1906	5=1872	5=1884
6=1904	5=1887	6=1900
7=1893	7=1871	7=1904
7=1895	8=1873	8=1886
7=1900	9=1886	9=1901
10=1880	9=1895	10=1876
10=1870		

Note: Readings of rainfall and mean earth temperature were taken at 3 ft 2 in depth in Greenwich during the third quarter of the year.

Source: Registrar General, *Seventy-Fourth Annual Report of the Registrar General* (London, 1913), Table XXII, p. xxxiv, BPP 1912-1913 XII.

1 Registrar General, *Sixty-Fourth Annual Report*, p. xxxiv. The diarrhoea IMR was 50 per cent higher in 1897 compared with 1876, 1878 and 1884, all years with similar summers.

2 A greater amount of artificial feeding in the late 1890s could also account for some of these differences; however, at present this cannot be substantiated.

3 Registrar General, *Seventy-Fourth Annual Report*, Table XXII, p. xxxiv gives data for 1870-1911. 1911 has the second highest diarrhoea mortality rate, the highest temperature (with 1899) and the second lowest rainfall. See pp. 241-60 for a discussion of infant mortality in 1911.

4 If scatter graphs are drawn to examine the relationships between diarrhoeal mortality and temperature and diarrhoeal mortality and rainfall then respective linear correlation equations are $y = 0.0998x + 59.489$ ($R^2 = 0.3607$) and $y = -0.1341x + 9.3138$ ($R^2 = 0.2301$). The lower level of R^2 in the second equation is partly due to the greater variations in rainfall compared with temperature. Pearson's product-moment correlation coefficient between the variables diarrhoeal mortality and temperature is 0.600585 and that between diarrhoeal mortality and rainfall is -0.47965, both of which suggest strong correlations with the minus indicating that a decrease in rainfall results in an increase in diarrhoeal mortality.

were for Greenwich, but the majority of diarrhoea deaths occurred in the Midlands and the North and, while hot London summers may be indicative of similar ones throughout the rest of the country, there is sufficient climatic variability throughout Britain to suggest that this was not always the case and this may account for some of the differences shown in Table 3.7. Likewise, both the temperature and rainfall figures are average third quarter ones (July-September) and it could be that they mask shorter periods of intense heat which produced peaks of diarrhoea deaths. The best way of untangling these relationships is at the local level and, since temperature and rainfall data are available for many places these could easily be compared with local series of infant deaths.[1]

Examining the impact of diarrhoeal diseases over the course of the nineteenth century within different environments is difficult because, while diarrhoea is a symptom that is easy to identify, without accurate microbiological investigation it is not necessarily easy to determine its cause. There was often considerable overlap between the different terms used and this may have caused problems when it came to allocating each death to the relevant published causes of death. For example, the 1891-1900 Decennial Supplement grouped together 'Diarrhoea and Dysentery' deaths and reported that the IMR from this cause was 17.5 deaths per 1,000 live births while Table XXII in the 1911 Annual Report grouped diarrhoea and enteritis deaths together (labelled as Diarrhoeal Diseases) and the mean annual IMR from this 'cause' for 1891-1900 was nearly 50 per cent higher at 25.3.[2] A large number of infant deaths appeared under the 'other causes' category in the Decennial Supplements and some of these may have been recategorised for publication in the 1911 Annual Report. Exactly how Table XXII of that report was constructed is not known and this means that making comparisons over time is difficult. Whatever the true level of 'diarrhoea' deaths may have been, infantile diarrhoeal mortality was mainly an urban phenomenon with some smaller districts hardly being affected. Petworth, Ringwood, Alresford, Camelford, Haltwistle, Bellingham, Belford, Glendale, Brampton and Longtown all recorded fewer than 10 infant diarrhoea deaths during the whole of the 1890s while Catherington in Hampshire recorded none.[3] The rise in infantile diarrhoea deaths in the 1890s is not only important in distorting the pattern of infant mortality decline. It was very visible to many medical health officials and helped them focus on how this disease could be combatted, and more generally, how wider infant mortality decline could be achieved.

Causes of death for infants

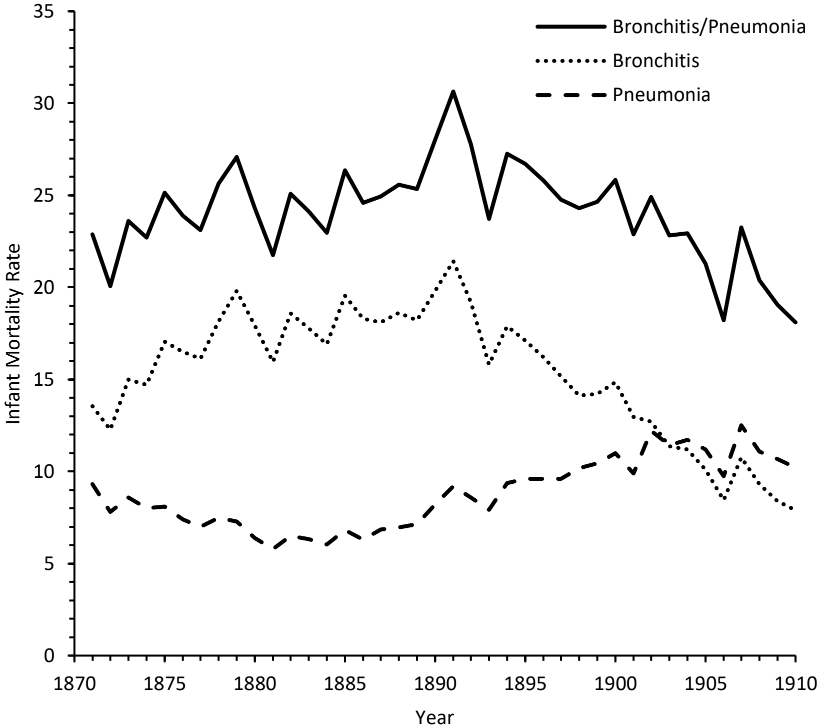
The third question mentioned above relates to the underlying causes of decline that have been identified throughout Tables 3.2-3.5. We have already seen how diarrhoea distorted the overall pattern of change and it might be thought that an analysis of other causes of death may provide an answer to this question. The Registrar General's annual reports

1 Liverpool's Medical Officer of Health reports recorded daily diarrhoea deaths alongside rainfall and temperature between 1867 and 1889. See W.S. Trench, *Report of the Health of Liverpool during 1867* (Liverpool, 1868), pp. 16-7 and G. Newman, *Infant Mortality, a Social Problem* (London, 1906), pp. 153-60 for other examples.

2 Registrar General, *Supplement to the Sixty-Fifth Annual Report*, pp. 4-5; Registrar General, *Seventy-Fourth Annual Report*, p. xxxiv. See also the discussion in Hinde and Harris, 'Mortality decline', p. 382.

3 Registrar General, *Supplement to Sixty-Fifth Annual Report.* Also see Woods and Shelton, *Atlas of Victorian Mortality,* pp. 55-61; A. Newsholme, 'Infantile mortality: a statistical study from the public health standpoint', *The Practitioner*, 75 (1902), pp. 489-500, here at p. 496.

Figure 3.5 **Bronchitis and pneumonia infant mortality rates, England and Wales, 1871-1910**



Source: Registrar General's *Annual Reports* for the years 1870-1910.

provide detailed causes of death for London and England and Wales as a whole from 1871 onwards. Unlike the Decennial Supplements, where a large proportion of infant deaths are categorised under 'other causes', almost all deaths are given a specific cause.[1] We start by examining bronchitis and pneumonia (Figure 3.5). At first sight it would appear that the trend in these respiratory deaths broadly followed the national one, although there are annual variations and probably some link to climate since these diseases were more likely to be encountered in the colder months. Decadal rates for bronchitis and pneumonia combined between 1871 and 1910 were 23.8, 24.9, 26.2 and 21.4 per 1,000 live births, although most of the increase during the 1890s was due to a spike in deaths between 1890 and 1892. However, Figure 3.5 shows that separately the two trends differed significantly with pneumonia steadily increasing from 1890 while bronchitis declined. It seems likely therefore that at least part of the explanation for these differences relates to how the two diseases were diagnosed and recorded rather than the result of epidemiological change. In 1871 pneumonia was listed together with laryngitis, bronchitis, pleurisy, asthma and lung disease

1 In 1871 only 2.3 per cent of infant deaths (2,854 out of 125,868) were unascertained or not specified, while in 1910 this figure had fallen to only 0.1 per cent (79 out of 94,579). By comparison the 1871-1880 decennial *Supplement* placed 35.3 per cent of infant deaths in the 'other causes' category, Registrar General, *Thirty-Fourth Annual Report of the Registrar General* (London, 1873), pp. 144-5, BPP 1873 XX; Registrar General, *Seventy-Third Annual Report of the Registrar General* (London, 1912), pp. 306-7, BPP 1911 XI; Registrar General, *Supplement to the Forty-Fifth Annual Report*, pp. 2-3.

under the general heading of Diseases of the Respiratory Organs, but from 1901 it was listed together with other infectious diseases.[1] Lung disease was no longer a cause of death in 1910; it had presumably been subsumed into other respiratory causes of death. Yet throughout the period 1871-1910 the vast majority of infant respiratory deaths were ascribed to either bronchitis and pneumonia and, as far as it is possible to tell, Figure 3.5 confirms that there was some decline in this group of diseases from 1890. More intriguingly, Figure 3.5 also hints that there was a steady increase from 1870 which would be consistent with an increasing proportion of infants being born in urban areas and a greater likelihood of them being exposed to respiratory infections, although exactly what caused the change after 1890 is difficult to determine.

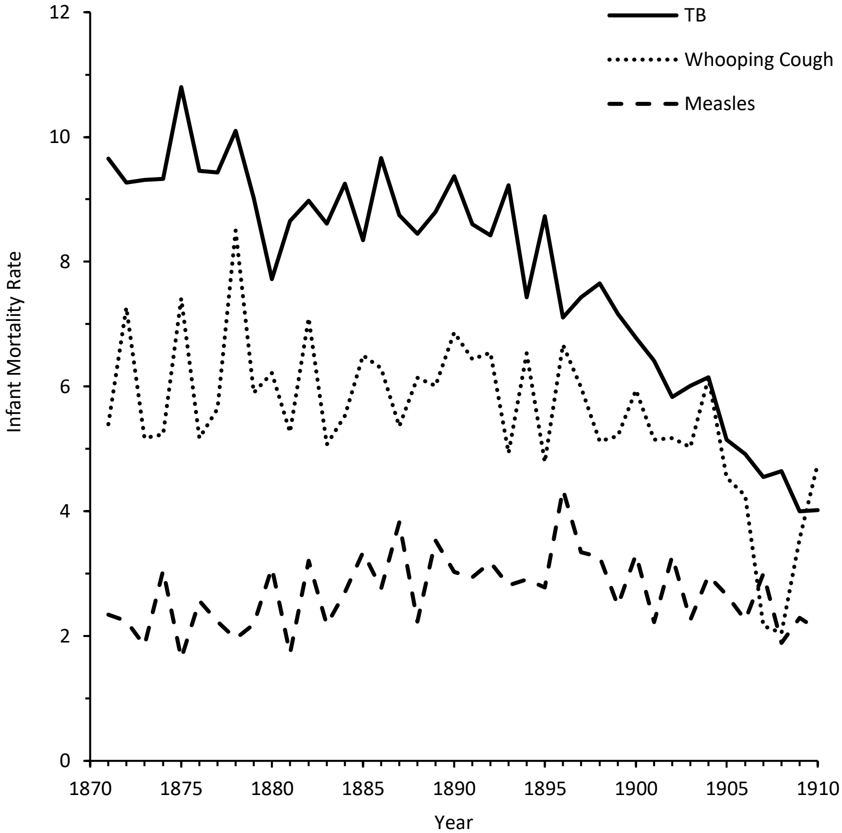
When it comes to an examination of other diseases the situation becomes more complicated. Figure 3.6 shows three of the most important infectious diseases to affect infants: tuberculosis, whooping cough and measles. As can be seen, all three display slightly different patterns. Tuberculosis mortality shows a steady decline throughout the period. Whooping cough mortality exhibits considerable annual variation, general stability until the end of the nineteenth century, and then some decline. Measles deaths also vary annually: they increase steadily, peak in 1896, and then decline slightly afterwards. If these diseases are viewed in isolation, convincing explanations could be given for each of the observed patterns. For example, the decline in infant tuberculosis mortality, which mirrored that in the rest of the population, could be seen as a consequence of lower exposure to the tuberculosis bacteria given that the infant's immediate family suffered less from this disease.[2] The slight increase in measles mortality could be related to increasing urbanisation as greater concentrations of population resulted in a greater chance of catching the disease at a younger age while the isolation of patients and improvements in treatment of both whooping cough and measles could account for their early twentieth century decline.[3] However, such

1 In 1871 there were 433 infant deaths attributed to laryngitis, 10,611 to bronchitis, 27 to pleurisy, 7,434 to pneumonia, none to asthma and 1,424 to lung disease, see Registrar General, *Thirty-Fourth Annual Report*, pp. 146-7. By 1910 there were 136 laryngitis deaths, 10 from croup (not spasmodic or membranous), 2 from other diseases of the larynx and trachea, 7,082 from bronchitis and 9,052 from pneumonia, see Registrar General, *Seventy-Third Annual Report,* pp. 292-3, 300-1. There were also a few infant influenza deaths—94 in 1871 and 93 in 1910.

2 See Woods and Shelton, *Atlas of Victorian Mortality*, Figure 31, p. 97 for the reduction in age-specific tuberculosis (phthisis) mortality rates in England Wales, 1851-1910. Women aged 20-40 years experienced the greatest falls in mortality in this period. Writing about the reasons for this reduction Woods and Shelton argued that '[t]he simplest explanation is that the disease became less virulent and that this was the principal reason for a reduction in the risk of the disease developing and leading to early death', but this did not mean that, 'poor nutrition, overcrowded housing and poverty in general did not influence the outcome and its speed once the disease began to develop' (p. 114). See also A. Hardy, *The Epidemic Streets: Infectious Disease and the Rise of Preventive Medicine, 1856-1900* (Oxford, 1993) and L. Bryder, *Below the Magic Mountain: a Social History of Tuberculosis in Twentieth-century Britain* (Oxford, 1988).

3 See A. Cliff, P. Haggett and M. Smallman-Raynor, *Measles: an Historical Geography of a Major Human Viral Disease from Global Expansion to Local Retreat, 1840-1990* (Oxford, 1990). M. Smallman-Raynor and A. Cliff, *Atlas of Epidemic Britain* (Oxford, 2012), p. 50 note that many measles deaths result from respiratory complications and it is interesting to note that the pattern of measles mortality is very similar to that of bronchitis/pneumonia in Figure 3.5. Smallman-Raynor and Cliff (pp. 52-3) also show that whooping cough and measles mortality mirrored one another quite closely despite their very different epidemiology. Woods and Shelton, *Atlas of Victorian Mortality*, pp. 76-83 also discuss this phenomenon.

Figure 3.6 Tuberculosis (TB), whooping cough and measles infant mortality rates, England and Wales, 1871-1910



Source: Registrar General's *Annual Reports* for the years 1870-1910.

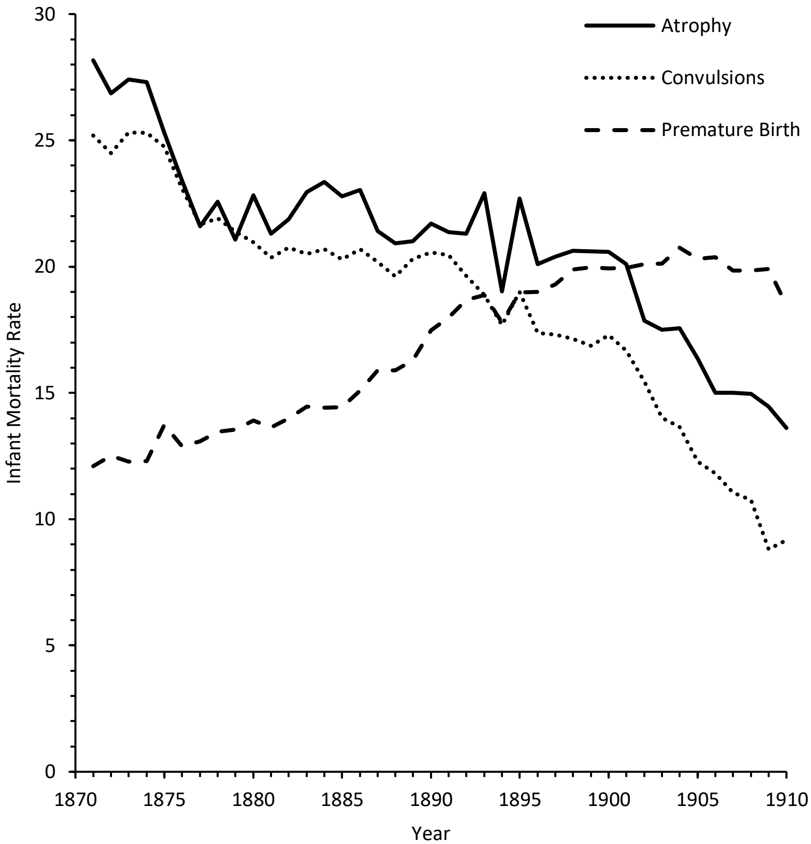
suggestions must remain speculation and providing a consistent and convincing explanation that can account for all three patterns remains difficult, the more so when other common infectious childhood diseases are considered. Smallpox, scarlet fever and diphtheria were responsible for relatively few infant deaths, with the numbers dying from each disease being respectively 3,161, 1,206 and 227 in 1871 (4,594 in total) and 3, 44 and 112 in 1910 (159 in total). All these diseases declined steadily throughout the period with the IMR from these three diseases combined being 5.8 per 1,000 live births in 1871, but only 0.2 in 1910.[1] The decline in smallpox can be attributed to more effective vaccination which virtually eliminated the disease throughout the population; that of scarlet fever to a general decline in the disease's virulence that affected all children, while that of diphtheria is less certain.[2] The

1 Registrar General, *Thirty-Fourth Annual Report*, pp. 146-7; Registrar General, *Seventy-Third Annual Report,* p. 290.

2 For smallpox see Woods and Shelton, *Atlas of Victorian Mortality*, pp. 73-4 and for scarlet fever see R.J. Davenport, 'Urbanization and mortality in Britain, *c.* 1800-50', *Economic History Review*, 73 (2020), pp. 455-85, here at pp. 478-80 and Woods and Shelton, *Atlas of Victorian Mortality*, pp. 83-92.

combined IMR from the six infectious diseases discussed above was 23.1 per 1,000 live births in 1871, 17.0 in 1881, 18.5 in 1891, 14.5 in 1901 and 11.2 in 1910. It is noteworthy that this pattern was similar to that of the overall IMR and, perhaps more importantly, to that within childhood mortality more generally.

Figure 3.7 **Atrophy, convulsions and premature birth infant mortality rates, England and Wales, 1871-1910**



Note: Debility and inanition deaths are included together with those from atrophy.

Source: Registrar General's *Annual Reports* for the years 1870-1910.

So far it seems that our analysis of causes of death has provided a way forward towards explaining overall changes in infant mortality. However, when three of the most important causes of death are considered: atrophy, convulsions and premature birth, the picture becomes far more complicated (Figure 3.7). Both atrophy and convulsions declined substantially throughout the period while mortality from premature birth steadily increased. In each case it is difficult to determine how these causes should be interpreted. Atrophy was primarily associated with early childhood—infants comprised 73.8 per cent of all atrophy deaths in 1870 and 93.6 per cent in 1910—with this term being used to describe infants who died because they 'failed to thrive' for some reason.[1] Providing a modern understanding for the myriad of possible reasons why a death from atrophy might have occurred is of course impossible. The same is also true to some extent with deaths due to premature birth. Not surprisingly, all deaths in this category were infant ones with 99 per cent being aged between 0 and 3 months in 1910. It is a pity, therefore, that further subdivision by age was not given at this date since it might be expected that most deaths recorded as being due to 'premature birth' would have been early neonatal ones.[2] Such a breakdown would also be useful in determining whether, as seems likely, there was some transfer in deaths from atrophy to premature birth from 1870 onwards.[3] If the increase in deaths from premature birth was not related to changes in recording practices then this would imply that there must have been a substantial decline in maternal health leading to an increase in early neonatal mortality and this is surely not tenable given the general decline in adult mortality in this period. The final cause to be considered is convulsions or convulsive fits which appeared under the heading Diseases of the Brain, and which were most likely a final symptom of other unspecified diseases. Convulsions were primarily an infant cause of death with 79.4 per cent of deaths being aged under 1 year in 1871 and 87.6 per cent in 1910.[4] Again it would seem likely that the decline in deaths from convulsions was associated with better diagnosis and perhaps an increasing reluctance by doctors to use this term on the death certificate. That there was some fluidity in how doctors allocated causes of death is demonstrated by Armand Routh who argued that the statistics on infantile syphilis were unreliable due to:

> the desire of the medical practitioner in charge of the case to avoid adding to the grief of the mother and father by putting syphilis as the primary cause of the death in the death certificate, 'atrophy', 'debility', and 'marasmus', or 'prematurity', being convenient and partially true substitutes.[5]

Deaths from atrophy, convulsions and premature birth comprised about 40 per cent of all infant deaths throughout the period and, given how imprecise these causes were, with their use probably varying over time, this must undermine any analysis of infant causes of death.

Anne Hardy has argued that the 'interpretation of Victorian and Edwardian cause of death statistics is an exercise of detective skills and a test of historical intuition' with the registered causes often bearing 'only an approximation to the truth'.[6] These statements are

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1 Registrar General, *Thirty-Fourth Annual Report*, pp. 148-9; Registrar General, *Seventy-Third Annual Report*, pp. 306-7. Atrophy, debility and inanition deaths formed a single cause. All were wasting diseases.

2 Age breakdowns were given for 0-3, 3-6 and 6-12 months between 1888 and 1910, but the trends for each of these age groups were identical to that of the overall IMR. The trends in neonatal and early neonatal deaths may be more revealing, but these cannot of course be determined.

3 In 1910, Arthur Newsholme noted that 'probably a considerable amount of transference between (deaths within) these three headings has occurred', A. Newsholme, *Supplement to the Thirty-Ninth Annual Report of the Local Government Board 1909-10 Containing a Report by the Medical Officer on Infant and Child Mortality* (London, 1910), pp. 27-30, quotation on p. 27.

4 Registrar General, *Thirty-Fourth Annual Report*, pp. 146-7; Registrar General, *Seventy-Third Annual Report*, pp. 298-9.

5 A. Routh, 'A lecture on ante-natal hygiene: its influence upon infantile mortality', *British Medical Journal*, 14 February 1914, pp. 355-63, here at p. 360.

6 A. Hardy, ' "Death is the cure of all diseases": using the General Register Office cause of death statistics for 1837-1920', *Social History of Medicine*, 7 (1994), pp. 472-92, here at pp. 472-3. See also A. Newsholme, *The Elements of Vital Statistics* (London, 1899), pp. 21-9 for a general discussion of the reliability of nineteenth-century causes of death.

confirmed by the above analysis with the nineteenth century perhaps best viewed as a period of transition from the largely symptomatic causes found in parish registers and the London Bills of Mortality to the increasing sophistication of the medical terms used in the twentieth century.[1] Moreover, in cases where the doctor was called post-mortem he would have had to rely on secondary evidence and in some cases the doctor did not even see the dead body and instead had to infer the cause of death from witnesses and/or previous visits to the patient.[2] The situation is further complicated by the fact that more than one cause of death was often given on the death certificate, but the death had to be allocated to a single cause in the published returns and it is not entirely clear how this was done. The GRO recommended that:

> In cases of multiple causes of death, the causes were to be written under each other without connecting verbs in the order of their *appearance* and not in the presumed order of their *importance*.[3]

Thus, if an infant contracted diarrhoea, subsequently suffered convulsions and then died, then the death certificate should give diarrhoea as the primary cause and convulsions as the secondary cause, but it is conceivable that either convulsions, diarrhoea or both could have appeared on the certificate and this death could have appeared under either cause in the published returns.[4] In terms of developing strategies aimed at reducing mortality, which was one of the primary reasons why deaths were classified and published in this way, such decisions were critical. While the imprecision of many causes of death and their possible shift in use over time must limit the overall value of any analysis of Victorian and Edwardian causes of death, especially infant ones, as Hardy argued, it is still possible to use 'historical intuition' and make conclusions from these data. Diarrhoea was easy to diagnose, as were a range of common childhood diseases such as measles, smallpox and scarlet fever which nineteenth-century doctors would have encountered on an almost daily basis. Likewise, respiratory deaths would have been easy to identify, even though differing terms may have been used. It therefore seems safe to conclude that the increase in diarrhoea deaths noted above was indeed responsible for the apparent failure of infant mortality to decline at the end of the nineteenth century. There was also a general decline in tuberculosis and the common infectious diseases of childhood throughout the period as well as a decline in

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1 Even late-twentieth-century causes of death are open to some measure of question with some studies suggesting that up to 30 per cent of causes may be changed following autopsy. See for example, M. Britton, 'Diagnostic errors discovered on autopsy', *Acta Medica Scandinavia*, 196 (1974), pp. 203-10; G. Maudsley and E.M.I. Williams, ' "Inaccuracy" in death certification - where are we now?', *Journal of Public Health Medicine*, 18 (1996), pp. 59–66; M.B. Nashelsky and C.H. Lawrence, 'Accuracy of cause of death determination without forensic autopsy examination', *American Journal of Forensic Medicine and Pathology*, 24 (2003), pp. 313-9.

2 N. Williams, 'The reporting and classification of causes of death in mid-nineteenth-century England: the example of Sheffield', *Historical Methods*, 29 (1996), pp. 58-71, here at p. 62.

3 Williams, 'Reporting and classification of causes of death', p. 60. In the Registrar General's *Seventh Annual Report*, pp. 249-329, William Farr described how doctors and registrars should fill in the death certificates, differentiate primary from secondary causes of death and adopt an appropriate detailed nosology. See also the discussion in Woods, *Demography of Victorian England and Wales*, pp. 312-6.

4 Williams, 'Reporting and classification of causes of death', p. 65 concluded that 'there is no definitive way of knowing exactly how certain cause of death statements were in fact manipulated and eventually classified'.

respiratory diseases from 1890. Indeed, a recent analysis has shown that these changes were also witnessed more generally within the wider population:

> [t]he causes which contributed to the decline of mortality between 1850 and 1910 were, in descending order, pulmonary tuberculosis; a group comprising water- and food-borne infections plus typhus; scarlet fever; and diseases of the lungs.[1]

However, with other causes being responsible for the majority of infant deaths, it would appear that an analysis of causes of death alone cannot provide a full explanation for the underlying changes that occurred within this period.

Recent work on Victorian and Edwardian infant mortality

Our discussion of causes of death has given hints as to what brought about the decline in infant mortality, but no definitive conclusions have been forthcoming. The most convincing explanation of the secular decline in infant mortality was given by Robert Woods in his book *The Demography of Victorian England and Wales*.[2] He noted that some facts are well established:

> the risks of dying in childhood varied in a distinct fashion with age; that those risks were far greater if the child's mother was not married, if the father was unskilled, poorly paid, unemployed; that the risks were especially high if the baby was born in an urban environment or in winter, was born premature with a low birthweight, was not breastfed or was weaned early. The risks were also high if the mother was in her teens, late thirties or forties or if the baby was the first born (parity 1) or above parity 5 or 6.[3]

Most of these relationships were derived from data published by the Registrar General whilst others had to be inferred from studies, often undertaken by local medical officers, that began to appear from the 1890s.[4] Family-specific relationships are difficult to demonstrate with aggregate data and in the parish register period IMRs by parity or mother's age are calculated from family reconstitutions. Given the unreliability of nineteenth-century parish registers and the present embargo on accessing birth, death and marriage registers it is extremely difficult to undertake family reconstitution after 1837, and instead Woods was forced to make these inferences using data from countries such as Sweden.[5]

Woods also explored the influence of class and place on mortality. The lack of individual level data means that this relationship is difficult to assess during the nineteenth century, and the only study to do so was undertaken by Naomi Williams who linked entries from a copy of the death register for Sheffield during the 1870s with burial records and census

1 Hinde and Harris, 'Mortality decline', pp. 377-403.

2 Woods, *Demography of Victorian England and Wales*, pp. 247-309.

3 Woods, *Demography of Victorian England and Wales*, p. 251. These relationships should also have occurred in the pre-registration era even though some cannot as yet be demonstrated. They also occurred throughout the twentieth century.

4 See for example, A. Hill, 'On the causes of infant mortality in Birmingham', *The Practitioner*, 51 (1893), pp. 70-80; and the discussion in C. Galley, 'Social intervention and the decline of infant mortality: Birmingham and Sheffield, *c.* 1870-1910', *Local Population Studies*, 73 (2004), pp. 29-50.

5 Woods, *Demography of Victorian England and Wales*, p. 277, which quotes K.A. Lynch and J.B. Greenhouse, 'Risk factors for infant mortality in nineteenth-century Sweden', *Population Studies*, 48 (1994), pp. 117-33, here at p. 121.

enumerators books.[1] By examining third quarter mortality rates she discovered that place and class were important influences; they acted independently of each other and also cumulatively. The relationship between mortality and class, with father's occupation being used as a surrogate for class, can however be demonstrated at the end of our period. The 1911 Annual Report of the Registrar General gives IMRs by father's occupation, thereby allowing class-specific rates to be calculated. These show the expected mortality gradient: Class I (upper and middle) had an IMR of 75.7 per 1,000 births, Class II (intermediate, excluding scholars) 106.4, Class III (skilled workmen) 112.7, Class IV (intermediate) 121.5 and Class V (unskilled workmen) 152.5.[2] The GRO also constructed three special classes comprised of selected groups of workers: Class VI (textile workers), with an IMR of 148.1; Class VII (miners), 160.1; and Class VIII (agricultural labourers) 96.9. Classes III-VIII represent the working classes and, in the case of agricultural labourers, the benefits of living in a healthy environment outweighed the handicaps of their class.[3] Unfortunately, the summer of 1911 was hot and this caused a significant increase in infant deaths from diarrhoea and dysentery, especially in the larger towns where many of the working classes lived. In the census of that year married women were also asked about their fertility history. They were required to state the number of children that had been born alive to their existing marriage and the number of live-born children who had died prior to the census.[4] By analysing these responses using indirect estimation techniques it is possible to show that the class gradient in mortality stretches back to at least 1895.[5] Eilidh Garrett and her colleagues, in their extensive analysis of the 1911 fertility census, offered a more sophisticated discussion of these data and were able to show that the relationship between place and class is complicated, but that, during the late nineteenth and early twentieth centuries, 'the surroundings in which people lived appear to have been much more important with regard to the risks of infant and child mortality than was their social class'.[6] They explain much of the social class gradient in terms of the ability of the higher social classes to work, have higher incomes, live in better environments and also have lower fertility.[7] While their analysis is based on 1911, it seems inconceivable that many of their results would not also apply to at least part of the nineteenth century; however, the influence of social class will only be fully explained once access to individual records become more readily available.

1 N. Williams, 'Death in its season: class, environment and the mortality of infants in nineteenth-century Sheffield', *Social History of Medicine*, 5 (1992), pp. 71-94.

2 Woods, *Demography of Victorian England and Wales*, pp. 264-7; Registrar General, *Seventy-Fourth Annual Report*, Table 28B, p. 88. Table 28A, pp. 73-87, gives the full occupational breakdown.

3 See S. Szreter, 'The genesis of the Registrar-General's social classification of occupations', *British Journal of Sociology*, 35 (1984), pp. 522-46, here at pp. 530-4, for a discussion of how these classes were constructed.

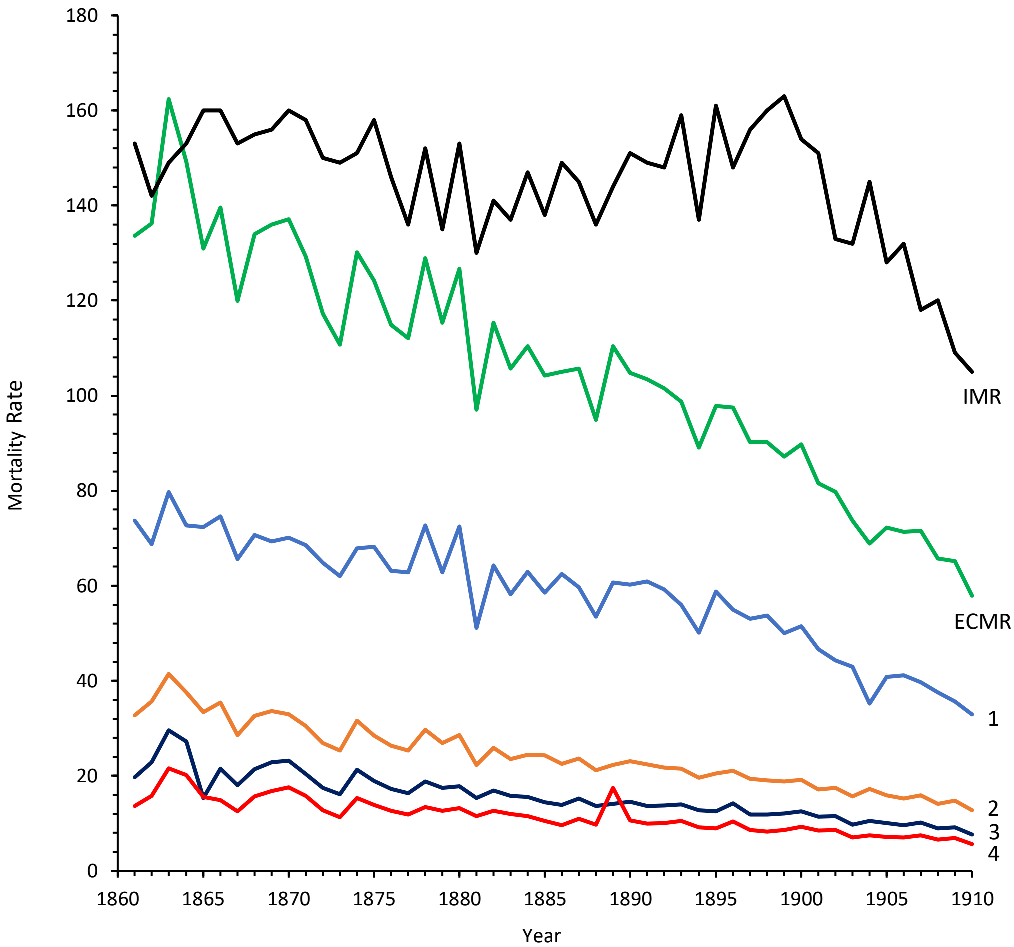
4 Registrar General, *1911 Census of England and Wales, Vol. XIII Fertility of Marriage, Part I* (London, 1917), p. iv, BPP 1917-1918 XXXV.

5 Woods, *Demography of Victorian England and Wales*, pp. 264-5; Woods, *et al.*, 'Causes of rapid infant mortality decline, part 1', p. 364. See Garrett *et al.*, *Changing Family Size in England and Wales*, pp. 110-2 for an explanation of the methods used to calculate these rates.

6 Garrett *et al.*, *Changing Family Size in England and Wales*, p. 146. See also the analysis in M.R. Haines, 'Socio-economic differentials in infant and child mortality during mortality decline: England and Wales, 1890-1911', *Population Studies*, 49 (1995), pp. 297-315.

7 Garrett *et al.*, *Changing Family Size in England and Wales*, p. 198.

Figure 3.8 Infant mortality (IMR) and early childhood mortality (ECMR) rates, England and Wales, 1861-1910



Notes: Mortality rates are given for single years of age 1, 2, 3 and 4 years together with years 1-4 combined (ECMR) and the infant mortality rate. In standard life table notation these measures are q_0, q_1, q_2, q_3, q_4 and ${}_4q_1$. The rates are expressed as deaths per 1,000 live births or deaths per 1,000 survivors at the beginning of each period of life. For an explanation of how these measures are calculated see A. Hinde, *Demographic Methods* (London, 1998), pp. 8-16, 30-4.

Source: Registrar General's *Annual Reports*.

At the heart of Woods' *Demography of Victorian England and Wales* is his analysis of the demographic transition, the inter-relationship between mortality and fertility decline. With respect to mortality, it is notable that, while the national IMR did not decline until the beginning of the twentieth century, other mortality rates, especially that in early childhood (ages 1-4 years), began to decline from the 1860s (Figure 3.8). While Tables 3.2-3.5 showed that the origins of the secular decline in infant mortality did indeed coincide with that of childhood mortality, the increasing levels of urbanisation throughout the nineteenth century should have placed upward pressure on early childhood mortality rates (hereafter ECMRs) since most deaths in this age group were caused by crowd diseases. Therefore, as populations increased, exposure rates should have done likewise. The fact that IMRs and ECMRs diverged remains one of the key conundrums of the early years mortality transition. Indeed, ECMRs exhibited a closer relationship with population density than IMRs and the greatest declines also occurred where rates had previously been higher, in the densely populated cities.[1] Childhood mortality was dominated by the common infectious diseases of childhood, notably scarlet fever, measles, whooping cough, diphtheria and smallpox. These diseases occurred in cycles as pools of susceptibles, those not previously exposed to the disease, were needed for infections to flourish. Consequently, mortality rates were higher in towns and cities with death often occurring as a consequence of pulmonary complications. As far as it is possible to tell, the decline in ECMRs was not caused by a revolution in treatments since most remedies in this period were 'rudimentary if not harmful'.[2] Instead, much of the decline between 1860 and 1900 occurred within one disease, scarlet fever. About 27 per cent of all early childhood deaths were from scarlet fever in the 1860s, but only 8 per cent in the 1890s.[3] According to Hardy, it was 'one of the first diseases to have an active preventive policy directed against it'.[4] Compulsory notification was introduced in 1889, attempts were made to isolate cases, some patients were hospitalised and outbreaks caused by infected milk were traced to their source. Yet none of these can wholly account for the substantial decline that occurred.[5] Instead, infection rates hardly changed, but case fatality rates decreased considerably and the most plausible explanation for this is that scarlet fever appears to have undergone a significant decline in its virulence.[6]

Smallpox was all but eradicated by 1900 as vaccination became increasingly more effective.[7] There were also declines in tuberculosis and respiratory deaths and, in contrast to

1 R. Woods, N. Williams and C. Galley, 'Differential mortality patterns among infants and other young children: the experience of England and Wales in the nineteenth century', in C.A. Corsini and P.P. Viazzo (eds), *The Decline of Infant and Child Mortality: the European Experience: 1750-1990* (The Hague, Netherlands, 1997), pp. 57-72, here at p. 62; Woods and Shelton, *Atlas of Victorian Mortality*, p. 66.

2 Woods and Shelton, *Atlas of Victorian Mortality*, p. 65.

3 Between 1861 and 1870 55,095 out of 200,820 deaths to persons aged 1-4 years were ascribed to 'scarlatina' (a synonym for scarlet fever) and between 1891 and 1900 the figures were 12,134 and 149,331 respectively. Thus, between these periods early childhood deaths declined by 51,489 and scarlet fever deaths by 42,961. These figures need to be set against a nearly 36 per cent increase in the population of those aged 1-4 between the 1860s and 1890s, see Registrar General, *Supplement to the Thirty-Fifth Annual Report*, p. 2; Registrar General, *Supplement to the Sixty-Fifth Annual Report*, p. 3.

4 Hardy, *Epidemic Streets*, p. 56.

5 Hardy, *Epidemic Streets*, p. 79.

6 Hardy, *Epidemic Streets*, p. 56 notes that '[s]carlet fever is, however, a notoriously variable disease'. See also A. Mercer, *Infections, Chronic Disease, and the Epidemiological Transition: a New Perspective* (Rochester, 2014), pp. 101-8 and Woods *et al.*, 'Differential mortality patterns', pp. 67-70 for a discussion of the demographic impact of scarlet fever. Scarlet fever is now a very mild disease and after 1959 'exceptionally few' scarlet fever deaths were recorded, see T. Lamagni, R. Guy, M. Chand, K.L. Henderson, V. Chalker, J. Lewis, V. Saliba, A.J. Elliot, G.E. Smith, S. Rushton, E.A. Sheridan, M. Ramsay and A.P. Johnson, 'Resurgence of scarlet fever in England, 2014–16: a population-based surveillance study', *The Lancet Infectious Diseases*, 18 (2018), pp. 180–7, here at p. 185.

7 There were 3,655 smallpox deaths in the 1860s and only 328 in the 1890s, Registrar General, *Supplement to the Thirty-Fifth Annual Report*, p. 2; Registrar General, *Supplement to the Sixty-Fifth Annual Report*, p. 3.

infants, there was also a decrease in deaths caused by diarrhoea and dysentery amongst children aged 1-4 years.[1] Typhus also declined rapidly in this age group and was 'the only one of the communicable diseases in the nineteenth-century preventive canon which had ceased to be a significant cause of concern' by 1900; however, typhoid was not distinguished from typhus until the 1870s when other types of fever began to appear in the GRO's classification system.[2] By contrast, mortality from some diseases, notably measles and whooping cough, hardly changed between 1861 and 1900 and deaths from diphtheria more than doubled.[3] As we have already noted, interpreting nineteenth-century cause of death data remains difficult, especially when changes in classification occurred. The returns of common childhood infectious disease deaths should however be amongst the most reliable and consequently it is possible to conclude that much of the decline in ECMRs was due to changes in three diseases: scarlet fever, smallpox and 'fever'. With respect to the other diseases, the continued growth of the urban population throughout the nineteenth century suggests that ECMRs should have increased due to greater rates of exposure. That this did not happen means that something must have mitigated the increasing threats caused by the urban environment and the most likely explanation is that preventive measures such as isolation, hospitalisation and disease avoidance meant that increasing numbers of young children either avoided these diseases entirely or, if they encountered them, did so at older ages and consequently had better chances of survival.[4] Likewise, better housing conditions, for some at least, meant that those who were infected could more easily be kept away from other family members; better nursing may also have prevented secondary pulmonary complications; and lower levels of debilitating disease would have meant there were greater numbers of young children who were sufficiently healthy to survive any infection.[5] Much remains to be done to explain fully the causes of mortality decline and, while a great amount of effort has been expended in seeking explanations for the changes in IMRs, by comparison

1 Woods and Shelton, *Atlas of Victorian Mortality*, pp. 72-90. Woods, *Demography of Victorian England and Wales*, p. 340.

2 Hardy, *Epidemic Streets*, p. 210. Between 1861 and 1870 there were 23,323 deaths to persons aged 1-4 years from typhus, whilst between 1891 and 1900 there were just 51 deaths from typhus, 4,369 from enteric fever (typhoid) and 252 from simple continued fever, see Registrar General, *Supplement to the Thirty-Fifth Annual Report*, p. 2; Registrar General, *Supplement to the Sixty-Fifth Annual Report*, p. 3.

3 There were 6,115 measles deaths to persons aged 1-4 years in the 1860s, 3,742 deaths from whooping cough and 9,925 deaths from diphtheria. This compares with 7,594 measles deaths, 3,299 whooping cough deaths and 23,348 diphtheria deaths during the 1890s. The increase in diphtheria deaths did not occur everywhere: it was especially prominent in London, the south-east and south Wales, see Woods and Shelton, *Atlas of Victorian Mortality*, pp. 34, 84, 87-9. According to Hardy, *Epidemic Streets*, p. 109 diphtheria began to decline during the 1890s.

4 According to E.W. Hope, *Report on the Health of Liverpool during the Year 1900* (Liverpool, 1901) p. 86, '[a] large number of special investigations have been made into cases of fatal infantile diarrhoea, measles, whooping cough, bronchitis and pneumonia, and instructions given to parents upon these matters'.

5 See Hardy, *Epidemic Streets*, pp. 267-94 for a discussion of the impact of preventive medicine on the decline of mortality. On pp. 290-1 she concludes that attempts to control infectious childhood diseases had only a limited impact while the public health movement had greater success in reducing adult mortality. See also Woods, *Demography of Victorian England and Wales*, pp. 203-46 for a discussion of occupational differences in adult mortality during the nineteenth century; and Hinde and Harris, 'Mortality decline' for a recent re-examination of nineteenth-century cause of death data.

early childhood mortality remains 'one of the most important, complicated, interesting and yet neglected aspects of the epidemiology of Victorian England'.[1]

Alongside the changes in infant and early childhood mortality, there were also mortality declines amongst older children and young adults. Annual mortality rates for children aged 5-9 years declined from 33.9 per 1,000 persons in 1861 to 21.1 in 1900, whilst at the same time rates for children aged 10-14 declined from 21.8 to 12.1.[2] Likewise, the survival chances of young adults improved by about one third during the same period with much of the change being due to a decline in phthisis (pulmonary tuberculosis).[3] Those factors that helped reduced mortality within the adult population would also have affected young children and infants, albeit to a much lower extent. Tuberculosis caused relatively few deaths amongst infants and young children but, if fewer mothers and fathers died, or were incapacitated by this disease, then they would be in a better position to care for their children. Alongside declining mortality, there were also falls in marital and illegitimate fertility starting from around 1870, which is consistent 'with the notion that knowledge about and perhaps also the means of contraception became more widely available towards the end of the nineteenth century'.[4] That changes in fertility and mortality are linked is not surprising, with the impact of improvements in female education probably being crucial as an explanatory variable. In conclusion, Woods offers four broad reasons for the secular decline in infant and childhood mortality:

1. The decline of fertility, both marital and illegitimate, from the 1870s and certainly from the 1890s served to reduce the level of infant mortality both by affecting the number of pregnancies a woman might experience and by increasing the intervals between successive births.
2. Long-term improvements in levels of female education helped not only to increase the likelihood that family limitation would be attempted, but also to improve the status of women, their access to written information, the way in which they cared for their children and the way in which they cared for themselves. They may even have encouraged more women to breastfeed.
3. The 'health of towns' movement did make significant advances possible, most of which bore fruit during the late nineteenth century or early twentieth century when the availability of uncontaminated water was transformed by schemes for water carriage and purification.
4. The improvement in milk supply and food quality, the availability of more highly qualified midwives, the institution of ante-natal care and the extension of the post-natal health visitor service were all of special significance, particularly the last mentioned, but usually they served to reinforce an existing trend by focusing medical

1 Woods and Shelton, *Atlas of Victorian Mortality*, p. 92. Epidemiological studies of individual diseases together with their inter-reaction with each other would be welcome.

2 Registrar General, *1861 Census, Population Tables*, p. x; Registrar General, *1901 Census, Summary Tables: Area, Houses and Population* (London, 1903), p. 139, BPP 1903 LXXXIV; Registrar General, *Twenty-Fourth Annual Report*, pp. *120-1*; Registrar General, *Sixty-Fourth Annual Report*, pp. 136-7.

3 Woods, *Demography of Victorian England and Wales*, p. 216. For men aged 35-44 years the probability of dying aged 35-44 decreased by 15 per cent between 1860-1871 and 1900-1902. For those aged 45-54 the probability remained about the same and for those aged 55-64 it increased by 7 per cent.

4 Woods, *Demography of Victorian England and Wales*, p. 143: '[f]or those married aged 20-24 the number of children ever born fell from 7.4 for the pre-1851 cohort to 5.1 for the 1891-96 cohort' (p. 116).

> and health service attention on those mothers and children most at risk in areas with the highest childhood mortality rates.[1]

Woods therefore argues that infant mortality was a complicated process, strongly related to the demographic transition, that fundamentally altered British society from the mid nineteenth century onwards.

Many studies of nineteenth century infant mortality using national or RD level data have been published. Broadly speaking they fall into three categories: those that have used the Registrar General's published returns to discover correlations between IMRs and a number of explanatory variables; those that have examined one or more of the major influences on infant mortality, and others that have undertaken in-depth local studies.[2] Ian Gregory used geographic information systems and advanced analytic tools to examine infant mortality trends in RDs from the Decennial Supplements. He noted that rates declined in many districts during the second half of the nineteenth century with the greatest declines occurring in rural districts, especially to the north and east of London, although apparently similar districts in the north, west Wales and in the south west failed to improve much.[3] Paul Atkinson and his colleagues extended this work and also sought to provide explanations for the patterns they observed.[4] They identified seven clusters of rural districts, not entirely regionally separated, that exhibited slightly different trends and developed a 'mixed-effects longitudinal model' that aimed to explain these trends. Their model, heavily influenced by the work of Robert Millward and Frances Bell,[5] examined the impact of fertility, maternal health (measured via the female tuberculosis mortality rate), education (measured by the number of brides signing marriage registers), income (measured by county wage rates for agricultural labourers), elevation, and distance from London. They concluded that about a quarter of the decline in infant mortality could be associated with maternal health and a further sixth with female education.[6] The work of Atkinson and his colleagues is important in highlighting rural infant mortality as an under-researched topic and in identifying places that warrant further investigation. They also reveal some of the problems associated with undertaking any study that attempts to correlate IMRs calculated for large areas such as RDs

1 Woods, *Demography of Victorian England and Wales*, pp. 305-6.

2 Correlation is the interdependence of two or more variables. Unfortunately, a mathematical correlation between two variables does not necessarily imply a causal link, see D. Speigelhalter, *The Art of Statistics: Learning from Data* (London, 2019), pp. 96-7.

3 I. Gregory, 'Different places, different stories: infant mortality decline in England and Wales, 1851–1911', *Annals of the Association of American Geographers*, 98 (2008), pp. 773-94. These patterns can be observed by comparing Figures 3b and 3e above. Gregory's work expanded and clarified findings by C.H. Lee, 'Regional inequalities in infant mortality in Britain, 1861-1971: patterns and hypotheses', *Population Studies*, 45 (1991), pp. 55-65; and Williams and Galley, 'Urban-rural differentials'.

4 P. Atkinson, B. Francis, I. Gregory and C. Porter, 'Patterns of infant mortality in rural England and Wales, 1850–1910', *Economic History Review*, 70 (2017), pp. 1,268-90; P. Atkinson, B. Francis, I. Gregory and C. Porter, 'Spatial modelling of rural infant mortality and occupation in 19th century Britain', *Demographic Research*, 36 (2017), pp. 1,337-60. S.G. Hastings, I. Gregory and P. Atkinson, 'Explaining geographical variations in English rural infant mortality decline using place-centered reading', *Historical Methods*, 48 (2015), pp. 128-40, examines newspaper evidence to explain differential patterns of infant mortality in three Suffolk RDs.

5 R. Millward and F. Bell, 'Infant mortality in Victorian Britain: the mother as medium', *Economic History Review*, 54 (2001), pp. 699-733.

6 Atkinson *et al.*, 'Patterns of infant mortality', p. 1,288.

with socio-economic variables.[1] The first relates to the implicit assumption that any area under consideration must be uniform, but, as with Sheffield and Lincoln RDs, most districts contained both rural and urban elements. Indeed, as they acknowledge, all their rural districts included at least one market town and it could well be that the patterns they identified resulted, in part at least, from the changing proportion of infants being born in the rural and urban areas of these districts.[2]

Table 3.8 Infant mortality rates in Devon registration districts, 1871-1910, ordered by the rate in 1871-1880

District	Population density	Infant mortality rate 1871-1880	1891-1900	1901-1910	Difference 1870s-1890s	1870s-1900s	Whether urban
Exeter	5,154	170.4	155.7	140.6	14.7	28.8	Urban
East Stonehouse	9,882	168.8	185.7	152.4	-16.9	16.4	Urban
Plymouth	12,716	163.2	173.8	140.5	-10.6	22.7	Urban
Stoke Damerel	5,688	141.0	145.7	115.5	-4.7	24.5	Urban
Newton Abbot	167	122.4	124.9	108.9	-2.5	13.5	Urban SD
St Thomas	100	113.9	121.7	92.0	-7.8	21.9	Urban SD
Plympton St Mary	88	113.4	123.2	92.8	-9.8	20.6	
Totnes	102	112.9	111.9	90.7	1.0	22.2	Urban SD
Axminster	71	112.7	93.9	75.7	18.8	37.0	
Tiverton	66	111.9	108.8	80.5	3.1	31.4	
Barnstaple	68	110.0	114.4	98.6	-4.4	11.4	Urban SD
Tavistock	42	109.4	116.0	91.8	-6.6	17.6	
Kingsbridge	60	108.6	109.3	89.0	-0.7	19.6	
Bideford	78	108.3	116.7	99.1	-8.4	9.2	Urban SD
Honiton	63	107.5	103.0	77.8	4.5	29.7	
Holsworthy	27	105.1	103.2	96.5	1.9	8.6	
Okehampton	32	99.3	96.5	100.3	2.8	-1.0	
South Molton	31	96.0	100.4	82.0	-4.4	14.0	
Crediton	46	95.9	95.0	91.0	0.9	4.9	
Torrington	41	92.7	91.1	93.1	1.6	-0.4	

Notes: Population density is given in persons per km² in 1891. Districts are classified as urban if their population density was greater than 183 persons per km². 'Urban SD' means that the registration district had one or more sub-districts classified as 'urban', even though as a whole it did not meet the criteria for being 'urban'.

Sources: R. Woods, *Causes of Death in England and Wales, 1851-60 to 1891-1900: the Decennial Supplements* [computer files] Colchester, England, United Kingdom Data Archive [distributor], 1997. SN 3552, https://doi.org/10.5255/UKDA-SN-3552-1. Full details can be found on the PopulationsPast website, www.populationspast.org [accessed January 2021]. See also J.D. Day, *Registration Sub-District Boundaries for England and Wales 1851-1911* (Cambridge, 2016).

1 Some of these are discussed in Gregory, 'Different places, different stories', pp. 775-6.

2 Atkinson *et al.*, 'Patterns of infant mortality', p. 1,270. Many coal mines were located in what were initially rural districts and miners experienced notoriously high IMRs, see L.M. Davies, 'Faith Street, South Kirby – 'that troublesome place': infant mortality in a Yorkshire coal-mining community, 1894-1911', *Family and Community History*, 6 (2003), pp. 121-7.

Table 3.8 explores this possibility by examining IMRs in the predominantly rural county of Devon. Atkinson and his colleagues used a population density of 183 persons per km^2 to differentiate urban from rural districts and, as can be seen, most Devon RDs can be classified as rural apart from Exeter and the three that contained Plymouth and Devonport.[1] The table is ordered by the IMR in 1871-1880 and there is an obvious relationship between population density and infant mortality: IMRs are high in the urban districts and well below the national rate in the rural districts. In terms of the changes in rates between 1871 and 1900, there were considerable differences between districts with Tiverton and Honiton recording large amounts of decline while Okehampton, Crediton and Torrington, which started with some of the lowest rates, recorded hardly any change.[2] These patterns do, however, need to be set against the number of events that occurred within the districts: Holsworthy only recorded 305 infant deaths during the 1870s, Torrington recorded 423 and South Molton 503, compared with 3,598 in Plymouth and 2,448 in Newton Abbot.[3] Thus, there remains the possibility that some of the patterns shown in Table 3.8 will in part be affected by chance variation in the number of infant deaths recorded. When the RDs are examined at a finer level of detail, five districts are discovered to contain at least one RSD that would be classified as urban by Atkinson and his colleagues (Table 3.9). Not surprisingly, IMRs in these 'urban' sub-districts were generally (although not always) higher than in the 'rural' sub-districts, but not to the extent of IMRs in Exeter or Plymouth. Newton Abbot RD is interesting in that it is revealed to be a mainly urban district with 62 per cent of the population living in Teignmouth and Torquay in 1891. Moreover, the population density of Newton Abbot RSD, which contained the market town of that name, was just below 183 persons per km^2 (rounded up for the table), thereby reinforcing the urban nature of the RD. Thus this RD was far from uniform, being composed of three important towns, where most of the population lived, along with more sparsely populated rural areas. It is noteworthy however, that while these towns had higher IMRs than the purely rural sub-districts, they were nevertheless low when compared with cities and industrialising towns.[4] This also suggests that local studies of infant mortality in towns such as Torquay and Newton Abbot would be a welcome addition to the literature.

The RD of Barnstaple is also interesting since it comprised a small sub-district containing the town itself, with a corresponding high population density, together with an extensive low density rural hinterland although, even here, just under half the population of the Ilfracombe RSD resided in the town of Ilfracombe.[5] The IMR in Barnstaple RSD is much higher than the other rural sub-districts and consequently it had an important influence on the overall

1 Atkinson *et al.*, 'Patterns of infant mortality', p. 1,270. For a map of Devon RDs see Registrar General, *1891 Census of England and Wales Vol. II, Registration Areas and Sanitary Districts, Division V. South West Counties* (London, 1893), p. 1, BPP 1893-1894 CV.

2 Likewise, Exeter recorded steady decline throughout the period while the three 'Plymouth' districts recorded increases during the 1890s.

3 Registrar General, *Supplement to the Forty-Fifth Annual Report*, pp. 185-95.

4 The population of Exeter was 37,404 in 1891 which was similar to that of Torquay, however its IMR was higher. See Registrar General, *1891 Census of England and Wales Vol. 1 Administrative and Ancient Counties* (London, 1893), p. 67, BPP 1893-1894 CIV. The IMRs shown in Tables 3.8 and 3.9 are not strictly comparable since those in Table 3.8 are calculated from the decennial supplements, while those in Table 3.9 are calculated from the quarterly returns over a five-year period up to the relevant census.

5 The population of Ilfracombe town was 7,692 in 1891, Registrar General, *1891 Census of England and Wales Vol. 1*, p. 70.

Table 3.9 Infant mortality rates, Devon registration districts with 'urban' subdistricts, 1871-1901

Registration district (RD)	1891		Infant Mortality Rate				Difference
and sub-district	Density	Population	1871	1881	1891	1901	1871-1901
Newton Abbot (RD)	167	79,496					
Teignmouth	***467***	***13,217***	***131***	***124***	***124***	***135***	***-4***
Chudleigh	69	6,642	75	103	114	95	-20
Moreton Hampstead	30	2,692	111	128	119	116	-5
Ashburton	42	5,516	112	108	110	115	-3
Newton Abbot	183	15,587	134	123	117	132	2
Torquay	***843***	***35,842***	***117***	***134***	***119***	***135***	***-18***
St Thomas (RD)	100	52,853					
East Budleigh	86	4,049	125	86	97	122	3
Exmouth	***460***	***10,394***	***129***	***138***	***100***	***131***	***-2***
Woodbury	54	3,096	113	119	91	114	-1
Broad Clyst	49	3,113	82	89	108	-	-
Topsham	151	4,045	82	102	112	108	-26
Heavitree	***185***	***8,194***	***141***	***107***	***126***	***107***	***34***
St Thomas	111	12,914	162	134	133	129	33
Alphington	51	-	86	91	-	-	-
Christow	30	1,455	86	90	67	-	-
Kenton	69	5,593	80	100	101	88	-8
Totnes (RD)	102	40,431					
Paignton	***248***	***7,929***	***111***	***91***	***98***	***88***	***23***
Brixham (SD)	***257***	***8,545***	***138***	***124***	***108***	***113***	***25***
Dartmouth (SD)	***373***	***7,500***	***126***	***132***	***109***	***134***	***-8***
Totnes	116	5,759	116	122	123	90	26
Buckfastleigh	52	4,251	123	94	126	123	0
Ugborough	40	3,952	98	102	109	122	-24
Haberton	40	2,495	79	112	84	110	-31
Barnstaple (RD)	68	41,368					
Barnstaple	***2,080***	***11,441***	***142***	***138***	***120***	***145***	***-3***
Paracombe	22	3,103	65	77	85	-	-
Lynton	-	-	-	-	-	91	-
Combe Martin	35	3,877	79	104	106	106	-27
Ilfracombe	89	16,064	119	93	109	99	20
Braunton	61		114	97	-	-	-
Bishops Tawton	47	6,883	60	104	108	98	-38
Bideford (RD)	78	20,196					
Bideford	***378***	***8,278***	***130***	***118***	***127***	***142***	***-12***
Northam	***301***	***5,498***	***105***	***100***	***105***	***128***	***-23***
Parkham	35	2,304	104	106	114	79	25
Hartland	27	3,386	77	96	93	91	-14
Bradworthy	20	730	116	112	95	-	-
Putford	-	-	-	-	-	106	-

Note: Density is given as persons per km². The Decennial Supplements do not give data for subgroups, although the Quarterly Returns do. The IMRs are calculated for five year intervals based around the stated year.

Source: A. Reid, H. Jaadla and E. Garrett, *Demographic and Socio-economic Data for Registration Sub-districts of England and Wales, 1851-1911*. [data collection]. (UK Data Service, 2020). SN: 8613.

rate in the RD. It is a pity therefore that it is not possible to determine whether rates in the urban part of Ilfracombe RSD differed from those in the rural parts of the district. In the other Devon districts with 'urban' RSDs, rates were generally higher, although not exclusively so, and all had a substantial town at their core. Even at the RSD level therefore, most districts had rural and urban components which may explain why places such as Heavitree, Paignton and Northam managed to record relatively low IMRs. Likewise, of the other rural RDs in Table 3.8, many contained urban elements even if these were not sufficient to alter the overall character of the district. Of course, Tables 3.8 and 3.9 represent mere snapshots of what was happening during the nineteenth century and much more detailed work is needed to determine exact trends, especially as urbanisation steadily increased across the century. Boundary changes occurred to some districts as RSDs were incorporated into others or new ones were created (hence the gaps in Table 3.9), and this means that when time series are constructed like is not always being compared with like. Nevertheless, the results from Tables 3.8 and 3.9 are sufficiently robust to conclude that small towns need to be factored into any subsequent discussion of rural mortality change.

The lack of homogeneity throughout many districts also affects attempts to use surrogate social and economic variables to describe the underlying characteristics of districts. In order to assess income, Atkinson and his colleagues employed a data set relating to the wages of agricultural labourers by county.[1] While this seems plausible, in the predominantly rural county of Devon in 1871 only 26 per cent of the county's male workforce (aged 15 years and above) was employed in agriculture and only 13 per cent worked as agricultural labourers.[2] By 1901 these figures had fallen to 20 and 10 per cent as a consequence of increasing rural to urban migration which affected many areas in this period. The 1901 census also gives figures for urban and rural occupations separately and nearly twice as many males in Devon were employed in the towns than in the countryside. Not surprisingly, there were considerable urban-rural differences in occupational structure: in the towns, only 4.6 per cent were employed in agriculture and only 1.7 per cent as agricultural labourers; in the rural districts, as expected, percentages were higher at 50.2 and 25.8 respectively.[3] Thus, even in the most rural parts of Devon only about one in four males were employed as agricultural labourers and, given the results presented in Tables 3.8 and 3.9, this suggests that their wages were not necessarily reflective of the vast majority of family incomes within this county.

Since mother's health could not be measured directly, Atkinson and his colleagues relied on Millward and Bell who argued that '[t]he death rate of females aged 15-44 from

1 Atkinson *et al.*, 'Patterns of infant mortality', p. 1,279.

2 Registrar General, *1871 Census, Population Abstracts, England and Wales, Vol. III* (London, 1873), pp. 249-50, BPP 1883 LXXX Volume 3. A further 474 females gave their occupation as 'agricultural labourer' which compares with a total of 25,619 males (p. 253).

3 The urban figures are: total employed 128,757 (males aged 10 years and over); 5,872 in agriculture and 2,235 as agricultural labourers. The rural figures are: 68,837, 34,534 and 17,780 respectively. Registrar General, *1901 Census of England and Wales: County of Devon, Area, Houses and Population* (London, 1902), pp. 90-3, BPP 1902 CXVIII.

tuberculosis (TB) seems the best proxy available since it is accepted by some as reflecting primarily the mother's current resistance to disease (which will reflect her whole past health history)'.[1] It is not necessarily surprising that with both the IMR and female TB death rate steadily declining throughout the second half of the nineteenth century a strong correlation between these two variables was identified.[2] This does not, however, mean that there was a causal link between the two: for this relationship to hold, it is necessary that the entire female population must have been exposed to TB, that healthier women were more likely to survive and that most of the survivors were healthy enough to raise their infants successfully. Indeed, it is conceivable that declining mortality rates had a detrimental impact on maternal health as fewer deaths left a greater number of invalids. This relationship would also not hold if Woods is right about the reduction of TB deaths being due to declining virulence and therefore independent of maternal health. This thesis also does not take into account migration—people may become infected in one place and once sick may return to their places of origin where they subsequently die and cause mortality rates in that district to increase.[3] A mother's health, with respect to her ability to bear children and ensure their survival, is determined by a whole host of factors, and to choose one—particularly one that relates to mortality—seems at best an oversimplification. Of course, social and economic variables such as maternal health and income had a profound impact on infant mortality; however, they acted within the confines of individual families and their effects would have been diluted when examined at the RD level. Thus, whilst the conclusions of Atkinson and his colleagues may be sound, they require further confirmation and until that is done it may be best to state that they are 'not proven'.

Another recent study by Brian Beach and Walker Hanlon used a similar methodology to examine the damaging effects of coal smoke on infant mortality in the 1850s. By employing a battery of statistical tests on Woods' decennial supplement IMRs for the 1850s, the 1851 census to determine industrial activity and a 1907 Census of Manufacture to assess coal use intensity, they concluded that 'industrial coal use explains roughly one-third of the urban mortality penalty for infants'.[4] If correct, Beach and Hanlon's work would provide an explanation for high levels of respiratory deaths amongst infants, something that has previously been lacking within the literature. However, the rather convoluted way in which they measured industrial coal smoke, especially over large RDs, raises the suspicion that, with most industrial manufacture being located in towns, the effects they record are simply a consequence of more general urban/rural differences in mortality. Beach and Hanlon only considered infant mortality and it is important to determine whether their findings are also consistent with patterns of respiratory diseases amongst other age groups, especially the elderly. Moreover, by just concentrating on a single decade any sense of change over time is

1 Millward and Bell, 'Mother as medium', p. 714. Note that no reference is given for the 'some' who claim this relationship to be true.

2 According to Millward and Bell, 'Mother as medium', p. 723, '[a] 10 per cent decline in the female TB death rate is associated, cross sectionally and over time, with a 2 per cent fall in the infant mortality rate. Since the improvement of mothers' health, so defined, was of the order of 70 per cent from the early 1870s to the early 1900s, this would, on its own, yield a substantial fall in infant mortality'.

3 A. Hinde, 'Sex differentials in phthisis mortality in England and Wales, 1861–1870', 20 (2015), pp. 1-27; A. Reid and E. Garrett, 'Mortality, work and migration: a consideration of age-specific mortality from tuberculosis in Scotland, 1861-1901', *Historical Life Course Studies*, 6 (2018), pp. 111-32.

4 B. Beach and W.W. Hanlon, 'Coal smoke and mortality in an early industrial economy', *Economic Journal*, 128 (2018), pp. 2,652–75, here at p. 2,654.

absent and, for their thesis to hold, they would need to confirm that their arguments are consistent with the patterns shown in Figure 3.5. After 1860 industries expanded and domestic use of coal increased. Therefore, greater amounts of smoke were produced and air quality deteriorated, but there was no corresponding increase in IMRs.[1] Likewise, in the 1900s as rates declined, there was no sudden reduction in coal smoke. It could be the case that the poor quality of air in towns meant that more urban infants were kept indoors, especially in winter, and it was the air quality within the house that had the greater impact on an infant's health, although this thesis would be hard to test.

Another study that focuses on the increase in infant mortality during the late nineteenth century was undertaken by Nigel Morgan, who observed that in Preston—and by implication in other towns—there was 'an explosive increase in the population of horses' which led to an increase in 'enteric diseases spread by flies which bred in horse manure'.[2] This explanation for the high incidence of summer diarrhoea in the 1890s could be explored further by mapping the location of stables and infant deaths; relevant data might well exist in certain localities as local medical officers became increasingly interested in infant mortality and the nuisances caused by stables. Morgan focused on the 1890s and it would be interesting to examine the extent to which the early-twentieth-century decline in mortality was aided by a possible reduction in horse traffic.

These studies can be complemented by others, some going back to the nineteenth century, that have focused on particular causes. These include the employment of women, nutritional status, the milk supply, the child welfare movement and sanitation, with a particular emphasis being placed on infantile diarrhoea.[3] Of course, each of these is an important influence on infant welfare, but by themselves they cannot fully explain the

1 B. Luckin, 'Pollution in the city' in M. Daunton (ed.), *The Cambridge Urban History of Britain. Volume III* (Cambridge, 2000), pp. 207-28, here at p. 211. Luckin notes the 'widely held belief that foggy towns were prosperous'. It was only after the Great London Smog of 1952 that serious attempts were made to control smoke emissions.

2 N. Morgan, 'Infant mortality, flies and horses in later-nineteenth-century towns: a case study of Preston', *Continuity and Change*, 17 (2002), pp. 97-132, here at p. 97. See also the discussion in E. Garrett, A. Reid and S. Szreter, 'Residential mobility and child mortality in early twentieth century Belfast' in D. Fariñas and M. Oris (eds), *New Approaches to Death in Cities During the Health Transition* (Switzerland, 2006), pp. 55-76.

3 The literature on these topics is vast and the following represent a few selected examples. For the industrial employment of women see Newman, *Infant Mortality*, pp. 90-138; for maternal influences on infants see A. Newsholme, *Supplement to the Thirty-Ninth Annual Report of Local Government Board 1909-10, Containing a Report by the Medical Officer on Infant and Child Mortality* (London, 1910), pp. 45-55; C. Dyhouse, 'Working-class mothers and infant mortality in England 1895-1914', *Journal of Social History*, 12 (1979), pp. 248-67; for the milk supply see G.F. McCleary, 'The infants' milk depot: its history and function', *Journal of Hygiene*, 4 (1904), pp. 329-68; G.F. McCleary, *Infantile Mortality and Infants Milk Depots* (London, 1905); M.W. Beaver, 'Population, infant mortality and milk', *Population Studies*, 27 (1973), pp. 243-54; A.H. Ferguson, L.T. Weaver and M. Nicolson, 'The Glasgow Corporation milk depot 1904–1910 and its role in infant welfare: an end or a means?', *Social History of Medicine*, 19 (2006), pp. 443–60; for the child welfare movement see J.E. Claypon, *The Child Welfare Movement* (London, 1920); J. Lewis, *The Politics of Motherhood: Child and Maternal Welfare in England, 1900-1939* (London, 1980); for sanitation and diarrhoea see A. Newsholme, 'The public health aspects of summer diarrhoea', *The Practitioner*, 69 (1902), pp. 161-80; Peters, 'Observations upon the natural history of epidemic diarrhoea'; B. Thompson, 'Infant mortality in nineteenth-century Bradford', in R. Woods and J. Woodward (eds), *Urban Disease and Mortality in Nineteenth-century England* (London, 1984), pp. 120-47; I. Buchanan, 'Infant feeding, sanitation and diarrhoea in colliery communities, 1880-1991', in D. Oddy and D. Miller (eds), *Diet and Health in Modern Britain* (London, 1985), pp. 148-77. The first two decades of the twentieth century saw an explosion of publications on infant and child mortality.

patterns observed above. For example, the employment of mothers outside of their homes was highlighted during the nineteenth century as commentators observed that when female employment rates were high so were IMRs. Working mothers 'were accused of neglect, of depriving their children of valuable breast-milk and nurture, and of unduly exposing them to harsh climatic conditions as they took them to child-minders in the early hours of the day'.[1] However, Garrett and her colleagues discovered that the children of mothers working in retail suffered no mortality disadvantage and those working in the professions had a slight mortality advantage. Moreover, they concluded that the relationship between women's work and infant mortality might well operate in the reverse direction:

> it would be at least valid to argue that a child's death allowed a woman, who would otherwise have had to stay at home to look after her children, to return to the workforce. The census snapshot thus captures, in the workforce, a disproportionate number of women who have suffered the loss of a child, giving the impression that women's work was bad for babies. In fact it may be more true to say that, as today, babies were bad for women's work.[2]

Finally, once infant mortality began to be recognised as a problem that could and should be tackled a wealth of studies began to appear from the late nineteenth century onwards. These were of variable quality—just because a contemporary noted that working-class mothers were responsible for high IMRs does not necessarily mean that this was true. Likewise, the substantial discussion of baby farming (the practice of child rearing for financial reward leading to some infants being wilfully neglected), whilst being an important topic in its own right and reflecting attitudes to infant care amongst some individuals, was largely confined to illegitimates and had little or no impact on overall IMRs.[3] All these individual studies have made contributions to our understanding of the influences on infant mortality, and some of the most important, especially those by George Newman and Arthur Newsholme, still remain relevant, not least for their discussions of the major influences on infant mortality, and perhaps more importantly, for the insights they reveal as to how the problem of infant mortality was viewed by contemporary public health officials.[4]

As a complement to these more general surveys, a number of micro-studies have explored non-GRO sources to examine infant mortality at the local level. One of the best, by Christopher French and Juliet Warren, used cemetery burial records, census enumerators books, valuation field books (which provide details of properties) and MOH reports to build

1 Garrett *et al.*, *Changing Family Size in England and Wales*, p. 130.

2 Garrett *et al.*, *Changing Family Size in England and Wales*, p. 132. See pp. 128-33 for a wider discussion.

3 M.L. Arnot, 'Infant death, child care and the state: the baby-farming scandal and the first infant life protection legislation of 1872', *Continuity and Change*, 9 (1994), pp. 271-311. William Farr concluded that, '[b]aby-farming … does not, indeed, out of London, appear much to be carried on', see Registrar General, *Thirty-Fourth Annual Report*, p. 227.

4 Newman, *Infant Mortality*. Arthur Newsholme's views on infant mortality are best summarised in his various reports for the Local Government Board, see A. Newsholme, *Report by the Medical Officer on Infant and Child Mortality* (London, 1910); A. Newsholme, *Supplement to the Forty-Second Annual Report of Local Government Board 1912-13, containing a Second Report by the Medical Officer on Infant and Child Mortality* (London, 1913); A. Newsholme, *Supplement to the Forty-Third Annual Report of Local Government Board 1913-14, Containing a Third Report by the Medical Officer on Infant Mortality Dealing with Infant Mortality in Lancashire* (London, 1914).

up a picture of infant mortality in the Canbury area of Kingston-upon-Thames.[1] They concluded that Canbury experienced high levels of infant mortality, especially in the 1890s, due to overcrowding, an 'unhealthy environment made worse in the summer months by the proximity of animals to living space' which was exacerbated by 'poor feeding and child-care practices' made worse in the hot dry summers of the late 1890s.[2] Such conclusions confirm that the urban penalty was experienced even in relatively small towns.[3] Other local studies have exploited smallpox vaccination birth registers and infant death registers to examine the causes of high neonatal mortality rates, the influence of class and migration and the reasons why one street in a coal mining area experienced very high rates.[4] These micro-studies reveal the potential value of further local studies, perhaps exploiting unique local sources; however, all results will need to be compared with the wider picture and it would be useful to have some that cover most of the Victorian and Edwardian periods.

While all of the above studies have added interesting nuances to the history of infant mortality, none have superseded the account given by Woods and this must remain the standard by which future work must be judged. The main reason why progress in explaining infant mortality decline has stalled is that, while most of the influences on infant mortality are clear and well-established, the means by which they operated have proved difficult to fully assess. Notwithstanding this, advances in our understanding of the various problems relating to infant and child mortality can still be made by carefully examining additional sources that are available in many local record offices around the country. Two of these will be discussed in the following section.

Researching infant mortality, 1837-1910

With access to original death and death registers not at present being possible, it is necessary to explore other sources or undertake other types of analyses to make further progress. Many local sources pertinent to the study of infant mortality exist and two of these will be discussed in this section: Sheffield's death registers, which are edited copies of the original death register, and a selection of MOH reports from Liverpool, St Pancras (London) and the Isle of Wight.

The Sheffield Death Registers

For a short period, mainly in the 1860s, Sheffield Heath Committee requested that the registrars of Sheffield and Ecclesall Bierlow RDs compile a list of all deaths that occurred

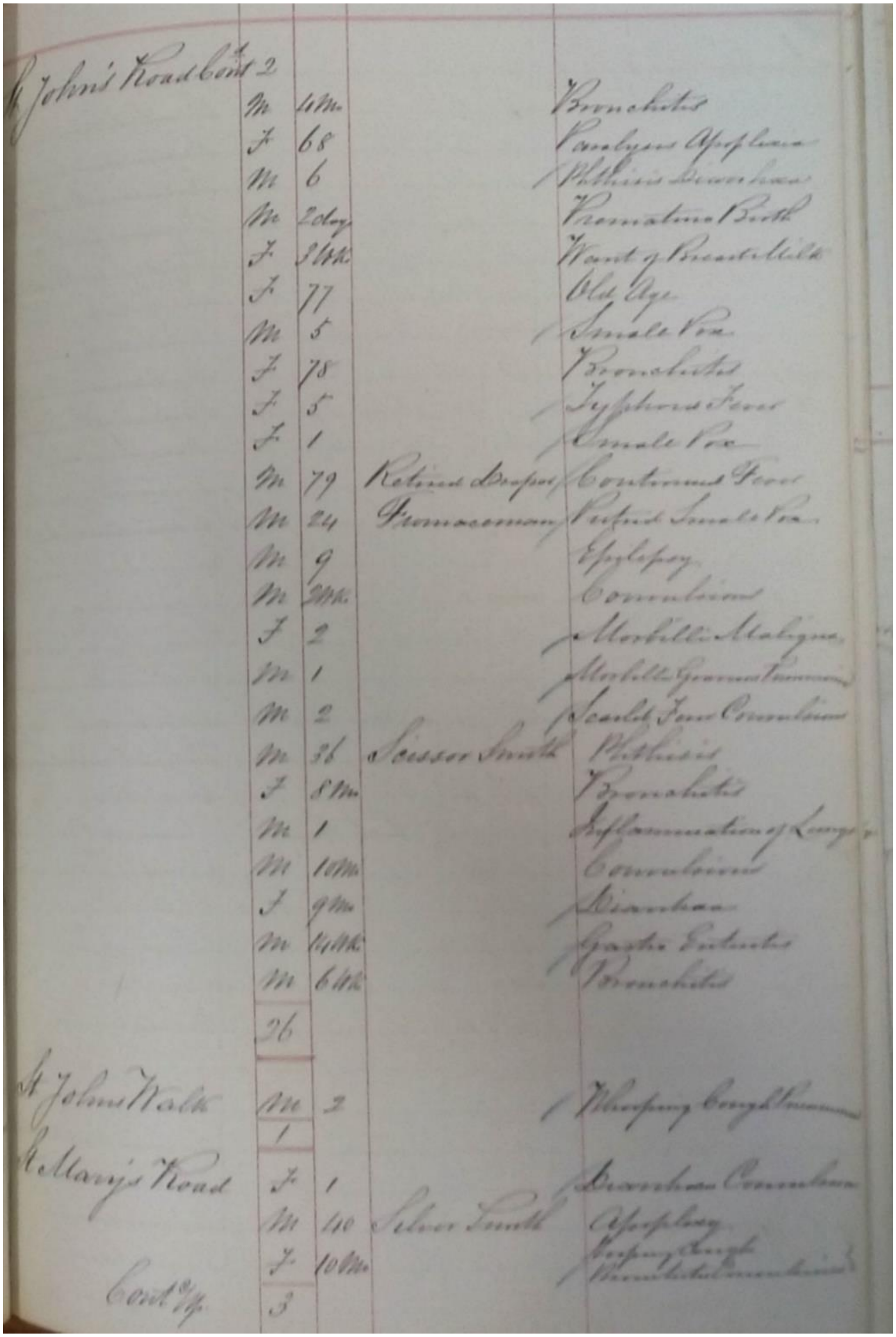
1 C. French and J. Warren, 'Infant mortality in the Canbury area of Kingston upon Thames, 1872-1911', *Continuity and Change*, 22 (2007), pp. 253-78; C. French, 'Infant mortality in Asylum Road, Kingston upon Thames, 1872-1911: an exercise in microhistory', *Family and Community History*, 7 (2004), pp. 141-55.

2 French and Warren, 'Infant mortality in the Canbury area', p. 272.

3 French and Warren, 'Infant mortality in the Canbury area', pp. 257-9 state that 36 per cent of infant burials in Kingston-upon-Thames came from this part of the town.

4 T. James, 'Neonatal mortality in Northamptonshire: Higham Ferrers 1880-1890', *Family and Community History*, 6 (2003), pp. 129-39; S.M. Smith, '"Who you are or where you are?": determinants of infant mortality in Fulham 1876-1888', *Family and Community History*, 6 (2003), pp. 113-20; A. Clark, 'Family migration and infant mortality in rural Kent, 1876-1888', *Family and Community History*, 6 (2003), pp. 141-50; Davies, 'Faith Street'.

Figure 3.9 Extract from the Sheffield death register, 1871



St John's Road Cont'd	2			
	M	4 Mo		Bronchitis
	F	68		Paralysis Apoplexia
	M	6		Phthisis Diarrhoea
	M	2 day		Premature Birth
	F	3 Wk		Want of Breast Milk
	F	77		Old Age
	M	5		Small Pox
	F	78		Bronchitis
	F	5		Typhoid Fever
	F	1		Small Pox
	M	79	Retired Draper	Continued Fever
	M	24	Furnaceman	[illegible] Small Pox
	M	9		Epilepsy
	M	3 Wk		Convulsions
	F	2		Morbilli Maligna
	M	1		Morbilli [illegible]
	M	2		Scarlet Fever Convulsions
	M	36	Scissor Smith	Phthisis
	F	8 Mo		Bronchitis
	M	1		Inflammation of Lungs
	M	10 Mo		Convulsions
	F	9 Mo		Diarrhoea
	M	14 Wk		Gastro Enteritis
	M	6 Wk		Bronchitis
	26			
St John's Walk	M	2		Whooping Cough [illegible]
	1			
St Mary's Road	F	1		[illegible] Convulsions
	M	40	Silver Smith	Apoplexy
	F	10 Mo		Hooping Cough Bronchitis Convulsions
Cont'd	3			

Note: Last entry reads 'F(emale) 10 Mo(nths) Hooping Cough Bronchitis Convulsions'.

Source: Sheffield Archives: MD7191/12, p. 266.

in the town of Sheffield.[1] For each of the six townships, deaths (with names omitted) were listed by street with each entry giving details of sex, age, occupation and cause of death (Figure 3.9). These annual lists appear alongside summary statistics for the town in bound volumes with the later ones being written on printed forms. Some of this information was similar to that required by the GRO; however, the compilation of lists of deaths by street would have required a considerable investment in time. These registers predate the appointment of a MOH in June 1873, but during the 1880s and 1890s large parts of the MOH's annual reports were devoted to listing the number of deaths by street, subdivided by certain causes of death, and therefore similar documents must have been created for these years even though they do not appear to have survived.[2] Williams argued that it was 'concern about the high mortality level in the town, and the premature death of grinders, in particular, that prompted the special preparation of these registers'.[3] Given that the Health Committee was charged with improving health throughout the town, these documents were clearly thought to be an important way of identifying high mortality blackspots, even though in practice the small number of deaths that occurred in most streets meant that this was difficult to achieve. In November 1862 G.L. Sanders, the Chief Sanitary Inspector, used these data to produce a short report on the sanitary state of Sheffield for the Health Committee which compared mortality in 1858 and 1861.[4] This report painted a largely positive picture of sanitary progress in the town: '[i]n conclusion we may fairly anticipate that by the means and blessing I have pointed out, as well as by the continued labours of and exertions of the Health Committee, the sanitary state of this increasing town may be greatly advanced'.[5] With respect to infant mortality, however, he was less positive, '[t]he loss of infant life is as usual sadly great, 2,365 deaths, or about 50 per cent, ageing from birth to five years old: those deaths in a large proportion occurring amongst the poorer classes'.[6] Whilst we may be sceptical about these conclusions, for our purposes the Sheffield death registers allow additional insights to be given into infant mortality in the town.

The Sheffield registers are edited versions of the death registers, but without access to the original death certificates it is impossible to determine exactly what has been omitted. With respect to occupation, while infants obviously did not have one, it was usual for that of the father to be included on the original death certificate, but these have been excluded. Likewise, no information about medical certification or who registered the death is provided. In most instances only one cause of death is listed, but as occurs with the last entry of Figure 3.9, sometimes multiple causes are given. Although 5.7 per cent of infants had more than one cause in 1861, only 0.9 per cent did so in 1866, but this percentage increased to 17.9 in

1 On 3 March 1862 Sheffield Health Committee passed the following resolution, 'That the Health Committee be empowered to obtain yearly Returns of the number of Deaths, Causes of Death, Trade, Age and Locality of deceased persons in the Borough of Sheffield', Sheffield Archives CA-HEA/1/3, p. 350. These reports survive for 1858 and then annually from 1861 to 1871, see Sheffield Archives MD 7191/1-12.

2 See S. White, *Annual Report on the Health of the Borough of Sheffield for the Year 1885* (Sheffield, 1886), pp. 27-46 and H. Littlejohn, *Annual Report on the Health of Sheffield for the Year 1893* (Sheffield, 1894), pp. 52-73 for examples. In both instances these data comprised about 30 per cent of the report's content, although the MOHs provided little or no supplementary analysis. Similar documents may also exist for other places.

3 Williams, 'Reporting and classification of causes of death', p. 62.

4 G.L. Sanders, *Sanitary State of the Town: Report to the Health Committee of the Town Council* (Sheffield, 1862), see Sheffield Archives CA-HEA/1/4, after p. 653.

5 Sanders, *Sanitary State*, p. 4.

6 Sanders, *Sanitary State*, p. 3.

1871. This pattern is difficult to explain. It appears that the low level in 1866 was a consequence of different standards being applied when the originals were transcribed since no multiple causes were recorded for deaths in the township of Sheffield. Nevertheless, the proportion of multiple causes in the other townships was still low compared with the other years. Does the threefold increase by 1871 reflect an increasing likelihood of multiple causes being given, did this trend continue and were deaths at other ages likewise affected? At present these questions cannot be answered and it will be necessary to have more information for other years and places to determine if these figures are representative of trends throughout the Victorian period. Distinguishing between primary and secondary causes of death is an obvious problem with multiple causes; nevertheless, because ages at death appear to have been recorded precisely in months, weeks, days and sometimes even minutes, these registers do allow us the opportunity to analyse the age structure of causes of death.

Before doing this, it is important to say a little about the registration process. In the mid-1870s about seven per cent of all deaths in Sheffield were not medically certified, with the percentage in the poorest parts of the town being over twice this level.[1] Many uncertified deaths would have been of infants who died at or shortly after birth, since in many cases the only persons who witnessed these events were the mother, the midwife and some of the mother's relatives or friends. In such instances the registrars would do their best to allocate a cause of death from witness descriptions, the majority being given by females, most of whom were not able to sign the register.[2] It is therefore not surprising that many infants were allocated imprecise causes of death such as atrophy, debility or convulsions. The existence of multiple causes of death also creates problems when it comes to classifying causes into single categories since it is difficult to determine which of the causes listed is the principal one. For instance, in the case of the last entry in Figure 3.9, the cause of death is stated as 'hooping cough, bronchitis and convulsions. As discussed above, these 'diseases' seem to have been listed in the order of their appearance not necessarily their importance. Thus, it may be assumed that the infant first contracted whooping cough, this then developed into bronchitis and finally death followed a convulsive fit.[3] It is however impossible to determine how this death was classified for publication in the Registrar General's reports because 'the reference manuals that helped the clerks to classify the returns in a standard way are no longer in existence'.[4] As far as understanding how this single death fits into the wider causes of infant mortality during the nineteenth century, reference to Figure 1.4 is useful. First the infant was exposed to the bacterium that causes whooping cough; this resulted in the infant becoming ill; complications then set in; and these eventually led to the child's death. In a nineteenth century context there were two possibilities to

1 Williams, 'Reporting and classification of causes of death', p. 63, quoting F. Griffiths, *Annual Report of the Health of Sheffield for the Year 1876* (Sheffield, 1877), pp. 19-20. Rates of medical certification had increased significantly by the end of the nineteenth century.

2 Williams, 'Reporting and classification of causes of death', p. 59 quotes figures from W. Farr, 'Letter to the Registrar-General on the causes of death in England', in Registrar General, *Twenty-Seventh Annual Report of the Registrar General* (London, 1866), p. 179, BPP 1866 XIX. They refer to 11 RDs, not including Sheffield. In 1864, 38 per cent of deaths were registered by males and 62 per cent by females with 26 per cent of males and 62 per cent of females signing the register with a mark. This means that about 50 per cent of all deaths were registered by someone who signed with a mark.

3 The National Health Service website gives pneumonia and fits as common complications of whooping cough, see https://www.nhs.uk/conditions/Whooping-cough/ [accessed 30 April 2021].

4 Williams, 'Reporting and classification of causes of death', p. 65.

prevent this and similar deaths from occurring. The first involved trying to avoid contact with the bacteria and the second related to better treatment. While effective treatments are now readily available, during the nineteenth century this was not necessarily the case and the most important factor in determining whether this infant died was its initial exposure to the highly infectious whooping cough bacterium.[1] In this instance we must therefore consider the primary cause of death to be whooping cough.

For this small-scale study three years covering the period 1861-1871 were chosen for analysis. This created a sufficiently large sample, 5,205 infant deaths in total, so that some general observations could be made. Table 3.10 shows the distribution of infant deaths in Sheffield for the three years 1861, 1866 and 1871.[2] First it is apparent that all three years display a similar, although not identical distribution. It is also notable that about 7 per cent of all infant deaths occurred on the first day, about 13 per cent in the first week and about 27 per cent in the first month. Of the first day deaths about 30 per cent of these occurred within the first hour which means that about 2 per cent of all infant mortality occurred at or immediately after birth. These figures are similar to others that have been calculated for this period and suggest that the age structure of infant mortality during the Victorian and Edwardian periods was relatively stable.[3] They also reinforce the fact that neonatal and endogenous mortality must have declined significantly from the second half of the eighteenth century. Most of these very early deaths would have had an endogenous cause, either as a consequence of inadequate development in the womb or a difficult birth. The median age of infant death was about three months, which again emphasises how the balance between neonatal and post-neonatal causes had shifted by the mid nineteenth century. Whilst it would be unwise to draw too many conclusions from these data, they have revealed the potential of this type of analysis in being able to account for the changes in the structure of infant mortality that occurred during the Victorian and Edwardian periods, provided of course that other similar data become available.

The Sheffield death data can also be used to examine the age distribution of causes of death. As we have seen it is not possible to replicate the GRO's classification methods since it is not known how the clerks dealt with multiple causes or interpreted some of the more difficult ones. Indeed, the process of classifying nineteenth-century causes of death, especially for infants, appears to be as much an art as a science. Here where multiple causes occur, they have been placed into the cause that is either the more specific or obviously the primary one. In nearly every instance this process was straightforward, although it is impossible to determine if this replicated the methods adopted by the GRO. Thus, 'diarrhoea and convulsions' was classified as diarrhoea, 'marasmus and hydrocephalus' as hydrocephalus and 'pertussis and pneumonia' as whooping cough, since pneumonia would have been a complication of whooping cough.[4] In the three sample years 'convulsions' was included in 60 per cent of all infant deaths given multiple causes. Thus, the national decline

1 Vaccination against whooping cough became available from the 1950s.

2 The IMRs for the RDs of Sheffield and Ecclesall Bierlow combined were 179 in 1861, 206 in 1866 and 202 in 1871. The number of births in the municipality was not given separately so it is not possible to calculate the IMR for town of Sheffield, see Table 1.

3 See Table 2.3 and also C. Galley, N. Williams and R. Woods, 'Detection without correction: problems in assessing the quality of English ecclesiastical and civil registration', *Annales de Démographie Historique*, (1995), pp. 161-83, here at p. 172.

4 These examples are from Sheffield Archives MD 7191/2, pp. 51, 57.

Table 3.10 Distribution of infant deaths by age, Sheffield death registers, 1861, 1866 and 1871

	Days							Weeks				Months												
Year	0	1	2	3	4	5	6	0	1	2	3	0	1	2	3	4	5	6	7	8	9	10	11	Total
1861 number	110	15	18	16	16	5	7	187	65	74	74	400	162	113	95	102	66	83	60	84	69	83	63	1,380
1861 %	8.0	1.1	1.3	1.2	1.2	0.4	0.5	13.6	4.7	5.4	5.4	29.0	11.7	8.2	6.9	7.4	4.8	6.0	4.3	6.1	5.0	6.0	4.6	
Cumulative %	***8.0***							***13.6***				***29.0***		***48.9***			***68.0***			***84.4***			***100***	
1866 number	143	33	24	17	22	10	9	258	89	92	71	510	237	170	134	124	94	99	87	109	99	95	98	1,856
1866 %	7.7	1.8	1.3	0.9	1.2	0.5	0.5	13.9	4.8	5.0	3.8	27.5	12.8	9.2	7.2	6.7	5.1	5.3	4.7	5.9	5.3	5.1	5.3	
Cumulative %	***7.7***							***13.9***				***27.5***		***49.4***			***68.4***			***84.3***			***100***	
1871 number	91	44	34	25	20	11	7	232	95	84	81	492	260	158	135	137	110	119	98	113	137	115	95	1,969
1871 %	4.6	2.2	1.7	1.3	1.0	0.6	0.4	11.8	4.8	4.3	4.1	25.0	13.2	8.0	6.9	7.0	5.6	6.0	5.0	5.7	7.0	5.8	4.8	
Cumulative %	***4.6***							***11.8***				***25.0***		***46.2***			***65.6***			***82.4***			***100***	
Total number	344	92	76	58	58	26	23	677	249	250	226	1,402	659	441	364	363	270	301	245	306	305	293	256	5,205
Total %	6.6	1.8	1.5	1.1	1.1	0.5	0.4	13.0	4.8	4.8	4.3	26.9	12.7	8.5	7.0	7.0	5.2	5.8	4.7	5.9	5.9	5.6	4.9	
Cumulative %	***6.6***							***13.0***				***26.9***		***48.1***			***67.2***			***83.6***			***100***	

Source: Sheffield Archives MD 7191/2, 7, 12.

in convulsions deaths seen in Figure 3.7 could have occurred as a consequence of a greater reluctance by doctors to use this term or the increasing use of multiple causes which were subsequently allocated into different causes by the GRO.[1] With deaths being listed by street it also became apparent when transcribing the registers that localised concentrations of different terms were used to describe what were probably the same diseases. Thus, the terms 'pertussis', 'hooping cough' and 'whooping cough' did not occur randomly throughout the registers, but instead their differing use was concentrated into certain streets which probably reflected the fact that different doctors were using different terms for the same disease. Only two infants were given 'low state of vital power' as a cause of death during the three years and these both came from the workhouse in 1871.[2] The best example of this phenomenon did not concern infants and also occurred in Sheffield Workhouse. In 1868 the causes of death of 26 males aged over 60 were ascribed to 'abscess of prostrate' and, as far as it is possible to tell, this cause of death was not given to any other individual in the registers that were examined. Thus, even when deaths were medically certificated, which should have been the case in the Workhouse, some degree of uncertainly should be placed on any nineteenth-century cause of death.

In the vast majority of cases the causes of death were easy to interpret and the process of classification straightforward. The age structure of infant deaths by cause is shown in Table 3.11.[3] There are obviously numerous ways in which to classify deaths; here the emphasis has been placed on causes that are relatively easy to identify, at least within the context of nineteenth-century disease understanding, or (in the case of respiratory diseases) this category has been widely interpreted. It is apparent therefore that, in spite of this attempt to clarify the causes of death, many were still ascribed to the three imprecise causes of 'premature birth', atrophy and convulsions which together accounted for about 38 per cent of all deaths. About 94 per cent of 'premature birth' deaths occurred within the first month of life, although four infants aged over six months were given this cause. 'Atrophy' and 'convulsions' deaths were more evenly distributed, although in both cases there were very important neonatal components. Moreover, with 60 per cent of multiple causes including convulsions, often alongside an infectious disease, this raises the possibility that the overall impact of infectious diseases was hidden by the large number of convulsions deaths. A further 12 per cent of deaths were categorised under 'other' and while most were easily understood, the small number of deaths for each cause means that trends cannot be determined. Thus, approximately half of all infant deaths in Table 3.11 remain ill defined which obviously limits the value of these data. Some worthwhile deductions can nevertheless be made. Perhaps the most important is that about 20 per cent of infant deaths can be ascribed to 'respiratory' causes which mainly affected post-neonatal infants. This category represents the single most important cause amongst infants and is largely absent from discussions of infant mortality in the demographic literature. The common childhood

1 The GRO could also have encouraged doctors not to use 'convulsions' or instructed their clerks to classify causes of death in a different way.

2 Sheffield Archives MD 7191/12, pp. 187-8. These were classified under debility.

3 The only comparable analysis of causes of infant death by age appears in Registrar General, *Fifty-fourth Annual Report of the Registrar General* (London, 1892), pp. xiv-xv, BPP 1892 XXIV, which compared deaths in infancy between three towns (Blackburn, Leicester and Preston) and three rural counties (Dorset, Hertfordshire and Wiltshire). See the discussion in Woods and Shelton, *Atlas of Victorian Mortality*, pp. 54-5.

Table 3.11 Distribution of infant deaths by age and cause, Sheffield death registers, 1861, 1866 and 1871 combined

	Age at Death with Cumulative Percentages in Brackets						
Cause of Death	0 Days	0 Weeks	0 Months	1-2 Months	3-5 Months	6-11 Months	Under 1
Premature Birth	178 (45.6)	287 (73.6)	366 (93.8)	18 (98.5)	2 (99.0)	4 (100)	390
Atrophy	48 (6.7)	101 (20.4)	270 (37.9)	217 (68.7)	116 (84.7)	109 (100)	712
Convulsions	73 (8.1)	208 (23.1)	403 (44.8)	189 (65.9)	124 (79.6)	183 (100)	899
Diarrhoea	0 (0)	1 (0)	91 (12.1)	227 (42.4)	203 (69.5)	229 (100)	750
Respiratory	1 (0.1)	2 (0.3)	55 (5.8)	205 (25.9)	244 (50.3)	498 (100)	1,002
Smallpox	0 (0)	0 (0)	10 (10.9)	23 (35.9)	21 (58.7)	38 (100)	92
Whooping Cough	1 (0.3)	1 (0.3)	5 (2.0)	42 (16.0)	64 (37.9)	182 (100)	293
Measles	0 (0)	0 (0)	1 (1.8)	2 (5.3)	4 (12.3)	50 (100)	57
Scarlet Fever	1 (2.0)	1 (2.0)	1 (2.0)	6 (13.7)	9 (31.4)	35 (100)	51
Diphtheria	0 (0)	0 (0)	0 (0)	0 (0)	1 (12.5)	7 (100)	8
TB	0 (0)	1 (0.5)	13 (6.6)	43 (28.3)	59 (58.1)	83 (100)	198
Syphilis	0 (0)	0 (0)	2 (4.8)	19 (50.0)	15 (85.7)	6 (100)	42
Hydrocephalus	0 (0)	0 (0)	3 (3.8)	3 (7.7)	24 (38.5)	48 (100)	78
Violence	3 (13.0)	3 (13.0)	9 (39.1)	6 (65.2)	4 (82.6)	4 (100)	23
Other	39 (6.4)	72 (11.8)	173 (28.4)	100 (44.8)	107(62.3)	230 (100)	610
Total	344 (6.6)	677 (13.0)	1,402 (26.9)	1,100 (48.1)	997 (67.2)	1,706 (100)	5,205

Note: In 1861 the following causes were included under each heading: Premature Birth—'imperfect development'; Atrophy—'congenital weakness', 'debility from birth', 'exhaustion and vomiting', 'low vitality, 'murasmas', 'natural decay'; Convulsions—'chorea'; Diarrhoea—'bowel complaint', 'dysentery'; Respiratory—'bronchitis', 'diseased lungs', 'inflammation of chest', 'imflammation of lungs', 'pneumonia'; Whooping cough—'croup', 'pertussis'; Violence—'accidentally poisoned', 'accidentally scalded', 'found dead', 'narcotism', 'other violence', 'poisoned by an overdose of flyagaric'; Other—'absess in the neck', 'abcess of shoulder joint', 'aphtha [*a group of ulcers in mounth or on tongue*]', 'arachnitis [*inflammation of the arachnoid membrane*]', 'cerebral congestion', 'cerebral irritation', 'cleft spine', 'congestion of heart', 'deformity', 'difficult birth', 'diseased brain', 'eclampsia', 'effusion of brain', 'enlarged liver', 'erysipelas',' febricula (fever)', 'fever', 'found dead', 'found dead in bed', 'haemorrhage', 'heart affection', 'hypertrophy [*enlargement of organ or tissue*], 'inflammation of throat', 'jaundice', 'malformation of heart', 'mortification', 'pemphigus [*blisters on the skin*]', 'retention of urine', 'scurvy', 'spina bifida', 'syncope [*loss of consciousness caused by falling blood pressure*]', 'teething', 'ulceration of bowels', 'ulcerated throat', 'want of breast milk', 'want of care in the delivery'.

Source: Sheffield Archives MD 7191/2, 7, 12.

diseases of smallpox, whooping cough, measles, scarlet fever and diphtheria together accounted for about 10 per cent of deaths, although these figures may not be typical because these diseases appeared in cycles and the selection of particular years may have included or excluded epidemics. Tuberculosis, another infectious disease which mainly affected post-neonatal infants, is also shown to be an important cause of death.[1] Diarrhoea was responsible for about 14 per cent of deaths with most occurring at ages 1-5 months, although these deaths subsequently generated a large amount of discussion, especially towards the end of the nineteenth century when they began to be viewed as preventable. The lack of very early diarrhoea deaths also suggests that maternal breastfeeding must have been widespread at least during the first few weeks of infants' lives, with the increasing visibility of this disease after one month probably being due in part to greater numbers of mothers ceasing to breast feed. Unfortunately, we do not have any information about rates of breastfeeding in Sheffield for this period.

This discussion has raised far more questions than it has been able to answer.[2] Table 3.11 has showed the importance of respiratory, diarrhoeal and infectious diseases in determining the overall level of infant mortality. Likewise, it has also demonstrated the importance of neonatal causes, even though many of these were ill defined. Above all, Tables 3.8 and 3.9 have demonstrated the problems associated with analysing nineteenth-century cause of death data, especially for infants. Similar problems may also apply to other age groups and consequently we should be sceptical of any work, such as the various debates about standards of living initiated by McKeown and his colleagues, that is based on an analysis of nineteenth-century cause of death data since the assigning and classification of causes of death during this period may have been much less precise than many have assumed.[3]

On a more positive note, the Sheffield death registers illustrate the potential of such data in revealing possible changes to the age structure of infant mortality during this period. It would certainly be useful to replicate this type of analysis for other places and at the national level. Determining the levels of first hour, first day, first week and neonatal mortality would allow insights to be given into midwifery practices and early infant feeding and also enable changes brought about by the 1874 Registration Act to be assessed.[4] Likewise, issues such as whether the decline in 'atrophy' deaths was caused by a simple transference of neonatal deaths to the 'premature birth' category could also be answered. Above all, the Sheffield death registers show why it was so difficult for the medical authorities both to identify and then, more importantly, to do something to combat the high mortality amongst infants. With large numbers of infants assigned poorly-designated causes of death it was concluded that much infant mortality was irreducible and, given that the Sheffield Health Committee was essentially concerned with sanitary improvement via the elimination of nuisances, many of the main causes of infant mortality—especially neonatal ones—lay unaddressed. This

1 It is very rare for tuberculosis to be passed on to a foetus in utero.

2 It has however demonstrated that further research into these topics is possible using these or similar sources. Hopefully some readers may wish to pursue some of the questions posed in this section in their own research.

3 The literature on this subject is vast, see T.R. McKeown, R.G. Brown and R.G. Record, 'An interpretation of the modern rise of population', *Population Studies*, 26 (1972), pp. 345-82 and the discussion in Woods, *Demography of Victorian England and Wales*, pp. 312-59.

4 This should be possible for Scotland as a consequence of the Digitising Scotland project, see https://digitisingscotland.ac.uk/ [accessed 1 January 2021].

situation continued even after the appointment of a MOH following the implementation of the 1872 Public Act.1 It is to this issue that we now turn.

Medical Officer of Health reports

The origins of the MOHs lay in a desire by local authorities to implement sanitary reform as a means of combatting some of the problems caused by rapid urbanisation in Victorian Britain. Edwin Chadwick's famous suggestion that 'for the general promotion of the means necessary to prevent disease it would be good economy to appoint a district medical officer … to initiate sanitary measures' was echoed by the Health of Towns Association (1845), which recommended the appointment of local MOHs 'to inspect and report upon the [sanitary] conditions … to enquire into the nature and prevalence of epidemic and other diseases affecting the rate of mortality, and the circumstances which originate and maintain such diseases'.[2] These proposals bore fruit in 1847 when William Henry Duncan was appointed the country's first MOH in Liverpool. John Simon then became MOH for the city of London in the following year and, after local government reform in 1855, MOHs were appointed to each of the capital's 48 districts. By 1870 about 50 authorities outside of London had appointed MOHs, but the only large towns with full-time ones were Southampton, Leeds, Manchester, Birkenhead and Liverpool.[3] These appointments were indicative of a desire for sanitary improvement which became fully realised following the 1872 Public Health Act which created 1,453 urban and rural authorities, all of which were required to appoint MOHs. The role of the MOH was further shaped by the 1875 Public Health Act which brought together previous legislation on public health and gave local authorities greater powers with respect to controlling nuisances, which broadly interpreted meant anything injurious to health. According to Sidney Chave, 'the task of the new man (that is the MOH) was to be primarily with *prevention*'.[4]

The duties of the MOH were wide-ranging and encompassed the provision of clean water, sewerage, street regulation, the removal of nuisances, food inspection, the regulation of markets and offensive trades, sanitary burials and the suppression of infectious diseases.[5] The MOH worked in tandem with the local authority and sometimes this caused tensions since there were instances of MOHs being removed or having their salaries cut for pursuing

1 Galley, 'Social intervention and the decline of infant mortality'.

2 Chadwick's suggestion is quoted in W.M. Fazer, *Duncan of Liverpool* (London, 1947), p. 39; see also E.Chadwick, *Report on the Sanitary Condition of the Labouring Population of Gt Britain* (London, 1842). For the quotation from the Health of Towns Association, see C. Hamlin, *Public Health and Social Justice in the Age of Chadwick: Britain, 1800-1854* (Cambridge, 1998), p. 243.

3 B. Harris, *The Origins of the British Welfare State. Social Welfare in England and Wales, 1800-1945* (Basingstoke, 2004), p. 111; S. Chave, *Recalling the Medical Officers of Health* (London, 1987), p. 95.

4 S. Chave, 'The Medical Officer of Health 1847-1974', *Proceedings of the Royal Society of Medicine*, 67 (1974), pp. 1,243-7, here at p. 1,243.

5 Chave, *Recalling the Medical Officers of Health*, pp. 106-7. The philosophy underlying the work of the MOH can be summarised by Chadwick's belief that, 'diseases ranging from fever to tuberculosis, and social problems ranging from intemperance to revolutionary agitation, had one "all pervading cause": concentrated emanations of decomposing matter, whose effects could be prevented by flushing the matter down the drain', see C. Hamlin, 'Could you starve to death in England in 1839? The Chadwick-Farr controversy and the loss of the "social" in public health', *American Journal of Public Health*, 85 (1995), pp. 856-66, here at p. 862.

their work too assiduously.[1] Most MOHs were appointed on a part-time basis and their abilities varied considerably, as did the work they carried out. Some of the most important pioneers in infant and child welfare, such as Arthur Newsholme (Brighton), George Newman (Finsbury) and George McCleary (Battersea, Hampstead and Bedfordshire) served as MOHs; however, many others were local figures, not necessarily noted for their interest in the sanitary sciences, who had to rely for much of their income on private practice.[2] By 1888 MOHs in districts with a population of more than 50,000 had to hold the Diploma in Public Health.

Part of the MOHs' many responsibilities concerned disease prevention and it was in this respect that their attention sometimes turned towards infant mortality. The work that MOHs undertook can best be viewed by examining the annual reports they were required to produce for their employers.[3] Many of these were printed, but they varied considerably both in form and content, often reflecting the personalities of their authors. Some contain a rich discussion of the attempts the MOHs made to improve the sanitary state of their districts while others were perfunctory. Much of the content of these reports is concerned with reporting inspections carried out with respect to sewerage provision, road repairs, lighting, housing, the disinfection of unsanitary premises and the analysis of food; however, later ones frequently address disease prevention. Most reports begin with a discussion of the key demographic indicators for their districts and then go on to discuss some of the diseases that they deemed to be preventable. Increasingly MOH reports, especially urban ones, discuss infant mortality and their examination will be useful in assessing local awareness of infant health issues and any initiatives that local authorities instituted as a means of combatting high IMRs.[4]

The fact that MOH reports had no set content is both their strength and weakness. Sometimes they include data not available elsewhere; however, their lack of consistency, both over time and space, can make comparisons difficult if not impossible. For example, the 1895 report for Brumby and Frondingham, which now forms part of Scunthorpe, is only four hand-written pages long and contains nothing about infant mortality.[5] By contrast, the 1905 report for Birmingham is 136 pages long and includes a discussion of the trend in infant mortality, an analysis by age and cause, an examination of spatial variations, a comparison

1 Chave, *Recalling the Medical Officers of Health*, p. 104.

2 According to Chave, *Recalling the Medical Officers of Health*, p. 103, 'The British Medical Journal called them (MOHs), "amateurs, without proper training in sanitary science," who devoted to their public duties "only scraps of time" as they could spare from their private practice'. These views were echoed by J. Brownlee, 'The relation of infantile mortality to mortality in subsequent life', *Journal of the Royal Statistical Society*, 80 (1917), pp. 222-48, here at p. 223, who said that many MOHs were 'men of narrow outlook'.

3 Many of these documents were printed and can be found in local archives. The Wellcome Library has a large collection which can be read online, see https://archive.org/details/medicalofficerofhealthreports [accessed January 2021]. See also A. Engineer, 'Illustrations from the Wellcome Library: the Society of Medical Officers of Health: its history and its archive', *Medical History*, 45 (2001), pp. 97-114. Scottish medical officers of health reports for 1891 can be found at https://scotlandsplaces.gov.uk/search/results?st=medical%20officer [accessed January 2021].

4 C. French and J. Warren, 'Medical Officers of Health and infant mortality: the case of Kingston-upon-Thames in the late nineteenth and early twentieth century', *Local Population Studies*, 73 (2004), pp. 61-72, here at pp. 67-70, were able to link an analysis of infant diarrhoea deaths in the 1899 report to local mortality records, thereby demonstrating that most of these deaths were concentrated into a small, poor part of the town.

5 https://archive.org/details/medicalofficerofhealthreports?&and[]=year%3A%221895%22 [accessed January 2021]. The MOH was M.R.J. Behrendt.

with other towns together with a wide-ranging discussion of infant feeding practices.[1] To demonstrate the potential of these sources in shedding light on issues relating to infant mortality, the following discussion will examine three sets of reports from contrasting places: Liverpool (1867-1910), the London Borough of St Pancras (1856-1910) and the rural sanitary district of the Isle of Wight (1884-1910). The choice was dictated by the expectation that they should reveal differing experiences and that nearly complete runs of reports are available online from the Wellcome collection.

(a) Liverpool 1867-1910

Liverpool was the first place to appoint a MOH and consequently it might be considered a pioneer in preventive medicine. It also recorded the highest IMRs throughout the period and it should therefore prove instructive to examine attempts to address this problem here.[2] During the period for which the Wellcome Library has MOH reports, the post was taken by W.S. Trench (1867-1875), J. Stopford Taylor (1876-1893) and E.W. Hope (1893-1910) with the 1893 report having dual authorship.[3] The first report for 1867 appears to discuss infant mortality: 'at certain seasons, by the great excess of infant mortality, there were populous districts of the town in which the average age at death did not reach to adolescence'.[4] However, on closer inspection Trench takes 'infants' to mean children aged under five years with subsequent tables comparing deaths under five years with those over five years, by ward and for different zymotic diseases including typhus, cholera, diarrhoea, smallpox, scarlatina, whooping cough, croup, diphtheria, tuberculosis and phthisis.[5] Daily diarrhoea deaths for all ages combined were also given from July to October alongside comprehensive weather information.[6] The rest of the report, which comprised about 40 per cent of the total, is given over to the general sanitary work carried out by the MOH. Thus, infants only appear tangentially and the main conclusion that can be drawn from the report is the assumption that general sanitary improvement will bring about a reduction in infectious disease which in turn will improve 'infant' (that is, under five) mortality. Trench's other reports follow a near identical format. The main demographic indicator used to measure sanitary progress

1 J. Robertson, *Report of the Medical Officer of Health on the Health of the City of Birmingham for the Year 1905* (Birmingham, 1906), pp. 17-23. When Robertson became MOH he undertook an extensive study of infant mortality in the city, see J. Robertson, *Special Report of the Medical Officer of Health of the City of Birmingham* (Birmingham, 1904).

2 Note that the IMRs for Liverpool given in Table 3.4 refer to Liverpool RD while those in the MOH reports are for the whole city. In many cases rates will differ between the two since the central wards of Liverpool tended to experience the highest IMRs.

3 Hope was appointed assistant MOH in 1883 aged 26 years. He became full time MOH in 1894 and retired in 1924.

4 W.S. Trench, *Report on the Health of Liverpool during the Year 1867* (Liverpool, 1868), p. 5.

5 Trench, *Report on the Health of Liverpool during the Year 1867*, pp. 8, 10-11, 15, 18-26. The number of deaths at ages under one year was given, but these were then expressed per 1,000 deaths (p. 6) and comprehensive causes of death for infants (aged under one year) and other ages were also provided at the end of the report. 'Zymotic' is a nineteenth-century term used to describe an acute infectious disease.

6 In 1867 there were 796 deaths ascribed to diarrhoea of which 597 were infants (75 per cent), Trench, *Report on the Health of Liverpool during the Year 1867*, unpaginated table at the end of the report.

was the general death rate (deaths per 1,000 population), although some importance was also given to the 'infant' death rate (the proportion of under five deaths out of all deaths).[1]

The format of J. Stopford Taylor's first report follows closely that of his predecessor, a practice that was replicated throughout his tenure. His reports do however put forward an optimistic view of sanitary progress in Liverpool. For instance, in 1877 he noted that the 'reduction in deaths from Diarrhoea and Fever during the last twelve years affords very satisfactory evidence of the beneficial character of the sanitary operations during that period',[2] and in 1885 he argued that as the death rate had declined:

> [t]his large saving of life was not the only gain, for every death would represent 10 cases of sickness requiring medical attendance, nursing, &c., showing that 39,170 cases of serious illness were avoided, conferring a benefit on the community far in excess of the cost of all our Sanitary and Improvement Works combined.[3]

There is little about infant mortality in Taylor's early reports. The real IMR makes its first appearance in 1878, although only in passing, '[t]he deaths of Infants below one year of age amounted to 3,970, or 19.3 per cent of all the children born in the Borough'; yet on the same page, there follows a table that lists deaths at ages under and over five years for each ward and this remained Taylor's preferred measure of 'infantile' mortality in all his reports.[4] This situation continued whilst Taylor remained in office and the only additional mention of infant mortality occurred when from 1886 an additional column labelled 'Percentage of deaths under 1 year to Total births' was added to the table which gave deaths at ages under five years by quarter for each ward.[5] This practice was repeated in Taylor's subsequent reports, but he added no accompanying comments to these tables. Had he done so, he might have noticed a widening of spatial variations in infant mortality throughout the city with the wards of Rodney Street and Abercrombie having an IMR of 134 and St Paul's and Exchange a rate of 201 in 1886, whilst by 1892 the respective rates were 94 and 248.[6] Throughout Taylor's tenure much effort was directed towards sanitary improvement, but infant mortality was again virtually ignored.

The first report wholly authored by E.W. Hope was almost identical to those of Taylor, although maps of population density, birth and death rates, notified smallpox and typhus cases and a graph showing changes in the death rate between 1861 and 1894 were included,

1 This was 43.2 per cent in 1875, see W.S. Trench, *Report on the Health of Liverpool during the Year 1875* (Liverpool, 1876), p. 7. The 1871 report contained an extensive discussion of the 1870-1871 smallpox epidemic, but again, only smallpox deaths at ages under and over five years were given for the borough, see W.S. Trench, *Report on the Health of Liverpool during the Year 1872* (Liverpool, 1873), pp. 33-41.

2 J.S. Taylor, *Report on the Health of Liverpool during the Year 1877* (Liverpool, 1878), p. 4. In 1878 he noted that '[d]iarrhoea may be considered a "filth disease" arising from the decomposing of organic matter, but greatly influenced by atmospheric conditions', see J.S. Taylor, *Report on the Health of Liverpool during the Year 1878* (Liverpool, 1879), p. 3.

3 J.S. Taylor, *Report on the Health of Liverpool during the Year 1885* (Liverpool, 1886), p. 6.

4 Taylor, *Report on the Health of Liverpool during the Year 1878*, p. 10. On the following page, infant deaths are again reported per 1,000 population.

5 J.S. Taylor, *Report on the Health of Liverpool during the Year 1886* (Liverpool, 1887), p. 14. This showed that, within the city, the IMR varied from 134 to 262 per 1,000 births.

6 Taylor, *Report on the Health of Liverpool during the Year 1886*, p. 14; J.S. Taylor, *Report on the Health of Liverpool during the Year 1892* (Liverpool, 1893), p. 30.

together with some comparison with other large towns.[1] Indeed, this change marked the beginning of an expansion in the scope of the reports. The 1894 report contains 111 numbered pages with subsequent ones increasing steadily so that there were 203 pages in 1900, 215 pages in 1905 and 242 pages in 1910, with each report also containing a substantial appendix and large numbers of unpaginated tables, graphs and sometimes photographs. For the first time the 1895 report contains a section labelled infant mortality:

> in some parts of the City, out of every thousand infants born 129 die before attaining the age of twelve months, whilst in other parts of the City more than double the number die during the same period. In these latter cases but little attention is given by the parents to their offspring at any time, and those acquainted with the habits and customs of this too large section of the community, wonder, not that so many perish, but that so large a number survive.[2]

Whilst here is a specific reference to infant mortality and its apparent cause, it is not clear that Hope was just referring to deaths at ages under one year, since in the following paragraph he argued that:

> Those who have never had any opportunity to see this section of the community in its own environment of indolence and disorder, have a reflex of the domestic wretchedness in the condition of the ragged or half-naked children, many of tender years, begging in the streets.[3]

Likewise, the following table in this section, which is identical to those published in previous years, purports to show infantile mortality, but again emphasises deaths at aged under five years. The 1896 report follows the same format with much of the wording about infant mortality being identical. Hope makes explicit what he considers to be the cause of high infant mortality, '[e]xcessively high infant mortality is, without doubt, largely owing to ignorance and neglect on the part of the parents'.[4] The 1897 report does not contain a section devoted to infant mortality, but this subject is discussed in the section about zymotic diarrhoea, since in that year infant diarrhoea deaths had more than doubled giving rise to a special study of the problem:

> the fact is established beyond any dispute that errors in feeding, which under ordinary circumstances may be unattended with serious consequences, give rise in hot and dry weather to a high mortality. The reason of this is that artificial foods, cow's milk, etc., during hot and dry weather are liable to rapid putrefaction, owing to contamination by decomposing dirt and dust of various

1 E.W. Hope, *Report on the Health of Liverpool during the Year 1894* (Liverpool, 1895), pp. 10-14 and after p. 111.

2 E.W. Hope, *Report on the Health of Liverpool during the Year 1895* (Liverpool, 1896), p. 20. This section is only two pages long.

3 Hope, *Report on the Health of Liverpool during the Year 1895*, p. 20.

4 E.W. Hope, *Report on the Health of Liverpool during the Year 1896* (Liverpool, 1897), p. 21. Hope then repeats what he had said in his previous report, '[t]he condition of the very squalid children begging in the streets, ragged and filthy, … These children whose condition excites the astonishment of every visitor to the city, are used by their parents for the purpose of begging and owing to their apparently miserable plight, they are enabled to support their parents by the gifts of philanthropic but foolish people'. Again, these sentences are clearly not about infants.

> kinds … The deaths of children under three months of age, either wholly or partially fed on artificial foods, are fifteen times as great as they are amongst an equal number of infants fed on breast milk. Between the ages of three and six months, for every infant getting breast milk as part of its diet, who dies from diarrhoea, there are six who die amongst an equal number getting no breast milk.[1]

Hope also indicated that:

> [f]or several years past the Medical Officer has, with the sanction of the Health Committee, caused a memorandum of simple instructions to be widely distributed amongst the poorer classes at the commencement of summer. These instructions, whilst indicating the method by which infants should be fed, point out also the importance of cleanliness of person, clothing, and surroundings, and include the following paragraph:— "The water closet should be repeatedly and thoroughly flushed, and sinks and drains kept clean by frequent flushing each day. A free and unstinted use of water is far better than any disinfectant".[2]

The 1897 report also included a section about the work of female sanitary staff. In total, visits were made to nearly 13,000 dwellings, but the work of these female health visitors did not directly include infant welfare. Instead, they directed 'their efforts against drunkenness, sloth and improvidence' and 'were armed with no other powers than those of personal influence'.[3]

Hope's interest in infantile diarrhoea also prompted him to publish two, much-quoted, short papers on this topic in the Society of Medical Officers of Health's journal, *Public Health*.[4] The first was taken almost verbatim from his reports, whilst the longer second paper shows that his conclusions were based on an investigation made into more than 1,000 fatal cases of infant diarrhoea in which he 'made personal enquiry visiting the home[s]'.[5] Hope also provided further details of infant feeding from enquiries made at vaccination stations. Only 50 per cent of infants aged under three months were fed by breast alone. That number fell to 20 per cent for those aged three to six months and artificial foods were 'almost invariably given' to older infants.[6] He also noted that the Irish were 'less satisfactorily circumstanced in regard to hygienic surroundings', which was counterbalanced by the English resorting to artificial feeding during the earlier months and he concluded that 'parents cannot, or will not, desist from artificial feeding; therefore artificial feeding becomes a factor to be reckoned with'.[7] Thus, early in Hope's tenure he had clearly set out what he considered to be the main cause of high mortality—poor parenting—and his solution was

1 E.W. Hope, *Report on the Health of Liverpool during the Year 1897* (Liverpool, 1898), p. 40.
2 Hope, *Report on the Health of Liverpool during the Year 1897*, p. 43. These instructions had clearly had little effect as infant diarrhoea deaths had nearly doubled between 1896, when there were 613 infant diarrhoea deaths, and 1897 when there were 1,053 (see the relevant tables at the end of each report).
3 Hope, *Report on the Health of Liverpool during the Year 1897*, p. 107.
4 E.W. Hope, 'Summer diarrhoea', *Public Health*, 11 (1899), pp. 425-6; E.W. Hope, 'Observations on Autumnal diarrhoea in cities', *Public Health*, 11 (1899), pp. 660-5.
5 Hope, 'Observations on Autumnal diarrhoea', p. 661.
6 Hope, 'Observations on Autumnal diarrhoea', p. 661.
7 Hope, 'Observations on Autumnal diarrhoea', p. 661.

general sanitary improvement coupled with appropriate, targeted education aimed at improving infant feeding.

Hope's *Report on the Health of Liverpool during the Year 1898* again did not have a section devoted to infant mortality. Indeed, the IMR was not reported as such, although the rate of mortality per 1,000 living at all ages was given. Infants were mentioned in passing in the section on diarrhoea, where the above quotations were repeated, and in the section on the milk supply, where Hope reiterated his views about the benefits of breastfeeding. We also learn that three additional female sanitary staff had been recruited during the summer months.[1] The 1899 report follows a similar format with little mention of infant mortality, although in a special study of summer diarrhoea the bacteriologist discovered that tubes connected to feeding bottles contained 'putrefactive material' which merely confirmed Hope's prejudices and 'added confirmation to the neglect, ignorance and carelessness of the parents'.[2] During the nineteenth century therefore, Liverpool's MOH reports are notable for their general lack of interest in infant mortality, especially given that infants were responsible for about one quarter of all deaths throughout this period. Infant deaths were often grouped together with early childhood ones, which obscured their real causes and, apart from infantile diarrhoea, there is little sign of any real understanding as to why so many infants died. Perhaps not surprisingly, given that the highest IMRs were to be found in Liverpool, there was no discussion of how that city compared with the other large towns in this respect. Only Hope put forward some idea of what caused high infant mortality and he did this repeatedly and with confidence—parental (or, more accurately, maternal) ignorance and neglect. Thus, despite some measures aimed at tackling infantile diarrhoea there is little to suggest that Liverpool's MOHs had much interest in the topic of infant mortality; they certainly did not appear to have devised any effective strategies to deal with the problem.

As the reports expanded during the first decade of the twentieth century so did the space allocated to infant mortality, although it still remained small given the size of the problem. In 1900 a more nuanced discussion of infant mortality was provided:

> The high mortality amongst infants, however good their surroundings, and however intelligently maternal care is exercised, arises from many causes … it may be taken that an annual death-rate among infants of 100, is unavoidable, and if this be granted, it follows that anything above this is preventable, although the necessary means to prevent it are so extremely difficult to apply that even in the best districts the loss of infant life is in excess of the standard. In the poorer districts it is plain to the most casual observer that the necessary care and attention are not given to infants … The children of the very poor are in this way exposed to neglect and inattention which is practically unavoidable, and which, together with improper food and scanty clothing, is reflected in the sacrifice of life.[3]

Hope then goes on to discuss his investigation of the families that had suffered an infant death in that year. He discovered that 4,574 children had been born to these 1,082 families,

1 E.W. Hope, *Report on the Health of Liverpool during the Year 1898* (Liverpool, 1899), pp. 18, 41-2, 91, 123. The three extra staff enabled 'visits to be made to numbers of streets which had not previously been on the visiting list, owing to want of time'.

2 E.W. Hope, *Report on the Health of Liverpool during the Year 1899* (Liverpool, 1900), p. 144.

3 E.W. Hope, *Report on the Health of Liverpool during the Year 1900* (Liverpool, 1901), p. 12.

of which 2,229 had died, 'practically all in infancy', giving a rate of 487 deaths per 1,000 births. He also noted that the:

> most remarkable series of excessive fatality occurred in twelve families in which the large total of 117 infants had been born, and no less than 98 had perished in infancy. These extreme examples, it must be remembered, are occurring in families in which, so far as municipal sanitation is concerned, there is very little to choose between them and many of the families who rear all, or nearly all, their children, nor can it be shown or inferred that there was any inherent weakness in the offspring, since those who have survived are of fair physique.[1]

Hope then goes on to record the family 'circumstances of upwards of 1,000 consecutive [infant] deaths', finding that 21 per cent could be described as 'extremely and exceptionally' dirty, in 18 per cent the mothers went out to work, 'leaving the infant in the custody of others, frequently in the custody of another child who could give it no proper attention' and 11 per cent lived 'in dwellings unfit for human habitation'.[2] He further noted that in upwards of 25 per cent of cases, the families were intemperate which he considered 'one of the saddest features of city squalor, and … beyond the power of sanitation to ameliorate'.[3] Hope accepted that 'the natural guardian of the infant is the mother, and that it is only with extreme caution that the efforts of the municipality can be specifically directed to the preservation of infant life', and then went on to list what could be done to tackle the problem: hospital provision for those infants suffering whooping cough; the circulation of leaflets promoting better infant feeding; the employment of a large staff to give verbal instructions for better child care; the establishment of a sterilised milk depot for the provision of specially prepared milk and, finally, general sanitary improvements.[4] Here, then, we have a comprehensive discussion of the causes of infant mortality, subject to the limitations of knowledge at that time, together with some suggestions as to how these problems could be ameliorated, even though the tone is ultimately one of resignation.

The report for 1901 is disappointing in that it does not appear to progress matters. The infant death rate per 1,000 living is still quoted, infants are grouped with deaths to those aged under five years and the section on infant mortality is an almost word for word repeat of that of the previous year. The IMR by district is given from 1897 to 1901, but there is no follow up discussion.[5] The report also contains a section about the establishment of sterilised milk depots since, despite their 'ignorance and carelessness', there is a 'general desire on the part of the mothers to do what they can for their infants'.[6] Four depots were in operation and during the summer months they were distributing, at capacity, about 3,000 bottles per day which was enough to feed 333 infants.[7] The 1902 and 1903 reports are almost identical

1 Hope, *Report on the Health of Liverpool during the Year 1900*, p. 13.
2 Hope, *Report on the Health of Liverpool during the Year 1900*, pp. 13-4.
3 Hope, *Report on the Health of Liverpool during the Year 1900*, pp. 14.
4 Hope, *Report on the Health of Liverpool during the Year 1900*, p. 14. Infants are also discussed in the section on diarrhoea, although Hope repeats these passages verbatim from previous reports (p. 35). In total infants are mentioned in fewer that 10 of the report's 230 pages.
5 E.W. Hope, *Report on the Health of Liverpool during the Year 1901* (Liverpool, 1902), pp. 19, 25-9.
6 Hope, *Report on the Health of Liverpool during the Year 1900*, p. 149.
7 Hope, *Report on the Health of Liverpool during the Year 1900*, pp. 149-51. The bottles were distributed in baskets of nine, each of which contained a single feed. Each basket was sufficient for one day. Instructions were

to the 1901 report with the section on infant mortality being repeated word for word.[1] Again the 1904 report is similar to previous ones, although further emphasis is placed 'on those infants who are fed in some method other than that which nature intended' with the high mortality being especially prevalent in certain families along with the high incidence of summer diarrhoea.[2] Hope also provides an interesting and important assessment of the effectiveness of the milk depot scheme. He notes that, since its inception early in 1901, 8,481 infants had been fed of whom 526 had died, but many of those who died were already ill when admitted to the scheme had been fed irregularly or only had one week's supply of milk before they died. Only 85 healthy and properly fed infants died on the scheme and, whilst Hope's calculations are difficult to follow, he claimed that the IMR of those infants on the scheme was 89 per 1,000 live births compared with 196 in the city as a whole and 281 in the worst district.[3] The milk depots were clearly of some benefit even though their overall effectiveness is difficult to quantify.

The rest of the reports from the first decade of the twentieth century continue to illustrate Hope's theme of general sanitary progress and his attempts to target specific high-risk families. They also gradually expand in content without losing sight of his beliefs about what should be done to tackle the problem. Thus, the 1905 report includes a graph of diarrhoea deaths against temperature and rainfall figures for 1903-1905 and notes, '[v]aluable service was rendered by the authorities of the Stanley Hospital, a considerable number of patients, all of them infants, having been received into the Hospital during the summer months'.[4] Later Hope describes how the work done by the female sanitary staff had changed and, '[a] good deal of the time of the Inspectors has been occupied in visiting houses where births have occurred, the total number of visits being no less than 23,391'.[5] The addresses were obtained from the Registrars which meant that:

> the infant is on the average about six weeks old. It is a matter of great importance that the particulars regarding births should be obtained as early as possible, as improper feeding or want of care during the first few weeks of the life of the infant may lead to serious results before the Inspector has had an opportunity of interviewing the mother and advising the best methods to be adopted.[6]

Hope also said that the inspectors were 'welcomed by the parents, and in almost every case the advice given is carefully followed'.[7]

In 1906 Hope again repeats what he had said in previous years, but he begins his section on infant mortality by arguing that 'interest in the subject has spread far beyond the medical

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also given to the mothers who were charged 1s. 3d. weekly, payable in advance, for the service. The report includes four photographs of one of the depots.

1 The section on infant mortality in 1902 begins with, '[t]he subject has been dealt with in previous reports, but it is of sufficient importance to call for repetition', see E.W. Hope, *Report on the Health of Liverpool during the Year 1902* (Liverpool, 1903), p. 17.

2 E.W. Hope, *Report on the Health of Liverpool during the Year 1904* (Liverpool, 1905), p. 21.

3 Hope, *Report on the Health of Liverpool during the Year 1904*, p. 161 and pp. 158-64 for a fuller discussion.

4 E.W. Hope, *Report on the Health of Liverpool during the Year 1905* (Liverpool, 1906), p. 42. The graph is placed immediately afterwards.

5 Hope, *Report on the Health of Liverpool during the Year 1905*, p. 88.

6 Hope, *Report on the Health of Liverpool during the Year 1905*, p. 88. In Sheffield (see Table 3.10) about a third of all infant deaths took place within the first six weeks.

7 Hope, *Report on the Health of Liverpool during the Year 1905*, p. 88.

profession, and has made itself very apparent amongst all classes of the public'.[1] He also includes a list of the measures that have been carried out to lessen the IMR. None of these are different from what Hope had already discussed in previous reports; nevertheless, they are worth repeating:

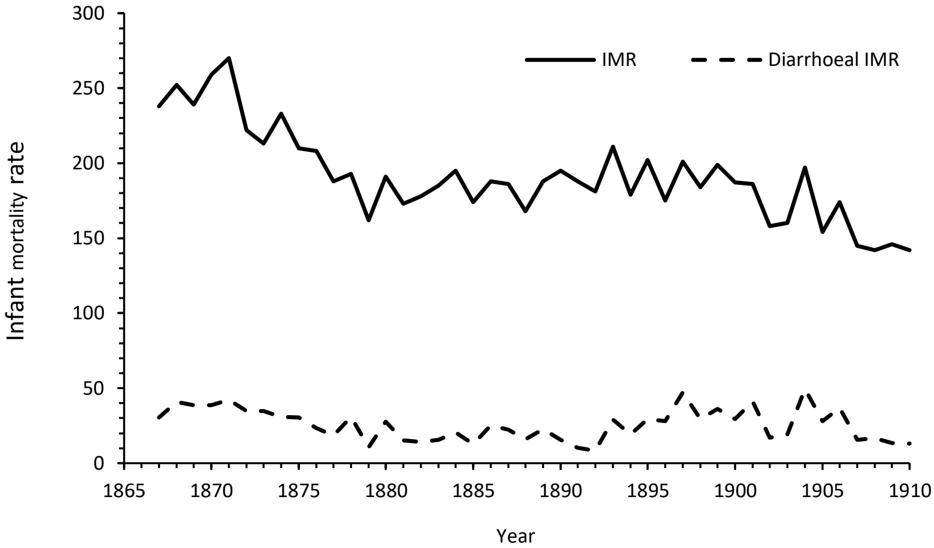
> The removal of insanitary slums, and the erection of proper dwellings in their place.
> The improvements in scavenging and cleansing, and the removal of all refuse likely to harbour flies.
> The substitution of small sanitary ashbins for large and foul ashpits.
> The provision of an unrestricted water supply.
> Hospital accommodation is available for infants suffering from measles and whooping cough, the benefit of which is not only to the immediate sufferer, but the spread of the disease is checked by the source of the infection.
> Arrangements have been come to by which the earliest possible notification of births shall be received, and a staff of Female Inspectors is employed to visit districts where it is advisable that instruction, both verbally and by card, should be given as to the way in which the infant should be fed and cared for. Many thousands of cards of instructions on these points are distributed throughout the city.
> Help of a similar kind is given through the midwives.
> For those mothers who are unable to suckle their infants a suitable food is provided at a price that is within reach of all.[2]

How these measures were ordered seems particularly significant. The first four concern general sanitary progress, which had always been the responsibility of the MOH. The fifth relates to the hospitalisation of infants suffering from infectious diseases, the sixth and seventh to targeted intervention and the last to the milk depots. Whilst all of these measures would have been beneficial, it is still difficult, if not impossible, to determine their individual or combined effectiveness. Hope's final reports from the Edwardian period both repeat and expand upon earlier ones, but they contain little of significance that is new. The 1907 report is interesting since it includes many examples of good and bad parenting. Thus, we learn that Mrs E. had given birth to seven children, including a set of twins aged four months, who were all living. She was poor, sober, kept her house and children clean—a model mother indeed. By contrast another Mrs E. was described as 'an incapable woman' who had fourteen children, all artificially fed, ten of whom had died in infancy.[3] Hope keeps returning to this theme: whatever municipal activities were carried out it was the mothers themselves who were responsible for the fate of their offspring.

What can we make of Liverpool's MOH reports? First, it is notable that during the nineteenth century, when the city suffered the highest IMRs in the country, the subject of infant mortality was virtually ignored. The rate was not calculated, its importance not recognised and infant deaths were grouped together with early childhood deaths which meant that the specific causes of infant mortality were hardly addressed. Instead, the primary

1 E.W. Hope, *Report on the Health of Liverpool during the Year 1906* (Liverpool, 1907), p. 18.
2 Hope, *Report on the Health of Liverpool during the Year 1906*, p. 19. A discussion of the National Conference on Infant Mortality held in June was also included with its resolutions being listed.
3 E.W. Hope, *Report on the Health of Liverpool during the Year 1907* (Liverpool, 1908), pp. 22-4.

Figure 3.10 Infant and diarrhoeal mortality rates, Liverpool, 1867-1910



Source: Liverpool Medical Officer of Health reports (various years).

focus of MOHs was on general sanitary progress. It was only after Hope's appointment that some consideration was given to infant mortality and then mainly through a discussion of infantile diarrhoea. Hope believed that the MOH could do little to combat the problem and repeatedly directed blame at the mothers who he thought responsible for a large proportion of infant deaths. During the first decade of the twentieth century the introduction of health visitors and milk depots were likely to have been beneficial, but many of Hope's prejudices remained. It is instructive to examine how the city's IMR changed alongside the diarrhoeal rate since that measure was the focus of much of Hope's efforts (Figure 3.10). First, there is a considerable decline in the IMR mortality from around 250 per 1,000 births in 1867 to under 200 by 1880, a fact that was ignored by the reports.[1] For the rest of the century the IMR remained largely unchanged until decline occurred from 1900 notwithstanding substantial increases in 1904 and 1906. By comparison there was a gradual decline in the diarrhoeal IMR until 1892, after which it increased substantially until 1897. Decline occurred from 1901 with notable peaks in 1904 and 1906 (both years with hot dry summers) (see Table 3.7 above). As we have seen with the Sheffield cause of death data, some note of caution needs to be attached here since it can never be certain that all diarrhoea deaths have been accurately recorded and classified. It is tempting to see Hope's interest in this subject coinciding with a recognition that diarrhoea deaths were on the increase and that the appointment of female sanitary workers did something towards ameliorating the problem. That said, it should be noted that the highest diarrhoeal rate (49.5 per 1,000 births) occurred in 1904 after the female sanitary staff were appointed, and diarrhoeal mortality was also high in 1906. Much of the variation in diarrhoea deaths was a consequence of climatic variation

1 The IMR reported in Figure 3.10 is for the city as a whole, not just the RD which was reported in Table 3.4. The reasons for this are linked to the spatial differences that occurred throughout the city with some of the healthier districts in the city being located in the adjacent RD.

and whatever advice had been disseminated by the health visitors clearly proved insufficient to combat the effects of a hot, dry summer.[1] Overall, Liverpool's MOHs would have appeared to have little influence over the city's IMR, although it is notable that the greater interest shown in the problem at the end of the century coincided with the beginning of the secular decline in infant mortality. The Liverpool reports identify many issues worthy of further investigation: notably the spatial variations that emerged throughout the city during the nineteenth century and the effectiveness of the various intervention strategies.[2]

(b) St Pancras, London, 1856-1910

The St Pancras MOH reports begin in 1856 after Thomas Hillier's appointment. He was succeeded by Thomas Stevenson in 1868, Shirley F. Murphy in 1878 and John F.J. Sykes in 1885 who remained in post until the end of our period. The first annual report contains some discussion of early age mortality: 'I have thought that the comparison of children dying under 5 years of age with the number born, would give a valuable guide to the relative salubrity of the sub-districts', but once again infant and early childhood mortality are conflated.[3] In a discussion of deaths under five years of age in the 1858 report, the number of deaths under one year of age per 1,000 births was stated, although the significance of this measure was not highlighted.[4] In 1861 a section of the report is headed 'infant mortality' and rates of mortality are given by street throughout the district, but once again only under-five mortality is discussed.[5] Indeed, this confusion continued throughout Hillier's tenure even though in 1864 he had noted that '[i]nfantile mortality is always regarded as a test of the sanitary condition of a place', but the measure he used was the number of deaths to babies under one year of age per 1,000 infants living and most of his discussion concerned under-five deaths.[6] Little changed after Thomas Stevenson became MOH. He sometimes mentioned deaths at ages under one year, but his reports are short, often less than 20 pages long, and under-five deaths were discussed as a whole. His failure to analyse infant deaths properly was highlighted in 1876:

> It will be seen that the death of infants under one year of age formed a smaller proportion of the number of registered births than in the preceding year. Since, however—owing to a change in the statuary law—registration of births has

1 Between 1897 and 1910 annual IMRs due to diarrhoea were: 47.3, 29.4, 36.1, 29.3, 41.2, 17.0, 19.3, 49.5, 28.0, 37.0, 15.7, 16.5, 13.3 and 13.0. In 1911, a year with a particularly hot summer, the diarrhoeal IMR rose to 33.0 (or 43.7 if diarrhoea and enteritis deaths are combined), see E.W. Hope, *Report on the Health of Liverpool during the Year 1911* (Liverpool, 1912), p. 6 and Table D.

2 The unexplained decline before 1880 is also worthy of further investigation.

3 T. Hillier, *First Annual Report of the Medical Officer of Health for St Pancras, Middlesex during 1856* (London, n.d.), p. 3.

4 T. Hillier, *Third Annual Report of the Medical Officer of Health for St Pancras, Middlesex during 1858* (London, n.d.), pp. 12-3.

5 T. Hillier, *Sixth Annual Report of the Medical Officer of Health for St Pancras, Middlesex during 1861* (London, n.d.), pp. 3-4. In order to calculate the under 1 mortality rate, the MOH assumed that '[t]he number of children living in the Parish under 1 year of age may be taken as the mean of the numbers born in 1860 and 1861' (p. 3). This assumption is, of course, false.

6 T. Hillier, *Ninth Annual Report of the Medical Officer of Health for St Pancras, Middlesex during 1864* (London, n.d.), p. 4.

> become more general of late, it would, perhaps be safer to take the deaths among infants and compare them with the deaths of all ages.[1]

Even though Stevenson did publish the number of under-one deaths per 1,000 births for 1874-1876, his failure to attach any significance to this measure meant that there was little meaningful discussion of infant mortality during his tenure. [2]

This situation did not change with Shirley F. Murphy's appointment. He preferred the proportion of infant to total deaths as his main indicator of infant mortality. In 1881 a section of the report was given over to the 211 diarrhoea deaths that had occurred in the year, 195 of which were infants, with Murphy noting that St Pancras was more affected by this disease than the rest of London. Murphy associated the increase in diarrhoea deaths with poor sanitation combined with hot weather, but he did not come to any definite conclusions and he 'failed in St Pancras to find any evidence that would lead me to conclude that children brought up by hand suffer more than children wholly breast-fed'.[3] The other reports written by Murphy follow a similar pattern. There was some discussion of wasting and convulsive deaths of infants, deaths at ages under one year in proportion to births were given for sub-districts and diarrhoea deaths were mentioned, but the discussion was largely descriptive and little understanding of the real causes of infant mortality can be gleaned from reading these reports.[4] Thus, the reports of the first three MOHs largely ignored infant mortality. Indeed, whilst the IMR is visible on occasion, as was the case with Liverpool, infant deaths were often grouped together with early childhood ones and little attention was given to what caused so many of them to die. Underlying everything that was written was the belief that sanitary improvement would bring about a general decline in mortality.

It was only after John F.J. Sykes became MOH in 1885 that increasing attention was paid to infant mortality, even though this change was slow to take effect. The length of Sykes' reports steadily increased, but their form and content hardly changed, especially during his first years in office. Infant deaths from wasting and convulsive diseases were discussed and a general breakdown of causes of deaths by age was given for the whole district and by sub-district. In 1886 the IMR (given under the heading deaths of children aged under one year per 1,000 births) was published for the period between 1876 and 1886; this showed little change over time with the rate remaining close to 150 for much of the period.[5] Subsequent reports followed a similar pattern and it was not until 1894 that the term 'infantile mortality rate' was used when comparing variations between different districts. Little discussion of infant mortality was included, with most of the report being devoted to childhood infectious diseases and sanitary improvement, a situation that was replicated in the following three reports.[6] In 1898 a small amount of space was devoted to the prevention of diarrhoea,

1 T. Stevenson, *Twenty-First Annual Report of the Medical Officer of Health for St Pancras, Middlesex during 1876* (London, n.d.), p. 2.

2 Stevenson, *Twenty-First Annual Report*, p. 13.

3 S.F. Murphy, *Twenty-Sixth Annual Report of the Medical Officer of Health for St Pancras, Middlesex: Being the Report for the Year, 1881* (London, n.d.), p. 33.

4 S.F. Murphy, *Twenty-Ninth Annual Report of the Medical Officer of Health on the Sanitary Condition for St Pancras, Middlesex: Report for the Year, 1884* (London, n.d.), pp. 6-7, 28, 57. By comparison the 1884 report contained an extensive discussion of the smallpox epidemic, see pp. 8-22.

5 J.F.J. Sykes, *Thirty-First Annual Report of the Medical Officer of Health on the Vital and Sanitary Condition of St Pancras, Middlesex: Report for the Year 1886* (London, n.d.), pp. 21, 33 and Table 3.

6 J.F.J. Sykes, *Thirty-Ninth Annual Report of the Medical Officer of Health on the Vital and Sanitary Condition of St Pancras, Middlesex: Report for the Year 1894* (London, n.d.), p. 19.

especially in infants. We learn that a pamphlet had been distributed to mothers and those who cared for infants. In words reminiscent of Hope, Liverpool's MOH, Sykes suggested that infantile diarrhoea's principal cause was 'improper food and feeding' and, whilst he argued that 'mother's milk was the most natural' food, he gave instructions as to the best means by which the infant could be fed artificially.[1] The next report only contains a table showing IMRs by sub-districts without any follow up discussion[2] and the 1900 report begins with a set of tables detailing the district's vital statistics from 1856 to 1900 which includes numbers dying from certain diseases, the total number of deaths at ages under one year and IMRs.[3] Presumably these were constructed with the aim of demonstrating sanitary progress, but again there is no accompanying discussion and, whilst infantile diarrhoea is mentioned, this time in relation to contaminated condensed milk, more space is devoted to plague than to infant mortality.[4] The 1901 report is silent about infant mortality; in 1902 there is further discussion of infantile diarrhoea which was thought to be caused by artificial feeding from contaminated milk, and in 1903 nothing significant about infant mortality was published.[5] Thus, while infant mortality is mentioned in all these reports it was clearly seen to be peripheral to the main concerns of the MOH.

The 1904 report marks a shift in the attention paid to infant mortality. A major inquiry into the prevention of infant mortality had been undertaken by two female inspectors which 'occupied a great part of the year' and focused on infant feeding methods and age at weaning. The enquiry only captured 45 per cent of births in the district and, while a series of summary tables was published, the report contained no additional discussion of the results or main conclusions.[6] Later in the same report, the suggestion was made that 'depôts for the provision and sale of sterilized and humanised milk for the food of infants' would be beneficial.[7] Subsequent reports show increasing interest in infant mortality. In 1905 it was reported that a sanitary inspector had been appointed for the prevention of infant mortality.[8] This person, Blanche Gardiner, had been one of the people who in the previous year had carried out the investigation into the causes of infant mortality. The report also contains an extensive discussion of the prevention of infant mortality with tables showing seasonal IMRs, a comprehensive breakdown of causes of death into weeks and months together with

1 J.F.J. Sykes, *Forty-Third Annual Report of the Medical Officer of Health on the Vital and Sanitary Condition of St Pancras, Middlesex: Report for the Year 1898* (London, n.d.), p. 28.

2 J.F.J. Sykes, *Forty-Fourth Annual Report of the Medical Officer of Health on the Vital and Sanitary Condition of St Pancras, Middlesex: Report for the Year 1899* (London, n.d.), p. 17. The IMRs varied from 149 in Regent's Park to 220 in Tottenham Court.

3 J.F.J. Sykes, *Forty-Fifth Annual Report of the Medical Officer of Health on the Vital and Sanitary Condition of St Pancras, Middlesex: Report for the Year 1900* (London, n.d.), pp. 10-2.

4 Sykes, *Forty-Fifth Annual Report*, pp. 30-6. Plague had re-emerged during the second half of the nineteenth century with significant epidemics occurring in southern China and Hong Kong in 1894. Plague spread to a number of ports and there was considerable concern that passengers from infected places would bring this disease to London. An extensive discussion of the measles epidemic that occurred in 1900 was also included in the report, see pp. 42-50.

5 J.F.J. Sykes, *Forty-Seventh Annual Report of the Medical Officer of Health on the Vital and Sanitary Condition of St Pancras, Middlesex: Report for the Year 1902* (London, n.d.), pp. 98-100.

6 J.F.J. Sykes, *Forty-Ninth Annual Report of the Medical Officer of Health on the Vital and Sanitary Condition of St Pancras, Middlesex: Report for the Year 1904* (London, n.d.), pp. 26-9, 75. The conclusions may have been published elsewhere, perhaps in the minutes of the relevant committee.

7 Sykes, *Forty-Ninth Annual Report*, p. 112.

8 J.F.J. Sykes, *Fiftieth Annual Report of the Medical Officer of Health on the Vital and Sanitary Condition of St Pancras, Middlesex: Report for the Year 1905* (London, n.d.), p. 10.

a comparison between rates in St Pancras, London and England and Wales as a whole.[1] Whilst acknowledging the risks posed by infantile diarrhoea Sykes concluded that:

> in order to diminish infantile mortality it is necessary to ameliorate, firstly, the pre-natal conditions, and secondly, the post-natal conditions, and that during both periods efforts should be first exhausted upon the mother before confining attention to the infant.[2]

He also noted that:

> little or no general attention has been directed towards improving the health of pregnant mothers so as to prepare them for suckling their infants when born, and for endowing them before birth with viable constitutions.[3]

The measures that had been adopted in the previous report were reiterated and there followed an account of a conference on the prevention of infant mortality that had taken place at the Town Hall on 5 June. This conference resolved to focus on improving the health of mothers, to distribute cards to mothers encouraging breastfeeding, to target high-risk mothers with visits— commencing in the poorest streets— and to avoid premature weaning (before the infant was nine months old) since 'hand feeding is expensive, troublesome, and unsatisfactory, risky at all times and in summer dangerous and often fatal'.[4] The female inspector was responsible for distributing advice cards to every mother outlining the above recommendations. These cards were sent by post to mothers once births had been identified and they were also distributed to hospitals, dispensaries, midwives, maternity nursing associations, the maternity ward at the workhouse and some medical practitioners, with the aim of providing advice to mothers before their babies were born. The inspector noted that, '[i]t was encouraging to find that with very few exceptions the mothers received the Women's Sanitary Inspectors and Voluntary Visitors most cordially'. She also pointed out that these visits also enabled some cases of disease to be identified, notably, 'the far too frequent cases of pulmonary phthisis amongst the mothers (and fathers)', which could then be treated thereby preventing its spread.[5] The 1905 report also discussed the registration and notification of births. Obviously, in order to achieve the MOH's objectives it was necessary for the various female health visitors to make contact as soon as possible after a birth had occurred, but fewer than 30 per cent of births in St Pancras were registered before the infant was six weeks old.[6] As a consequence of this problem London County Council began to require that midwives notify the council of any birth they had attended in the previous week.[7]

In 1906 Sykes argued that '[t]he general opinion is that the first step in the prevention of infantile mortality is the earliest possible notification of births' and for the short period of three months, the council gave one shilling to everyone who notified them of a birth within

1 Sykes, *Fiftieth Annual Report*, pp. 27-37.
2 Sykes, *Fiftieth Annual Report*, p. 37.
3 Sykes, *Fiftieth Annual Report*, p. 39.
4 Sykes, *Fiftieth Annual Report*, p. 41.
5 Sykes, *Fiftieth Annual Report*, p 51. Tables giving the number of visits made, mode of feeding, age of weaning, causes of weaning and causes of death were also included.
6 Sykes, *Fiftieth Annual Report*, p. 25. This was despite the law stating that births had to be registered within 42 days.
7 Sykes, *Fiftieth Annual Report*, p. 24.

48 hours.[1] This resulted in notifications from 299 mainly working-class families which together with 1,034 midwife notifications meant that these families could be given early visits.[2] These early notifications still only represented about 23 per cent of the 5,744 births that occurred in St Pancras in 1906 and consequently the majority of births, including those middle class births which would not have warranted a health visit, still only became visible to the MOH after they had been registered. This led to an inevitable delay before any advice could be offered. In the same report Sykes sought to assess the success of the infant mortality prevention measures that had been introduced in 1904 and continued during 1905 and 1906. He noted that the IMR had declined between 1904 and 1906 which was significant because there was only a slight mortality peak in 1904 and no peak in 1906 despite both summers being warm and dry (Figure 3.10 showed how these summers affected Liverpool). Sykes concluded that this was due to 'the discouragement of the artificial feeding of infants of suckling age and the encouragement of natural or breastfeeding by prompt advice and the personal influence of Women Inspectors and Women Voluntary Visitors'.[3]

These themes were repeated in the last four reports, which all followed a similar format. Thus, in 1907 we learn the extent of the health visiting scheme, 'since the autumn of 1905 there have been some 21 Women Philanthropists intermittently working for various periods, and 14 Professional Women working for longer periods, about half of whom have since obtained public appointments'.[4] This work was reinforced by the setting up of the St Pancras Mothers' and Infants' Society which provided consultations, dinners for suckling mothers, lessons on food with an emphasis on feeding the mother, extra help during confinement, fathers' evening conferences on the duties of the father (with smoking allowed!) together with home visits. The methods adopted in St Pancras were enlightened and focused on the mother along with her infant, and as the MOH noted, '[a]ll this work is essentially work for women and not for men'.[5]

The 1907 Notification of Births Act came into force on 9 March 1908. In 1908 only 54 per cent of births were notified within 36 hours, but this figure increased to 76 per cent in

1 J.F.J. Sykes, *Fifty-First Annual Report of the Medical Officer of Health on the Vital and Sanitary Condition of St Pancras, Middlesex: Report for the Year 1906* (London, n.d.), p. 26. The 'reward' of one shilling followed the famous Huddersfield scheme initiated by the Chairman of the Health Committee Benjamin Broadbent and S.G.H. Moore the MOH: see C. Parton, 'The infant welfare movement in early twentieth century Huddersfield', *Journal of Regional and Local Studies,* 3 (1983), pp. 69-77; H. Marland, 'A pioneer in infant welfare: the Huddersfield Scheme 1903-1920', *Social History of Medicine*, 6 (1993), pp. 25-50. The Huddersfield scheme was similar to many others that were implemented around the beginning of the century, the main difference being the payment of 1s. for all notifications of births within 48 hours which allowed an early visit to be made by the health visitor. The scheme had only limited success in its first year of operation since the IMR in 1906 did not decline from that in previous years. However, in November 1904, to celebrate his election as mayor, Broadbent during his one year in office offered a sovereign to the parents of every infant born in Longwood, his village of birth, with payment to be made if the infant survived to its first birthday. While advice was posted to mothers during the diarrhoea season, no other help was offered yet the IMR was reduced from a decadal average of 122 to 53 in 1906 (p. 36).

2 Sykes, *Fifty-First Annual Report*, p. 25.

3 Sykes, *Fifty-First Annual Report*, p. 28. The MOH also noted that 'the lowering of the infantile mortality has been accomplished without the municipal distribution of milk'.

4 J.F.J. Sykes, *Fifty-Second Annual Report of the Medical Officer of Health on the Vital and Sanitary Condition of St Pancras, Middlesex: Report for the Year 1907* (London, n.d.), p. 23.

5 Sykes, *Fifty-Second Annual Report*, p. 24.

Table 3.12 Age distribution of infant deaths with infant mortality rates, St Pancras 1905 and 1910

	Weeks				Months												
Year	0	1	2	3	0	1	2	3	4	5	6	7	8	9	10	11	Total
1905 rate	26.6	5.9	4.7	5.6	42.6	16.6	15.6	8.6	6.6	11.0	7.1	4.0	6.4	6.2	6.6	4.7	135.7
Number of deaths	154	34	27	32	247	96	90	50	38	64	41	23	37	36	38	27	787
1910 rate	20.1	5.9	5.0	4.1	35.1	11.9	9.1	8.4	4.8	5.9	3.7	4.8	7.2	6.7	4.8	5.2	107.7
Number of deaths	108	32	27	22	189	64	49	45	26	32	20	26	39	36	26	28	580
Difference (1905 – 1910)	6.5	0	-0.3	1.5	7.5	4.7	6.5	0.2	1.8	5.1	3.4	-0.8	-0.8	-0.5	1.8	-0.5	28.0

Notes: The table of infant deaths in the 1905 report gives 5,811 births whereas previously it was stated that there were only 5,801 births (p. 15). In 1910 the table of infant deaths gives 580 infant deaths and 5,385 births which produce an infant mortality rate of 107.7 whereas the rate discussed elsewhere is 107.8 (p. 27). It is not known how these discrepencies arise.

Sources: J.F.J. Sykes, *Fiftieth Annual Report of the Medical Officer of Health on the Vital and Sanitary Condition of St Pancras, Middlesex: Report for the Year 1905* (London, n.d.), p. 29; J.F.J. Sykes, *Fifty-Fifth Annual Report of the Medical Officer of Health on the Vital and Sanitary Condition of St Pancras, Middlesex: Report for the Year 1910* (London, n.d.), p. 17.

1909 and 88 per cent in 1910.[1] Visits were targeted at those deemed to be in greatest need, in particular mothers living in the poorest streets which suggests that the MOH acknowledged a social gradient in infant mortality. In 1908 Somers Town was identified as an area of special concern with all births that occurred there being visited. In 1910 Sykes published a summary of the infant welfare work that had been carried out:

> Briefly the evolution of mothercraft in St Pancras was as follows:—At the beginning of this century distrust of artificial feeding of infants began to grow in St Pancras, until in 1902-3 all leaflets on artificial feeding were destroyed and no more distributed, and in 1904 to 1906 the experiment of persistently preaching breast-feeding entirely, and converging efforts upon the mother was carried to the well-known successful issue in the extraordinary fall of the summer mortality of infants in St Pancras, as compared with other boroughs and towns. In 1907 the St Pancras School for Mothers was started to provide medical consultations for those mothers and infants unable to procure medical advice, dinners for mothers suckling their infants, and educational demonstrations in mothercraft at the School and in the home.[2]

The encouragement of maternal breastfeeding, and perhaps of equal importance, a focus on the health of the nursing mother, lay at the heart of this work.

The success of the St Pancras scheme can be examined by comparing the age structure of infant mortality between 1905 and 1910 (Table 3.12). Whilst this period is rather short for such an analysis, 1905 represents the first year in which the measures adopted in St Pancras were fully implemented and 1910 is the end of our period. Table 3.12 shows that there was a decline in the IMR from 135.7 to 107.7, two thirds of which occurred within the first three months of life. Most of the decline occurred in the first week and amongst infants aged three to six months and it is interesting that there was little decline amongst infants aged over six months. In St Pancras the focus on breastfeeding appears to have helped combat infectious diseases while the emphasis on the health of the mother may have helped reduce perinatal mortality. Rates within some age groups increased between 1905 and 1910, although only by small amounts. Further insights can be gained by examining changes in causes of deaths between these dates (Table 3.13). As discussed above, reservations should be placed on all cause of death data in this period. It is apparent that there is a decline in all causes with the exception of the common infectious diseases of childhood. This was due to severe outbreaks of measles and whooping cough in 1910 which caused rates from these diseases almost to double compared with 1905 and this was why mortality amongst older infants increased slightly in 1910. The most striking feature of Table 3.13 is the dramatic decline in diarrhoeal mortality, a disease that was specifically targeted by the MOH. Likewise, all the other causes declined to varying degrees. It is notable that respiratory diseases declined by the next largest amount since this group of diseases was highlighted in the female sanitary officer's report.[3]

1 J.F.J. Sykes, *Fifty-Third Annual Report of the Medical Officer of Health on the Vital and Sanitary Condition of St Pancras, Middlesex: Report for the Year 1908* (London, n.d.), p. 26; J.F.J. Sykes, *Fifty-Fourth Annual Report of the Medical Officer of Health on the Vital and Sanitary Condition of St Pancras, Middlesex: report for the Year 1909* (London, n.d.), p. 25; J.F.J. Sykes, *Fifty-Fifth Annual Report of the Medical Officer of Health on the Vital and Sanitary Condition of St Pancras, Middlesex: report for the Year 1910* (London, n.d.), p. 25.

2 Sykes, *Fifty-Fifth Annual Report*, p. 29.

3 Sykes, *Fifty-First Annual Report*, pp. 37-8.

Table 3.13 Infant mortality rates by cause of death, St Pancras 1905 and 1910

	Rate		Difference
Cause	1905	1910	1905-1910
Common Infectious Diseases	8.1	15.6	-7.5
Diarrhoeal Diseases	27.8	11.1	16.7
Wasting Diseases	43.3	39.6	3.7
TB	5.0	2.4	2.6
Meningitis	4.5	1.5	3.0
Convulsions	3.3	2.6	0.7
Respiratory Diseases	25.0	19.7	5.3
Suffocation	5.3	3.2	2.1
Other	13.4	12.1	1.3
Total	135.7	107.7	28

Notes: 'Common infectious diseases' are: smallpox, chickenpox, measles, scarlet fever, diphtheria (croup), whooping cough; 'Diarrhoeal diseases' are: diarrhoea, enteritis, gastritis; 'Wasting diseases' are: premature birth, congenital defects, injury at birth, want of breast milk, atrophy, debility, marasmus; 'Respiraory diseases' are: bronchitis, laryngitis, pneumonia.

Sources: J.F.J. Sykes, *Fiftieth Annual Report of the Medical Officer of Health on the Vital and Sanitary Condition of St Pancras, Middlesex: Report for the Year 1905* (London, n.d.), p. 29; J.F.J. Sykes, *Fifty-Fifth Annual Report of the Medical Officer of Health on the Vital and Sanitary Condition of St Pancras, Middlesex: Report for the Year 1905* (London, n.d.), p. 17.

The pattern of age- and cause-specific decline appears to follow that which might have been expected from an examination of the measures taken to prevent infant mortality in St Pancras. Whilst such conclusions will need confirmation from other sources, this albeit circumstantial evidence seems sufficient to confirm that the early twentieth century decline in infant deaths was aided by the methods adopted by the council.

(c) Isle of Wight (1884-1910)

The Isle of Wight was split up into the urban district of Newport, the main town, and the rest of the island which formed the rural sanitary district of the Isle of Wight. During the early twentieth century a further urban district, East Cowes, was created. Here we will examine the rural reports to provide a counterweight to the urban examples discussed above. Joseph Groves was MOH from 1884 until 1906 after which J. Albert Gibson took over. By comparison with the urban reports already discussed, their reports tend be rather short: for example the 1884 report is only 44 pages in length with the first 20 pages describing geology and climate.[1] The IMR is reported, but with little comment other than to note that the rate of 85 per 1,000 live births, which was based on just 65 infant deaths, was much lower than that in the rest of the country (137). Accounts of other infectious diseases are given as are reports of sanitary improvements. The reports for 1885 and 1886 are identical in format and in 1887 the MOH, when discussing diarrhoea deaths noted that, '[s]o far as I could judge

1 J. Groves, *First Annual Report on the Health of the Rural Sanitary District of the Isle of Wight* (Newport, 1884). By comparison the 1895 report for the urban district is 14 pages long while the 1904 report for East Cowes was not published and exists only in typescript, see W. Foster, *1895 Annual Report on the Health of the Urban Sanitary District of Newport, Isle of Wight* (Isle of Wight, n.d.). The East Cowes report is available on the Wellcome website, although I could not decipher the signature of its author.

three of the children died from improper feeding and two from diarrhoea associated with teething'.[1] Joseph Groves remained in position until 1906 and all his reports follow a very similar format. He always reported the IMR and compared it to the national rate, but perhaps because his district was a rural one and the rate generally low there was no substantive discussion of the causes of infant mortality. Indeed, even in 1892 when the IMR rose to an unprecedented 143, this was not recorded as being of significance.[2] In 1906 a comprehensive breakdown of infant deaths by age and cause was given, but there was no follow-up discussion.[3] Indeed, with the IMR being under 100 for nearly every year throughout the period infant mortality was clearly a low priority for the MOH as is shown in the 1908 report, 'I have again to congratulate you on a low rate of infantile mortality, which, although higher than last year, bears a favourable comparison with other rural districts and small towns'.[4] Overall then, there is nothing in these rural reports to suggest that the MOH made any specific efforts to reduce IMRs.[5]

The three examples discussed above have revealed very different approaches to infant welfare. For most of the period in Liverpool the IMR was not calculated properly and infant health was ignored. Sparked by an increase in diarrhoea deaths during the 1890s, E.W. Hope began to investigate the problem and he laid the blame for high mortality rates squarely on the poor child-rearing methods of working-class mothers. It was not until the turn of the century that a policy of education via female health visitors was introduced. Milk depots were also opened during the early twentieth century. In St Pancras there was also a general neglect of infant mortality until the late 1890s when pamphlets about infant feeding began to be distributed. From 1904 maternal breastfeeding was promoted and measures aimed at improving the health of the mother introduced. In the rural parts of the Isle of Wight the IMR was always measured correctly, but there is no evidence that the MOH adopted any active intervention measures. The three districts therefore followed different strategies and it is instructive to compare patterns of infant mortality in these places (Figure 3.11). While significant annual variations occurred in all three districts, they also share the common underlying pattern that is evident at the national level (see Tables 3.2-3.5)—a variable, but largely stable rate until *c.* 1900 followed by decline. St Pancras shows this pattern more clearly and it might be tempting to conclude that the MOH's more enlightened policies brought greater rewards. Compared with Liverpool there was only a slight increase in mortality in 1904 and none in 1906, both years with hot summers associated with increases in diarrhoea deaths. There was also much less variation during the nineteenth century. IMRs in the rural

1 J. Groves, *Annual Report on the Health of the Rural Sanitary District of the Isle of Wight for the Year 1887* (Newport, n.d.), p. 12. Likewise, in 1888 J. Groves, *Annual Report on the Health of the Rural Sanitary District of the Isle of Wight for the Year 1888* (Newport, n.d.), p. 12 noted two diarrhoea deaths, one was aged over 90 years, 'the other was an infant of five months who died at Brading from infantile diarrhoea, the result of feeding with farinaceous food, the cause of so much infantile sickness'.

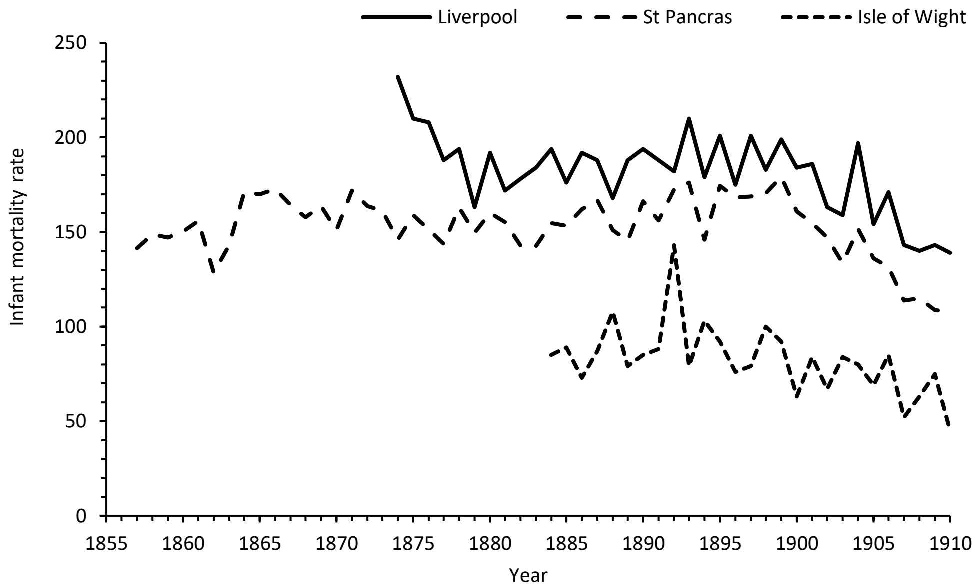
2 J. Groves, *1892 Annual Report on the Health of the Rural Sanitary District of the Isle of Wight* (Isle of Wight, n.d.), p. 5. Details of infant deaths were not given so the reasons why infant mortality increased during this year cannot be determined.

3 J. Groves, *1906 Annual Report on the Health of the Rural Sanitary District of the Isle of Wight* (Isle of Wight, n.d.), Table V, after p. 15.

4 J.A. Gibson, *1908 Annual Report on the Health of the Rural Sanitary District of the Isle of Wight* (Isle of Wight, n.d.), p. 3.

5 For the first time a section entitled 'Means of Prevention of Mortality in Childbirth and Infancy' was included in the 1911 report, but this was mainly concerned with midwifery, see J.A. Gibson, *1911 Annual Report on the Health of the Rural Sanitary District of the Isle of Wight* (Isle of Wight, n.d.), pp. 52-4.

Figure 3.11 Infant mortality rates in Liverpool, St Pancras and Isle of Wight (rural), 1857-1910



Source: Liverpool, St Pancras and Isle of Wight (rural) Medical Officer of Health reports (various years).

parts of the Isle of Wight were low; they appear to have declined slightly before 1900, stayed at the same level until 1906, and afterwards declined again. These three examples suggest that there must have been strong national forces governing the overall course of infant mortality, notwithstanding that local policies could make a difference. The enlightened policies adopted in St Pancras appear to show what was possible, but it will be necessary to examine a wider set of reports before making more general conclusions.[1] It does seem however that the MOHs were slow to identify infant mortality as being a public health problem that could and should be tackled. Certainly before about 1900 the reports reveal a general neglect of this issue and it was only after an increase in diarrhoea deaths towards the end of the nineteenth century that infant health gained a higher profile. Perhaps this was because it was thought that this disease could be tackled by sanitary improvement which after all was the MOH's primary objective. Even after health visiting had been implemented,

1 In Birmingham the MOH, Alfred Hill, identified many of the causes of infant mortality as early as 1877, yet these were not addressed systematically and health visitors were only appointed in 1899. Visits increased during the early decades of the twentieth century, but the impact on infant mortality was limited with the more prosperous outer districts, which generally received few visits, witnessing greater declines than the poorer districts where the vast majority of visits were made. By comparison, Sheffield also introduced female health visitors in 1899, but the city appears to have been less active in promoting infant welfare than Birmingham. Nevertheless, after 1900 IMRs declined at similar rates in both cities. See the discussion in C. Galley, 'Social intervention and the decline of infant mortality'; M. Drake, 'Surely they made a difference? Health visitors in Birmingham and Sheffield in the 1900s', *Local Population Studies*, 76 (2006), pp. 63-9; C. Galley, 'Health visitors: How much difference did they make? A reply to Michael Drake', *Local Population Studies*, 76 (2006), pp. 69-75; R.J. Proctor, 'Infant mortality: a study of the impact of social intervention in Birmingham 1873 to 1938' (unpublished Master of Philosophy thesis, University of Birmingham, 2011).

given the delay between birth and registration, many infants had died or were already being fed inappropriate foods before visits could be made and advice given.[1] MOHs could make a difference, but before 1910 their ability to influence rates was limited.

Discussion and conclusion—infant mortality, 1837-1910

On the evening of 20 May 1840 William Groves, a clockmaker, left a candle burning in the tower of York Minster. A fire broke out which spread to the nave roof destroying the wooden structure. Fortunately, John Browne had already undertaken an extensive study of the medieval building which meant that drawings had been made of all the nave roof bosses, originally carved before 1360.[2] This enabled accurate copies to be made when the roof was reconstructed. One of these is of particular interest. It is 'a representation of the Nativity, or of the infant Jesus, his blessed Mother, and St Joseph at Bethlehem. The Blessed Virgin is giving nourishment to the Holy Infant, whilst St Joseph appears to be asleep' (see front and end covers).[3] One significant detail was changed in the nineteenth century reconstruction. In the medieval boss Jesus is being breast-fed (end cover) while in the Victorian 'copy' (front cover) he is bottle fed. Given what we know about the dangers of artificial feeding, if indeed Jesus was fed in this way, then he was lucky to have survived infancy. Do these roof bosses suggest that Victorian mothers were more likely to bottle feed their infants? Or was it simply the case that the York Minster Victorian nativity roof boss reveals that it was not considered appropriate to show the Virgin's breast in a public place of worship, even at a height of 27 metres?[4] The answers to these questions are unknown, but the first is of crucial importance to any understanding of infant mortality in the Victorian period.

The single most important factor in infant welfare was the mother, in her ability both to provide appropriate care for her child and to shield him or her from the threats posed by the domestic and wider public environments.[5] Even in the harshest of conditions good, effective parenting can mitigate the worst socio-economic circumstances and, in the first instance, the best way of achieving this is via maternal breastfeeding. Alternatives to breastfeeding, dry or wet nursing, have a long history and were favoured by some mainly richer individuals, although from the mid eighteenth century onwards the medical profession began actively to encourage maternal breastfeeding. By the end of the nineteenth century, it was noted by many MOHs that artificially-fed infants were at a much higher risk of dying and maternal breastfeeding was promoted as the means by which diarrhoea deaths amongst the poor could be reduced. Figure 3.12, dating from the early twentieth century, starkly

1 The IMR for England and Wales in 1905 was 128 per 1,000 births and the neonatal rate 42 which means that 32.8 per cent of infant deaths occurred in the neonatal period, Registrar General, *Sixty-Eighth Annual Report of the Registrar General for 1905* (London, 1907), pp. cxxii-cxxiii, BPP 1906 XX. This means that if the delay in registration in the rest of the country was similar to that in St Pancras a significant proportion of infants would not have received any benefits from health visiting.

2 J. Browne, *The History of the Edifice of the Metropolitan Church of St Peter York, Volume 1 Text, Volume 2 Plates* (London, 1847).

3 Browne, *History of the Edifice, Volume 1,* p. 141. The Virgin breastfeeding her child was a common subject in medieval times, see S. Laurence, *The Hand that Rocked the Cradle: the Art of Birth and Infancy* (Norwich, 2018), p. 101.

4 Medieval sculptors did not have such scruples. At the top of a column close to the choir in York Minster there is a carving of a man inserting a carrot into the backside of a donkey.

5 Williams and Galley, 'Urban-rural differences', Figure 4, p. 417.

Figure 3.12 Four Liverpool families in 1913

Notes: Clockwise from top left the captions read:
Ten children born, two living. Mother states that the children had been breast-fed. Father a dock labourer
Ten children born, all living. All children breast-fed. Father a Corporation labourer
Eleven children born, all living. All children breast-fed. Father a fish hawker
Fifteen children, four living. All children artificially fed after first few weeks. Father is an iron moulder.

Source: E.W. Hope *Report on the Health of Liverpool during 1913* (Liverpool, 1914), following p. 72.

illustrates the perils of artificial feeding and poor parenting, thereby supporting the MOH's belief that by targeting those families at greatest risk IMRs could be reduced.[1] The issue of maternal breastfeeding is therefore crucial to all discussions of infant mortality, but little evidence of population-wide breastfeeding rates in the Victorian period appears to exist and quite simply we do not know enough about this topic.[2]

Compared with the parish register period, the relatively low IMRs that were experienced throughout the Victorian period, even in the cities, suggest that maternal breastfeeding must have been widespread. In 1870 William Farr made a request to the Obstetrical Society of London to help him gather information about infant mortality. He asked a series of questions, one of which concerned infant feeding. He received the following reply:

> Among the married poor suckling is evidently the rule, and a large amount of testimony is borne to the fact that it is often unduly protracted, even to eighteen months and two years, for the most part with the hope that it may prevent a rapid recurrence of pregnancy. Illegitimate children among the poor, on the other hand, are rarely suckled … Among the upper classes it would appear that the tendency for mothers not to suckle their children is on the increase.[3]

The same report also indicated that it was common to administer a mild purge to the new-born, especially in rural areas, while the sale of opium-based products to pacify babies appears to have been widespread, although not in the 'agricultural villages'.[4] The extent to which changes in breastfeeding occurred during the nineteenth century remains unknown. With respect to social variations in breastfeeding, anecdotal evidence exists. Anthony Trollope in his novel Dr Thorne wrote:

> Of course Lady Arabella could not suckle the young heir herself. Ladies Arabella never can. They are gifted with the powers of being mothers, but not nursing-mothers. Nature gives them bosoms for show, but not for use.[5]

Judith Flanders argues that many advice books promoted the convenience of bottle feeding and from the 1860s formula milk became increasingly available.[6] Flanders is wrong however

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1 In discussing these families Liverpool's MOH stated, '[t]he method of feeding and habits of the parents, appear to be important factors in the welfare of the children', E.W. Hope, *Report on the Health of Liverpool during 1913* (Liverpool, 1914), p. 71.

2 C.H.F. Routh, *Infant Feeding and its Influence on Life,* 2nd edn (London, 1863), pp. 10-8 discusses some quantitative evidence for nineteenth-century infant feeding methods. The pioneering work of Valerie Fildes deals mainly with the post-Victorian period: see V. Fildes, 'Breast-feeding in London, 1905-19', *Journal of Biosocial Science*, 24 (1992), pp. 53-70; V. Fildes, 'Infant feeding practices and infant mortality in England, 1900-1919', *Continuity and Change*, 13 (1998), pp. 251-80.

3 Registrar General, *Thirty-Fourth Annual Report*, p. 226.

4 Registrar General, *Thirty-Fourth Annual Report*, pp. 225 and 227. The amount of opium-based products sold, such as Godfrey's Cordial, was said to be 'enormous'. See pp. 110, 113 for a discussion of the administration of purges to the new-born.

5 A. Trollope, *Doctor Thorne*, 11th edn (London, 1868), p. 27. Trollope continues, '[s]o lady Arabella had a wet-nurse. At the end of six months the new doctor found that Master Frank was not doing quite so well as he should do; and after a little trouble it was discovered that the very excellent young woman … was fond of brandy'.

6 J. Flanders, *The Victorian House* (London, 2003), pp. 22-5. Ross, *Love and Toil*, p. 142, discusses artificial infant feeding and says that by 1883 'there were twenty-seven different brands of patent foods available in England'. See also I.G. Wickes, 'A history of infant feeding: part IV: nineteenth century continued', *Archives of Diseases in Childhood*, 28 (1953), pp. 416-22.

in stating that Mrs Beaton thought bottle feeding 'more nutritious'; indeed she enthusiastically promoted breastfeeding: '[n]ature has placed in the bosom of the woman the natural food of her offspring'.[1] What is true is that infant feeding products began to proliferate during the second half of the nineteenth century. Lebert's so-called *Treatise on Milk* published in 1868 by Nestlé promoted that company's products and even suggested that mothers needed to use them for supplementary feeding:

> We are consequently, always led back to the necessity of possessing a substitute for the milk of the woman and of the cow, which may be easily obtainable everywhere, and always of the same uniform quality, both rich in nutritive substances, and easy of digestion, as well as especially adapted for the support and growth of the infant. Before going further I must here combat the prejudice that, when the mother can really suckle the child, every other kind of food is to be carefully avoided. The mother has often an abundant supply of milk only during the first six or eight weeks … I am in favour of partially feeding the child, especially when no particular consideration on the score of health stands in the way.[2]

The most extensive study of the increase in artificial feeding in England, together with its negative effects on infant health, was undertaken by Anne Elizabeth Roberts.[3] While she provided a comprehensive discussion of the nineteenth-century literature, her assertion that between '1850 and 1900, the breastfeeding of babies as their principal means of nourishment declined progressively in favour of feeding with the "sucking bottle" and artificial foods' was not supported by quantitative evidence.[4] The late nineteenth century witnessed a growth in the promotion of infant feeding products, with advertising being common in women's magazines, newspapers and even on the front of horse-drawn omnibuses (Figure 3.13).[5] This suggests that more of these products must have been sold, but quantitative data about artificial feeding and the precise way it was carried out is hard to obtain and none appears to exist that covers the whole of the period 1860-1910. There is a possibility that the new propriety brands were mainly used by the upper and middle classes and their better living conditions enabled them to shield their infants from the wider environment or, perhaps, that these products were mainly used for supplementary feeding and simply replaced other

1 I. Beaton, *The Book of Household Management* (London, 1861), p. 1,034. She also wrote that '[n]ature is the best nurse' (p. 1,025) and thought that breastfeeding should continue, with some supplementary feeding, for between 9 and 15 months. Advice on alternative foods was only offered 'if the mother was deprived of the pleasure of rearing her infant' (p. 1,022).

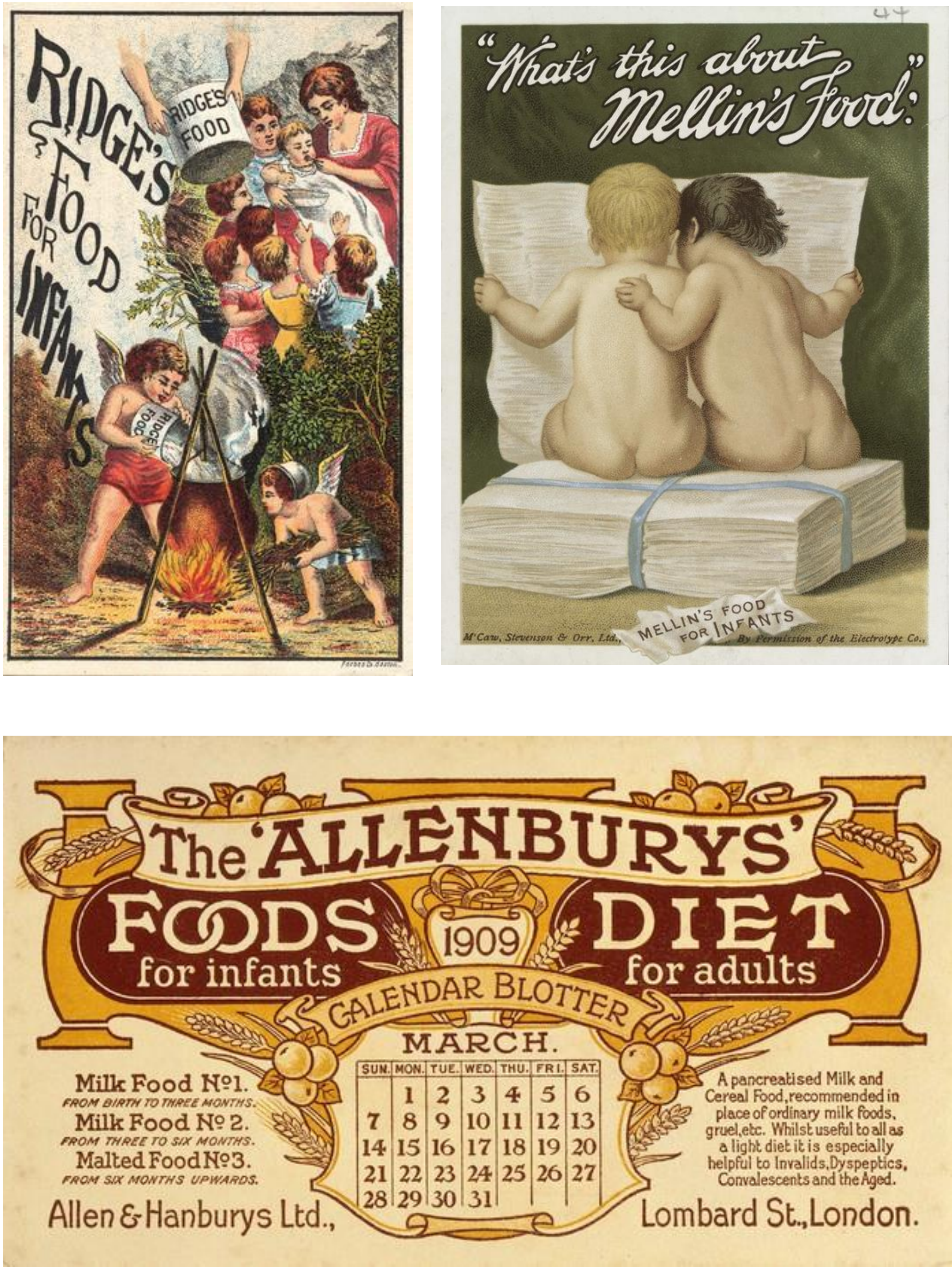
2 H. Lebert *A Treatise on Milk and Henri Nestlé's Milk Food, for the Earliest Period of Infancy and in Later Years* (Vevey, 1878), pp. 22-3.

3 A.E. Roberts, 'Feeding and mortality in the early months of life; changes in medical opinion and popular feeding practice, 1850-1900' (unpublished Ph.D thesis, University of Hull, 1973).

4 Roberts, 'Feeding and mortality', p. 24. Her thesis is devoid of tables or graphs.

5 For example, the front page of *The Daily Mail* of 11 August 1902, which was a special edition to commemorate the coronation of Edward VII, was entirely taken up with an advertisement for Mellin's food. This depicted a child on a throne together with the quote '[t]he child who possesses the splendid gifts of health and strength wields a sceptre more powerful than that of kings'. A video of London omnibuses around 1900 with a prominent advertisement for Nestle's milk can be found at www.youtube.com/watch?v=W8vxycnbDGA [accessed 1 January 2021]. Also see E. O'Brien, P. Myles and C. Pritchard, 'The portrayal of infant feeding in British women's magazines: a qualitative and quantitative content analysis', *Journal of Public Health*, 39 (2016), pp. 221–6, which examines attitudes to infant feeding in the twenty-first century. A similar study of Victorian attitudes would be welcome.

Figure 3.13 Victorian and Edwardian advertisements for infant foods



Source: © Wellcome Images

Table 3.14 Infant feeding methods in 5,358 houses, Brighton, 1903-1904

	Inspection of 608 infants				Diarrhoea Deaths, 1903-1904			
	Age in months				Age in months			
Feeding method	0-3	3-6	6-9	9-12	0-3	3-6	6-9	9-12
I—suckled only	133	104	90	55	4	3	-	-
ditto and farinaceous food	10	15	14	24	1	1	-	1
Ditto and cow's milk	5	3	1	2	1	-	-	-
ditto and condensed milk	1	3	2	-	1	-	-	-
II—cow's milk only	6	14	11	12	5	17	5	1
ditto and farinaceous food	3	15	19	19	1	-	3	6
III—condensed milk only	-	6	6	10	1	12	11	4
ditto and farinaceous food	1	4	6	2	-	3	-	-
IV—patent food only	3	1	-	3	1	-	-	-
V—farinaceous food or 'same food' as parents	-	-	-	5	-	-	-	-
VI—unknown	-	-	-	-	1	2	1	1
Total	162	165	149	132	16	38	20	13

Note: A total of 5,358 homes were inspected.

Source: A. Newsholme, *Annual Report on the Health, Sanitary Condition, &c. of the County of Brighton for the Year 1904* (Brighton, 1905), p. 46.

even more unwholesome foods. If there was an increase in artificial feeding, it needs to be set against the general decline in IMRs, and the adoption of scientific infant feeding could be an interesting example of supposedly 'better' childcare practices leading, inadvertently, to more infants being at risk of infantile diarrhoea, thereby paralleling concerns in many less economically developed countries during the late twentieth century.

Towards the end of the nineteenth century many MOHs working in the towns began to recognise that artificial feeding by some women posed a serious threat to infant health and studies were undertaken to determine the risks involved with different feeding methods. Table 3.14 illustrates the type of data that was collected. It derives from a house-to-house enquiry carried out by Arthur Newsholme, Brighton's MOH, into 'the method of feeding of all infants in the poorer streets in the town'.[1]

Information was gathered from 5,358 houses which contained 608 living infants and 87 infants who had died from epidemic diarrhoea. It should be noted that no attempt was made to collect data from better-off households, presumably because they were not thought to be affected by epidemic diarrhoea to any great degree. Table 3.14 shows that 63 per cent of infants in the enquiry were breastfed only, although an additional 13 per cent were given

1 A. Newsholme, *Annual Report on the Health, Sanitary Condition, etc. of the County of Brighton for the Year 1904* (Brighton, 1905), p. 45. For other examples see Fildes, 'Breastfeeding in London'; Fildes, 'Infant feeding practices'; Woods, *Demography of Victorian England and Wales*, pp. 287-9; H.R. Jones, 'The perils and protection of infant life', *Journal of the Royal Statistical Society*, 57 (1894), pp. 1-98, here at p. 82; W.J. Howarth, 'The influence of feeding on the mortality of infants', *The Lancet* (22 July 1905), pp. 210-3.

supplementary foods along with breast milk. Comparative figures for those that had died from diarrhoea were 8 and 6 per cent respectively. Table 3.14 also shows that relatively few of these poor infants were fed on patent foods. Instead, cow's milk, in one form or another, was the main substitute or supplement to breast milk. Thus, the data contained in Table 3.14 were sufficient for Newsholme to assert the superiority of breast over artificial feeding and for him to conclude that 'milk is probably the most common vehicle for the infection of diarrhoea' with condensed milk being especially dangerous.[1] However, Table 3.14 is not ideal for those seeking to understand the impact of breastfeeding on infant mortality. It does not provide information on exactly when and why supplementary foods were introduced or breastfeeding ceased. It would also be of interest to know whether infants were also given water since an impure supply might have had a detrimental effect on their health. Likewise, it would be useful to know about the impact of different infant feeding regimes on other causes of death. The vast majority of data about breastfeeding comes from the early twentieth century, after the secular decline in infant mortality had begun, and consequently change over time cannot be judged. Valerie Fildes, in her extensive analysis of breastfeeding in London during the first two decades of the twentieth century found that about 90 per cent of infants were breastfed at one month, 80 per cent at three months and 70 per cent at six months, and that the main reasons for early weaning related to an inability to continue breastfeeding, usually due to the ill health of the mother, rather than a wish to do so.[2] Fildes' London data was culled from MOH reports so, as with Table 3.14, her conclusions mainly apply to the poor. Her subsequent wider analysis of infant feeding in other parts of England largely confirmed her results, subject to some local variation, and she also argued that artificial feeding was largely confined to the upper and middle classes, who were usually able to do this safely, and illegitimates whose mothers were often unable to breastfeed due to their economic circumstances.[3] While all Fildes' data come from after the period when many MOHs had begun to make efforts to increase breastfeeding rates, she concluded that 'the incidence of breast-feeding in London was not declining, may have been higher than contemporaries estimated, and in the poorest areas probably could not have been improved upon'.[4] Evidence for breastfeeding rates amongst illegitimates seems especially lacking, but illegitimate IMRs were given for the country as a whole in 1906 (Table 3.15).[5] The excess illegitimate IMR increased steadily during the first weeks, reaching a peak at two months when illegitimate mortality was 2.7 times that of legitimates. Afterwards this excess slowly declined and this pattern is consistent with some illegitimate infants being breastfed for the

1 Newsholme, *Annual Report on the Health, Sanitary Condition, etc. of the County of Brighton for the Year 1904*, pp. 45-9, quotation on p. 45. Newsholme also believed that some of those infants, aged 9-12 months, who were recorded as being breastfed were also receiving supplementary foods (p. 47).

2 Fildes, 'Breastfeeding in London', p. 53.

3 Fildes, 'Infant feeding practices'.

4 Fildes, 'Breastfeeding in London', p. 64. According to P.J. Atkins, 'Mother's milk and infant death in Britain, circa 1900-1940', *Anthropology of Food*, 2 (2003), pp. 1-9, here at p. 3, '[d]ata collected by Medical Officers of Health in the period 1907-1930 suggest that an average of about 85 per cent of babies were breast-fed in their first two months of life'.

5 Registrar General, *Thirty-Eighth Annual Report*, p. xlvi, discussed illegitimate mortality in 12 high and 12 low mortality districts and discovered, with some local variation, that illegitimates also suffered about the twice the mortality of legitimates at this date (1875). Glass, *Numbering the People*, p. 184 argues that, while these rates would have been 'relatively reliable' they would have been 'depressed by the exclusion of infants who, dying shortly after birth, had been falsely certificated as stillbirths or whose birth and death had both been concealed' with illegitimates having been more affected than legitimates.

Table 3.15 Illegitimate and legitimate infant mortality rates in the first year of life, England and Wales, 1906

	Proportion of deaths among illegitimate/legitimate deaths to 1,000 illegitimate/legitimate births																
	Weeks				Months												Under
	< 1w	1w	2w	3w	<1m	1m	2m	3m	4m	5m	6m	7m	8m	9m	10m	11m	1 year
Illegitimate	41.59	11.98	13.75	10.27	77.59	34.37	29.02	22.31	19.66	14.68	13.85	11.74	10.88	9.87	8.29	9.09	261.3
Legitimate	24.29	5.85	5.92	4.35	40.41	13.47	10.69	9.68	8.25	7.77	7.12	6.59	6.37	5.99	5.51	5.28	127.13
Illegitimate/ Legitimate	1.7	2.0	2.3	2.4	1.9	2.6	2.7	2.3	2.4	1.9	1.9	1.8	1.7	1.6	1.5	1.7	2.1

Source: Registrar General, *Sixty-Ninth Annual Report of the Registrar General* (London, 1908), pp. cxxviii-cxxix, British Parliamentary Papers 1908 XVII.

first few weeks and then increasing numbers being fed artificially. Illegitimate IMRs were high throughout the first year, and indeed into the early years of childhood, but the mortality differential between illegitimate and legitimate births lessened when infectious diseases became a more prominent cause of death. Overall, the illegitimate IMR was just over twice the legitimate rate, although the illegitimate mortality rate from common infectious diseases was only slightly higher than the legitimate rate, whereas the illegitimate mortality rate from diarrhoeal diseases was 2.3 times higher.[1]

While more information is needed about breastfeeding patterns to resolve how any changes may have impacted on the secular decline in infant mortality, other influences can be more readily assessed. In the first instance it is useful to examine the opinions of those whose job it was to lower rates. As with many demographic phenomena, there was a lag between the event happening and it being identified to have happened. A decline in infant mortality was first mentioned by the Registrar General in his Annual Report for 1906 which was not published until 1908:

> since the close of the century, however, the subject of the waste of infant life, formally treated with apathy, has received close and increasing attention from all classes of the community, and to this awakening may fairly be ascribed some portion of the decline in the rate of infantile mortality that has taken place during the past few years.[2]

That an increase in public consciousness was responsible for some of the early twentieth century decline was also noted by Arthur Newsholme in his memoir, *Fifty Years in Public Health*.[3] Looking back from 1935, Newsholme argued that little of substance was achieved during the nineteenth century. For instance, the distribution of printed bills of instruction had little impact and in some cases they were even misunderstood, '[t]he directions as to methods of feeding infants, when artificial feeding became necessary, having been regarded as recommendations of artificial in lieu of breastfeeding'.[4] The attack on infantile diarrhoea yielded results only from 1901 once MOHs began to systematically target the disease, but the effects of the health visiting and child welfare centres were 'to be seen chiefly in the years following 1905 or even 1908'.[5] Newsholme thought that the decline in the IMR was brought about by the cumulative effect of the various initiatives:

> We must divide the credit for the steady reduction of infant mortality in the first years of the present century between the relatively small amount of specialised child welfare work and the general enlightenment of the population, the work done in sanitary administration in educating the public mind and

1 The mortality rate in the first year of life from common infectious disease was 7.9 for illegitimates and 7 for legitimate (1.1 times higher), while for diarrhoeal diseases rates were 70 and 31.1 (2.3 times higher): see Registrar General, *Sixty-Ninth Annual Report*, p. cxxx. Furthermore, urban illegitimates were 2.1 times more likely to die that urban legitimates while rural illegitimates were only 1.7 times more likely to die. These differences are consistent with the greater difficulties of artificial feeding in an urban environment.

2 Registrar General, *Sixty-Ninth Annual Report*, p. xxxvii. It is always difficult to identify when variation becomes permanent decline.

3 A. Newsholme, *Fifty Years in Public Health* (London, 1935), 321-46. See Woods, *Demography of Victorian England and Wales*, pp. 281-9 for a discussion of Newsholme's approach to tackling infant mortality.

4 Newsholme, *Fifty Years*, pp. 324-5, which summarises the work of Dr John Sykes, MOH for St Pancras.

5 Newsholme, *Fifty Years*, p. 332.

> conscience, and the improvement in domestic sanitation and personal hygiene resulting from these more general sources of enlightenment and reform.[1]

Writing in 1939, George Newman also attributed the decline to enlightenment, this time of mothers:

> It was this almost universal *maternal awakening* which really began to change the outlook of child health – as every Medical Officer of Health knew in his own district between 1904 and 1910. … Best and most effective of all was the wide extension of maternal knowledge, understanding, aptitude and practice of infant nurture and management.[2]

Even though it took a while for the various messages of the infant welfare movement to reach their chosen targets, many indirect benefits were forthcoming, and it is therefore not surprising that the better educated middle classes managed to achieve some of the greatest improvements in infant health. The effectiveness of the various measures adopted, both direct and indirect, would also have varied from household to household as shown in Figure 3.12, and this (in part) may help to explain the complex relationship between class and place noted above. The activities of the infant welfare movement achieved national prominence after many recruits to the British Army during the Boer War (1899-1902) were found to be physically unfit for service. The Government launched an enquiry with wide terms of reference and the resulting *Report of the Inter-Departmental Committee on Physical Deterioration*, published in 1904, concluded: 'where the tendency to a decrease in the birth-rate becomes more or less noticeable, the means by which infant mortality can be averted present a social problem of the first order'.[3] The report investigated various issues relating to infant health and devoted considerable space to the ways in which IMRs could be reduced. Its publication stimulated discussion of child welfare issues and George McCleary, writing in 1933 commented that:

> [i]nfant welfare became not only popular but fashionable. It had 'news value' for journalistic purposes, and was a favourite subject for addresses at drawing room meetings.[4]

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1 Newsholme, *Fifty Years*, p. 335.

2 G. Newman, *The Building of a Nation's Health* (London, 1939), p. 318. Writing earlier, E. Pritchard, 'Infant mortality and the welfare movement', *Contemporary Review*, 120 (1921), pp. 76-82, here at p. 79, had argued that infant health was affected by 'concentric zones of environment outside the home', about which the mother had no control. However, the mother was the 'mistress of the immediate environment of the child' and decline was achieved only after mothers were given sufficient knowledge to ensure their infant's survival. Similarly, J. Wheatley, 'Discussion of factors contributing to the recent decrease in infantile mortality', *British Medical Journal*, (27 October 1923), pp. 754-9, here at p. 758, concluded that the greatest improvements were brought about through better education.

3 Inter-Departmental Committee on Physical Deterioration, *Report of the Inter-Departmental Committee on Physical Deterioration: Vol. I Report and Appendix* (London, 1904), p. 44; also see Inter-Departmental Committee on Physical Deterioration, *Report of the Inter-Departmental Committee on Physical Deterioration: Vol. II List of Witnesses and Minutes of Evidence* (London, 1904) and Inter-Departmental Committee on Physical Deterioration, *Report of the Inter-Departmental Committee on Physical Deterioration: Vol III Appendix and General Index* (London, 1904); L. Brunton, 'The report of the Inter-Departmental Committee on Physical Degeneration', *Public Health*, 19 (1905), pp. 274-92; B. Bentley, 'Health and politics: the British Physical Deterioration Report of 1904', *Bulletin of the History of Medicine*, 39 (1965), pp. 143-53.

4 G.F. McCleary, *The Early History of the Infant Welfare Movement* (London, 1933), p. 112 quoted in R.A. Meckel, *Save the Babies* (Ann Arbor, 1980), p. 104.

By contrast with the comments made by Newsholme, Newman and some of the more perceptive writers on infant health, individual MOHs expressed a wide variety of views as to the causes of infant mortality decline. In response to a 1923 survey conducted by James Wheatley, county MOH for Shropshire, of 44 urban MOHs:

> twenty-five give health visiting and child welfare, or better midwifery services as the chief cause. Two give better education, four reduced birth rates, five improved sanitation and social conditions, two dried milk, and six are indefinite or refrain from making any statement.

Of 42 county MOHs:

> twenty-three give child welfare work as the chief cause, one ante-natal work, five general education, two improved standard of living, three improved sanitation, three horse traffic replaced by motor traffic, three cleaner milk, one the equable climate of late years, and one gives no reason.[1]

The majority of MOHs mentioned child welfare work, but their responses encompass just about the entire range of factors that have been posited to account for the fall in infant mortality and this lack of consensus suggests that, even by 1923, MOHs had not developed a consistent set of policies aimed at driving down IMRs. This diversity of opinion also makes it difficult to disentangle how the various influences on infant mortality operated. Moreover, if Newsholme and Newman were correct and it was maternal enlightenment that made the crucial difference, then this assertion remains difficult to assess. Measures of maternal education exist, such as the ability to sign a marriage register or the level of schooling attained; however, assessing both the level of knowledge needed to protect an infant from the threats posed by the domestic and wider environments and unravelling the pathways by which that knowledge was transmitted, are much more difficult to determine and may always remain elusive.

Protecting infants was a complicated process and real progress only began to be made during the twentieth century. There was a tension between the threats posed by the external environment and the ability of mothers to overcome these threats and this implies that the social variations that were evident at the beginning of the twentieth century should also have occurred earlier. Moreover, some families appear to have been increasingly able to mitigate the various environmental threats despite adopting artificial infant feeding methods. Some decline occurred in the nineteenth century, although it was offset by the worsening conditions in towns and cities, and this suggests that the causes of infant mortality decline are linked inextricably with those of fertility and early childhood mortality. The combined effects of fertility decline, improved female education and what can generally be termed the ‘health of towns’ movement began to have an impact, but this was reversed during the late nineteenth century when unfavourable climatic conditions created an increase in mortality and the various problems relating to infant health were only addressed successfully once targeted social intervention became increasingly effective during the early twentieth century. Moreover, these changes were part of a wider pan-European phenomenon as similar declines, albeit at different rates and from different levels, occurred throughout western

1 Wheatley, ‘Discussion of factors contributing to the recent decrease’, p. 755. There is an arithmetical error in the original as Wheatley stated that replies were received from only 40 counties.

Europe, north America, Australia and New Zealand, which suggests that similar underlying factors affected all these societies.[1]

Thus, while the broad outline of change is well understood, the exact way in which the various influences on infant mortality operated have yet to be fully delineated and this is mainly because large scale family-level data are lacking. As we have seen, local sources such as the Sheffield death register and MOH reports may in some instances be able to fill gaps in our knowledge, but it is likely that some issues will not be fully resolved until access to individual birth, death and marriage certificates becomes more widely available. In the meantime, further progress can be made by analysing those sources already in the public domain. Figure 3.14, adapted from Figure 1.4, shows the determinants of infant mortality in this period and can be used both as a template for understanding the likely causes of change and in setting an agenda for future research. Reading from left to right, three important factors relating to whether or not the infant becomes exposed to something that may cause its death are identified. Once exposure has occurred this may lead to illness or even death. However, as Figure 3.14 shows, at all stages in this process effective intervention is possible by taking measures to reduce exposure, by using prophylactics such as vaccination, or by developing better treatments. Thus inherited disorders, which often resulted in deaths from causes such as premature birth and atrophy, were influenced by the health of the mother which in turn may have been affected by her reproductive history. These types of disorder mainly affected endogenous or neonatal mortality, but unfortunately, neonatal deaths for England and Wales were only published between 1839 and 1846 and from 1905 and cause of death data are not sufficiently detailed to allow endogenous mortality to be calculated directly.[2] Deaths were reported for England and Wales and London at 0-3, 3-6 and 6-12 months from 1888 and each series of rates exhibited a pattern similar to that of the IMR. The trend in neonatal mortality is unknown, but it could have remained relatively stable throughout the nineteenth century since in 1905, after the overall IMR had begun to decline, the rate was still 42 per 1,000 live births which was not dissimilar to the 47 calculated for the years 1839-1846.[3] Between 1905 and 1920 the IMR declined by 43 per 1,000 births, while the neonatal rate only declined by 7 per 1,000 and first week mortality by 3 per 1,000.[4] If neonatal and, by implication, endogenous mortality remained largely invariant during the nineteenth century this would suggest that any improvements in maternal health brought about little change in the IMR. Evidence concerning stillbirths would be useful to confirm this supposition, but the exact trend is unknown even though the evidence that does exist

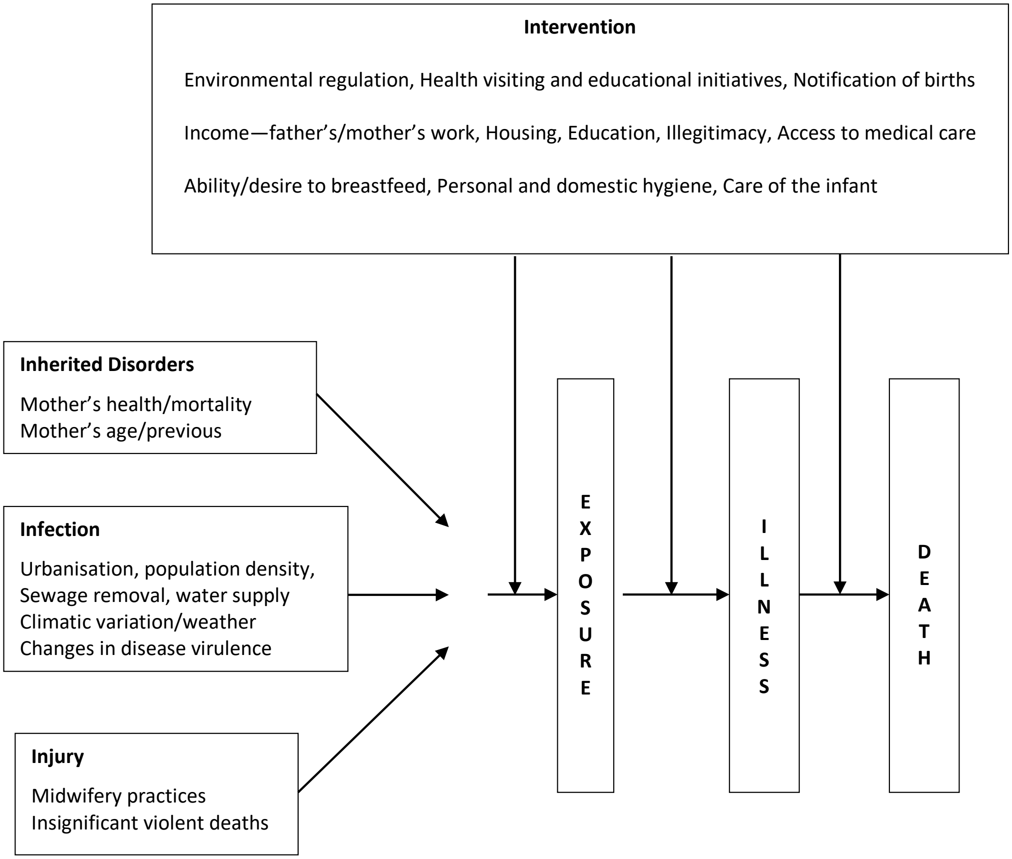
1 See the individual contributions in C.A. Corsini and P.P. Viazzo (eds), *The Decline of Infant Mortality in Europe—1800-1950—Four National Case Studies* (Florence, Italy, 1993); C.A. Corsini and P.P. Viazzo (eds), *The Decline of Infant and Child Mortality: the European Experience, 1750-1990* (The Hague, Netherlands, 1997) and A. Bideau, B. Desjardins and H.P. Brignoli (eds), *Infant and Child Mortality in the Past* (Oxford, 1997).

2 See pp. 52-3 for a discussion of the usefulness of Bourgeois-Pichat's method for calculating endogenous mortality rates.

3 Registrar General, *Eighth Annual Report*, pp. 84-5, 154-5; Registrar General, *Ninth Annual Report*, p. 119; A. Macfarlane *et al.* (eds) *Birth Counts: Statistics of Pregnancy and Childbirth*, Vol. 2 (London, 2000), p. 29.

4 Post-neonatal mortality therefore declined by 36 per 1,000, Macfarlane *et al.*, *Birth Counts*, p. 29. See also C. Galley and R. Woods, 'On the distribution of deaths during the first year of life', *Population: an English Selection*, 11 (1999), pp. 35-60, here at p. 49.

Figure 3.14 Determinants of infant mortality in the Victorian and Edwardian periods



suggests little change occurred.[1] Likewise, injuries at birth, and those inflicted either deliberately or by accident, were low throughout the period and changed little (see Table 3.11 for example). Cases of infant neglect and infanticide were highlighted in the press, but they were rare and of little demographic importance.[2] Discussion of infants being overlaid in bed and dying from suffocation occurred in some MOH reports with their incidence tending to increase at the weekends—the implication being that the parents were drunk

1 R. Woods and C. Galley, *Mrs Stone and Dr Smellie: Eighteenth-Century Midwives and their Patients* (Liverpool, 2014), pp. 25-6. A few nineteenth-century stillbirth rates have been calculated from hospital or midwifery records and these were similar to those recorded a century earlier. Even by 1928, when stillbirth rates began to be reported by the Registrar General, they had not fallen significantly. However, more rates are needed to confirm these trends and it would also be useful to know more about maternal mortality, since both were influenced by midwifery practices.

2 According to R. Sauer, 'Infanticide and abortion in nineteenth-century Britain', *Population Studies*, 32 (1978), pp. 81-93, here at p. 85, between 1852 and 1856 an average of 78 infants per year were declared murdered in England and Wales and by the end of century that figure had reduced considerably.

when these events occurred. Violence or neglect was responsible for less than three per cent of all infant deaths during the nineteenth century, with little change over time being evident.[1]

Most of the changes in infant mortality noted throughout this paper must therefore have been caused by changes in infection. The so-called common infectious diseases of childhood such as measles and smallpox accounted for a relatively small percentage of deaths, but infants were prey to a whole array of other infections, even if some of these will have manifested themselves as wasting diseases and convulsions in the published cause of death returns.[2] Changes in disease virulence, notably in scarlet fever and perhaps tuberculosis, would obviously affect death rates and certain diseases would have been affected by the weather: in summer, the complex group of pathogens that caused diarrhoea; and in winter, those that caused bronchitis and pneumonia. The overall disease load was also affected by levels of urbanisation and population density since most infectious diseases circulated more easily in towns. These would also have been affected by the efficiency of local sewage removal systems and access to clean water and uncontaminated food, which in turn may have been affected by municipal regulations. The high pathogenic load in towns and cities was responsible for much of the urban-rural differences in mortality and this mainly affected the post-neonatal period since neonatal mortality was highly influenced by endogenous factors. For example, when William Farr compared infant mortality between three unhealthy towns (Blackburn, Leicester and Preston) and three healthy counties (Dorset, Hertfordshire and Wiltshire) during 1889-1891, he found that the urban excess increased over the first year of life: it was 1.2 times greater within the first week and 1.4, 1.8, 2.1 and 2.2 times greater at 1, 3, 6 and 12 months respectively.[3] Whether or not an infant succumbed to the threats posed by the environment into which it was born was determined by the ability of its mother or increasingly, the whole family unit, to mitigate these threats. A mother's ability to protect her infant was however affected by a hierarchical series of factors some of which were outside her influence. Those that operated within the wider environment such as levels of sanitation within a district, a smoky urban atmosphere or the presence of malaria in some marshy areas were beyond personal control; however, during the nineteenth century many local authorities began to make concerted efforts to combat some of these environmental threats. Thus, MOHs began to intervene by addressing a range of issues including sewage removal, ensuring a cleaner more efficient water supply, the regulation of markets and licensed premises, the removal of nuisances of various types, the inspection of shops, factories, other premises likely to cause a nuisance and also the inspection of some domestic dwellings. Towards the end of the century health visiting was introduced in some districts along with educational initiatives targeted at working-class mothers deemed in greatest need of help. These initiatives were helped when the Notification of Births Act (1907) came into force.

1 For example, in 1891 accidents and neglect accounted for 2.5 per cent of infant deaths of which 1.4 per cent were given as suffocation, Registrar General, *Fifty-Fourth Annual Report*, pp. 108-9, 120-1. There might have been some attempts to hide such deaths and there were local variations in rates. S. Sartain, 'A sociological investigation of infant overlaying death', (unpublished PhD thesis, University of Edinburgh, 2012) Table 6, p. 256 reports that in St Pancras between 1893 and 1902 about 3-4 per cent of deaths were due to suffocation. The St Pancras MOH reports show that nearly all violent infant deaths were given as suffocation. In 1898 there were 42 deaths from suffocation, 3 from murder, 2 from fractures or contusions, 1 from burns and 1 other, see Sykes, *Forty-Third Annual Report*, p. 82.

2 See Mercer, *Infections*, for a discussion of the link between infections and chronic disease.

3 Galley and Woods, 'Distribution of deaths', pp. 40-1.

While visible and quantifiable to a certain degree, these wider environmental initiatives did not directly affect infant health because they acted via an intermediary—usually the mother—who, by adopting good child care methods, could shield her infant from the harsh environment or (as sometimes happened) could exacerbate the problem if inappropriate child care methods were used. Indeed, this central role of the family in maintaining infant health remains the main reason why efforts to find associations between infant mortality and factors that operated within the wider environment such as municipal expenditure or improvements in the water supply, especially when considered over large areas such as RDs, have failed to produce definitive results. Parents had the ability to overcome most challenges posed by the wider environment, first by providing a clean, healthy domestic environment and, second, by adopting good child care methods. The home environment was important and its quality and health was influenced by income which also determined whether the mother needed to work and therefore devote less time and effort to her offspring. Income also allowed greater access to education and medical care, even though some medical services were not always beneficial for the infant. If an infant was illegitimate, family support was not always available and this meant that less than ideal care was often given to the infant resulting in illegitimates suffering twice the mortality rate of legitimates. Assessing the quality of the home environment has always been difficult. Once health visiting began, inspectors often made such judgements, although it needs to be remembered that these were made by middle-class women who tried to impose their values on working-class women.

The greatest influence on infant health was, not surprisingly, the mother since her knowledge of how best to care for her infant was crucial for its survival. Thus, the mother's personal and domestic hygiene together with her desire and ability to breastfeed were more important to her infant's survival than municipal efforts to provide a clean water supply or efficient sewage disposal. The simple matter of how often the mother changed the baby's nappy and whether or not she washed her hands afterwards—both of which are impossible to know—may therefore be of crucial importance in determining whether one infant died and another survived. Indeed, the importance of each mother in influencing the survival of her offspring is the main reason why attempts at fully delineating the causes of the secular decline in infant mortality have so far proved unsuccessful. Most of the crucial interventions that were possible in this period operated within the family and they will only be fully understood once more family-level data become available. Gaps in our knowledge can however by filled by examining sources that are readily accessible, many of which are to be found in local archives throughout the country. Some of these can be addressed by individuals working on local sources while others may need a wider perspective. The secular decline in infant mortality, together with the wider demographic transition of mortality and fertility, was a pivotal period in human history and it is worthy of further consideration.

Issues in infant mortality in the Victorian and Edwardian periods

Robert Woods' extensive analysis of infant mortality during the Victorian and Edwardian periods reached conclusions that broadly agreed with those of Arthur Newsholme and George Newman, the two most prominent advocates of infant welfare in the period, and they appear unlikely to be challenged in the foreseeable future. His four-part explanation that related infant mortality decline to the decline of fertility and childhood mortality, the 'health of towns' movement, the infant welfare movement and—underlying each of these—improvements in female education in the broadest sense, must therefore be the starting point for all further research into this topic. While each of these factors played a significant role in delineating the course of change during the period, the weight that needs to be attached to each of them together with possible changes over time, has yet to be determined with any degree of certainty. Thus, while some of the influences identified in Figure 3.14 will only be fully assessed once more family-level data become available, others can be examined using easily accessible sources and the following list provides some suggestions of issues that warrant further exploration.

(1) Further analysis of the age and sex structure of infant deaths would be useful. This would allow insights to be made into changes over time and the effectiveness of the various intervention strategies adopted at the local level. An examination of first day, first week and neonatal mortality would provide additional insights and could also be useful in assessing under-registration and the effectiveness of the 1874 Registration Act. These data should soon be available for Scotland and further analysis of the Sheffield death registers or similar local sources would also be helpful.

(2) Family reconstitution would be welcomed as a means of identifying how various influences operated at the family level. In the absence of birth and death data it may be possible to reconstruct family histories by starting with census enumerators' books and using church registers to identify births and deaths. This may not work for all families, but for church goers, especially in rural areas, this might be a feasible proposition. Once family histories have been created other individual level data could be added to the reconstitutions and some of the issues identified in Figure 3.14, particularly those relating to social class, addressed.

(3) An investigation into the extent to which infant mortality was concentrated into a relatively small number of families would also be welcomed and it would be interesting to discover if E.W. Hope's interest in this topic in Liverpool is replicated by other MOHs.

(4) Further research into nineteenth-century stillbirths and maternal mortality is needed both to establish levels and explore the links between midwifery practices and early age mortality. The examination of hospital and midwifery records should enable rates to be calculated.

(5) An examination of illegitimate infant mortality would be useful. Since these infants suffered very high IMRs it would be interesting to know if illegitimates suffered the same mortality differential in all environments, the exact cause of this differential and at what point rates began to fall.

(6) More local research into the increase in mortality experienced during the 1890s is needed, especially that due to diarrhoea and enteritis, to determine the extent to which local factors mitigated any climatic threats. Thus, those areas that experienced little increase could be compared with those that were severely affected, especially if contrasting adjacent districts could be discovered.

(7) The relationship between climate and infant mortality can be further explored by examining MOH reports. Many contained climate data and daily series of temperature and rainfall readings exist for many localities. These could then be compared with the

series of weekly infant and diarrhoea deaths found in some MOH reports such as those for Birmingham, Liverpool and (no doubt) many other places.

(8) Given the importance of the large towns in influencing the national IMR, it is worthwhile exploring whether changes in the proportion of the population living in the healthier suburbs could account for some of the change over time. This issue is inextricably linked to social differences in infant mortality and these spatial variations began to be increasingly noted by MOHs towards the end of the century.

(9) Some MOH reports give locational details of deaths and occasionally maps of infant deaths were provided. With additional research these could be compared with the location of stables, markets, main thoroughfares and other nuisances to examine Neil Morgan's thesis that an increase in horse traffic was responsible for some of the increase in mortality during the 1890s.[1]

(10) More research needs to be undertaken on infant mortality in small towns such as the Devon ones identified in Tables 3.8 and 3.9. This would be useful in determining whether population density was the main influence on urban rates and the extent to which trends in so-called rural RDs were influenced by what happened in the urban parts of these districts.

(11) Further work could be carried out into the common infectious diseases of childhood, thereby complementing Anne Hardy's work on London.[2] Many MOHs expended considerable effort in seeking to understand the causes of infectious disease, and a systematic trawl through their reports may provide interesting insights into the strategies that were developed to combat these diseases.

(12) More data are needed on infant feeding methods. Valerie Fildes examined London's MOH reports during the first two decades of the twentieth century.[3] But a systematic survey of other places has yet to be published and similar data from voluntary organisations active in child welfare work may also exist.

(13) As a complement to the work done by Ann Elizabeth Roberts which was carried out nearly 50 years ago, a new survey of nineteenth-century advice books and child care manuals should shed further light on attitudes towards infant feeding.[4] Issues such as the administration of purges to the newly born could also be investigated along with possible social class differentials in infant feeding methods. An examination of newspapers and women's magazines may also be revealing.

(14) An investigation into the patent infant milk industry in terms of the products that were produced and the quantity manufactured would enable the impact of these products on infant feeding to be measured. Likewise, an examination of how these products were advertised and who their target audience was would give further insights into their impact.

1 Morgan, 'Infant mortality, flies and horses'.
2 Hardy, *Epidemic Streets*.
3 Fildes, 'Breastfeeding in London'.
4 Roberts, 'Feeding and mortality in the early months of life'.

(15) Given that infant mortality decline occurred at similar times in many countries, a wider international consideration of some of the issues discussed above could prove valuable.

One of the main difficulties in examining infant mortality during the Victorian and Edwardian periods is the sheer amount of data and analysis, both modern and contemporary, that exists. Moreover, just because a MOH wrote that feckless mothers were responsible for the high IMRs does not necessarily mean that this was the case and such views need to be set against the wider picture. This wealth of both quantitative and qualitative data is in some sense a drawback, but it also means that the evidence needed to fill many of the gaps in our knowledge is likely to be out there waiting to discovered or reinterpreted.

4

Decline in the twentieth century

The twentieth century witnessed a remarkable improvement in infant health as the IMR declined almost continually from 151 per 1,000 live births in 1901 to under 6 by the end of the century.[1] Over the long term the reasons for this 96 per cent decline are obvious and relate to the significant improvements in education, living standards and medicine that greatly enhanced the health of the vast majority of the population throughout the century.[2] However, less is known about the precise effects of socio-economic variables such as infant feeding and care, place, class, housing and municipal health initiatives on changes in infant mortality, as is also the case with the impact of specific events, most notably the two world wars. In the first instance this paper will seek to chart the broad outlines of change in infant mortality from *c.*1910 until the end of the twentieth century. It will then examine the main influences on infant mortality and identify topics where further research can be readily undertaken, in part by carrying out small-scale studies using a variety of sources. It will end with suggestions for further research.

As was the case with the nineteenth century, the main sources for the student of infant mortality in England and Wales in the twentieth century are the various returns published by the General Register Office and its successor the Office of National Statistics.[3] These can be supplemented for the earlier part of the century by a multitude of studies such as Arthur Newsholme's special reports to the Local Government Board (hereafter LGB) and offshoots of work undertaken by MOHs.[4] For the later part of the century there are major

1 1901, A. Macfarlane and M. Mugford (eds), *Birth Counts: Statistics of Pregnancy and Childbirth,* Vol. 2 (London, 2000), pp. 2-4; 2000, Office of National Statistics, *Review of the Registrar General on Deaths in England and Wales, 2000, Childhood, Infant and Perinatal Mortality Statistics,* Series DH3 no. 33 (London, 2002), p. 113. During the twenty-first century the decline in infant mortality has stalled with the infant mortality rate in 2019 being 4 per 1,000 live births (Office of National Statistics, *Deaths Registered in England and Wales: 2019* [2020] https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/bulletins/deathsregistrationsummarytables/2019#stillbirth-rates-and neonatal-and- infant-mortality-rates [accessed April 2021].

2 This resulted in life expectancy at birth increasing from about 50 years in 1901 to 78 years in 2001 (Office of National Statistics, *How Has Life Expectancy Changed over Time'* [2015] https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/lifeexpectancies/articles/howhaslifeexpectancychangedovertime/2015-09-09 [accessed April 2021].

3 See pp. 122-30 for a discussion of the strengths and weaknesses of these sources. By the twentieth century the national returns of births, marriages and deaths can be considered accurate.

4 For Newsholme's special reports, see A. Newsholme, *Supplement to the Thirty-Ninth Annual Report of the Local Government Board 1909-10 Containing a Report by the Medical Officer on Infant and Child Mortality* (London, 1910); A. Newsholme, *Supplement to the Forty-Second Annual Report of the Local Government Board 1912-13 Containing a Second Report by the Medical Officer on Infant and Child Mortality* (London, 1913); A. Newsholme, *Supplement to the Forty-Third Annual Report of the Local Government Board 1913-14 Containing a Third Report by the Medical Officer*

surveys carried out by organisations such as The National Birthday Trust Fund and the 1946 Birth Cohort Study.[1] Finally, there are many individual research projects that have sought to understand how infant mortality might be reduced.[2] Obtaining individual data remains difficult because restrictions remain on accessing large numbers of birth and death records and, even when this is possible, a 100-year rule is often applied to ensure confidentiality. Moreover, even after privileged access has been allowed, very large datasets are often created and their analysis requires sophisticated statistical and computing expertise which is sometimes beyond the means of a single unsupported researcher.[3] Alice Reid's use of rare Derbyshire notification of birth registers is a notable exception which allowed her to make

on Infant and Child Mortality Dealing with Infant Mortality in Lancashire (London, 1914); A. Newsholme, *Supplement to the Forty-Fourth Annual Report of the Local Government Board Containing a Report on Maternal Mortality in Connection with Childbearing and its Relation to Infant Mortality* (London, 1915); A. Newsholme, *Supplement to the Forty-Fifth Annual Report of the Local Government Board Containing a Report on Child Mortality at Ages 0-5, in England and Wales* (London, 1916). Perhaps the most famous example of work undertaken by a MOH is G. Newman, *Infant Mortality, a Social Problem* (London, 1906), which was written whilst Newman was working for the London Borough of Finsbury.

1 On the National Birthday Trust Fund's work, see N.R. Butler and D.G. Bonham, *Perinatal Mortality: the First Report of the 1958 British Perinatal Survey under the Auspices of The National Birthday Trust Fund* (Edinburgh, 1963). For the 1946 Birth Cohort Study, see Joint Committee of the Royal College of Obstetricians and Gynaecologists and the Population Investigation Committee, *Maternity in Great Britain* (Oxford, 1948); M. Wadsworth, D. Kuh, M. Richards and R. Hardy, 'Cohort profile: the 1946 National Birth Cohort (MRC National Survey of Health and Development), *International Journal of Epidemiology*, 35 (2006), pp. 49–54.

2 Two notable studies published as part of a series of papers are: J.R. Gibson and T. McKeown, 'Observations on all births (23,970) in Birmingham, 1947: III. Survival', *British Journal of Social Medicine*, 5 (1951), pp. 177-83; and J.R. Gibson and T. McKeown, 'Observations on all births (23,970) in Birmingham, 1947: VII. Effect of changing family size on infant mortality', *British Journal of Social Medicine*, 6 (1952), pp. 183-7. For another series of papers see J.N. Morris and J.A. Heady, 'Social and biological factors in infant mortality: I. Objects and methods', *The Lancet*, 265 (6,859) (1955), pp. 343-9; J.A. Heady, C. Daly and J.N. Morris, 'Social and biological factors in infant mortality: II. Variation of mortality with mother's age and parity', *The Lancet*, 265 (6,860) (1955), pp. 395-7; C. Daly, J.A. Heady and J.N. Morris, 'Social and biological factors in infant mortality: III. The effects of mother's age and parity on social-class differences in infant mortality', *The Lancet*, 265 (6,861), pp. 445-8; J.A. Heady, C.F. Stevens, C. Daly and J.N. Morris, 'Social and biological factors in infant mortality: IV. The independent effects of social class, region, the mother's age and her parity', *The Lancet*, 265 (6,862) (1955), pp. 499-503; J.N. Morris and J.A. Heady, 'Social and biological factors in infant mortality: V. Mortality in relation to the father's occupation 1911-1950', *The Lancet*, 265 (6,863) (1955), pp. 554-9; J.A. Heady and J.N. Morris, 'Social and biological factors in infant mortality: VI. Mothers who have their babies in hospitals and nursing homes', *British Journal of Preventive and Social Medicine*, 10 (1956), pp. 97–106; J.A. Heady and J.N. Morris, 'Social and biological factors in infant mortality: VII. Variation of mortality with mother's age and parity', *Journal of Obstetrics and Gynaecology of the British Empire*, 66 (1959), pp. 577-91; S.L. Morrison, J.A. Heady and J.N. Morris, 'Social and biological factors in infant mortality: VIII. Mortality in the post-neonatal period', *Archives of Diseases in Childhood*, 34 (174) (1959), pp. 101-14. See also J.A. Heady and M.A. Heasman, *Studies on Medical and Population Subjects no. 15. Social and Biological Factors in Infant Mortality* (London, 1959).

3 For example, the Integrated Census Microdata (I-CeM) Project 'produced a standardised, integrated dataset of most of the censuses of Great Britain for the period 1851 to 1911' from raw data given by its commercial partner FindMyPast. The resulting dataset comprised '35 million household observations and over 200 million observations of individuals, and is one of the largest historical datasets in the world'. While some data are freely available via their website, the main files can only be accessed by 'accredited researchers in higher education institutions'. See University of Essex, *Integrated Census Microdata (I-CeM): Unlocking our Past* [n.d.] https://www1.essex.ac.uk/history/research/ICeM/default.htm [accessed April 2021].

an extensive study of infant and child mortality during the period from 1917 to 1922.[1] These sources were compiled following the 1915 Notification of Births (extension) Act which required all births to be notified to the local MOH within 36 hours, thereby enabling more effective health visiting to be provided.[2] Alongside information relating to the infant, they included details of the doctor or midwife who delivered the infant, the number of rooms in the house where the infant resided and details of the mother's childrearing history.[3] These sources allowed Reid to write a detailed and nuanced analysis of infant and childhood mortality at the end of the First World War.[4]

One of the main problems with undertaking research into infant mortality during the twentieth century is the sheer mass of data that is available in both primary and secondary form. Much research was undertaken by contemporaries whose aim was to understand the determinants of infant mortality with a view to recommending policies that would force down the rate. This research often accessed confidential data that cannot be readily re-examined, although for the recent past, at least, the main influences on infant mortality and the course of change have been determined with relative certainty.[5] As medicine progressed significantly during the second half of the century many of the causes of infant death began to be fully understood and, moreover, increasingly they became treatable. At the same time inequalities in infant mortality persisted. For example, in 2000 the IMR in class I (professional) was 3.6 per 1,000 live births while in class 5 (unskilled) it was over twice as high at 7.9.[6] While the causes of health inequalities are well known, a lack of political resolve to address the relevant issues during the 2010s has meant that unfortunately inequalities still persist.[7] Given the difficulties in accessing data from the recent past it seems that, for the foreseeable future at least, most students of the history of infant mortality in the twentieth century will focus their attention on the first half of that century.

1 See A. Reid, 'Neonatal mortality and stillbirths in early twentieth century Derbyshire, England', *Population Studies*, 55 (2001), pp. 213-32.

2 The 1915 Act extended the 1907 Notification of Births Act to areas where it had not been previously adopted, see W. Lawson, 'Infant mortality and the Notification of Births Acts, 1907, 1915', *Journal of the Statistical and Social Inquiry Society of Ireland*, 97 (1917), pp. 479-97.

3 Reid, 'Neonatal mortality and stillbirths', p. 214.

4 A. Reid, 'Health visitors and child health: did health visitors have an impact?', *Annales de Démographie Historique*, (2001), pp. 117-37; A. Reid, 'Infant feeding and post-neonatal mortality in Derbyshire, England, in the twentieth century', *Population Studies*, 56 (2002), pp. 151-66; A. Reid, 'The effects of the 1918-1919 influenza pandemic on infant and child health in Derbyshire', *Medical History*, 49 (2005), pp. 29-54; A. Reid, 'The influences on the health and mortality of illegitimate children in Derbyshire, 1917-1922', in A. Levene, T. Nutt and S. Williams (eds), *Illegitimacy in Britain, 1700-1920* (Basingstoke, 2005), pp. 168-89; A. Reid, 'Health visitors and "enlightened motherhood" ', in E. Garrett, C. Galley, N. Shelton and R. Woods (eds), *Infant Mortality: a Continuing Social Problem* (London, 2006), pp. 191-210; A. Reid, 'Infant feeding and child health and survival in Derbyshire in the early twentieth century', *Women's Studies International Forum*, 60 (2017), pp. 111-9.

5 D. Taylor-Robinson, E.T.C. Lai, S. Wickham, T. Rose, P. Norman, C. Bambra, M. Whitehead and B. Barr, 'Assessing the impact of rising child poverty on the unprecedented rise in infant mortality in England, 2000–2017: time trend analysis', *BMJOpen*, 9 (2019), e029424.

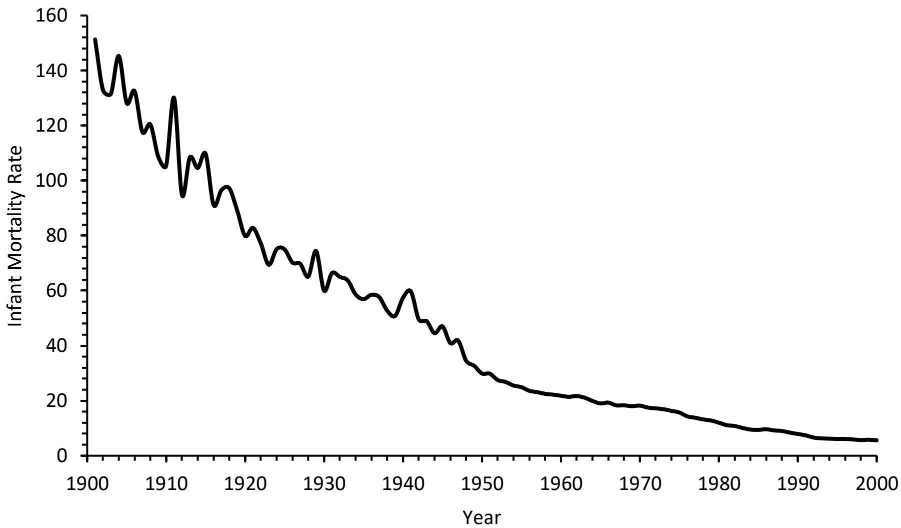
6 Office for National Statistics, *Review of the Registrar General on Deaths in England and Wales, 2000*, Series DH1 no. 33 (London, 2002), pp. xxiv, 61.

7 P. Townsend and N. Davidson, *Inequalities in Health: The Black Report*, Penguin edn (London, 1992) examines general health inequalities with pp. 27, 43-5, 62-3, 74, 115-7, 140-2, 175 discussing infant mortality. See J. Maher and A. Macfarlane, 'Inequalities in infant mortality: trends by social class, registration status, mother's age and birthweight, England and Wales, 1976-2000', *Health Statistics Quarterly*, 22 (2004), pp. 14-22, for a discussion of recent inequalities.

Decline during the twentieth century

In 1901 there were 551,585 deaths in England and Wales, of which 25.5 per cent (140,648) were infants; by 2000 the total number of deaths was similar, 535,664, but only 3,377 of these were infants (0.6 per cent).[1] Between 1901 and 2000 the population increased from about 33 million to over 52 million, birth and death rates declined substantially causing the age structure of deaths to change significantly so that by 2000 the vast majority of deaths were of older people.[2] Thus, by the end of the century, while concerns about reducing infant mortality remained, the health services, not surprisingly, focused much of their efforts on reducing mortality within the adult population.

Figure 4.1 Infant mortality rates in England and Wales, 1901-2000



Source: 1901-1970, A. Macfarlane and M. Mugford (eds), *Birth Counts: Statistics of Pregnancy and Childbirth,* Vol. 2 (London, 2000), pp. 2-4; 1971-2000, Office of National Statistics, *Review of the Registrar General on Deaths in England and Wales, 2000, Childhood, Infant and Perinatal Mortality Statistics,* Series DH3 no. 33 (London, 2002), p. 113.

The steady decline in infant mortality can be seen in Figure 4.1. During the first half of the century there were considerable annual fluctuations, but from the late 1940s these disappeared and the rate then declined almost continuously. In terms of years of special significance, the peaks of 1904, 1911 and 1940-1941 stand out, but if someone who knew little about the history of the twentieth century was asked to use this graph to identify when two world wars, a major economic depression and an influenza pandemic had occurred, they would be hard pushed to do so correctly.[3] It could be that these events had little impact on

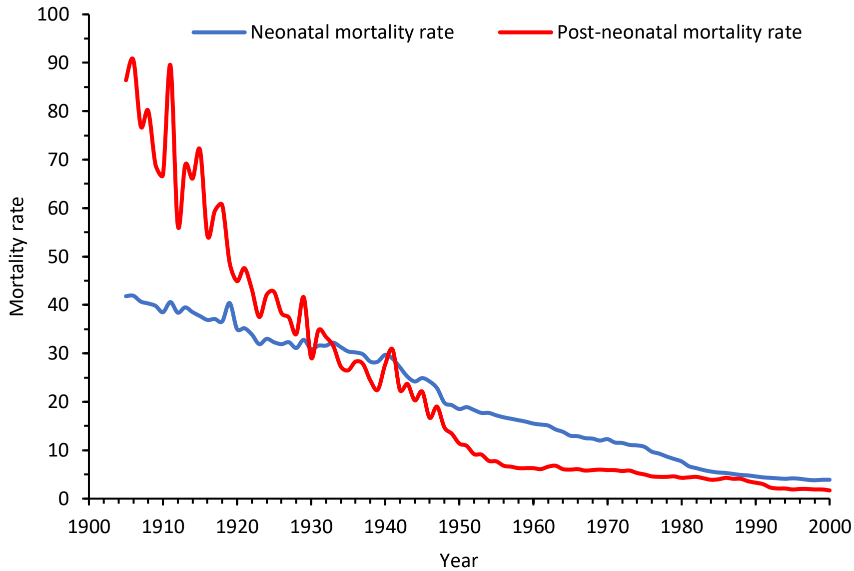
1 Registrar General, *Sixty-Fourth Annual Report of the Registrar General* (London, 1903), pp. 2, 136-7; Office of National Statistics, *Review of the Registrar General on Deaths in England and Wales, 2000*, pp. xv, 1.

2 J. Hicks and G. Allen, 'A century of change: trends in UK statistics since 1900', *House of Commons Library Research Paper*, 99/111 (1999), pp. 1-34, here at p. 6.

3 C. Griffiths and A. Brock, 'Twentieth century mortality trends in England and Wales', *Health Statistics Quarterly*, 18 (2003), pp. 5-17, here at p. 7, give a short account of this trend. W. Taylor, 'The changing

infant health or—perhaps counter-intuitively—they may even have been beneficial, or that other factors may have mitigated the negative effects of these national crises. Such events nevertheless warrant further investigation and some will be examined as case studies later in this chapter with the aim of showing how local studies can enhance our understanding of national trends.

Figure 4.2 Neonatal and post-neonatal mortality rates, England and Wales, 1905-2000



Note: The Registrar General's annual reports only provided an age breakdown of infant deaths from 1905.

Sources: 1901-1970, A. Macfarlane and M. Mugford (eds), *Birth Counts: Statistics of Pregnancy and Childbirth,* Vol. 2 (London, 2000), pp. 29-30; 1971-2000, Office of National Statistics, *Review of the Registrar General on Deaths in England and Wales, 2000, Childhood, Infant and Perinatal Mortality Statistics,* Series DH3 no. 33 (London, 2002), p. 113.

Figure 4.2 seeks to examine infant mortality decline in more detail by breaking the overall IMR up into its neonatal and post-neonatal components. It is immediately apparent that the two lines follow very different paths. Neonatal mortality declined steadily throughout the twentieth century, with only a small upward kink in 1919. In contrast, most of the decline in overall infant mortality during the first half of the century, and nearly all the annual variations, occurred within the post-neonatal component. Indeed, while post-neonatal mortality was more than double neonatal mortality in 1905 (86.4 per 1,000 live births compared with 41.8), by 1930 it was lower and from 1933 it remained so apart from in 1941. By the early 1950s post-neonatal rates were already under 10 per 1,000 live births and most of the subsequent decline in overall infant mortality occurred within the neonatal component. After 1950 both neonatal and post-neonatal mortality continued to decline, and

pattern of mortality in England and Wales: I. Infant mortality', *British Journal of Preventive and Social Medicine*, 8 (1954), pp. 1-9, here at p. 5 discusses the complicated and sometime contradictory factors associated with the trend between 1901 and 1950.

in 2000 neonatal mortality was more than double post-neonatal mortality (3.9 compared with 1.7). These two distinct patterns suggest that several different factors must have been responsible for the overall decline in infant mortality.

The decline in post-neonatal mortality is relatively easy to explain and was led by a sustained reduction in deaths from infectious diseases. Interpreting early twentieth century causes of death is fraught with difficulties due to changes in how some 'causes' were used and classified over time.[1] The adoption of the International Classification of Causes of Death (ICD) system in 1911, and its regular updating, meant that 'causes' such as 'premature birth' and 'convulsions' were increasingly abandoned in favour of more precise, 'scientific' ones.[2] Moreover, as medicine developed a better understanding of the reasons why infants died, a greater number of causes began to be employed. Consequently, before a comprehensive analysis of causes of death during the twentieth century can be given, considerable time and effort is needed to ensure that causes are classified in such a way that like is always being compared with like.[3] For our purposes however, it can be demonstrated relatively easily that the decline in post-neonatal mortality during the first half of the twentieth century was driven by a reduction in deaths from infectious diseases. Table 4.1 compares IMRs from the principal causes of death in 1911 with the same or similar causes in 1951.[4] Four causes, or groups of causes, representing the most important infectious diseases, have been selected: diarrhoeal diseases, respiratory diseases, the most common diseases of childhood (measles, whooping cough and diphtheria) and tuberculosis. In each case mainly post-neonatal infants were affected and we can be reasonably confident that these diseases were relatively easy to identify and their classification did not change too much over time.[5] Between 1911 and 1951

1 Writing in 1906 George Newman noted, 'that more accurate medical diagnosis, and therefore more accurate certification of the cause of death, has been secured in recent years, with the obvious result that there has been a tendency to a transference of deaths from indefinite to definite causes', see Newman, *Infant Mortality*, p. 59. For similar problems with nineteenth-century cause of death data, including the interpretation of multiple causes, see pp. 144-51.

2 The ICD was developed by the French statistician Jacques Bertillon and adopted by the International Statistical Institute in 1893 as a means by which causes of death could be standardised and compared between different countries. As medicine advanced frequent revisions were made to the system and, from its creation in 1948, the World Health Organization assumed responsibility for the ICD, see I.M. Moriyama, R.M. Loy, and A.H.T. Robb-Smith, *History of the Statistical Classification of Diseases and Causes of Death* (Washington, 2011), pp. 9-21.

3 See Office for National Statistics, *The 20th Century Mortality File, 1901-2000* [2013], https://data.gov.uk/dataset/2548e46b-873e-4668-968c-25d6c155dd73/the-20th-century-mortality-files [accessed April 2021] which provides detailed cause of death data by age. Deaths were classified according to the following revisions: 1901-1910, ICD-1; 1911-1920, ICD-2; 1921-1930, ICD-3; 1931-1939, ICD-4; 1940-49, ICD-5; 1950-1957, ICD-6; 1958-1967, ICD-7; 1968-1978, ICD-8; 1979-1984, ICD-9a; 1985-1993, ICD-9b and 1994-2000, ICD-9c.

4 It should be noted that 1911 was an exceptional year because the hot summer caused a substantial increase in diarrhoeal deaths (Figure 4.1), although a significant epidemic of measles also occurred. Had another year been chosen, the same pattern would have been evident, although perhaps to a lesser degree.

5 For instance, in 1921 the neonatal mortality rate from these four diseases combined was 2.7 while the corresponding post-neonatal rate was 31.6 (11.7 times higher), see Registrar General, *Registrar General's Statistical Review for 1921: Tables, Part I Medical* (London, 1923), pp. 44-5. During the early part of the twentieth century the Registrar General repeatedly exhorted doctors not to give diarrhoea as a cause of death and instead use gastro-enteritis. Since diarrhoea is a symptom rather than a cause it is possible that some deaths that would have been ascribed to diarrhoea in 1911 would have been given another cause in 1951; however the scale of the decline reported in Table 4.1 is sufficient to demonstrate that there must have been a substantial reduction in these types of infectious deaths by 1951.

Table 4.1 Infant mortality rates by significant causes of death, 1911 compared with 1951

	Infant mortality rate		
	1911	1951	Change
Overall	130.1	29.7	-100.4
Post-neonatal	89.5	10.9	-78.6
Neonatal	40.6	18.8	-21.8
Causes of death			
Infectious			
Diarrhoeal diseases	36.2	1.2	-35.0
Respiratory diseases	19.1	6.0	-13.1
Measles/Whooping cough/Diphtheria	7.6	0.5	-7.1
Tuberculosis	3.8	0.1	-3.7
Infectious Total	***66.7***	***7.8***	***-58.9***
Ill-defined			
Premature birth	20.1	5.7	-14.4
Congenital debility and sclerema	15.0	-	-15.0
Convulsions	9.7	0.1	-9.6
Ill-defined Total	***44.8***	***5.8***	***-39.0***

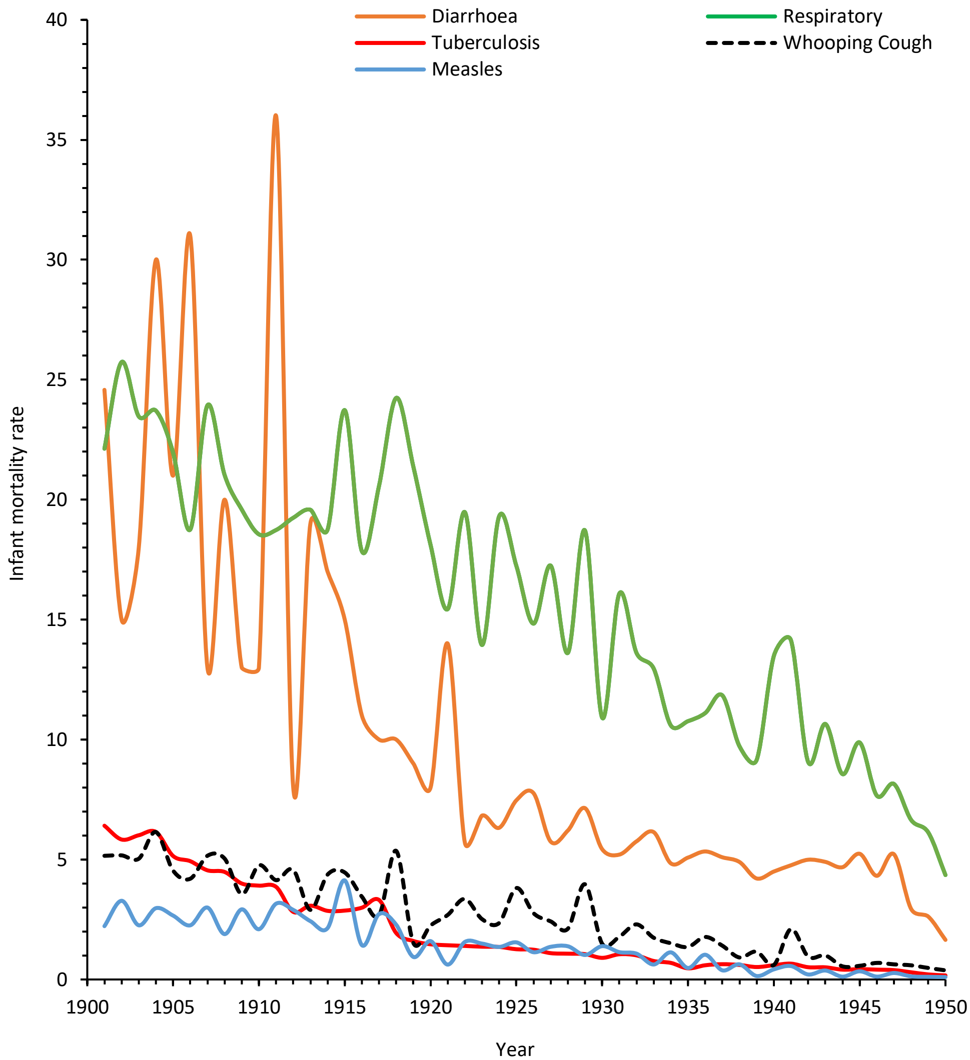
Note: Diarrhoea was reported as 'diarrhoea and enteritis' in 1911 and 'gastroenteritis' in 1951; respiratory diseases are 'bronchitis', 'pneumonia', 'influenza' and 'other respiratory diseases' in both 1911 and 1951; tuberculosis is 'tuberculosis of the nervous system', 'tuberculosis of intestines and peritoneum' and 'other tuberculosis diseases' in 1911 and 'tuberculosis of meninges and central nervous system' and 'other tuberculosis diseases' in 1951; premature birth is reported as 'immaturity' in 1951. Sclerema is a hardening of the skin that occurs in neonatal infants and is often associated with sepsis, congenital heart disease, respiratory problems or severe dehydration.

Source: 1911, Registrar General, *Registrar General's Statistical Review for 1921. Tables, Part I Medical* (London, 1923), p. 42; 1951, Registrar General, *Registrar General's Statistical Review for 1955* (London, 1956), p. 61.

mortality from these causes decreased by 58.9 per 1,000 live births whilst the total post-neonatal mortality rate declined by 78.6 which suggests that controlling infections explains much of the decline in post-neonatal mortality. While further detailed work on all causes of death is required to confirm this conclusion, other infectious causes, which had been responsible for many infant deaths during the nineteenth century, such as scarlet fever and syphilis, had virtually ceased to affect infants by 1951.[1] The decline in infectious diseases can also be seen in Figure 4.3 which shows annual IMRs from diarrhoea, respiratory diseases, tuberculosis, measles and whooping cough. The downward trend is evident in each series. In the case of diarrhoea, pronounced peaks occurred in 1904, 1906 and especially 1911 (see below for a discussion of this year) and, while infants died from diarrhoea at all times of the year, deaths were particularly high during hot, dry summers. Between 1901 and 1950 diarrhoea mortality declined gradually and the peaks reduced significantly, the last major

1 Only 19 congenital syphilis deaths were recorded in 1951 while scarlet fever, that scourge of Victorian Britain, did not appear in the table of the most common causes of infant death, see Registrar General, *Registrar General's Statistical Review for 1955* (London, 1956), p. 61.

Figure 4.3 **Infant mortality rates from diarrhoea, respiratory diseases, tuberculosis, whooping cough and measles, England and Wales, 1901-1951**



Source: Office for National Statistics, *The 20th Century Mortality File, 1901-2000* [2013], https://data.gov.uk/dataset/2548e46b-873e-4668-968c-25d6c155dd73/the-20th-century-mortality-files [accessed April 2021].

one being associated with the drought year of 1921.[1] In the case of respiratory diseases decline was less pronounced, peaks still appeared and by 1950 this group of diseases was responsible for about a half of all post-neonatal deaths. These patterns, albeit to a lesser extent, also occurred with whooping cough and measles and, while both these diseases

1 L.J. Barker, J. Hannaford, S. Parry, K.A. Smith, M. Tanguy and C. Prudhomme, 'Historic hydrological droughts 1891–2015: systematic characterisation for a diverse set of catchments across the UK', *Hydrology and Earth System Science*, 23 (2019), pp. 4,583–602.

mainly affected children over the age of one year, they still made important contributions to the overall decline in infant mortality. By contrast, tuberculosis deaths were not epidemic in nature, although a gradual reduction is still evident. Figure 4.3 shows that infectious disease control was the main cause of the decline in post-neonatal mortality and this suggests that medical officials must have had increasing success both in reducing exposure to these diseases and in mitigating their effects.

Explaining change using causes of death is complicated by the prominence in 1911 of three ill-defined causes: 'premature birth', 'congenital debility and schlerema' and 'convulsions'. These 'causes' appear to have declined substantially during the period, although the reasons for this are mainly due to changes in nosology rather than in their incidence and possible changes in reporting practices. 'Premature birth' was essentially a neonatal cause of death while 'congenital debility' and 'convulsions' deaths were divided almost equally between neonates and post-neonates.[1] While neonatal mortality decreased by 21.8 per 1,000 live births between 1911 and 1951, the apparent decline in these three ill-defined 'causes' was 39 which suggests that many deaths ascribed to these causes in 1911 would have been classified as other causes had they occurred in 1951.[2] Indeed, some mortality rates from causes that almost exclusively affected neonates, such as atelectasis (lung collapse) and birth injury, even increased between 1911 and 1951.[3] Determining the cause of death of some very young babies is difficult and a combination of factors was probably responsible for the decline in neonatal mortality, a conclusion that appears confirmed when neonatal mortality rates are broken down into different age groups.

Figure 4.4 shows early age mortality rates between 1921 and 2000 together with stillbirth rates from 1928.[4] The neonatal and stillbirth rates are fairly close to each other. Initially the stillbirth rate is higher than the neonatal mortality rate with the small initial rise probably reflecting better registration as the new system was introduced. The stillbirth rate then declined significantly until 1950 when it stalled for nearly a decade. Afterwards it continued to decline rapidly so that by the mid-1970s neonatal and stillbirth rates were nearly identical. The increase from 1993 reflects a change in how stillbirths were defined (from 28 to 24 weeks gestation). When neonatal deaths are broken down into their different components a more complicated picture emerges. Both first day and first week mortality appear to follow a similar, but not identical, trend that shows steady decline throughout the period with the downward trend being halted during the 1950s and early 1960s in first day deaths, but not in infants aged from one day to one week. Deaths of neonates aged over one week follow a slightly different path with more variation and a significant decline during the late 1940s. It should be remembered that all these age divisions are arbitrary and do not necessarily reflect development processes within the infant. Nevertheless, with substantial decline being

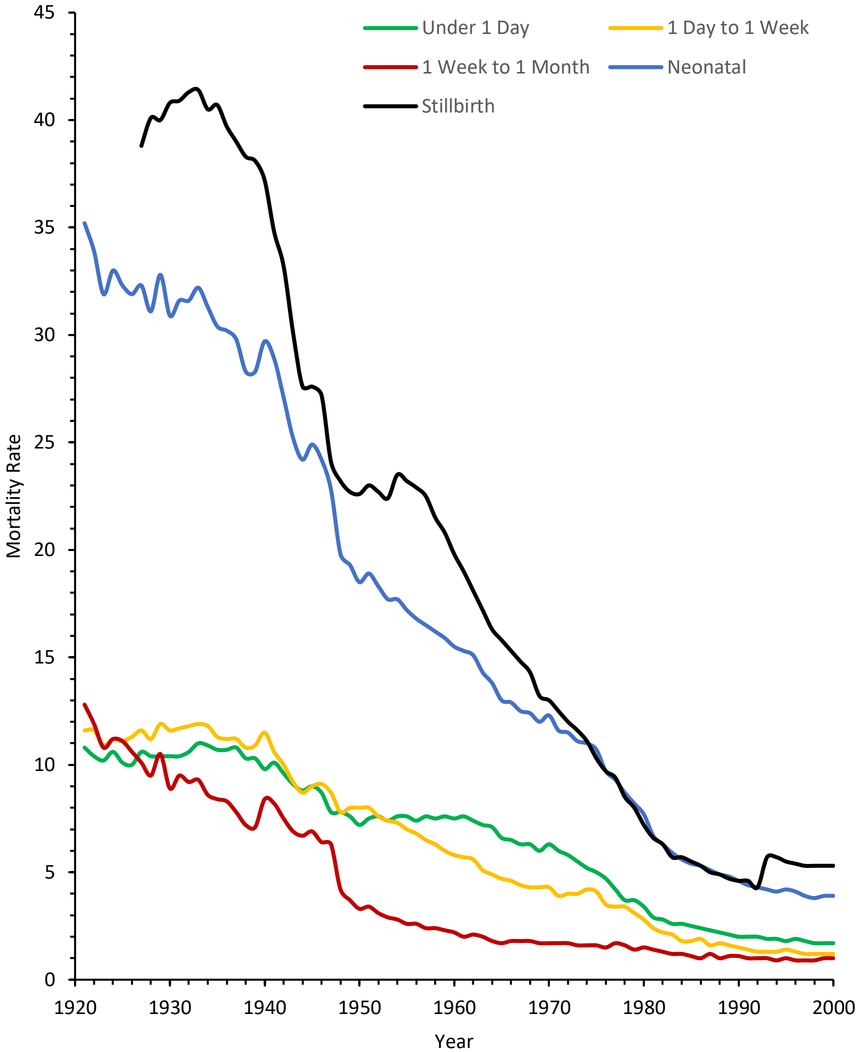
1 Registrar General, *Statistical Review for 1921*, p. 46 shows that about 90 per cent of 'premature birth' deaths were neonatal ones.

2 These include 'spina bifida and meningocele' (caused by the imperfect development of the spine) and 'hemolytic disease of the newborn' (a blood disorder that occurs when the infant's blood type is incompatible with that of its mother) which appear in 1951, but not in 1911.

3 In 1911 the IMR for atelectasis was 1.69 per 1,000 live births and for birth injury 1.03. Comparable IMRs in 1951 were 3.58 (post-natal asphyxia and atelectasis) and 2.87 respectively, Registrar General, *Statistical Review for 1921*, p. 42; Registrar General, *Statistical Review for 1955*, p. 61.

4 Compulsory stillbirth registration started in England and Wales on 1 July 1927 so 1928 was the first year when annual stillbirth rates can be calculated.

Figure 4.4 Early age mortality and stillbirth rates, England and Wales, 1921-2000



Note: From 1928 to 1992 stillbirths relate to fetal deaths at or over 28 weeks gestation, and from 1993 to at or over 24 weeks gestation.

Source: Office of National Statistics, *Review of the Registrar General on Deaths in England and Wales, 2000, Childhood, Infant and Perinatal Mortality Statistics,* Series DH3 no. 33 (London, 2002), pp. 112-3.

evident in all five series, it is likely that some common factors were responsible for these trends, although other, more individual factors, such as improvements in maternal health and midwifery practices, were more likely to have affected stillbirth rates and first day mortality.

The balance of factors responsible for causing these differing, age-specific trends remains as yet unresolved in part because relatively little effort has been devoted to addressing this topic. This is mainly due to the fact that, rather than concentrating on explaining these subtle age-specific variations, most research has focused on the effects of particular sets of socio-economic variables on infant mortality.[1] In order to make progress towards understanding why these variations in infant mortality trends occurred, four types of explanations seem worthy of further investigation. The first relates to the extent to which direct medical interventions, such as better midwifery practices, the introduction of antibiotics from the 1930s, mass vaccination and surgical advances, even on fetuses, improved infant health. The second concerns general improvements in infant welfare education and includes improvements in infant feeding, greater hygiene and isolating infants from infectious disease. The third requires disentangling the precise contribution that various socio-economic improvements, such as increasing prosperity, better housing and a cleaner living environment, made towards decreasing IMRs. Finally, the twentieth century witnessed a dramatic decline in fertility and it is important to investigate how this phenomenon impacted on infant health. The fact that steady improvements occurred in all these areas means that teasing out the exact contribution that each interlocking variable made to overall infant mortality decline remains difficult if not impossible.[2] As a first step towards exploring some of these issues, assessments will be made of the state of contemporary knowledge about the causes of infant mortality during the early twentieth century, the 1950s and in 2000. We begin by examining the work of George Newman and Arthur Newsholme, the two most important pioneers in infant welfare working in the early twentieth century.

Understanding infant mortality during the early twentieth century

George Newman's landmark publication, *Infant Mortality, a Social Problem*, published in 1906, was the first book length treatment of the subject.[3] In 356 pages of plain, easy to understand text Newman surveyed national and local patterns of infant mortality, examined the fatal diseases of infancy (with special emphasis being placed on epidemic diarrhoea), discussed how social factors such as women's work, domestic conditions and infant management affected infant survival and proposed a series of preventive measures relating to the mother, her infant and the environment that should have brought about a decline in infant mortality. Newman (1870-1948) was born into a prominent Quaker family and his lifelong faith fueled his desire to serve as a 'medical missionary'.[4] Following a series of part-time appointments in public health he became MOH for Bedfordshire (1897) and then for the London Borough of Finsbury (1900); he went on to become Chief Medical Officer to the Board of Education (1907) and Chief Medical Officer to the newly created Ministry of Health (1919). These last two appointments, held concurrently, were key public positions that helped him to shape post-war public health policy. Newman wrote *Infant Mortality* as a consequence of his work as MOH:

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1 See for example R.A. Cage and J. Foster, 'Overcrowding and infant mortality: a tale of two cities', *Scottish Journal of Political Economy*, 49 (2002), pp. 129-49; D. Dorling, 'Infant mortality and social progress in Britain, 1905-2005', in Garrett *et al.*, *Infant Mortality: a Continuing Social Problem*, pp. 213-28.

2 Writing about population studies more widely, E.A. Wrigley, 'The interplay of demographic, economic, and social history', *Journal of Interdisciplinary History*, 50 (2020), pp. 495–515, here at p. 495, argues that, 'although *description* may be feasible, *explanation* often presents problems. It is normally the case that a number of factors are involved, and determining their relative importance often presents severe difficulties'. In many studies single causes for what are inevitably complicated ones are often investigated.

3 Newman, *Infant Mortality*.

4 Newman's career is discussed in C. Galley, 'George Newman – a life in public health', in Garrett *et al.*, *Infant Mortality: a Continuing Social Problem*, pp. 17-31.

> During the last five years my work in Finsbury has necessitated a careful study of the problem of infant mortality. This book is part of the outcome. It is an attempt to state in a plain way the chief facts concerning a question which is not without national importance.[1]

Newman did not offer a new approach to tackling high IMRs, instead he provided an extensive survey of what others had written on the subject and, using his considerable experience as someone whose daily work entailed a constant fight to improve infant health, proposed a number of simple practical measures which he believed would bring about a reduction in infant mortality. As the title of the book implies, Newman believed that high infant mortality was essentially a *social* rather than a *medical* problem with the mother being placed centrally as the single most important influence on her infant's survival:

> The problem of infant mortality is not one of sanitation alone, or housing, or indeed of poverty as such, *but is mainly a question of motherhood.* No doubt external conditions as those named are influencing maternity, but they are, in the main, affecting the mother, and not the child. They exert their influence upon the infant indirectly through the mother. Improved sanitation, better housing, cheap and good food, domestic education, a healthy life of body and mind—these are the conditions which lead to efficient motherhood from the point of view of child-bearing. They exert but an indirect effect on the child itself, who depends for its life in the first twelve months, not upon the State or the municipality, nor yet upon this or that system of *crèche* or milk-feeding, but upon the health, the intelligence, the devotion and maternal instinct of the mother.[2]

Such a conclusion has proved controversial since some researchers have argued that Newman sought to blame mothers, or more specifically working-class mothers, for high IMRs.[3] However, Newman's argument is more subtle than this. Writing about public health more generally he argued that while the causes of high mortality were well understood by public health officials, 'the people perish for lack of knowledge' and '[m]uch remains to be done in England in the direction of educational life in public health'.[4] Newman remained consistent on this point, writing in 1931 that 'the State cannot itself save the child*, but it can help the mother to save it*'.[5] Later in 1941, when commenting on the substantial decline in infant mortality that had by then occurred, he firmly ascribed this success to the mothers:

> There has been nothing comparable in the history of Preventive Medicine in England with this great triumph. The State and the doctors have no doubt done

1 Newman, *Infant Mortality*, p. v.

2 Newman, *Infant Mortality*, pp. 257-8.

3 For examples see, A. Davin, 'Imperialism and motherhood', *History Workshop*, 5 (1978), pp. 9-65, here at pp. 12-4, 24-8; C. Dyhouse, 'Working-class mothers and infant mortality in England, 1895-1914', *Journal of Social History*, 12 (1978), pp. 248-67, here at pp. 257-9; J. Lewis, *The Politics of Motherhood: Child and Maternal Welfare in England, 1900-1939* (London, 1980), pp. 61-88; D. Dwork, *War is Good for Babies and Other Young Children* (London, 1987), pp. 226-30; E. Ross, *Love and Toil: Motherhood in Outcast London, 1870-1918* (Oxford, 1993), p. 201.

4 G. Newman, *The Health of the State* (London, 1907), pp. 177, 194.

5 G. Newman, *Health and Social Evolution* (London, 1931), p. 131.

> their part, but this is the achievement of the mothers of England themselves, aided by a zealous army of devoted and skilled helpers.[1]

Thus, Newman believed that raising maternal enlightenment was the key to reducing infant mortality and his stress on the social causes of infant mortality, the various direct and indirect factors responsible for causing infant deaths, resonates with those seeking to understand the secular decline and persistent inequalities in infant mortality that occurred throughout the twentieth century.[2] Newman's work still remains relevant since, as well as providing an extensive analysis of infant mortality in Edwardian Britain, the final chapters can serve as a model by which explanations of infant mortality decline can be investigated and evaluated.

Newman's book is divided into 11 chapters. The first two provide an overview of the incidence and distribution of infant mortality. They note that adult and childhood mortality, along with fertility, had declined in the years before 1906, but infant mortality had not done likewise. They show that high infant mortality was associated with towns, especially industrial ones, poverty, illegitimacy and that the risks infants faced decreased considerably with age. International and spatial variations are also examined and New Zealand, the country with the lowest IMR, was shown to have attained the 'ideal' IMR of 71 in 1904.[3] Chapters 3 and 4 discuss the fatal diseases of infancy (see Table 4.1 above). The differences between town and countryside are again highlighted and Newman also examines in detail those deaths that have an ante-natal cause. Here, in an important conclusion, he suggests that the, 'poor physique and ill-nutrition of the mother exerts, in a considerable percentage of cases, an injurious effect upon the infant'.[4] The next chapter deals with the industrial occupation of women. It notes a broad correlation between districts that employ a large proportion of women and high IMRs and it details how the employment of women close to giving birth and an immediate return to work thereafter is detrimental to infant health. Newman is less successful in demonstrating that the industrial employment of women is a direct cause of

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1 G. Newman, *English Social Services* (London, 1941), pp. 19-20. Eric Pritchard, a leading figure in the infant welfare movement, also stressed the importance of motherhood: '[t]he moment we began to concentrate on the mother, to educate her, and to equip her with a special knowledge, special resources, the special expedients, and the special instruments necessary for protecting her baby from the dangers of its immediate environment, from that moment the Infant Mortality rate began to fall', E. Pritchard, 'Infant mortality and the welfare movement', *Contemporary Review*, 120 (1921), pp. 76- 82, here at p. 80.

2 See the discussion in R. Woods, 'Newman's *Infant Mortality* as an agenda for research', in Garrett *et al.*, *Infant Mortality: a Continuing Social Problem*, pp. 33-49. Woods also examines the sources that Newman used.

3 Newman, *Infant Mortality*, p. 10. See also G. Newman, *On the State of the Public Health: Annual Report of the Chief Medical Officer of the Ministry of Health for the Year 1932* (London, 1933), p. 223, where he wrote that the IMR was then reaching an 'irreducible minimum' (the national IMR was 65 in 1932). See also, G.F. McCleary, 'The influence of ante-natal conditions on infantile mortality', *British Medical Journal*, 2 (2,276) (1904), pp. 321-3, here at p. 321; H.T. Ashby, *Infant Mortality* (Cambridge, 1915), pp. 76-93; and A. Newsholme, *Fifty Years in Public Health* (London, 1935), p. 346 who writes about non-preventable or partially preventable neonatal deaths. The notion of irreducible levels of mortality derives from Farr's 'healthy districts' which were defined as those with a crude death rate of 17 per 1,000 population or less, see E. Lewis-Fanning, 'A survey of the mortality in Dr Farr's 63 healthy districts of England and Wales during the period 1851-1925', *Journal of Hygiene*, 30 (1930), pp. 121-53. By the 1940s the Registrar General was arguing that, '[t]here seems no reason to postulate an irreducible hard core of neonatal mortality, nor of infant mortality generally, and any attempt to set "targets" for these is unprofitable', Registrar General, *Registrar General's Statistical Review of England and Wales for the Six Years 1940-1945*, Vol. 1 (London, 1949), p. 32. For a twenty first century discussion of this concept, see, J. Drife, 'Can we reduce perinatal mortality in the UK?', *Expert Reviews in Obstetrics and Gynaecology*, 3 (2008), pp. 1-3.

4 Newman, *Infant Mortality*, p. 89.

high infant mortality and he is forced to concede that, '[s]tatistical returns do not entirely support the assertion that factory employment of women is the main cause of high infant mortality'.[1] Chapter 6 concerns epidemic diarrhoea, arguing that it is essentially a 'filth' disease particularly associated with the working-class populations of towns and consequently, because of the large differences in rates between places and classes, it could be remedied by preventive action.[2] Chapter 7 examines domestic and social influences, and shows how poverty, upbringing, education, food, housing and overcrowding create conditions detrimental to infant health. Newman notes that some families living in the worst of conditions still managed to raise their children successfully, but here conditions within the home made the crucial difference, 'so long as domestic insanitation exists … the life of infancy among the poor cannot be otherwise injuriously affected'.[3] Also included in this chapter, and perhaps influenced by his Quaker upbringing, is a discussion of alcoholism which—as far as it is possible to tell—may have had a devasting impact on individual families, but not on the overall IMR. The most important influences on infant mortality, feeding and infant management, are discussed in Chapter 8, which begins with the stark statement that, 'expressed bluntly it is the ignorance and carelessness of mothers that directly causes a large proportion of the infant mortality which sweeps away every year in England and Wales alone 120,000 children under twelve months of age'.[4] What follows is a section that promotes the benefits of maternal breastfeeding, an examination of alternative feeding methods if breastfeeding is not possible, and a comprehensive discussion of the best methods of caring for the infant.

The final three short chapters discuss preventive strategies relating to the mother, her child and the wider environment. This hierarchical order reflects Newman's belief that the mother had the ability to shield her infant from the composite dangers posed by the domestic and wider environments and that, while improvements to both would be beneficial, much greater changes could be brought about by improving the health and knowledge of the mother.[5] With respect to the mother these related to her physical condition and the care she devoted to her infant. Thus, existing agencies should be reformed to deal with this issue since 'no society exists in England for the assistance and counsel of married women before,

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1 Newman, *Infant Mortality*, p. 136. Furthermore, Newman concluded that, 'infant mortality … is as much a financial as a hygiene question' (p. 138).

2 More general class differentials in IMRs were discovered by Seebohm Rowntree in his survey of poverty in York which showed that in three working class areas, the 'poorest', 'middle' and 'highest' had IMRs of 247, 184 and 173 respectively which compared with 176 for the whole of York and only 94 amongst the 'servant keeping class', see B.S. Rowntree, *Poverty: a Study of Town Life* (London, 1901), p. 206.

3 Newman, *Infant Mortality*, p. 196.

4 Newman, *Infant Mortality*, p. 221. This statement would appear directly to criticise mothers, but the extent to which Newman is seeking to blame mothers for high infant mortality revolves around the interpretation of the word 'ignorant'. Most dictionaries define ignorant as 'lack of knowledge', see for example J. Coulson, H.M. Petter, D. Eagle and J. Hawkins (eds), *The Oxford Illustrated Dictionary*, 2nd edn (Oxford, 1975), p. 419, but it can also take on connotations of blame. Thus, it is often assumed that a person described as being ignorant needs to accept some responsibility for their own ignorance. However, the fact that Newman devotes so much effort to improving maternal education suggests that he is not so judgemental. J.M. Campbell, *The Carnegie United Kingdom Trust Report on the Physical Welfare of Mothers and Children: England and Wales*, Vol. 2 (Liverpool, 1917), p. 97 supports Newman on this point.

5 N. Williams and C. Galley, 'Urban-rural differentials in infant mortality in Victorian England', *Population Studies*, 49 (1995), pp. 401-20, Figure 4, here at p. 417, essentially presents Newman's views in diagrammatic form. Woods, 'Newman's *Infant Mortality* as an agenda for research', pp. 42-4 summarises Newman's preventive measures.

during and after confinement' and, as to improving maternal welfare, this essentially boils down to '*feed the mother*'.[1] Much of the rest of the chapter addresses how best to educate mothers about improper feeding and careless exposure to diseases such as bronchitis, pneumonia, measles and whooping cough. Newman believed that many of the leaflets that had been distributed to new mothers were inadequate and better education could be achieved through female health visitors and the instruction of girls in domestic hygiene. He notes that Irish and Italian mothers in Finsbury were more likely to breastfeed their infants and consequently these groups experienced lower IMRs than their English counterparts, even though they lived in similar or worse conditions.[2] Newman also makes recommendations about women's working conditions and believed that one of the benefits of crèches was that they taught mothers cleanliness under medical supervision. With respect to the child, Newman recommends the early registration of births so that health visiting could be more effective and he reviewed the success of three acts of parliament, the Midwives Act (1902), the Infant Life Protection Act (1897) and the Prevention of Cruelty to Children Act (1904). All were beneficial, but they had little impact on the IMR. The rest of the chapter discusses artificial feeding and crèches. The final chapter deals with general health reform in factories, the home and in towns. It includes recommendations about the substitution of water closets for privy-middens, the repairing of defective drains and sewers, better paving and improving the quality of milk.

For its time, *Infant Mortality: a Social Problem* presented a 'state of the art' account of why infant mortality was a problem of national importance and, moreover, one that could be resolved through direct action targeted specifically at those mothers in greatest need. Newman realised that wider environmental problems made the task of those mothers living in the harshest environments substantially more difficult, but improving these would require much greater investment of time and money. Instead, since infant mortality was 'intimately related to the social life of the people',[3] he placed emphasis on educating mothers, albeit expressed in a manner that appeared critical, as the most likely means by which infant mortality decline could be achieved, in the short term at least. Essentially the assumption was that if working-class mothers adopted middle-class values with respect to domestic cleanliness and infant care then IMRs in working class areas would fall, and there is little within his recommendations that would be out of place in a modern infant care manual. There were however a number of issues about which Newman was silent. Most notably he failed to acknowledge the potential for medical advances to improve infant health and he did not realise that the profound demographic changes that were already underway by 1906 were part a pan-European phenomenon. Nevertheless, the timing of the book's publication, just before the first National Conference for the Prevention of Infant Mortality took place, was apt and its findings can serve as a model for assessing the means by which infant mortality decline was brought about. Before doing this, it is appropriate to examine the work of perhaps the most important pioneer in infant welfare, Arthur Newsholme.[4]

1 Newman, *Infant Mortality*, pp. 258, 260.

2 Newman, *Infant Mortality*, pp. 225-6. For similar conclusions about Jewish mothers see L.V. Marks, *Model Mothers: Jewish Mothers and Maternity Provision in East London 1870-1939* (Oxford, 1994).

3 Newman, *Infant Mortality*, p. vi.

4 A wealth of publications about infant mortality appeared during the early twentieth century, but the only other book length treatment was Ashby, *Infant Mortality*. Ashby's analysis of the problem was not as extensive as either those of Newman or Newsholme, but his recommendations about how best to reduce infant mortality were similar.

After a varied medical career, Newsholme (1857-1943) developed an interest in hygiene and this led him to become part-time MOH for Clapham (1884-1888), one of six subdistricts of Wandworth, full-time MOH for Brighton (1888-1908) and finally Medical Officer to the LGB (1908-1919), the body that effectively oversaw national public health policy.[1] It was in this last position that Newsholme published five major reports into infant mortality.[2] These reports were written against the background of a 'widespread awakening to the national importance of child mortality'.[3] They were aimed at a largely professional audience, principally the MOHs who were responsible for implementing policies to reduce infant and childhood mortality. The first report provides Newsholme's most widespread analysis of the problem and he hoped that MOHs would find it 'a useful starting point for intensive investigation of the causes of excessive child and especially excessive infant mortality in their individual counties and districts'.[4] The report has three objectives:

1. [to determine] whether reduction of infant mortality implies any untoward influence on the health of survivors in later years;
2. to indicate the communities which are characterised by a continuing high rate of infant mortality;
3. to assess as far as possible, the relative value of the different factors of excessive infant mortality.[5]

The first objective addresses eugenic concerns that a reduction in infant mortality would necessarily result in an increasing number of 'unfit' individuals within the population. After an extensive county-level analysis of infant mortality, Newsholme is reluctant to make a definitive statement on 'whether a heavy infant mortality has any selective influence on the population beyond infancy', but he shows that 'the counties having high infant mortalities continue in general to suffer somewhat excessively throughout the first twenty years of human life and that the counties having low infantile mortalities continue to have relatively low death-rates'.[6] He also suggests that areas with high mortality have high sickness rates and consequently, he concludes that it was the 'overwhelming influence exerted by the evil environment' that was the most important influence on high infant mortality.[7] The second objective is dealt with relatively straightforwardly by an examination of age- and cause-specific IMRs and the patterns Newsholme describes are similar to those reported by Newman.

The third part of the report contains an 'incomplete' list of influences affecting infant mortality:

1. The proportion of male to female births.
2. The proportion of illegitimate to legitimate births.

1 J.M. Eyler, *Sir Arthur Newsholme and State Medicine* (Cambridge, 1997), pp. 4-8. Newsholme's major publications on hygiene are: A. Newsholme, *Hygiene: a Manual of Personal and Public Health* (London, 1884); A. Newsholme, *School Hygiene: the Laws of Health in Relation to School Life* (London, 1887) and A. Newsholme, *Lessons on Health: Containing the Elements of Physiology and Their Application to Hygiene* (London, 1890).

2 These are listed in footnote 4 p. 213.

3 Newsholme, *Supplement to the Thirty-Ninth Annual Report of the Local Government Board*, p. 1.

4 Newsholme, *Supplement to the Thirty-Ninth Annual Report of the Local Government Board*, p. 74.

5 Newsholme, *Supplement to the Thirty-Ninth Annual Report of the Local Government Board*, p. 1.

6 Newsholme, *Supplement to the Thirty-Ninth Annual Report of the Local Government Board*, p. 178.

7 Newsholme, *Supplement to the Thirty-Ninth Annual Report of the Local Government Board*, p. 75. See also pp. 78-83 and the discussion in Eyler, *Sir Arthur Newsholme*, pp. 301-5.

3. The magnitude of the birth rate, which may for the present purpose be otherwise put as the size of the family.
4. The number of still-births.
5. The quality of the help given at birth.
6. The age of the wife at marriage.
7. Poverty and social conditions.
8. The extra-domestic employment of married women.
9. Urban or rural conditions of life.
10. Domestic and municipal sanitation.
11. Condition of housing.
12. Ignorance and fecklessness of mothers.[1]

Newsholme states that these are 'not given in order of importance' and he notes that climate, which he accepted was an important influence in the short term, has been omitted from the list. He argues that these influences can be classified into pre-natal (1-4 and 6), natal (4, 5) and post-natal (7-12) and that most should be amenable to preventive action. There are only minor differences between Newsholme and Newman in how they viewed the major causes of infant mortality with the main difference being one of emphasis. Newsholme was basically providing information to MOHs to help them put in place policies that would drive down IMRs. Factors 1-3 and 6 can be classified as well-established demographic influences (males suffered higher rates than females, illegitimates more than legitimates, there was a tick shaped relationship between mother's age and infant mortality, and lower fertility resulted in lower infant mortality) and there was little that a MOH could do to influence them. The others were more amenable to direct action and Newsholme made a number of recommendations for MOHs.[2] The first was to undertake more detailed investigation into the causes of infant mortality within their districts. The rest referred to the better training of midwives, earlier notification of births, more focused health visiting and a widespread improvement in sanitary conditions, especially in the towns. While Newsholme did identify the ignorance and fecklessness of mothers as being an important influence, perhaps because his target audience was the MOH, he placed greater emphasis on improving the urban sanitary environment than did Newman. He also explains that the mother's lack of knowledge was in part due to:

> the inefficient as well as insufficient care received by a large proportion of parturient women of the wage-earning classes during child-birth, and the ignorant and often mischievous guidance in infantile hygiene which they receive from incompetent midwives and still more from monthly nurses. To this must be added the frequently insufficient nursing both of mother and infant during the period of weakness and greatest danger following birth.[3]

Thus, while Newsholme's wording is similar to that of other writers, he concludes that the education of mothers will bring rewards since, '[h]appily it is beyond doubt that nearly every mother is profoundly wishful to secure the welfare of her offspring, and will welcome any

1 Newsholme, *Supplement to the Thirty-Ninth Annual Report of the Local Government Board*, p. 40.
2 Newsholme, *Supplement to the Thirty-Ninth Annual Report of the Local Government Board*, pp. 76-8.
3 Newsholme, *Supplement to the Thirty-Ninth Annual Report of the Local Government Board*, p. 56. Newsholme, *Supplement to the Forty-Fourth Annual Report of the Local Government*, returned to this theme in his report on maternal mortality where he showed that midwifery practices had a profound effect on maternal and perinatal mortality.

aid judiciously offered in this direction'.[1] Newsholme also states that maternal ignorance 'is a comfortable doctrine for the well-to-do person to adopt; and it goes far to relieve his conscience in the contemplation of excessive suffering and mortality among the poor'.[2]

In subsequent reports Newsholme repeated his general conclusions as to the causes of infant mortality. For example, in his second report published in 1913, the recent decline in infant mortality was ascribed, 'to the result of improved sanitary and housing conditions, of more efficient municipal and domestic cleanliness, of education in hygiene, of increased sobriety of the population, and of the widespread awakening of the national importance of child mortality, with concentration on efforts of child welfare work such as had never previously occurred'.[3] Indeed, in his autobiography published in 1935, Newsholme largely reiterated these views stating that 'no one factor is responsible' for the great reduction in infant mortality that had then taken place.[4] He ascribed the initial decline during the first decade of the twentieth century to 'the relatively small amount of specialized child welfare work and the general enlightenment of the population, the work done in sanitary administration in educating the public mind and conscience, and the improvement in domestic sanitation and personal hygiene resulting from these more general sources of enlightenment and reform'.[5] Improvements in all these factors occurred during the first half of the twentieth century, but with respect to maternal ignorance, Newsholme noted that mothers within all classes were ignorant to some extent and the crucial difference was that 'the mother in comfortable circumstances is able to ensure for her infant certain advantages which the infant of the poorer often cannot obtain'.[6] Thus, the environmental threats were much greater for poor mothers than for better-off mothers and more often overwhelmed their ability to care for their infants.[7]

Table 4.2 shows the major influences on infant mortality identified in the work of Newman and Newsholme.[8] They are divided into those that affected the mother, those that

1 Newsholme, *Supplement to the Thirty-Ninth Annual Report of the Local Government Board*, p. 76.

2 Newsholme, *Supplement to the Thirty-Ninth Annual Report of the Local Government Board*, p. 64. See also the discussion in Eyler, *Sir Arthur Newsholme*, p. 312.

3 Newsholme, *Supplement to the Forty-Second Annual Report of the Local Government Board*, pp. iii-iv. This report (Newsholme's second) also sought to provide an assessment of the policies adopted in 241 urban districts, pp. 118-382. It gives details about the extent of health visiting, but not about its quality. For example, according to the midwife and health visitor, Emilia Kanthack, '[y]ou will not be a scrap of use to them or their babies unless you understand them and they understand you. So you must do your level best to make yourself acquainted with their habits of mind and modes of speech and their code of manners, as well as with their physical and economic conditions', see E. Kanthack, *The Preservation of Infant Life: a Guide for Health Visitors* (London, 1907), p. 2, also quoted in Davin, 'Imperialism and motherhood', p. 41. Some of the limitations of health visiting are discussed in J. Lewis, 'The working-class wife and mother and state intervention, 1870-1918' in J. Lewis (ed.), *Labour and Love: Women's Experience of Home and Family 1850-1940* (Oxford, 1986), pp. 99-120, here at pp. 111-2. Newsholme's second report can, nevertheless, provide useful information for researchers wishing to investigate the influence of health visiting on infant mortality.

4 A. Newsholme, *Fifty Years in Public Health* (London, 1935), p. 325.

5 Newsholme, *Fifty Years*, p. 335. Newsholme also stressed the importance of intimate personal hygiene (p. 326).

6 Newsholme, *Fifty Years*, p. 372.

7 Newsholme, *Fifty Years*, p. 372. Newsholme also noted that poor mothers were more likely to breastfeed, but in some cases this was not sufficient to overcome a poor environment.

8 R.I. Woods, P.A. Watterson and J.H. Woodward, 'The causes of rapid infant mortality decline in England and Wales, 1861-192, part 2', *Population Studies*, 43 (1989), pp. 113-32, here at p. 114, provides a similar exercise based on the work of Arthur Newsholme.

affected the child and the domestic and wider environments. Most categories are self-explanatory. The ones relating to ante-natal factors are derived from Newsholme's list (see above) with family size probably being the most important. It is not known exactly how this relationship operated, but it is thought to have arisen because in smaller families the mother is able to devote more time to the care of her infants, there is less chance of infants being exposed to a range of pathogens, and hence higher parity births suffered higher IMRs.[1] A broad factor, maternal health, has also been added to the list. Whilst this was alluded to by both Newman and Newsholme it was not stated explicitly. However, a mother's childbearing history had, and continues to have, a profound influence on her future infant's life chances,

Table 4.2 Factors influencing infant mortality during the early twentieth century, based on those identified by George Newman and Arthur Newsholme

Mother		Infant	Environment	
Antenatal	Natal		Home	Wider
Age	Delivery	Feeding type:	Poverty	Water quality
Health	Midwifery (quality)	1. Breastfeeding	Housing	Sewage removal
Family size	Maternal mortality	2. Artificial	Women's work	Household waste removal
Illegitimacy	Multiple births	Health visiting	Hygiene	Scavenging
Women's work	Medical advances	Infant care		Paving
Alcoholism		Medical advances		Milk supply
Personal hygiene				Climate
Maternal health				Disease environment

Sources: G. Newman, *Infant Mortality, a Social Problem* (London, 1906); A. Newsholme, *Supplement to the Thirty-Ninth Annual Report of the Local Government Board 1909-10 Containing a Report by the Medical Officer on Infant and Child Mortality* (London, 1910); A. Newsholme, *Supplement to the Forty-Second Annual Report of the Local Government Board 1912-13 Containing a Second Report by the Medical Officer on Infant and Child Mortality* (London, 1913); A. Newsholme, *Supplement to the Forty-Third Annual Report of the Local Government Board 1913-14 Containing a Third Report by the Medical Officer on Infant and Child Mortality Dealing with Infant Mortality in Lancashire* (London, 1914); A. Newsholme, *Supplement to the Forty-Fourth Annual Report of the Local Government Board Containing a Report on Maternal Mortality in Connection with Childbearing and its Relation to Infant Mortality* (London, 1915); A. Newsholme, *Supplement to the Forty-Fifth Annual Report of the Local Government Board Containing a Report on Child Mortality at Ages 0-5, in England and Wales* (London, 1916).

as does her health status. As we have seen, the quality of care given at confinement is crucial both to the mother and her infant's survival and future health. Not mentioned by either Newman or Newsholme, multiple births were more dangerous for the mother, with stillbirth and IMRs being higher for multiple births than for singletons. With respect to the infant, the most important influence on its survival was how it was fed and cared for, with the advice given to the mother, both informally and by municipal health visitors, being crucial.[2] During the twentieth century medical advances such as mass vaccination programmes,

1 See the discussion in Woods *et al.*, 'The causes of rapid infant mortality decline', pp. 121-6.

2 For a discussion of the work undertaken by female health visitors see F.J. Greenwood, 'Women as sanitary inspectors and health visitors' in E.J. Morley (ed.), *Women Workers in Seven Professions* (London, 1914), pp. 221-34.

isolation and the widespread use of antibiotics also brought distinct benefits both to infants and their mothers.[1]

The environmental threats faced by individual infants varied considerably, with rural/urban differences being significant. Those that affected the home include the physical state of the house and the level of household poverty, with the two being inextricably linked, although levels of cleanliness within the home were also very important. As to the wider environment, both Newman and (especially) Newsholme stressed the importance of general levels of sanitation, particularly with respect to waste disposal (both human and household). The quality of both the water and milk supplies was also important and the responsibility for improving the wider environment lay with public authorities. We might also add that the disease environment was an important influence, with epidemics—especially of the common diseases of childhood but also 'summer diarrhoea'—being more commonly encountered in densely populated places.

Newman and Newsholme shared many characteristics. They were both middle-class and hardworking, and their deep religious convictions influenced their decisions to devote their lives to public service. Both were married but, perhaps surprisingly for individuals who devoted much of their working lives to improving child health, neither had children. They also had a complicated relationship since they became bitter rivals over whether the LGB or the Ministry of Education should assume responsibility for child welfare work.[2] They were, nevertheless, largely in agreement about the causes of infant mortality and the necessary course of action needed to bring about decline even though they differed about how this process should be administered. They believed that infant mortality decline was a multi-layered process and that improvements in all of the inter-linked factors identified in Table 4.2 had taken place by the 1930s. The frameworks they developed to understand the problem still remain relevant however and they can be used as a means by which the causes of the secular decline in infant mortality during the twentieth century can be investigated further.

Understanding infant mortality during the second half of the twentieth century

In 1950 the IMR was 30 per 1,000 live births, a fifth of what it had been in 1901, and neonatal mortality was twice that of post-neonatal mortality, the reverse of the situation in 1901. The decline in post-neonatal mortality had been achieved mainly due to the increasing control of infectious diseases and better, more hygienic, infant feeding and care practices.[3] Thus by the late 1950s most infant mortality was 'due to conditions present before or during birth, such as malformations, birth injury and immaturity' and this 'hard core' of mortality became increasingly difficult to reduce further.[4] Compared with the Registrar General's annual

1 For example, much of the steep decline in maternal mortality that occurred between 1935 and 1950 was due to the increasing use of antibiotics, first the sulphonamides and then after 1945 penicillin: see I. Loudon, *Death in Childbirth: an International Study of Maternal Care and Maternal Mortality 1800-1950* (Oxford, 1992), pp. 254-62.

2 Eyler, *Sir Arthur Newsholme*, pp. 320-36. At one point, Newman wrote in his diary that Newsholme was 'weak, vacillating, incompetent, untrustworthy & vain' (29 Oct 1918), quoted on p. 335. Unfortunately, we do not have Newsholme's diary, if he kept one, to give us an alternative view of this relationship.

3 Morris and Heady, 'Social and biological factors in infant mortality: I', p. 343; Heady and Morris, 'Social and biological factors in infant mortality: VII', p. 589.

4 Registrar General, *Registrar General's Statistical Review of England and Wales for the Year 1958, Part III Commentary* (London, 1960), pp. 59-60. The fact that the causes of many early infant deaths were still poorly understood hampered attempts to reduce rates.

reports in the first decades of the twentieth century, those from the 1950s onwards (now called 'statistical reviews') tended to avoid any proselytising about the measures needed to reduce infant mortality; instead they merely provided detailed data on patterns and causes of death. They also devoted less space to the problem, in part because infants were responsible for a much lower proportion of all deaths. For example, the Registrar General's Statistical Review for 1958 provides tables on historical trends from 1841, stillbirth rates, infant deaths by age and legitimacy, IMRs for certain urban and rural districts and by cause.[1] Alongside these tables the commentary devotes only 4 pages to infant mortality but a further 14 to tables giving detailed cause of death data and showing change over time.[2] As a means of providing a framework in which to examine change over time the statistical reviews do provide the raw data, but they give little information about the practical measures needed to bring about further change.[3]

Instead, a better way to do this is to examine studies, such as the one undertaken by Morris, Heady and their colleagues on *c.*80,000 stillbirths and infant deaths in England and Wales during 1949 and 1950, which they describe as an 'epidemiological exercise in the vital statistics of infant mortality'.[4] This study sought to identify those vulnerable mothers thought to be at highest risk of losing their infants. By establishing the range of mortality rates throughout the country it argued that the lowest rates 'will indicate a goal which can be achieved in the present state of medical knowledge' and that preventive measures could then be taken to achieve this goal.[5] Set against a background of generally declining rates, the first set of factors that was investigated related to mother's age and parity (the number of live births to the mother), (Table 4.3). As can be seen, mortality rates increased both with respect to the age of the mother and to the size of her family.[6] Thus, the first births of mothers aged between 40 and 44 years were twice as likely to die as those from mothers aged 25 to 29 years. Likewise, the sixth-born infant of a mother aged 25 to 29 was more than twice as likely to die than the first born. The main exception to these patterns occurred with births to young mothers who experienced very high IMRs and, within this age group, rates at higher parities increased significantly. When the data in Table 4.3 were broken down into stillbirths, neonatal and post-neonatal mortality the age and parity effects were still apparent, although in a less exaggerated form.[7] However, two major differences appear. Stillbirth rates amongst very young mothers were comparable to those of mothers aged 20 to 30 years and the greatest parity effects occurred within post-neonatal mortality. Thus, two sets of vulnerable mothers could be identified: older ones, who also experienced particularly high stillbirth

1 Registrar General, *Registrar General's Statistical Review of England and Wales for the Year 1958, Part I Tables, Medical* (London, 1960), pp. 4-5, 267-79, 325-9.

2 Registrar General, *Registrar General's Statistical Review of England and Wales for the Year 1958, Part III*, pp. 58-61, 85-98.

3 By the end of the century Office for National Statistics publications had become simply the means by which the relevant statistics were disseminated.

4 Morris and Heady, 'Social and biological factors in infant mortality: I', p. 345.

5 Morris and Heady, 'Social and biological factors in infant mortality: I', p. 349. They also argued that the levels of mortality they discovered were just the 'tip of the iceberg of morbidity'.

6 The small number of births within some of the categories, especially those at higher parities, means that these relationships are not perfect. They are however strong enough to identify those mothers at greatest risk of having an infant death.

7 Daly *et al.*, 'Social and biological factors in infant mortality: III', p. 396.

Table 4.3 Infant mortality rates by mother's age and parity, England and Wales, 1949

Mother's Parity	Age 16-19	20-24	25-29	30-34	35-39	40-44	All
1	37.0	24.3	22.8	26.9	35.0	45.1	26.0
2	51.5	31.8	21.4	19.3	23.2	30.3	24.3
3		44.9	30.7	24.0	25.8	31.1	29.8
4		59.7	35.4	28.7	30.1	34.1	33.6
5		84.1	41.2	35.9	34.7	30.8	37.2
6			47.3	38.1	35.2	38.8	39.5
7			74.9	43.0	38.7	42.0	44.6
8				47.9	45.1	49.4	47.0
9					31.0	66.7	48.4
10+					49.4	55.4	54.6
All	38.8	28.3	24.9	24.9	29.6	37.8	27.5

Source: J.A. Heady, C. Daly and J.N. Morris, 'Social and biological factors in infant mortality. II Variation of mortality with mother's age and parity', *The Lancet*, (19 February 1955), pp. 395-7, here at p. 396.

rates, and young ones, especially those with large families. Morris, Heady and their colleagues concluded that, while biological processes were certainly important, the greater differences within post-neonatal mortality suggested that social factors, in particular the care that was given to the infants, must have played a large role in determining whether some infants survived. They also gave three possible reasons to explain these patterns, 'the increased opportunity for infection in a large family …, other economic consequences of a large family at most levels of income and the ability to "cope" of young mothers, particularly those in adverse circumstances'.[1]

Morris, Heady and their colleagues then went on to examine the influence of social class on infant mortality.[2] Taking account of the fact that, in general, higher-class mothers were older and tended to have smaller families, a distinct social class gradient in mortality was nevertheless observed (Table 4.4). After the rates had been standardised to take into account age and parity, the unskilled (classified according to father's occupation) experienced mortality rates nearly 1.9 times higher than the professional classes. This gradient was virtually identical for stillbirths, slightly lower for neonatal mortality and over 2.9 times higher for post-neonatal mortality—those deaths thought to be most readily addressed through direct action. This gradient was consistent and evident within all classes. The study also considered change over time and discovered that there had been a 'remarkable similarity of the decline among various social groups', but, '[t]here had been no narrowing of the social gap in infant mortality; if anything it may have widened slightly'.[3] This was despite the post-war boom which led to full employment, higher real wages and an expansion in social services. Morris, Heady and their colleagues were somewhat at a loss to provide persuasive reasons as to why this was the case and concluded that '[t]he reasons for the persisting social differences in mortality are in fact imperfectly understood'.[4] They did however suggest that

1 Daly *et al.*, 'Social and biological factors in infant mortality: III', p. 397.
2 See R.M. Titmuss, *Birth, Poverty and Wealth: a Study of Infant Mortality* (London, 1943), pp. 22-35 for a discussion of social class variations during the first half of the century.
3 Morris and Heady, 'Social and biological factors in infant mortality: V', p. 556.
4 Morris and Heady, 'Social and biological factors in infant mortality: V', p. 559.

Table 4.4 Stillbirth and infant mortality rates by social class of the father, England and Wales, 1949

			Infant Mortality Rate		
Class	Description	Stillbirth	Neonatal	Post-neonatal	Total
I	Professional	14.3	13.3	5.4	18.7
II	Intermediate	18.9	14.1	6.7	20.8
III	Skilled	21.5	16.1	10.7	26.8
IV	Partly Skilled	23.2	18.2	13.3	31.5
V	Unskilled	26.0	19.0	15.8	34.8
All		21.5	16.4	11.1	27.5
V/I		1.82	1.43	2.93	1.86

Note: The rates have been standardised to take into account mother's age and parity. Only single, legitimate births in 1949 were used.

Source: C. Daly J.A. Heady and J.N. Morris, 'Social and biological factors in infant mortality. III The effects of mother's age and parity on social-class differences in infant mortality', *The Lancet*, 265 (6,861) (1955), pp. 445-8, here at p. 446.

a time-lag may be occurring with respect to how best practice was being adopted by some mothers:

> There may be a lag also in the knowledge of, use by, or availability to, families in social classes IV and V of new scientific advances, of services, and of facilities, compared with classes I and II. The better educated, that is to say, may have benefitted more from recent medical progress than others. The disappointing take-up of 'welfare vitamins' may be recalled here. The period being studied, 1911-50, saw the great expansion of personal preventive medical services. But in 1946 it was found that ante-natal services were used mainly by the 'middle classes'. A further survey in 1953 confirmed this observation, and showed that the greatest improvement since 1946 had been among the wives of skilled manual workers, not those in classes IV and V. This may be an example of 'cultural lag' of family traditions (the influence of grandmother?) which might be counteracting the benefits of community provision.[1]

This resistance to change would therefore have counteracted some of the medical and social advances. Moreover, Morris, Heady and their colleagues also argued that some vulnerable groups appeared to be more reluctant to use ante-natal services and they sought medical help later than others who were more enthusiastic users of the various services on offer. They concluded that it was important 'for the medical services to pay attention to these young mothers and to try to reduce the differential mortality within social classes as well as between them'.[2]

Morris, Heady and their colleagues also considered differences in outcomes between the 40 per cent of mothers who gave birth at home and those who gave birth in institutions (hospitals or nursing homes). Many high-risk confinements occurred in hospital and therefore hospital mortality rates were higher than those that occurred elsewhere; however,

1 Morris and Heady, 'Social and biological factors in infant mortality: V', p. 558.

2 Morrison *et al.*, 'Social and biological factors in infant mortality: VIII', p. 113. See also the discussion on pp. 109-13 which quotes from J.W.B. Douglas and J.M. Bloomfield, *Children Under Five* (London, 1958).

four groups of high-risk mothers were identified who would have benefited from giving birth in hospital: mothers aged over 35 years having a first confinement, all mothers aged over 40, mothers who had previously lost an infant, and mothers having multiple births.[1] With many mothers having safe deliveries at home, teasing out the benefits of a hospital over a home confinement proved difficult to achieve. Whilst Morris, Heady and their colleagues aimed to identify vulnerable mothers so that inequalities could be addressed and potentially eradicated, compared with the work of the early twentieth century pioneers in child welfare, their study made little attempt to discuss the environmental influences on infant health. In part this was because the scope of their study was epidemiological in nature and the relevant data that would have made it possible to examine environmental effects were not collected. Some discussion of regional variations occurred, but the areal units considered were large and the analyses superficial.[2] While significant environmental improvements had occurred by the 1950s, large areas of slum housing with poor access to resources still existed (Figure 4.5). Thus by the 1950s many of the factors identified by Newman and Newsholme were still influential in accounting for the patterns of infant mortality, despite the apparent lack of any interest in 'sanitary improvement'. A striking difference in tone is also evident in the work of Morris, Heady and their colleagues compared with previous studies—there is a complete absence of any inference of blame. Instead, their primary aim was to identify those mothers at greatest risk and then target them for special attention. In this way it was thought that IMRs would continue to be reduced and inequalities diminished.

The means by which further improvements in infant mortality could be achieved lay in the more directed use of pre-war methods backed up by the various medical advances that were then taking place. Writing in 1960 George McCleary, a major public health administrator and MOH for Battersea and then Hampstead, argued that infant mortality decline was brought about by 'the modern agencies of the maternity and child welfare movement' and included the notification of births, state registration of midwives, maternity and child welfare centres, ante-natal clinics and trained health visitors.[3] He also suggested that further decline could be brought about by more efficient, better coordinated use of these services together with the encouragement of family planning. This appears to have happened, as IMRs steadily declined during the second half of the twentieth century, even though the social gradient in infant mortality identified in Table 4.4 still persisted. Shaw and her colleagues' wide-ranging analysis of health conditions in the 'best' and 'worst' parliamentary constituencies during the 1990s discovered considerable social differences

1 Heady and Morris, 'Social and biological factors in infant mortality: VI', p. 103. These four groups were responsible for about 15 per cent of all births. For a critical account of the benefits of hospital deliveries for normal confinements, see M. Tew, *Safer Childbirth. A Critical History of Maternity Care*, 3rd edn (London, 1998).

2 Daly *et al.*, 'Social and biological factors in infant mortality: III', p. 447; Heady *et al.*, 'Social and biological factors in infant mortality: IV', pp. 500-1; Heady and Morris, 'Social and biological factors in infant mortality: VI', p. 98.

3 G.F. McCleary, 'Reducing infant mortality', in G.F. McCleary, *On Detective Fiction and Other Things Including Pickwick, Cambridge, Infant Mortality, Slums, Stevenson, Motherhood and Incentives* (London, 1960), p. 95. McCleary's most important publications on infant welfare were G.F. McCleary, *Infantile Mortality and Infants Milk Depots* (London, 1905); G.F. McCleary, *The Early History of the Infant Welfare Movement* (London, 1933) and G.F. McCleary, *The Maternity and Child Welfare Movement* (London, 1935). See *British Medical Journal*, 1 (5,272) (1962), p. 193 for an obituary.

Figure 4.5 Back-to-back housing: Courts 1 and 2, Park View Road, Hillsborough, Sheffield, March 1959

Note: The houses comprised a ground floor room, a bedroom together with an attic and cellar. Some also had a small kitchen annexe. The photograph was taken from the roof of the outside toilets in court 3. The author was born in house 2, court 3.

Source: © PictureSheffield.

between these two sets of constituencies, with IMRs being about twice as high in the 'worst' than in the 'best'.[1] Similar differentials were reported in virtually all studies and official publications that appeared during the second half of the twentieth century.[2] Even as late as 2000, the report into childhood, infant and perinatal mortality for that year published by the Office for National Statistics, which gave detailed data on cause of death, age of mother, birth weight, class (based on father's occupation), mother's country of birth and various combinations thereof, identified a similar pattern.[3] Table 4.5 gives IMRs and stillbirth rates by father's social class in 2000. The social class gradient is apparent in both sets of figures with Class V (unskilled) infants suffering IMRs 2.2 times higher than class I (professional)

Table 4.5 Infant mortality and stillbirth rates, by social class, England and Wales, 2000

		Rate	
	Class	Infant Mortality	Stillbirth
Inside Marriage	I	3.7	4.3
	II	3.6	3.7
	IIIN	5.4	5.1
	IIIM	5.0	5.0
	IV	5.9	5.6
	V	8.0	8.3
	Other	7.7	6.4
	All	4.8	4.8
Outside Marriage	I	3.5	3.4
	II	4.4	4.1
	IIIN	6.2	5.5
	IIIM	5.7	5.2
	IV	6.4	5.4
	V	7.8	6.9
	Other	16.8	8.3
	All	6.4	5.3

Note: A 10 per cent sample was coded for social class using the father's occupation. Only those births outside of marriage jointly registered by the mother and father were used for comparative purposes. Social classes were defined as follows: I Professional; II Managerial and technical occupations; IIIN Non-manual skilled occupations; IIIM Manual skilled occupations; IV Partly skilled occupations; V Unskilled occupations; Other All residual groups.

Source: Office of National Statistics, *Review of the Registrar General on Deaths in England and Wales, 2000, Childhood, Infant and Perinatal Mortality Statistics,* Series DH3 no. 33 (London, 2002), p. 61. The social classes are defined on p. xxiv.

1 M. Shaw, D. Dorling, D. Gordon and G. Davey Smith, *The Widening Gap: Health Inequalities and Policies in Britain* (Bristol, 1999), pp. 18-9. The gap between 'best' and 'worst' had also increased during the 1990s, see pp. 161-2. For health inequalities more generally, see E.R. Pamuk, 'Social class inequality in mortality from 1921 to 1972 in England and Wales', *Population Studies*, 39 (1985), pp. 17-31.

2 Butler and Bonham, *Perinatal Mortality*, p. 25 being one of many examples.

3 Office of National Statistics, *Review of the Registrar General on Deaths in England and Wales, 2000, Childhood, Infant and Perinatal Mortality Statistics,* Series DH3 no. 33 (London, 2002).

infants. The stillbirth gradient was slightly lower (1.9 times higher) and amongst unmarried couples who registered their infants jointly the differentials were virtually the same: 2.2 and 2.0 respectively. According to Shaw and her colleagues, the key factor in explaining these differences was poverty, '[t]he key policy that will reduce inequalities in health is the alleviation of poverty through the reduction of inequalities in income and wealth'.[1] While the exact way in which poverty influences infant mortality and a host of other health conditions remains complicated and difficult to address, this basic conclusion has not been challenged.[2]

Following the introduction of the National Health Service in 1948, a range of high quality services has been available free to all and, while success has been achieved in terms of significantly reducing mortality rates within all sections of the population, inequalities have not been eliminated. According to Nick Freemantle and his colleagues, 'it is well established that determinants of infant mortality outside health services have a more profound effect than the provision of health care per se'.[3] Alongside more general health inequalities, the 2000 report into childhood, infant and perinatal mortality identified certain groups of women who were subject to much higher risks. Table 4.6 shows infant mortality and stillbirth rates according to mother's country of birth. The differences here are striking, with some mothers born in the New Commonwealth, particularly in Pakistan and the Caribbean, suffering rates over two times those of European-born mothers. Moreover, the differences between what may appear at first sight to be similar ethnic groups, such as those mothers born in Pakistan and Bangladesh, suggest that these inequalities are multi-causal.[4] Likewise, it is interesting that mothers born in the far east experienced some of the best rates of any group. The 2000 report did not give IMRs by mothers' ethnicity and Table 4.5 therefore only provides information about first generation migrants who, perhaps in general terms, were more likely to have been poorer than the rest of the population and perhaps less likely to use the full range of health services on offer. Tables 4.5 and 4.6 show that a range of inequalities in infant mortality persisted throughout the twentieth century; indeed, they are still evident today and the challenge remains as to whether they can be addressed successfully. According to the latest UK Government health profile for England, '[h]ealth inequalities are avoidable and unfair differences in health status between groups of people or communities'.[5] Some progress was made towards reducing health inequalities by the last Labour government (1997-2010) and a commitment was made to eliminate them by 2020,

1 Shaw *et al.*, *Widening Gap*, p. 169.

2 For an extensive discussion of contemporary health inequalities, see M. Marmot, *The Health Gap: the Challenge of an Unequal World* (London, 2015).

3 N. Freemantle, J. Wood, C. Griffin, P. Gill, M.J. Calvert, A. Shankar, J. Chambers and C. MacArthur, 'What factors predict differences in infant and perinatal mortality in primary care trusts in England? A prognostic model', *British Medical Journal*, 339 (7,717) (2009), b2892, which references M. Marmot, S. Friel, R. Bell, T.A.J. Houweling and S. Taylor, 'Closing the gap in a generation: health equity through action on the social determinants of health', *The Lancet*, 372 (9,650), pp. 1,661-9.

4 Many studies have considered this issue, see for example A.C. Bakeo, 'Investigating variations in infant mortality in England and Wales by mother's country of birth, 1983–2001', *Pediatric and Perinatal Epidemiology*, 20 (2006), pp. 127-39; N. Small, 'Infant mortality and migrant health in babies of Pakistani origin born in Bradford, UK', *Journal of Intercultural Studies*, 33 (2012), pp. 549-64.

5 Public Health England, *Health Profile for England: 2018*, Chapter 5 [2018] https://www.gov.uk/government/publications/health-profile-for-england-2018/chapter-5-inequalities-in-health [accessed April 2021].

Table 4.6 Infant mortality and stillbirth rates, by selected mother's country of birth, England and Wales, 2000

	Rate	
Country of Birth	Infant Mortality	Stillbirth
All	5.5	5.3
UK	5.3	4.9
Irish Republic	5.4	4.9
Other EU	3.8	7.2
Canada, Australia, New Zealand	4.7	4.1
New Commonwealth	8.2	7.9
India	6.5	6.7
Pakistan	12.2	9.4
Bangladesh	4.7	6.9
Caribbean	10.4	8.5
Far East	3.9	3.9

Source: Office of National Statistics, *Review of the Registrar General on Deaths in England and Wales, 2000, Childhood, Infant and Perinatal Mortality Statistics,* Series DH3 no. 33 (London, 2002), p. 82.

but with the advent of austerity post-2010, progress has stalled.[1] It is only through concerted government action that health inequalities will be reduced.

The general paucity of individual-level data available throughout the twentieth century means that most research will have to be undertaken using official sources or studies already published, unless of course, similar sources, such as the ones unearthed by Alice Reid, can be discovered. Thus, while changes in infant mortality can be charted in some detail throughout the twentieth century, for those researchers wishing to investigate socio-economic influences it is likely that most research will be undertaken on the first half of the century because a wider range of sources are available. In particular MOH reports appear to offer much potential for further research and, with the aim of demonstrating what is possible, the following section will provide short case studies that have the potential to be more widely applied. These will examine the last major epidemic of infantile summer diarrhoea in 1911, the impact of world war on infant mortality and the effects of economic depression during the 1930s.

1 Shaw *et al.*, *Widening Gap*, p. 169, writing in 1999 were optimistic about the future: '[t]here is widespread public support for poverty reduction in Britain and the government has pledged to eliminate childhood poverty by 2020'. T. Robinson, H. Brown, P.D. Norman, L.K. Fraser, B. Barr and C. Bambra, 'The impact of New Labour's English health inequalities strategy on geographical inequalities in infant mortality: a time-trend analysis', *Journal of Epidemiology and Community Health*, 73 (2019), pp. 564–8, here at p. 564, concluded that '[t]he English health inequalities strategy period [1999-2010] was associated with a decline in geographical inequalities in the IMR. This research adds to the evidence base suggesting that the English health inequalities strategy was at least partially effective in reducing health inequalities, and that current austerity policies may undermine these gains'. The IMRs for 2018 (Public Health England, *Health Profile for England: 2018*, Chapter 5), show that the gap between higher managerial and manual workers has not changed since 2011. Moreover, writing at a time when the use of food banks is increasing and the Covid-19 pandemic is adversely affecting disadvantaged groups within society, the prospects for eliminating inequalities in the immediate future do not look promising.

1911

As Figure 4.1 showed, the steady decline in infant mortality during the twentieth century was interrupted in 1911 when the IMR increased by 25 deaths per 1,000 live births. This increase can be explained relatively easily since in 1911 deaths attributed to diarrhoeal causes rose more than fourfold compared with 1910, with the non-diarrhoeal IMR being 'only 2 per 1,000 in excess of that for 1910, which was the lowest then recorded'.[1] These excess diarrhoea deaths were caused by the summer of 1911 being 'abnormally hot and dry',[2] the two most important factors associated with epidemics of infant diarrhoea. This climatic shock, which also occurred throughout much of Europe, overwhelmed the various preventive measures that had been responsible for reducing IMRs since 1900. Yet not everywhere was affected equally, and an analysis of infant mortality in 1911 will allow the effectiveness of early twentieth century public health provision to be examined during a period of great stress. The so-called 'perfect summer' of 1911 was one of the warmest on record and 'included the driest July over England and Wales in the last 100 years, an exceptionally sunny July and one of the warmest Augusts' with the heat and drought being especially pronounced in the Midlands and south and south-east England.[3] The summer of 1911 was also extreme in much of western, central and southern Europe and this also led to increases in infant mortality in many countries.[4] Incidentally, the cool, rainy summer of the following year, which was labelled 'calamitous', was far healthier for infants as the IMR in England and Wales fell to 95, the lowest on record at that time.[5] The climate of the British Isles is however notoriously variable and, while Kendon and Prior note that the heatwave was particularly evident in the southern parts of Britain, it was not necessarily the case that all parts of the country were affected equally.

The impact of the hot summer of 1911 can best be seen by examining its effects on a single community. In Huddersfield the IMR increased from 99 per 1,000 live births in 1910 to 132 in 1911 and, according to the town's MOH, this increase can be 'practically accounted

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1 There were 94,962 infant and 7,109 infant diarrhoea deaths in 1910 and 114,600 infant and 31,900 infant diarrhoea deaths in 1911. In 1910 'diarrhoea' deaths appeared under the headings Diarrhoea due to Food, Infective Enteritis, Epidemic Diarhhoea and Dysentery, and in 1911 as Diarrhoea &c. For total infant deaths, see Macfarlane and Mugford, *Birth Counts*, p. 2 and, for diarrhoea deaths, Registrar General, *Seventy-Third Annual Report of the Registrar General of Births, Deaths and Marriages in England* (London, 1912), pp. 290-1; Registrar General, *Seventy-Fourth Annual Report of the Registrar General of Births, Deaths and Marriages in England* (London, 1913), pp. vii and 313. Measles also 'showed more than average mortality' in 1911. See R. Dudfield, 'Diarrhoea in 1911', *Proceedings of the Royal Society of Medicine*, 5 (1912), pp. 99-148 for a discussion of the causes of diarrhoea mortality, especially in Paddington. Dudfield emphasised the association between diarrhoea and artificial feeding, poor housing, climate and flies.

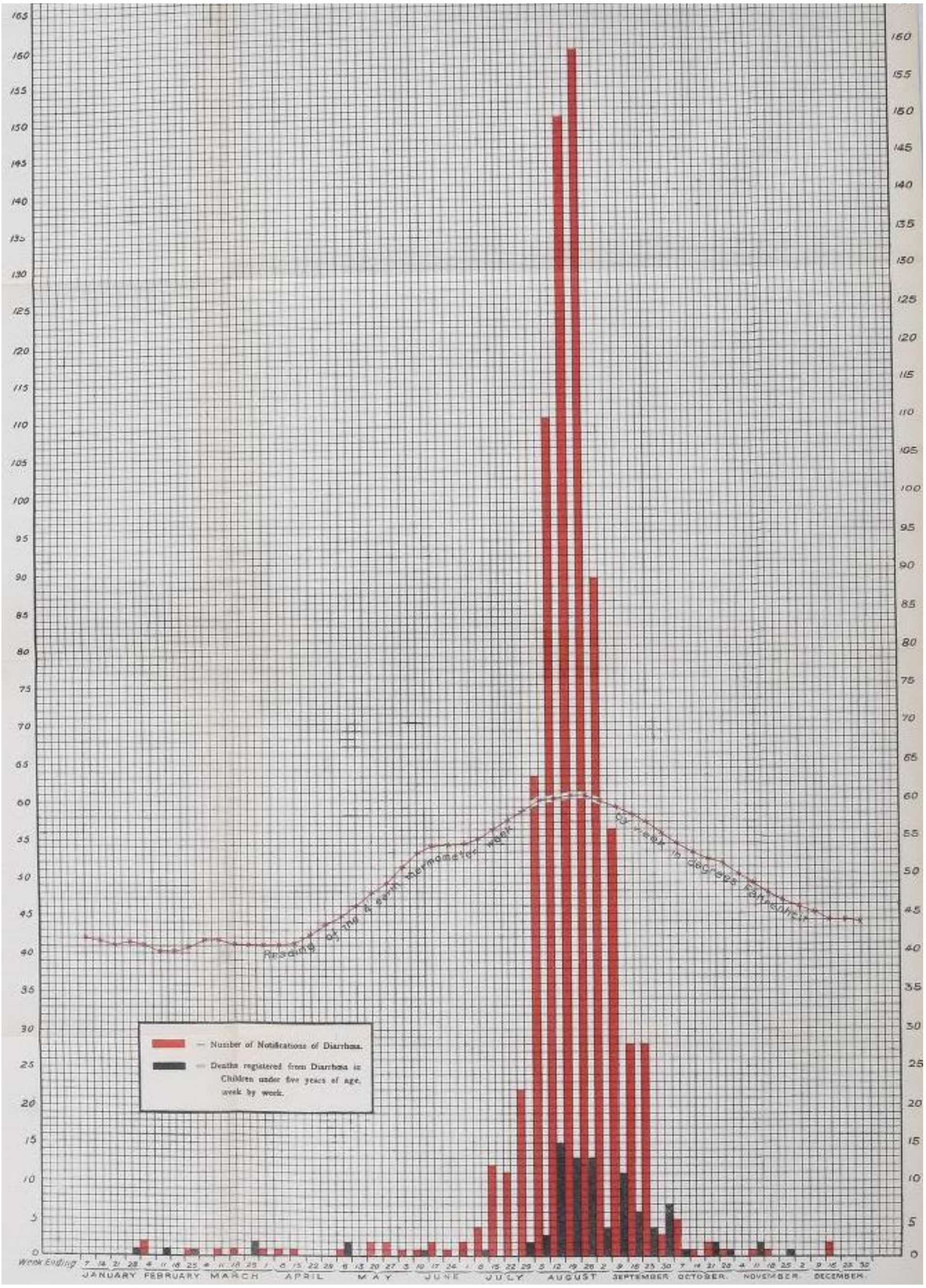
2 Registrar General, *Seventy-Fourth Annual Report*, p. xxxiii.

3 J. Nicolson, *The Perfect Summer: Dancing into Shadow in 1911* (London, 2006). This summer was clearly not 'perfect' for infants however. M. Kendon and J. Prior, 'Two remarkable summers – 'perfect' 1911 and 'calamitous' 1912', *Weather*, 66 (2011), pp. 179-84, here at p. 179.

4 C. Rollet, 'La canicule de 1911: observations démographiques et médicaleset reactions politiques', *Annales de Démographie Historique*, 120 (2010), pp. 105-20; J. Vögele, ' "Has all that has been done lately for infants failed?" 1911, infant mortality and infant welfare in early twentieth-century Germany', *Annales de Démographie Historique*, 120 (2010), pp. 131-46; L. Pozzi and D.Ramiro Fariñas, 'The heat wave of 1911: a largely ignored trend reversal in the Italian and Spanish transition?', *Annales de Démographie Historique*, 120 (2010), pp. 147-78; G. Masuy-Stroobant, '1911: Un été exceptionnel Belgique?', *Annales de Démographie Historique*, 120 (2010), pp. 179-97.

5 Kendon and Prior, 'Two remarkable summers'.

Figure 4.6 Diarrhoea notifications and deaths at ages under five years, Huddersfield, 1911



Note: The red vertical bars represent diarrhoea notifications and the black bars deaths. The text on the temperature line is: Reading of the 4' thermometer week by week in degrees Fahrenheit.

Source: S.G.H. Moore, *Annual Report of the Urban Sanitary Authority of the County Borough of Huddersfield for the Year 1911* (Huddersfield, no date), after p. 16. © Wellcome Library.

for by the deaths from diarrhoeal diseases, which jumped from 23 in 1910 to 79 in 1911 owing to the phenomenal meteorological conditions which prevailed during the summer'.[1] Figure 4.6, taken from the MOH's annual report, gives weekly diarrhoea notifications and deaths at ages under five years and shows that, while a small number of diarrhoea cases occurred throughout the year, it was only when the temperature began to rise in July that first notifications and then deaths increased sharply. Notifications and deaths peaked at the end of August and then decreased rapidly so that by October numbers were back to what they had been before July. At the peak of the epidemic, in the last week of August, there were 160 notifications and 13 deaths. It is unfortunate that Figure 4.6 does not separate infants from those aged 1-4 years, but we do know that 79 of the 94 deaths were infant ones.[2] In total there were 769 notifications (up from 206 in the previous year) and these extra 563 cases resulted in an additional 56 infant deaths.[3] With around 1,000 births occurring annually in Huddersfield, the scale of this outbreak suggests that many families must have suffered with the poorer, working class families being hardest hit.[4] The widespread nature of this epidemic suggests that the work of the infant welfare movement in Huddersfield can be considered only partially successful by 1911. Samson Moore, the town's MOH and a leading advocate of infant welfare, had attempted to distribute appropriate advice to mothers, yet he was not surprised that the adverse climatic conditions had resulted in extra deaths. Indeed, he predicted such in 1910 when he argued that infant welfare work:

> needs continually repeated sustentation, otherwise, although some of the good done will remain permanently, the phenomenal success which has apparently rewarded the special work cannot be maintained. Much of the reduction in the death rate among infants resulted from the intense widespread public interest which was due to the passing of the Notification of Births Act, and from the action of Alderman Broadbent during the first year of his Mayoralty. This interest is gradually subsiding, and it is therefore advisable that something should be done if possible to re-awaken and sustain it. The meteorological conditions during the year were favourable, and there is no room to doubt that given unfavourable meteorological conditions the rate will increase.[5]

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1 S.G.H. Moore, *Annual Report of the Urban Sanitary Authority of the County Borough of Huddersfield for the Year 1911* (Huddersfield, no date), p. 14.

2 Moore, *Annual Report of the Urban Sanitary Authority of the County Borough of Huddersfield 1911*, p. 26. There were also 15 deaths aged 1 year, 4 aged 2-4 years, 1 aged 5-15, 1 aged 15-25, 12 aged 45-65 and 19 aged 65 years and over. Of the infant deaths, 5 were aged under 1 month, 19 aged 1-3 months, 24 aged 3-6 months, 17 aged 6-9 months and 10 aged 9-12 months.

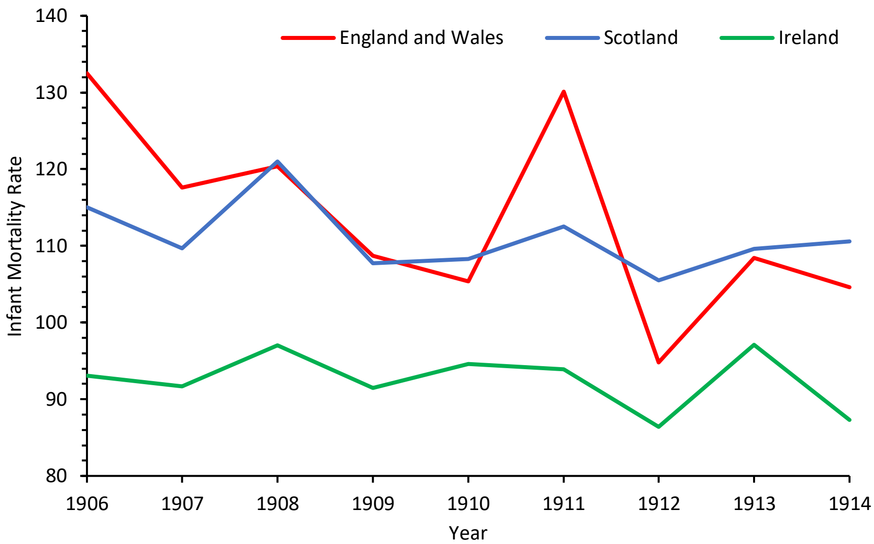
3 The proportion of infant deaths per notified case remained similar in both 1910 and 1911—it was 9.0 per cent in 1910 (23/206) and 9.7 per cent in 1911 (79/769).

4 Moore, *Annual Report of the Urban Sanitary Authority of the County Borough of Huddersfield 1911*, p. 12. Many infants must have survived infection, although whether their health was impaired to such an extent that they succumbed to some other disease cannot be determined.

5 S.G.H. Moore, *Annual Report of the Urban Sanitary Authority of the County Borough of Huddersfield for the Year 1910* (Huddersfield, no date), pp. 19-20. The difficulties of disseminating advice, especially in written form, were highlighted by Moore when he noted that out of 13 untrained midwives working in Huddersfield, 6 were illiterate (p. 16). For a discussion of infant welfare work in Huddersfield see C. Parton, 'The infant welfare movement in early twentieth century Huddersfield', *Journal of Regional and Local Studies*, 3 (1983), pp. 69-77; H. Marland, 'A pioneer in infant welfare: the Huddersfield scheme 1903-20', *Social History of Medicine*, 6 (1993), pp. 25-50.

Moore's prophetic words bring out the fragile nature of the progress that had been made in infant welfare, at least amongst that group of families most likely to succumb to infection. Thus, while Moore was unsuccessful with those families who suffered outbreaks of diarrhoea, and especially with the 79 infants who died from that disease, the IMR in 1911 was nevertheless lower than it had been a few years previously which suggests that many families must have benefitted from the advice that had been disseminated.[1]

Figure 4.7 Infant mortality rates in England and Wales, Scotland and Ireland, 1906-1914



Source: A. Macfarlane and M. Mugford (eds), *Birth Counts. Statistics of Pregnancy and Childbirth,* Vol. 2 (London, 2000), pp. 2, 6.

The IMR in 1911 did not increase everywhere. Figure 4.7 shows national rates in England and Wales, Scotland and Ireland between 1906 and 1912. The pattern in each country is different: in England and Wales the increase in 1911 was dramatic, in Scotland it was only slight, whilst in Ireland the rate was lower than it was in 1910. The reasons for this could be partly climatic as the western and northern extremes of the British Isles are noted for being wetter and cooler than elsewhere.[2] Moreover both Scotland and Ireland were less urbanised than England and Wales and diarrhoea deaths were much less common in rural areas.[3] This could also be the reason why rates in Scotland and Ireland were more stable between 1906 and 1914, although other factors may have been important. For example, when Belfast is compared with Glasgow, the MOHs of both cities noted that diarrhoea deaths rose because the summer of 1911 was hot and dry. However, in Glasgow the IMR increased from 119 in

1 The IMR had been 151 in 1900, 138 in 1904, 97 in 1907, 112 in 1908 and 96 in 1909, see Moore, *Huddersfield 1911*, figure after p. 14.

2 Long-term Irish weather data can be found at https://www.met.ie/climate/available-data/long-term-data-sets/ [accessed April 2021].

3 See Chapter 3, p. 144 which showed that some rural registration districts recorded very few infant diarrhoea deaths during the 1890s.

1910 to 136 in 1911, but in Belfast it fell from 143 to 128.[1] Both cities promoted policies aimed at tackling infant mortality, although the Belfast MOH explicitly stated that advice about preventing infant deaths had been distributed prior to the epidemic season, '[i]n order to prevent the spread of epidemic [d]iarrhoea very special efforts were made throughout the year, and particularly approaching the season when its advent was to be feared'.[2] Did the proactive policies of Belfast's MOH make the difference or were other factors responsible? Diarrhoea deaths in Belfast were certainly higher in 1911 than in 1910, but deaths from other causes declined.[3] Belfast had one of the highest IMRs in Britain in 1910 so there was considerable scope for improvement, although further work on both the effectiveness of the policies adopted in Belfast and more detailed climatic data will be required to resolve this apparent anomaly. 'Hot' and 'dry' are relative descriptors and the exact levels at which increases in temperature or reductions in rainfall posed additional risks for infants have yet to be determined. Likewise, was a sustained period of hot weather necessary to increase risks or did short bursts of intense heat have the same effect?[4] Such questions will only be resolved by carrying out detailed local studies. Weather data are available for many places and these could be compared with local mortality series and the various health initiatives that had been put in place. Clearly national rates can only tell part of the story and the variability identified in Figure 4.7 needs to be examined at a finer level of detail. Figure 4.8 shows RD IMRs in 1911 compared with the average for the decade 1901-10.[5] The pattern within each map is similar, with increases in 1911 being apparent in many districts. Central London, South Wales, the industrial heartlands of the north Midlands, Yorkshire, Lancashire and north-east England stand out as having the highest rates, with many districts being in a higher band than in the previous decade. Rates in some Cornish RDs were also much higher and a number of mainly rural districts, mostly south of a line from the Severn to The Wash, were also in a higher band in 1911. By contrast, rates were lower than they had been in the 1900s in some districts in rural North Wales, Yorkshire and the north of England. Figure 4.8 suggests that, with some exceptions, large parts of the country were affected by the hot dry summer of 1911 and the urban areas more so.

Figure 4.8 is useful in allowing comparison over time and identifying districts where further research is warranted, but it hides many local differences and may mask some changes, since these will only be apparent if a district moved into a different level. As a first step towards providing more in-depth analysis, Table 4.7 compares IMRs between 1910 and 1911 at the county level.[6] The IMR in England and Wales increased by 24 per cent (from

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1 H.W. Bailie, *Report of the Health of the County Borough of Belfast for the Year 1911* (Belfast, no date), p. 87; A.K. Chalmers, *Report of the Medical Officer of Health of the City of Glasgow* (Glasgow, 1912), p. 11.

2 Bailie, *Report of the Health of the County Borough of Belfast 1911*, p. 64.

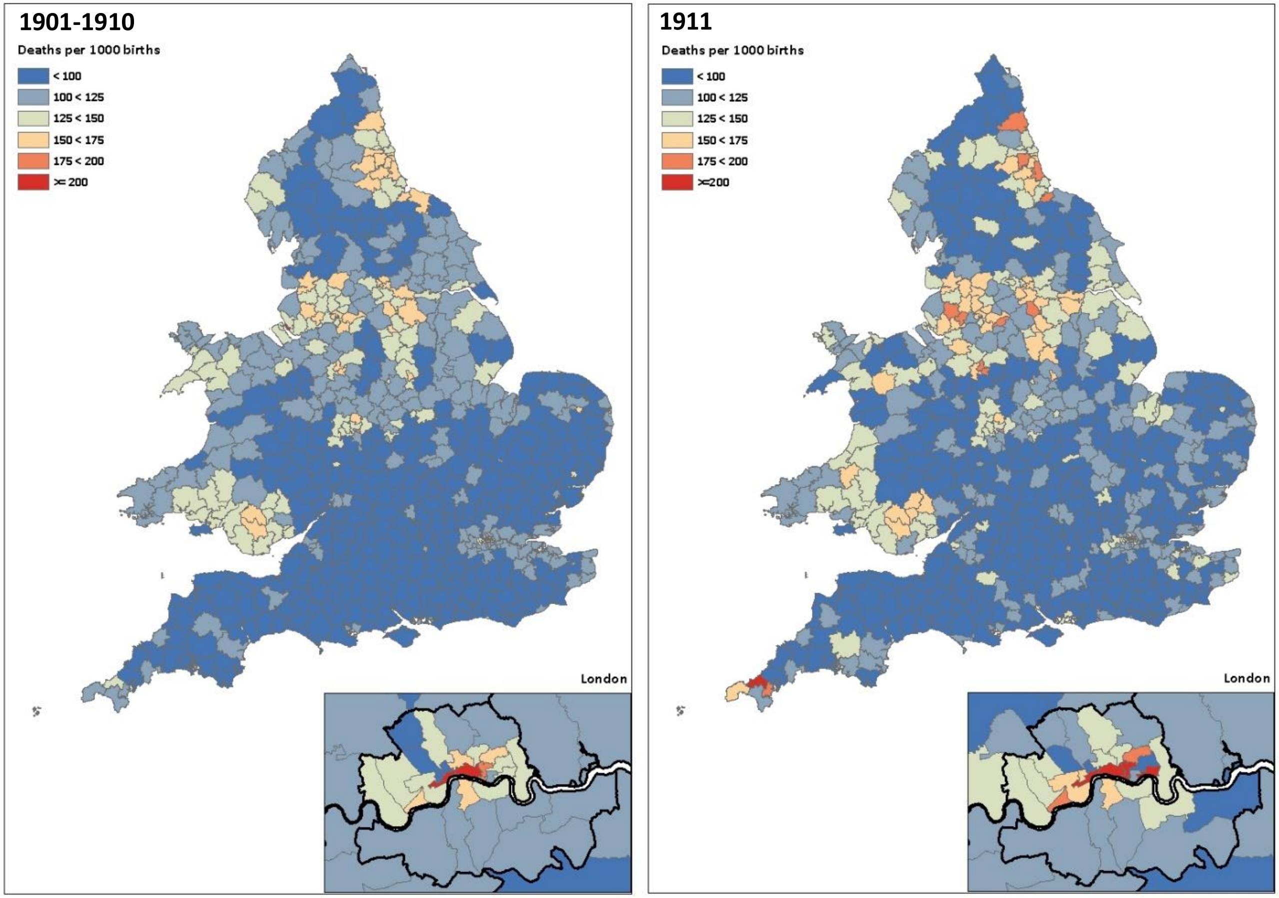
3 A strict comparison between 1910 and 1911 is not possible because enteritis deaths were given in 1910, but not in 1911. There were 348 infant diarrhoeal deaths in 1911, but only 241 total diarrhoea deaths in 1910, see Bailie, *Report of the Health of the County Borough of Belfast 1911*, pp. 29, 87-8 and the table on the following page.

4 Dudfield, 'Diarrhoea in 1911', pp. 120-9, noted the importance of flies as vectors of infection and consequently the influence of climate on diarrhoea deaths is bound up with the reproductive biology of flies.

5 The scale used is identical to that in Figure 3.3.

6 From 1911 the Registrar General changed the primary reporting units from RDs to local authority districts which were identical to those used by MOHs. In 1911 the Registrar General also began to use the International List of Causes of Death and redistributed births and deaths to place of residence, see Registrar General, *Seventy-Third Annual Report*, p. viii.

Figure 4.8 Infant mortality rates by registration district, 1901-1910 compared with 1911



Note: These RDs refer to the 614 standardised districts used in R. Woods and N. Shelton, *An Atlas of Victorian Mortality* (Liverpool, 1997), pp. 15-20. I wish to thank the authors for allowing me access to these data. The infant mortality rates in 1911 were calculated directly from the Registrar General's quarterly returns.

Source: The boundaries were created by Joe Day for the research project, *An Atlas of Victorian Fertility Decline*, see J.D. Day, *Registration Sub-District Boundaries for England and Wales 1851-1911* [2016]. This dataset was created by the 'Atlas of Victorian Fertility Decline' project (Principal Investigator: A.M. Reid) with funding from the Economic and Social Research Council (ES/L015463/1). Day's dataset has been created using A.E.M. Satchell, P.M.K. Kitson, G.H. Newton, L. Shaw-Taylor and E.A. Wrigley, *1851 England and Wales Census Parishes, Townships and Places* [2016] https://www.geog.cam.ac.uk/research /projects/occupations/datasets/documentation.html [accessed 30 November 2021]. The Satchell *et al*. dataset is an enhanced version of N. Burton, J. Westwood and P. Carter, *GIS of the Ancient Parishes of England and Wales, 1500-1850* [computer file] Colchester, England, UK Data Archive [distributor] 2004, SN 4828, which is in turn a GIS version of R.J.P. Kain and R.R. Oliver, *Historic Parishes of England and Wales: an Electronic Map of Boundaries before 1850 with a Gazetteer and Metadata*, Colchester, England, UK Data Archive [distributor] 2001, SN 4348. The original data have been deposited at the UK Data Service, University of Essex: see R. Woods, *Causes of Death in England and Wales, 1851–60 to 1891–1900: the Decennial Supplements* [computer file] Colchester, England, UK Data Archive [distributor] 1997. SN 3552, http://doc.ukdataservice.ac.uk/doc /3552/mrdoc/UKDA/UKDA_Study_3552_Information.htm. I am grateful to Eilidh Garrett for drawing these maps.

Table 4.7 Percentage difference in infant mortality rates, by registration county, 1911 compared with 1910

Greater than 20 per cent	Between 10 and 20 per cent	Less than 10 per cent	Negative difference
Middlesex (62)	Yorkshire, West Riding (18)	Worcestershire (9)	Carmarthenshire (-7)
Cornwall (52)	Somerset (18)	Westmoreland (9)	Yorkshire, East Riding (-7)
Rutland (42)	Norfolk (17)	Northamptonshire (9)	Radnorshire (-31)
Hertfordshire (41)	Suffolk (16)	Devon (9)	
Montgomeryshire (41)	Hampshire (16)	Carnarvonshire (8)	
Bedfordshire (39)	Merionethshire (16)	Cumberland (6)	
London (36)	Cardigan (15)	Nottinghamshire (5)	
Kent (35)	Glamorgan (15)	Sussex (4)	
Monmouth (35)	Staffordshire (15)	Pembrokeshire (4)	
Surrey (33)	Berkshire (14)	Leicestershire (3)	
Derbyshire (33)	Northumberland (14)	Warwickshire (3)	
Essex (29)	Gloucestershire (13)	Yorkshire, North Riding (2)	
Flintshire (26)	Lincolnshire (13)	Herefordshire (0)	
Oxfordshire (25)	Lancashire (12)		
Brecknockshire (25)	Anglesey (11)		
Cheshire (24)	Denbighshire (11)		
Durham (24)	Shropshire (11)		
England and Wales (24)			
Cambridgeshire (23)			
Buckinghamshire (22)			
Dorset (22)			
Huntingdonshire (21)			
Wiltshire (20)			

Note: Percentage change is given in brackets. In 1911 infant mortality rates were given for males and females separately and the average of the two was taken. Boundary changes affected a few counties in 1911. For example, Suffolk was divided into Suffolk, East and Suffolk, West in 1911 and an average of the two was taken to represent Suffolk.

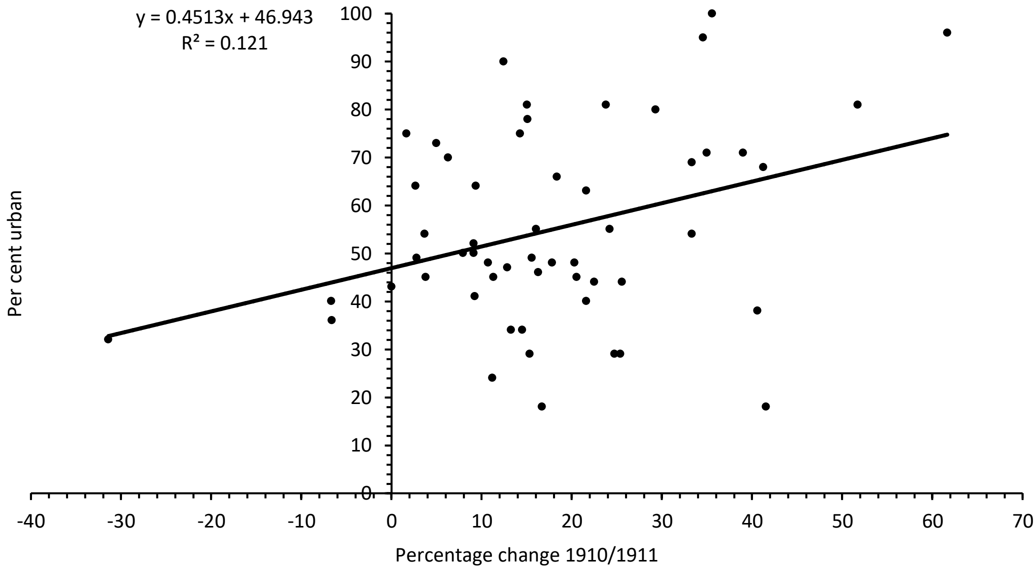
Sources: Registrar General, *Seventy-third Annual Report of the Registrar General of Births, Deaths and Marriages in England and Wales (1910)* (London, 1912), p. 88; Registrar General, *Seventy-fourth Annual Report of the Registrar General of Births, Deaths and Marriages in England and Wales (1911)* (London, 1913), pp. 30-1.

105 in 1910 to 130 in 1911), but the percentage change in different counties varied considerably. Middlesex had the greatest increase (62 per cent) and a few counties even recorded decreases. It should be noted, however, that measuring change with a percentage means that if an increase of say 25 deaths per 1,000 live births (the overall national increase) occurred uniformly across the country, then those counties with the lowest rates would have experienced the greatest percentage increases.[1] Thus, part of the reason why Radnorshire

1 A uniform increase in infant mortality of 10 per 1,000 live births would result in the following percentage increases for the given IMRs: 200—5 per cent, 100—10 per cent, 75—13 per cent, 50—20 per cent.

recorded such a large decrease was that it only recorded 29 infant deaths in 1911.[1] Notwithstanding this, Table 4.7 shows that the counties that recorded the highest increases tended to be south of a line from the Severn to The Wash, precisely those that suffered the most intense summer heat. Likewise, northern counties such as Northumberland, Westmorland and Cumberland, where the climate was likely to have been milder, recorded some of the lowest increases. Alongside these broad geographical patterns there are some interesting anomalies that will bear further investigation. For example, Sussex experienced only a slight increase, while neighbouring Surrey was well above the national average. Likewise, Cornwall experienced the second highest increase (52 per cent) which compared with only a 9 per cent increase in Devon. Climatic variations are unlikely to account for such differences, but Surrey and Cornwall were respectively more urbanised than Sussex and Devon and consequently greater percentages of infant deaths were recorded in the urban parts of Surrey (69) and Cornwall (81) than in the urban parts of Sussex (54) and Devon (52).[2] Figure 4.9 compares percentage change in IMRs between 1910 and 1911 with the percentage of the county that is urban. There is a broad correlation between these variables

Figure 4.9 Percentage increase in infant mortality rates from 1910 to 1911 compared with percentage urban, registration counties in England and Wales, 1911



Source: Registrar General, *Seventy-Third Annual Report of the Registrar General of Births, Deaths and Marriages in England and Wales (1910)* (London, 1912), p. 88; Registrar General, *Seventy-Fourth Annual Report of the Registrar General of Births, Deaths and Marriages in England and Wales (1911)* (London, 1913), pp. 30-1, 187-93.

1 Registrar General, *Seventy-Third Annual Report*, pp. 190-1. This means that there were about 13 fewer infant deaths recorded in 1911 than in 1910. There were 3,247 infant deaths recorded in Middlesex in 1911.

2 Registrar General, *Seventy-Third Annual Report*, pp. 188, 191.

with the greatest percentage increases tending to be associated with higher levels of urbanisation. The relationship is far from perfect, although not unexpected; indeed, when the Registrar General compared urban and rural diarrhoeal IMRs he found that rates were almost twice as high in the major towns than in rural areas (45.9 per 1,000 live births compared to 23.7).[1] Figures 4.6-4.9 and Table 4.7 therefore show that the diarrhoea epidemic caused by the summer of 1911 affected nearly the whole country and that climate and urbanisation were important in determining overall levels of mortality. Other more local factors, most notably levels of sanitation within individual places, coupled with the ability of local authorities to mitigate the threat posed by these exceptional circumstances were also crucial in explaining some of the differences identified above.

In order to examine local diversity in greater detail it is appropriate to focus on a single county. Figure 4.10, taken from Burnley's 1911 MOH report, compares IMRs in Burnley with other Lancashire towns. In 1911 the IMR in Burnley was 210 per 1,000 live births making it one of the highest in the country and 25 per cent higher than it had been in 1910. Such rates were common in industrial towns at the turn of the century, although in Burnley the IMR had been as high as 273 in 1899 which means that some decline had occurred in the first decade of the twentieth century. There had been spikes in 1904 (232) and 1906 (212), both years with hot summers, and even in 1908 the rate was still 201, well above most other industrial towns.[2] Thus, high infant mortality seems to have been endemic in Burnley and the hot summer merely exacerbated what was already a serious problem. Three female health visitors were working in 1911 and nearly 9,000 visits were made in respect of infant welfare, yet their impact can only have been marginal.[3] Even in the workhouse, where presumably the medical authorities had some influence, 14 of the 19 infants who were born there in 1911 died, which implies a staggering IMR of 737.[4] The MOH was clear as to the cause of Burnley's high IMR—201 of the 520 infant deaths in 1911 were caused by diarrhoea and, at the time of their death, 188 of these 201 infants were being fed artificially.[5] Further inquiries by the health visitors into the deaths of infants born in 1910 and 1911 revealed a high prevalence of artificial feeding: only 22 per cent of these infants were breastfed, 33 per cent were fed artificially, 31 per cent were fed a mixture of breast milk and artificial food and the method of feeding of the other 14 per cent was 'not stated'.[6] Overall, at least 64 per cent

1 Registrar General, *Seventy-Third Annual Report*, pp. 65, 69.

2 T. Holt, *Report on the Public Health and Sanitary Administration for the Year 1911* (Burnley, no date), p. 21. The illegitimate IMR in 1911 was 323 (p. 17).

3 Holt, *Report on Public Health 1911*, p. 63: '[t]he routine of visiting infants consists of a visit as soon after birth as possible, except in those cases where a medical man has been in attendance, when a visit is usually paid about the end of ten days. Re-visits are paid where necessary, and a second routine visit is paid at the end of six months. In addition to these routine visits, special visits are paid when illness is known or thought to exist and is not being attended by a doctor'. A total of 10,269 visits were made by the 3 women (including some to school children and workshops) which, assuming a 6 day week and no holidays, means that each visitor must have carried out about 11 visits per day. Along with travelling time, visits when the mothers were out and time needed for training and record keeping this suggests that each visit must have been relatively short. In an analyis of causes of death the MOH considered that 337 out the 520 infant deaths were preventible (65 per cent) (p. 18). The MOH for Blackburn had stressed the importance of re-visiting since in many instances he noted that the advice given had been ignored, see A. Greenwood, *Annual Report upon the Health of Blackburn for the Year 1908* (Blackburn, 1909), p. 35.

4 Holt, *Report on Public Health 1911*, p. 26.

5 Holt, *Report on Public Health 1911*, p. 18. Only 99 infants had died from diarrhoea in 1910 (p. 21).

6 Holt, *Report on Public Health 1911*, p. 141.

Figure 4.10 Infant mortality rates in Lancashire towns, 1910 and 1911

Name of Town.	1910.	1911.
BURNLEY	**168**	**210**
Ashton-under-Lyne	147	193
Wigan	131	193
Blackburn	136	187
Middleton	100	181
Accrington	109	180
Preston	158	173
Stalybridge	165	172
Stockport	136	172
Chorley	133	171
Bury	125	166
Bolton	116	161
Oldham	127	159
St. Helens	122	158
Liverpool	139	154
Salford	130	154
Widnes	122	153
Darwen	124	153
Swinton and Pendlebury	165	150
Hindley	122	146
Bootle	127	145
Colne	149	144
Rochdale	103	140
Birkenhead	135	135
Rawtenstall	97	129
Blackpool	111	127
Southport	102	118
Eccles	120	115
Waterloo-with-Seaforth	75	113
Bacup	102	111
Barrow-in-Furness	119	110
Lancaster	139	100
Nelson	113	77

Source: T. Holt, *Report on the Public Health and Sanitary Administration for the Year 1911* (Burnley, no date), p. 19.

of the infants who died had received some form of artificial food. The MOH also noted a high prevalence of mothers working in factories and while he provided some evidence as to the extent of this practice, it is difficult to assess the precise effect it had on levels of infant mortality, even though the MOH clearly thought that it was important.[1] Social class differences were also in evidence in Burnley, with the IMR amongst those infants born in back-to-back houses being 318 compared to only 45 among those, presumably middle-class, infants who were not given a health visit.[2] Burnley therefore appears to have had culture of high infant mortality and high levels of artificial feeding that stretched back well into the nineteenth century and, while the MOH had made some attempts to deal with this problem, by 1911 he had been largely unsuccessful.

While many of the towns that feature in Figure 4.10 may appear to share similar characteristics to Burnley their experiences during 1911 differed markedly. Climatic factors cannot have been responsible for these differences and in the main they must have been due to the sanitary nature of the different towns and the success by which the authorities could combat the climatic shock. For example, in Accrington the MOH explained that the town's substantial increase in infant mortality was due to a rise in diarrhoea deaths coupled with a whooping cough epidemic, although it is noteworthy that the Notification of Births Act was not in force in that town because it had not employed any female health visitors.[3] By contrast, in Birkenhead the IMR remained stationary in spite of the fact that the number of diarrhoea deaths increased from 98 in 1910 to 158 in 1911.[4] These excess diarrhoea deaths were balanced by declines in other causes. There had also been 152 diarrhoea deaths in 1906, the previous year with a hot summer, and throughout the first decade of the twentieth century the IMR had steadily declined.[5] Other than providing basic statistics on infant mortality the MOH was silent as to why the IMR did not increase in 1911 and female health visitors were not appointed until January 1912.[6] Thus, whatever was being done to tackle infant mortality in Birkenhead it was successful to a certain degree in spite of the more than 60 per cent increase in diarrhoea deaths in 1911.

In neighbouring Liverpool the IMR increased from 137 in 1910 to 154 in 1911, which was down from *c*.200 at the turn of the century.[7] This increase was nevertheless significant, and is revealed in Figure 4.11 which shows daily diarrhoea deaths, temperature and rainfall from July to October in 1910 and 1911. The pattern of diarrhoea deaths is similar to that in Huddersfield (Figure 4.6) although greater in extent, as deaths in 1911 began to increase in late July and continued at a high level until early October. Note that there was also a lag between the increase in temperature and deaths suggesting an intermediate variable, perhaps the need for the fly population to build up and facilitate the spread of infection. The

1 Holt, *Report on Public Health 1911*, pp. 136-42.

2 Holt, *Report on Public Health 1911*, p. 26.

3 A. Greenhalgh, *Annual Report of the Medical Officer for the Year 1911* (Accrington, no date), p. 17, Table IV. The appointment of 'Lady Health Visitors' had been discussed by the council, 'although the wisdom of such an appointment has grown in favour it has not so far been able to secure a majority of the Councillors to support it'.

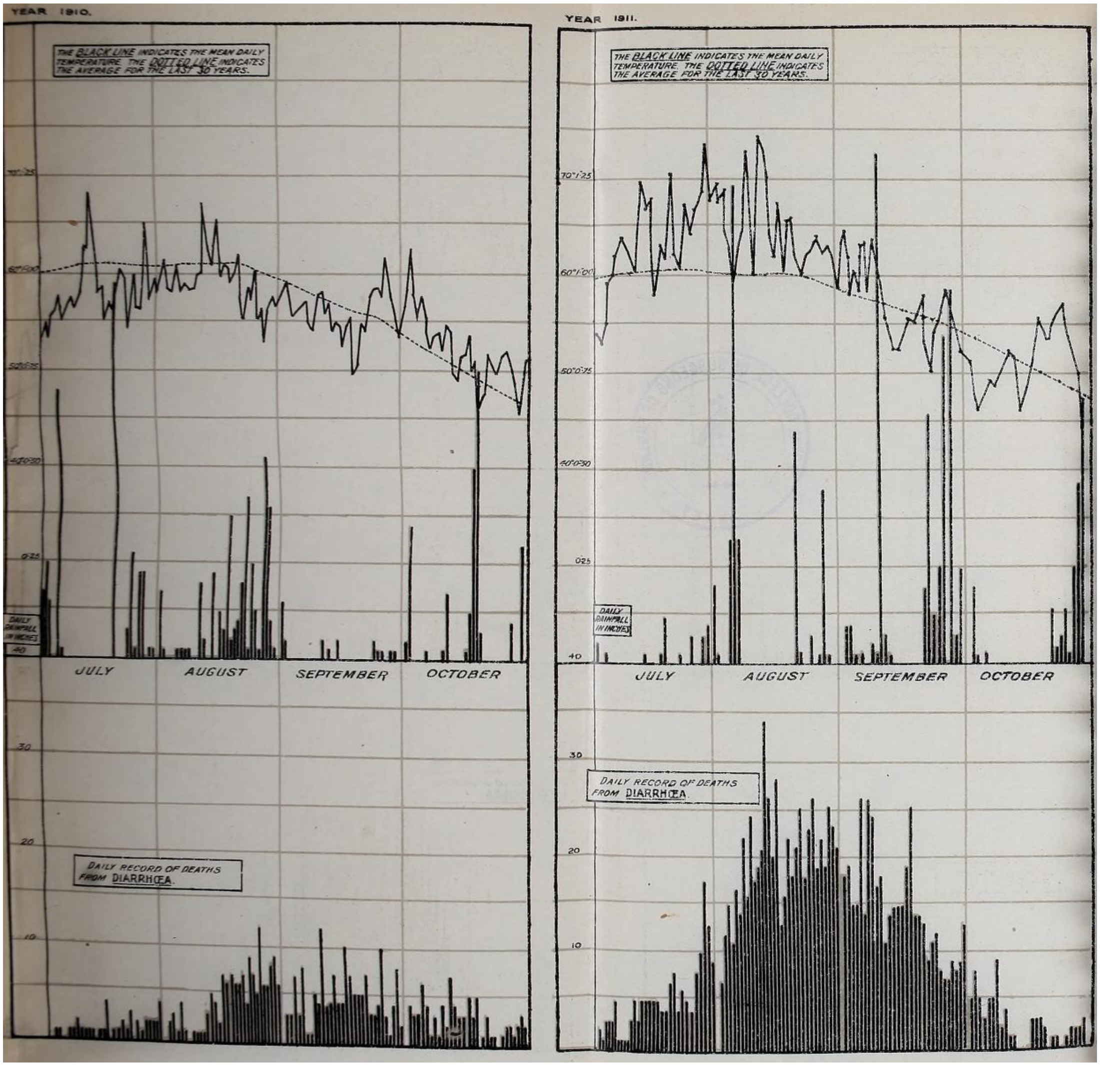
4 R.S. Marsden, *Report on the Sanitary Condition of the County Borough of Birkenhead for the Year 1911* (Birkenhead, 1912), p. 31. The MOH gives the IMR in 1911 as 136 which is the revised rate after the Registrar General had transferred births from other places.

5 Marsden, *Report on the Sanitary Condition of Birkenhead 1911*, p. 31.

6 R.S. Marsden, *Report on the Sanitary Condition of the County Borough of Birkenhead for the Year 1912* (Birkenhead, 1913), p. 19.

7 E.W. Hope, *Report on the Health of the City of Liverpool during 1911* (Liverpool, 1912), graph after p. 18.

Figure 4.11 **Daily temperature, rainfall and diarrhoea deaths, Liverpool: July to October 1910 and 1911**



Note: The top boxes read: 'The black line indicates the mean daily temperature. The dotted line indicates the average for the last 30 years'; 'Daily rainfall in inches'. The bottom boxes read: 'Daily record of deaths from diarrhoea'.

Source: E.W. Hope, *Report on the Health of the City of Liverpool During 1911* (Liverpool, 1912), after p. 46.

temperature was much higher in 1911 than in 1910 throughout July and August and August was also particularly dry.[1] In 1910 summer diarrhoea still occurred, although deaths were lower as that summer was less hot and had more rain than 1911. It is however interesting that in late September and early October of 1910, when the temperature was higher than in 1911, high numbers of diarrhoea deaths continued throughout October.

Liverpool's MOH, Edward William Hope, was forthright in his opinion as to the principal causes of infant mortality which he summarised as 'neglect', 'inattention', 'improper food' and 'scanty clothing'.[2] He was also pessimistic as to extent to which MOHs could bring about change since:

> as far as infantile diarrhoea is concerned, it must never be forgotten, however, that whatever is in the power of the municipality to do in regard to the preservation of infant life is insignificant when compared with what is in the power of the mother to do.[3]

It is difficult to judge whether Hope's culture of blame hampered his attempts to reduce rates, but as he did throughout his tenure, he reiterated his view that families living in the same environment often had very different experiences of infant mortality.[4] In Liverpool various means by which infant mortality could be prevented were in place by 1911. These included health visiting, midwives being instructed to give out appropriate advice, milk depots, hospital treatment for infants suffering measles, whooping cough and in some cases diarrhoea, improved scavenging and street cleaning.[5] With respect to diarrhoea, Hope concluded that:

> [i]nvestigation proves incontestably that the deaths of infants from this cause [diarrhoea] are closely associated with the method of feeding, putrefying food being the medium by which the specific poison is commonly introduced … The deaths amongst children under three months of age either wholly or partially fed on artificial foods, are fifteen times as great as they are amongst an equal number of infants fed upon breast milk.[6]

During the summer Hope geared much of his efforts towards the fight against infantile diarrhoea. On 18 August he received a circular from the LGB concerning:

> the necessity for close attention to municipal cleanliness during the hot season. It suggested that 'the Council may consider it advisable during the next few weeks to divert the Sanitary Inspectors from less urgent work, and to instruct

1 These more detailed weather and rainfall statistics will also allow more sophistical statistical analyses to be undertaken.

2 Hope, *Report on the Health of Liverpool 1911*, p. 17. See Chapter 3, pp. **000-00** for a discussion of attempts by Liverpool's MOHs to tackle infant mortality during the nineteenth and early twentieth centuries.

3 Hope, *Report on the Health of Liverpool 1911*, p. 18

4 Hope, *Report on the Health of Liverpool 1911*, p. 18

5 Hope, *Report on the Health of Liverpool 1911*, pp. 17-18, 42, 48-9.

6 Hope, *Report on the Health of Liverpool 1911*, p. 41. On p. 268 there is an analysis of infant feeding methods amongst 63 cases admitted to the City Hospital, Fazakerley suffering from infantile diarrhoea: 4 were breast fed alone, 27 were fed cow's milk, alone or combined with artificial foods and 32 were only given artificial foods.

> them to make rapid visits with a view to securing efficient sanitation, especially in and about the houses of the working classes'.[1]

Unfortunately, Hope was unable to act on this advice because of the general transport strike which culminated in the events known as 'Bloody Sunday' when the police baton charged a crowd of 85,000.[2] According to Hope the strike interrupted the milk supply and was:

> accompanied by conduct which threatened to affect most seriously the well-being of the poorer sections of the community, and still more seriously the health and lives of their infants and young children … the growing turbulence shared in by multitudes of women in the poorer quarters of the City was accompanied by the neglect of the infants and young children and of the homes, whilst the distracted women were lounging or fighting in the streets.[3]

Only parts of the city were affected by the strike, although it did mean that cleansing activities ceased in some districts, as did house to house visiting.[4]

It is difficult to judge the effects of the strike on infant health in Liverpool. Hope was once again highly critical of some working-class mothers, although it is hard to believe that many mothers were so caught up in the political fervor that they neglected their infants to such an extent that they died. Moreover, the overall increase in IMR in 1911 was only 12 per cent, well below the national average and many of the towns in Figure 4.10. Indeed, Liverpool had a number of circumstances favourable to good infant health, most notably the high prevalence of maternal breastfeeding that occurred throughout the city. In respect of over 15,000 visits made in connection with the Notification of Births Act in 1911, 80 per cent of infants were found to be breastfed, 4 per cent were given artificial supplements in addition to breast milk and the remaining 16 per cent were fed various forms of artificial foods.[5] In the wealthier, less crowded parts of the city IMRs were low and the IMR varied from 80 to 220 within districts.[6] This meant that many diarrhoea deaths were concentrated into the central parts of the city (Figure 4.12). Published without comment, this figure illustrates how infantile diarrhoea was widespread throughout the central part of Liverpool. It is clear that certain streets seem to have been especially affected, although the facts that deaths from three years were grouped together and it is not known how many babies were born in each street means that Figure 4.12 remains difficult to interpret. Reasons why concentrations of diarrhoeal deaths occurred in certain streets are easy to find, with the MOH providing some examples of poor housing (see Figure 4.13 for an example). By contrast some parts of the city had undergone considerable improvement by 1911 and Figure 4.14 shows the recent development of Bevington Street (indicated by an arrow in Figure 4.12). Here we can see an example of ideal, early twentieth century housing with a widened street; but even here, a single black dot appears on this street in Figure 4.12, showing that infantile diarrhoea could still persist even in the best environments.

1 Hope, *Report on the Health of Liverpool 1911*, p. 51.
2 S. Davies and R. Noon, 'The rank-and-file in the 1911 Liverpool General Transport Strike', *Labour History Review*, 79 (2014), pp. 55-81.
3 Hope, *Report on the Health of Liverpool 1911*, pp. 49-50.
4 Hope, *Report on the Health of Liverpool 1911*, p. 50-1.
5 Hope, *Report on the Health of Liverpool 1911*, p. 124.
6 Hope, *Report on the Health of Liverpool 1911*, graph after p. 18.

Figure 4.12 Map of central Liverpool showing streets recording infant diarrhoea deaths, 1909-1911

Bevington Street

Note: Bevington Street has been indicated.

Source: E.W. Hope, *Report on the Health of the City of Liverpool during 1911* (Liverpool, 1912), after p. 18.

Figure 4.13 Insanitary housing in an unnamed part of Liverpool

A TRIANGULAR SHAPED COURT, WITH TUNNEL ENTRANCE, CONTAINING NINE INSANITARY HOUSES, BACK TO BACK WITH ADJACENT FRONT HOUSES.

Figure 4.14 Housing in Bevington Street, Liverpool, 1911

A VIEW OF SELF-CONTAINED COTTAGES IN BEVINGTON STREET, LOOKING FROM TITCHFIELD STREET.
Erected on the site of former insanitary property.
(This Street was formerly only 28ft. wide, and is now 60ft. wide.)

Source: E.W. Hope, *Report on the Health of the City of Liverpool during 1911* (Liverpool, 1912), after p. 257. Plans of the Bevington Street development are also included in the same part of the report.

Despite the substantial increase in diarrhoea mortality shown in Figure 4.11, Hope's pessimistic view of some working-class mothers, the poor living conditions of many Liverpool residents and the strike that affected municipal efforts to combat the exceptional circumstances of 1911, it should be concluded that Liverpool was partially successful in mitigating the worst of the extreme summer weather as the IMR only increased by 17 per 1,000 live births (12 per cent). It was certainly more successful in combatting this crisis than most of the towns listed in Figure 4.10 and probably more successful that many other places in the rest of the country.

It is appropriate to end this section by examining what happened in the other two districts that were examined in chapter 3: the London Borough of St Pancras and the Isle of Wight rural district.[1] In St Pancras the IMR increased from 108 in 1910 to 121 in 1911, a rise of 12 per cent.[2] This relatively low rate was due in part to this district being one of the leaders in infant welfare with well-established and efficient health visiting, appropriate advice given to mothers and help with maintaining mothers' health, both in the ante- and post-natal periods, thereby ensuring that they were able to continue breastfeeding her infant.[3] John Sykes, the MOH, also enthusiastically followed up the advice given by the LGB in August (see above) and, in summarising the means by which the causes of infant mortality were understood and could be tackled, he stated that:

> the foremost means of securing a low infant mortality are: efficient domestic and municipal sanitation and housing, and intelligent and painstaking motherhood. There is much machinery which has already been devised to meet the last-mentioned end, including paid and voluntary women health visitors, schools for mothers, consultation centres for mothers, infant milk depots.[4]

Thus, much of the structure for good infant welfare was in place by 1911, but its operation was clearly not entirely effective as the various messages failed to reach, or were not fully implemented by, a small percentage of mothers. In an investigation of 129 infants who died from diarrhoeal diseases, the MOH found that 96 (74 per cent) were hand-fed at the time of death, 22 (17 per cent) 'mixed-fed' and only 11 (9 per cent) breastfed.[5] He also found that 44 of the infants not exclusively breastfed had been hand-fed from birth with a further 49 being moved onto artificial foods by the time they were one month old. Amongst a wider sample of 685 infants who were given regular visits, 606 (88 per cent) were breastfed, 41 (6 per cent) mixed-fed and only 38 (6 per cent) hand-fed.[6] IMRs were therefore relatively low in St Pancras in part because maternal breastfeeding rates were high and infant welfare

1 See pp. 185-94.

2 J.F.J. Sykes, *Fifty-Sixth Annual Report of the Medical Officer of Health on the Vital and Sanitary Condition of the Metropolitan Borough of St Pancras* (London, n.d.), p. 25. The corrected IMR, once institutional births and infant deaths had been reallocated to their place of residence, was 112 in 1911 which was low for an urban centre. The published rate for 1910 was uncorrected; had it been corrected, it would probably have been lowered to less than 108, meaning that some increase would still have occurred in 1911.

3 Sykes, *Fifty-Sixth Annual Report of the Medical Officer of Health*, p. 27.

4 Sykes, *Fifty-Sixth Annual Report of the Medical Officer of Health*, p. 27. Schools for mothers are discussed on pp. 29-32. See Campbell, *Carnegie United Kingdom Trust Report on the Physical Welfare of Mothers and Children*, pp. 83-119 for a wider discussion of these institutions.

5 Sykes, *Fifty-Sixth Annual Report of the Medical Officer of Health*, p. 33.

6 Sykes, *Fifty-Sixth Annual Report of the Medical Officer of Health*, p. 36. These infants were visited at various ages and some breastfed infants would no doubt have been moved onto mixed- or hand-feeding at some stage during their first year. These data do of course exclude infants who died prior to being visited.

measures effective and, despite experiencing the worst of the summer heat, the overall increase in infant mortality in 1911 was modest. While the various preventive measures that had been put in place by the council could not save every infant, with those infants whose mothers were not able to breastfeed them for whatever reason being especially vulnerable, the health authorities in St Pancras could claim some success in averting even higher increases in mortality.

In the rural district of the Isle of Wight the summer of 1911 passed almost without notice. The intense heat was noted by the MOH, but only one infant diarrhoea death was recorded in 1911 and the IMR was 50 up from 46 in the previous year.[1] The rate had been about 100 at the end of the nineteenth century, but too much should not be made of such small differences since only 26 infant deaths were recorded in 1910 and 27 in 1911. Perhaps because the IMR was so low, the MOH was silent about what was being done, if anything, to improve infant welfare. A section of the 1911 annual report is titled 'Means for Prevention of Mortality in Childbirth and in Infancy', but this only concerns midwives especially in respect of the 1902 Midwives Act and nothing is recorded about other infant welfare issues.[2] The rural environment would have certainly helped to mitigate any climatic threat, but it could be that, even in the absence of municipal involvement, knowledge about how to reduce IMRs had diffused into the wider public consciousness.

This short examination of the impact of an adverse climate on infant mortality in 1911 has raised many questions, but provided few answers. It was already well known that hot dry weather placed some infants at additional risks and the extreme weather tested many local authorities to their limit with their responses differing greatly from place to place. Climate and levels of urbanisation are key variables in explaining some of the broad differences, but personal factors were crucial. Social class was also important, especially as it influenced the ability of families to choose where they lived. The 1911 Annual Report of the Registrar General showed that infants whose fathers engaged in largely middle-class occupations, such as artists, medical practitioners and clergymen, suffered an IMR of only 45 per 1,000 live births compared with 186 amongst infants whose fathers had working-class occupations such as general labourers, ironworkers and scavengers.[3] This class relationship also held for illegitimate infants. The overall illegitimate IMR was 245, almost double that for legitimates, but it was 160 amongst infants whose mothers had lower middle-class occupations and 316 for mothers with working-class occupations.[4] The relationship between place and class was complicated, but by 1911 the middle classes were increasingly able to counter the detrimental effects of the climate either by living in healthier environments or by adopting more hygienic

1 J.A. Gibson, *1911 Annual Report on the Health of the Rural Sanitary District of the Isle of Wight* (Newport, 1912), pp. 9-11 and 65.

2 Gibson, *1911 Annual Report on the Isle of Wight*, pp. 9-11.

3 Registrar General, *Seventy-Fourth Annual Report of the Registrar-General*, p. xliv. The full list of occupations in Group A (middle-class) is: artists, merchants, medical practitioners, naval officers, solicitors, army officers, woodmen, C.E. clergymen, others connected with education; and in Group B (working-class): general labourers, foundry labourers, dock labourers, ironworkers, earthenware manufacture, brassworkers, tube manufacture, flax, hemp etc. workers, navvies, lamp etc. makers, tin miners, salt makers, factory labourers, scavengers, provision curers, costers, hawkers, patent fuel manufacture.

4 Registrar General, *Seventy-Fourth Annual Report of the Registrar-General*, p. xlv. The full list of occupations in Group A (lower middle-class) is: commercial clerks, milliners, shopkeepers and shop assistants, other workers in paper, sick nurses, teachers; and in Group B (working-class): other workers in dress, wool and worsted manufacture, barmaids, cotton manufacture, costermongers, hawkers, earthenware manufacture. Not all mothers of illegitimate infants would have recorded an occupation.

child care practices.[1] These relationships had existed throughout the nineteenth century, and perhaps even earlier, but what was different in 1911 was that many MOHs had by then taken active measures to reduce rates and, whilst these were mainly targeted at the working classes, the middle classes also benefitted so that, almost without exception, overall IMRs in 1911 were lower than they had been a decade earlier.

This case study suggests that prior to the outbreak of the Great War the progress made in tackling high infant mortality could be halted by an extreme event such as a heatwave, with those suffering most tending to be artificially-fed infants living in the worst urban conditions. It has identified a variety of experiences and shown that a wider examination of local responses to this crisis will provide further insights into the effectiveness of infant welfare provision at the beginning of the second decade of the twentieth century. In particular, the extent to which artificially-fed infants bore the brunt of the excess mortality is an issue worthy of further investigation. Likewise, the precise influence of climate on infant health has yet to be explored in detail. The impact of climate could also be examined in 1904 and 1906, both years when summers were hot and IMRs increased (Figure 4.1). The next comparable summer to 1911 occurred in 1933, although 1921 was also considered to be hot.[2] However, as far as the national rate was concerned there was only a slight increase in 1921 and none in 1933 (Figure 4.1).[3] It seems therefore that by 1933 greater progress had been towards to the elimination of summer infantile diarrhoea, although further research is needed to prove this assertion.[4]

World wars, epidemics and recession

Other major events that might have influenced infant mortality include the two world wars, the influenza pandemic that swept the world between 1918 and 1920 and the economic recession of the early 1930s. However, as Figure 4.1 showed, there are no obvious correlations between any of these events and an increase in the IMR, although this does not preclude the possibility that they did have some impact. For example, the 1930s recession particularly affected northern industrial and mining areas as unemployment rates reached 70 per cent in some places; however, other parts of the country were much less affected. The national trend could therefore mask considerable local variations and, as with all these events, their full impact can only be assessed through detailed local case studies.

It is appropriate to begin this discussion by examining the trend of infant mortality during the First World War. For Britain the war began on 4 August 1914 and ended on 11 November 1918, although small numbers of British troops were still fighting in Russia during 1919. Any impact that the war may have had on infant mortality is likely to have been felt during the years 1915-1918, although some lasting effects may have lingered into subsequent years. Figure 4.15 shows IMRs in England and Wales between 1910 and 1920 with diarrhoeal, non-diarrhoeal and neonatal rates being shown separately. The IMR was

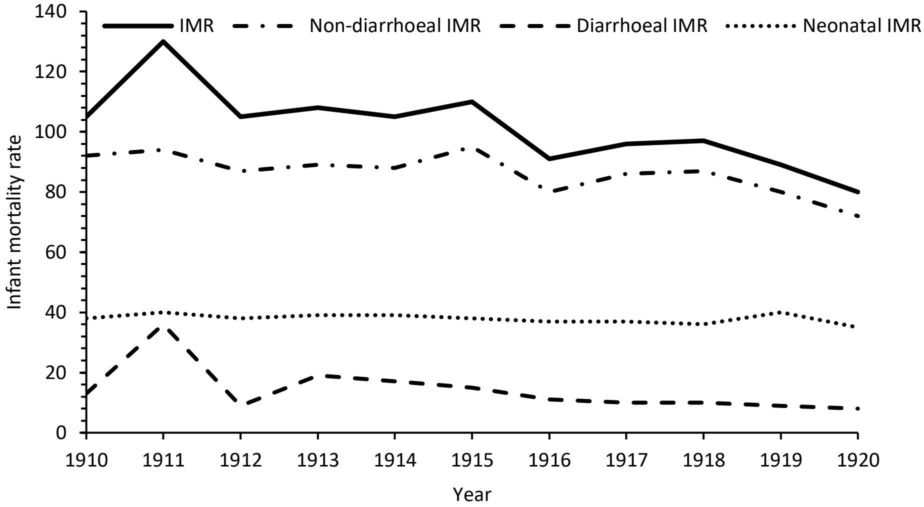
1 See E. Garrett, A. Reid, K. Schürer and S. Szreter, *Changing Family Size in England and Wales. Place, Class and Demography, 1891-1911* (Cambridge, 2001), pp. 139-47 for a wider discussion of this relationship.

2 Kendon and Prior, 'Two remarkable summers', p. 181.

3 National IMRs for the following years were: 80 per 1,000 live births in 1920, 83 in 1921, 77 in 1922, 65 in 1932, 64 in 1933, and 59 in 1934.

4 IMRs in some places did increase in 1933. For example, in Liverpool the IMR was 98 which compared with 93 in 1931 and 91 in 1932 with this increase being mainly caused by a rise in diarrhoea deaths, see W.M. Frazer, *Report on the Health of the City of Liverpool in the Year 1933* (Liverpool, 1934), pp. 17, 20, 110.

Figure 4.15 Infant, non-diarrhoeal, diarrhoeal and neonatal mortality rates: England and Wales, 1910-1920



Source: Registrar General, *Eighty-Third Annual Report of the Registrar General for England and Wales (1920)* (London, 1922), pp. xxxviii-xxxix.

105 in 1910 and 80 in 1920, an overall fall of 24 per cent, and during the five war years rates were 105, 110, 91, 96 and 97.[1] Not surprisingly, there was some fluctuation throughout this period and, given that IMRs were high in 1911 and low in 1912, it is difficult to calculate a representative pre-war rate. Consequently, the amount of change that occurred during the war will depend on exactly which years are selected for comparison.[2] The difficulty of assessing the impact of the war is compounded by falling birth rates from 1916 and the post-war baby boom. In 1914 879,096 births were registered in England and Wales, but the number of births fell to 662,661 in 1918 and then increased to 957,782 in 1920.[3] In a period of fluctuating birth rates, the method of calculating IMRs by dividing infant deaths by live births in a particular year becomes less reliable and the Registrar General made attempts to calculate alternative rates. Since about 30 per cent of infants who died in any year were born in the previous one, the Registrar General used 70 per cent of births in that year and 30 per cent of births in the previous one in the denominator of his infant mortality calculations.[4]

1 See J.M. Winter, 'Aspects of the impact of the First World War on infant mortality in Britain', *Journal of European Economic History*, 11 (1982), pp. 713-38 for a wider discussion. Mortality rates also declined throughout the rest of the civilian population: see J.M. Winter, 'The impact of the First World War on civilian health in Britain', *Economic History Review*, 30 (1977), pp. 487-507; J.M. Winter, *The Great War and the British People* (Basingstoke, 1985), pp. 103-40.

2 For example, see the discussion in J.M. Winter, J. Lawrence and J. Ariouat, 'The impact of the Great War on infant mortality in London', *Annales de Démographie Historique*, (1993), pp. 329-53, here at p. 330.

3 Macfarlane and Mugford, *Birth Counts*, p. 2.

4 Registrar General, *Eighty-First Annual Report of the Registrar General of Births, Deaths and Marriages in England and Wales (1918)* (London, 1920), p. xxxii, British Parliamentary Papers 1920/X (Cmd. 608). The Registrar General also related deaths at ages under three months to births in that year, and deaths at higher ages to the estimated population aged under one year, but the same trend is apparent in this alternative IMR series.

The effect of this change was to reduce the rate in 1917 from 96 to 91 and increase the rate in 1918 from 97 to 98.[1] Notwithstanding these relatively small differences, the conclusion still holds, as the Registrar General noted as early as 1916, that 'the war has not arrested the fall in infant mortality'.[2]

Figure 4.15 also reveals that neonatal mortality declined only slightly during the war years (it was 38 per 1,000 live births in 1910, 39 in 1914 and 36 in 1918, although it did increase to 40 in 1919) which means that most of the changes occurred within post-neonatal mortality.[3] After 1912 there was a year-by-year downward drift in diarrhoeal mortality so that all of the small increases were concentrated within post-neonatal, non-diarrhoeal mortality. Childhood infectious diseases accounted for the increase in infant mortality in 1915 as there was an epidemic of measles in the spring and greater numbers of winter bronchitis and pneumonia deaths.[4] The rise in 1918 was caused by an epidemic of whooping cough, and there were increases in respiratory diseases, especially influenza, with deaths from this cause being more than 900 per cent higher than the pre-war average.[5] None of these increases was a direct consequence of the war, although it could be argued that the influenza pandemic was exacerbated by war conditions, and it is therefore necessary to conclude that the increasing economic hardships of war, which resulted in some food shortages, appear to have had little detrimental effect on infant health.[6] Jay Winter and his colleagues noted that in London the decline in infant mortality during the war was less than in some northern industrial towns and, while they discussed a number of possible reasons for this, they were unable to reach any firm conclusions.[7] Thus, while some local variations may be expected, the wars years were characterised by a general decline in infant mortality with the greatest declines occurring in those places suffering the highest rates.

The most extensive discussion of the impact of war on infant health is Deborah Dwork's *War is Good for Babies* which highlighted the indirect benefit of war for Britain's babies as the

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For a general account of demographic changes during the war, see B. Mallett, 'Vital statistics as affected by war', *Journal of the Royal Statistical Society*, 81 (1918), pp. 1-36.

1 Registrar General, *Eighty-Third Annual Report of the Registrar General for England and Wales (1920)* (London, 1922), p. xxxviii.

2 Registrar General, *Seventy-Ninth Annual Report of the Registrar General of Births, Deaths and Marriages in England and Wales (1916)* (London, 1918), p. xxv, British Parliamentary Papers, 1917-1918/VI (Cd. 8869). This was in sharp contrast to some other combatant counties as the IMR in Germany plateaued whilst in France, Italy and Austria it increased, see Winter, *Great War and the British People*, p. 142. In Berlin, illegitimate births soared which caused overall IMRs to increase, see J. Winter and J. Cole, 'Fluctuations in infant mortality rates in Berlin during and after the First World War', *European Journal of Population*, 9 (1993), pp. 235-63.

3 Low levels of neonatal mortality occurred throughout the country as urban neonatal rates were only 2 per cent higher than rural ones in 1916. This differential increased to 50 per cent for infants aged 3-6 months, 56 per cent for infants aged 9-12 months. For all infants taken together the differential was 25 per cent. See Registrar General, *Eighty-Third Annual Report of the Registrar General*, p. xl. This pattern was similar in other years.

4 Registrar General, *Seventy-Eighth Annual Report of the Registrar General of Births, Deaths and Marriages in England and Wales (1915)* (London, 1917), p. xx, British Parliamentary Papers 1917-1918/V (Cd. 8484). Pneumonia is often a secondary complication of measles.

5 Registrar General, *Eighty-First Annual Report of the Registrar General*, p. xlv.

6 For discussions of the food supply see L. Bryder, 'The First World War: healthy or hungry?', *History Workshop Journal*, 24 (1987), pp. 141-57; P.E. Dewey, 'Nutrition and living standards in wartime Britain' in R. Wall and J. Winter (eds), *The Upheaval of War* (Cambridge, 1988), pp. 197-220; G. DeGroot, *Back in Blighty: the British at Home in World War 1* (London, 2014), pp. 128-33.

7 Winter *et al.*, 'Impact of the Great War on infant mortality in London'. See also Winter, *Great War and the British People*, pp. 141-53.

national need for a healthy fighting force, coupled with growing national concern over the declining birth rate, ensured that attention became increasingly focused on improving infant health.[1] Her book is essentially about the impact of the Boer War and the subsequent National Deterioration Report on infant health, although she notes that efforts to improve infant health accelerated during the First World War:

> the quickened interest in infant health aroused by the Great War was reflected in the increase in the number and variety of services which were made available. In 1914 local authorities employed 600 health visitors, and by 1918 this figure had more than quadrupled to 2,577. Whereas 300 municipal and 350 voluntary maternity and child welfare centres had been established by the beginning of the war, 700 of the former and 578 of the latter were in operation in 1918.[2]

Indeed, according to John Eyler, a circular issued by the LGB in July 1914 announcing grants for baby clinics which included a short memorandum from Sir Arthur Newsholme 'that outlined an ideal infant and maternal welfare scheme' marked the beginning of a significant increase in publicly funded infant welfare work; and throughout the war Newsholme, in spite of his many other responsibilities, 'spent more time on infant welfare than any other subject, other than war-related services'.[3] Thus, as both the scale and scope of the services on offer expanded, infant welfare achieved increasing prominence and, as a consequence of the work done by the large army of both paid and voluntary workers, this ensured that the IMR continued its downward trajectory despite any disruption brought about by the war.[4] The assertion that the infant welfare movement was instrumental in bringing about decline is supported by diarrhoea deaths, the group of diseases that was particularly targeted by MOHs, slowly declining after 1912 and the fact that those places with the highest pre-war rates tended to have the greatest decreases—since these places had a greater number of deaths that were more amenable to preventive action. An alternative view was taken by Winter who argued that the underlying reason why mortality declined during the war was an increase in living standards.[5] Whilst a sudden increase in living standards would no doubt have been welcomed it is hard to see how, during wartime, this could cause an immediate reduction in infant mortality given that a higher income could not easily be translated into improvements in those socio-economic factors, such as better housing or environmental conditions, that were necessary to improve infant health. Once again local studies are needed to examine this issue in more detail and one of few to have been carried out, Erin Miller's examination of Wigan which began the war with one of the highest IMRs, concluded that there the infant welfare movement did much to reduce rates in the town.[6] Thus, while similar studies would

1 D. Dwork, *War is Good for Babies and other Young Children: a History of the Infant and Child Welfare Movement in England 1898-1918* (New York, 1987).

2 Dwork, *War is Good for Babies*, p. 211.

3 Eyler, *Sir Arthur Newsholme*, p. 329.

4 For an example of how infant welfare gained increasing prominence amongst the wider public, see L. Bryder, 'Mobilising mothers: the 1917 National Baby Week,' *Medical History*, 63 (2019), pp. 2-23.

5 Winter, *Great War and the British People*, pp. 188-204. Winter also argued that 'although there were substantial improvements in public policy on maternal and infant welfare during the war, the major impact of these measures was not immediate, but lay, rather, in the future' (p. 188). Individual-level data are needed to test the hypothesis that increased living standards brought about a reduction in infant mortality.

6 E. Miller, *Infant Health in Wigan, England during the First World War* [2006] available at https://erinashleymiller.com/writing/the-effect-of-the-first-world-war-on-infant-health-in-wigan-england-abstract/ [accessed April 2021]. See also F. Walsh, ' "Every human life is a national importance":

be welcomed, it would seem that the downward trend that was established before the war, and which most commentators agree was mainly due to targeted intervention coupled with increased attention towards sanitary improvement, continued during the war and this was the main reason for the decline in infant mortality.

As a postscript to this discussion of World War I it is appropriate to mention the influenza pandemic that swept the world from 1918. This epidemic was unusual because the highest mortality rates occurred disproportionately within the young adult population, rather than within older age groups, as was normally the case with this disease.[1] Infants were also exposed to increased risk. In 1917 only 250 infant influenza deaths were recorded; this figure increased nearly ten-fold to 2,478 in 1918, although this still only represents an influenza IMR of 3.8 per 1,000 live births.[2] The likelihood is that some influenza deaths 'leaked' into other causes, but as the Registrar General noted in his 1918 annual report:

> if we deduct the excess of mortality from influenza and pneumonia over that recorded in 1917, in order to obtain an indication of what the rate might have been had there been no great epidemic of influenza, [the IMR] is reduced to 93, which is lower than any recorded rate except that of 1916.[3]

Thus, in spite of the effects of this extreme event, the overall trend remains one of decline. Moreover, given that influenza particularly affected women of childbearing ages, the loss or illness of a mother could have had a substantial impact on their infant's health. This issue was examined as part of Alice Reid's study of health visiting in Derbyshire and she concluded:

> influenza infection in the first or second trimesters of pregnancy can provoke premature delivery, and therefore stillbirths or vulnerability to early death. Older infants may be disadvantaged by their ailing mother's inability to provide adequate care and nutrition, such as through breast-feeding. Of course, infants out of the womb were also at risk of catching the disease, and there was a higher risk of death from the direct effects of the 'flu itself than from the indirect effects of a mother's health, but it is very likely that the latter raised the death rate more than it would otherwise have been. In a sense, therefore, increased adult mortality contributed to increased infant mortality.[4]

Such effects are of course difficult to verify, especially in the context of generally declining IMRs and the absence of national stillbirth registration. Once again further studies that utilize similar or alternative sources would be welcomed.

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the impact of the First World War on attitudes to maternal and infant health', in D. Durnin and I. Miller (eds), *Medicine, Health and Irish Experiences of Conflict 1914–45* (Manchester, 2017), pp. 15-30. The impact of absent fathers on infant and child health during the war has not been examined in any detail.

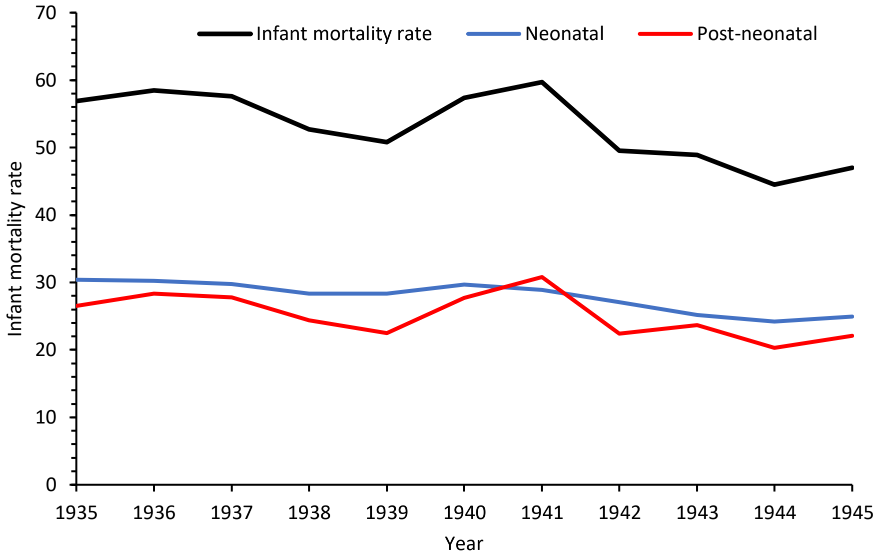
1 Registrar General, *Supplement to the Eighty-First Annual Report of the Registrar General of Births, Deaths and Marriages in England and Wales: Report on the Mortality from Influenza in England and Wales During the Epidemic of 1918-19* (London, 1920), pp. 7-10, 38 (Cd. 1010).

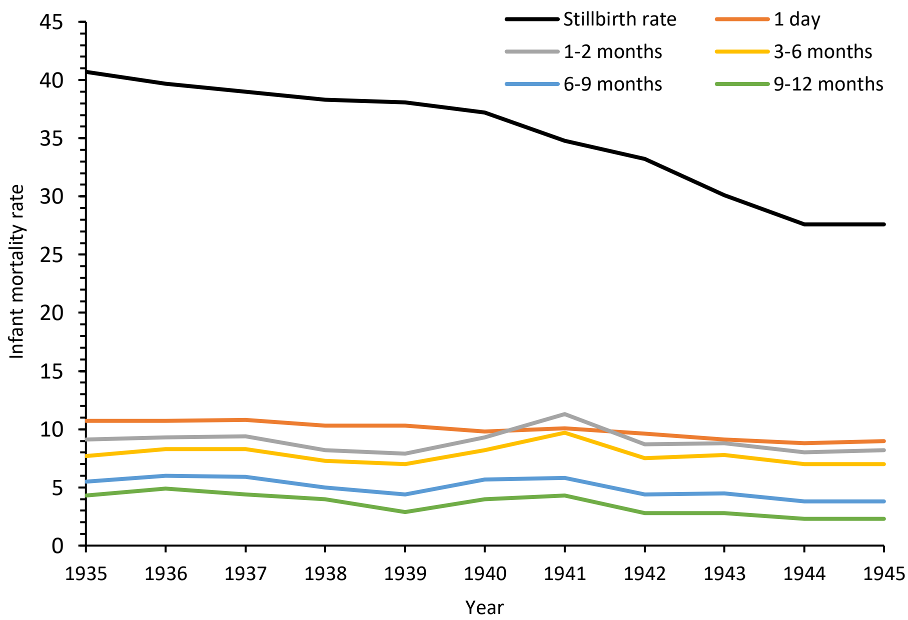
2 Registrar General, *Eightieth Annual Report of the Registrar General of Births, Deaths and Marriages in England and Wales (1917)* (London, 1917), p. 130, British Parliamentary Papers 1919/X (Cmd. 40); Registrar General, *Eighty-First Annual Report of the Registrar General*, p. 72. A total of 64,386 deaths was recorded in 1918.

3 Registrar General, *Eighty-First Annual Report of the Registrar General*, p. xxxii.

4 A. Reid, 'The effects of the 1918-1919 influenza pandemic on infant and child health in Derbyshire', *Medical History*, 49 (2005), pp. 29-54, here at p. 53.

Figure 4.16 **Infant mortality rates in England and Wales by selected age groups, 1935-1945**





Source: Registrar General, *The Registrar General's Statistical Review of England and Wales for the Six Years 1940-1945, Text Vol. 1: Medical* (London, 1949), pp. 31, 33.

On the theme of war, relatively little has been published about infant mortality trends during the Second World War. The Registrar General's annual reports ceased publication during the war and instead a three-volume combined report for the six years 1940-1945 began to appear from 1949.[1] This report was largely descriptive of the trends that had occurred. Figure 4.16 shows IMRs in the war years compared with the five previous years. The trend is one of decline notwithstanding that significant increases occurred in 1940 and 1941 (see Figure 4.1 for the significance of these increases within the twentieth century as a whole). Neonatal mortality decreased steadily so that the increases in 1940-1941 were confined to post-neonatal mortality, especially within the age groups 1-6 months. The winter of 1941 was particularly severe and respiratory diseases were higher than pre-war levels in both years, as were whooping cough deaths in 1941.[2] Both these phenomena appear to have affected the whole country and, while they do not account for all of the increase, they were largely independent of the effects of war—direct infant war deaths, presumably mainly from aerial bombardment, were 203, 231, 38, 26, 109 and 30 for the years 1940-1945 respectively.[3] According to the Registrar General, a possible explanation for the rise in infant mortality in 1940 and 1941 was 'that increased demands upon women resulted in a decline in breast feeding which counteracted at ages 1-6 months the effects of the factors tending to reduce infant mortality'.[4] No evidence is provided to support this statement, but it does appear to be worthy of further investigation. After 1941 the rest of the war years were notable as ones of decline with the Registrar General again providing an explanation of why this might have been the case:

> [t]he pronounced improvement in infant mortality, which occurred after 1942, was confined to two distinct age periods, the first week and the second half of the first year. The first probably resulted from the special attention devoted to pregnant women up to completion of maternity.[5]

This special attention also perhaps accounts for the dramatic decline in stillbirth rates which fell from 38.1 in 1939 to 27.6 in 1945, an overall decrease of 27.6 per cent. There was also a similar decline in the illegitimate IMR from a pre-war 87 (1936-1939) to 82 in 1940, 71 in 1943 and 65 in 1945, an overall decrease of 25 per cent, this in spite of the fact that illegitimate births nearly doubled during the war.[6] Illegitimate mortality rates were still higher than legitimate rates (91 compared with 50 in 1939), but the war witnessed a remarkable convergence so that by 1945 the illegitimate rate was 65 compared with a legitimate rate of

1 Registrar General, *Registrar General's Statistical Review of England and Wales for the Six Years 1940-1945*, 3 vols (London, 1949, 1951 and 1954). The reports for 1938 and 1939 also appeared as a single volume, see Registrar General, *The Registrar General's Statistical Review of England and Wales for 1938 and 1939* (London, 1947).

2 Registrar General, *Statistical Review for 1940-1945*, Vol. 1, pp. 30, 47. The mortality rate from bronchitis and pneumonia was 10.5 per thousand in 1936-1939, 12.7 in 1940 and 13.7 in 1941. By 1945 it had declined to 9.3. The mortality from whooping cough was 2.1 in 1941 which compares with 1.2 in 1936-1939 and 0.6 in 1940.

3 Registrar General, *Statistical Review for 1940-1945*, Vol. 1, p. 29. There were 34,550 infant deaths recorded in 1941.

4 Registrar General, *Statistical Review for 1940-1945*, Vol. 1, p. 46.

5 Registrar General, *Statistical Review for 1940-1945*, Vol. 1, p. 29.

6 Registrar General, *Statistical Review for 1940-1945*, Vol. 1, pp. 29, 47. There were 2,331 illegitimate births in 1939 and 4,005 in 1945.

47.[1] It is also instructive to examine early illegitimate deaths since these allow insights to be given into both the circumstances and quality of the birthing process, as well as illustrating the disadvantages of an illegitimate birth. Within the first 30 minutes, the illegitimate IMR was 6.1 per 1,000 live births in 1940 compared with only 1.1 for legitimates (5.5 times higher).[2] Illegitimates comprised a disproportionally high number of first births which are at higher risk than higher parities, but a 5.5-fold difference suggests much poorer pre-natal and lying-in care. By comparison, in the same year, the differential amongst infants dying on the rest of the first day was only 1.4 times (11.3 for illegitimates and 8.3 for legitimates).[3] However, during the war illegitimate deaths in the first thirty minutes declined steadily so that by 1945 the rate had declined to 4.2 with the differential reducing to 3.2-fold.[4] In 1945 the rest of the first day mortality was slightly higher for both legitimates and illegitimates (8.5 and 13.6) and the differential was 1.6-fold.[5] Such figures support the Registrar General's supposition about the devotion of care given to pregnant women and it is particularly impressive that mothers giving birth outside of wedlock appeared to have benefitted the most.[6] The war years marked significant improvements in infant health, although exactly how this was achieved has yet to be determined.

The other period that may warrant further investigation is the 1930s since this decade is associated with a major economic recession. However, J.M. Winter has shown that infant mortality continued to decline throughout the period (see Figure 4.1) and that decline occurred in all parts of England and Wales and also in Scotland.[7] In spite of the considerable economic hardships suffered by some sections of the population it would appear that these did not translate into higher mortality amongst infants, at least at the national, county or local authority level.[8] There were some local variations in levels of decline; however, these may well have been due to differences in the implementation of infant health initiatives and it does not preclude the possibility that unemployment affected infant health, but this can only be tested using individual family-level data. Throughout this period, and indeed from much earlier, the relationship between place and class that is so difficult to distinguish remains the key to explaining the emergence of infant mortality differentials.

Discussion and conclusions

This all-too-brief survey has shown that the initial stages of the twentieth-century decline in infant mortality can be attributed, both directly and indirectly, to what can loosely be

1 Registrar General, *Statistical Review for 1940-1945*, Vol. 1, p. 29. Illegitimate IMRs for the years from 1939 to 1945 were 91, 83, 78, 73, 69, 65 and 65 respectively.

2 Registrar General, *Statistical Review for 1940-1945*, Vol. 1, p. 38.

3 Registrar General, *Statistical Review for 1940-1945*, Vol. 1, p. 38.

4 Registrar General, *Statistical Review for 1940-1945*, Vol. 1, p. 42.

5 Registrar General, *Statistical Review for 1940-1945*, Vol. 1, p. 42.

6 The war may also have encouraged a more enlightened attitude towards unmarried mothers.

7 J.M. Winter, 'Infant mortality, maternal mortality and public health in Britain in the 1930s', *Journal of European Economic History*, 8 (1979), pp. 439-62; J.M. Winter, 'Unemployment, nutrition and infant mortality in Britain, 1920-50', in J. Winter (ed.), *The Working Class in Modern British History: essays in Honour of Henry Pelling* (Cambridge, 1983), pp. 232-56. See also C. Webster, 'Healthy or hungry thirties?', *History Workshop*, 13 (1982), pp. 110-29.

8 Winter, 'Infant mortality in the 1930s', pp. 447-9. In spite of the recession, and for working families at least, I. Gazeley and A. Newell, 'The end of destitution: evidence from urban British working households 1904–37', *Oxford Economic Papers*, 64 (2012), pp. 80–102, estimate that absolute poverty among working-class households in urban Britain had been virtually eliminated by 1937.

described as the infant welfare movement—a view being shared by many of those charged with reducing IMRs, the most prominent being George Newman and Arthur Newsholme. The implementation of policies designed to reduce infant mortality was relatively slow and haphazard, but the means by which lives could be saved became widely disseminated and this meant that the middle classes often benefitted the most, even though they were not targeted specifically. At the same time the health of all sections of the population was steadily improving and fertility was falling, both of which helped to reduce IMRs. As understanding of the causes of infant mortality improved it became increasingly easy to mitigate environmental threats and, as towns and cities expanded, heathier suburbs were developed, slums cleared and urban environments gradually improved. Treatments also improved. All these processes occurred at more or less the same time and each had a cumulative effect on lowering IMRs. By 1950 much of the mortality associated with infectious diseases had been eradicated and deaths became, and continued to be, increasingly concentrated within the neonatal age range. Throughout the whole period significant socio-economic influences on infant mortality were also apparent. There was a substantial social class gradient in rates, spatial variations within towns and cities emerged, and the experience of individual families living in the same environments could often be radically different. Thus, by the beginning of the twenty-first century the main issue with respect to infant mortality, as with many other aspects of health, was the persistent inequalities that have proved so difficult to reduce.

Infant mortality decline was, and still is, multi-layered, and teasing out the proportional contributions of each of the many responsible factors has proven difficult to achieve. Correlations between socio-economic variables and levels of infant mortality are easy to demonstrate, but this does not necessarily mean that causation can be demonstrated, especially when access to individual-level data is limited and significant amounts of mortality were concentrated into certain groups and families. The problems associated with assessing infant health initiatives during the first two decades of the twentieth century can be illustrated by what happened in Sunderland. In 1914 H. Renney, the town's MOH, writing in response to a circular sent out by the LGB which aimed to stimulate 'local authorities who have not yet taken up the work of maternity and child welfare to do so, and to those already engaged in the work to develop it still further',[1] outlined the work undertaken in Sunderland in this respect:

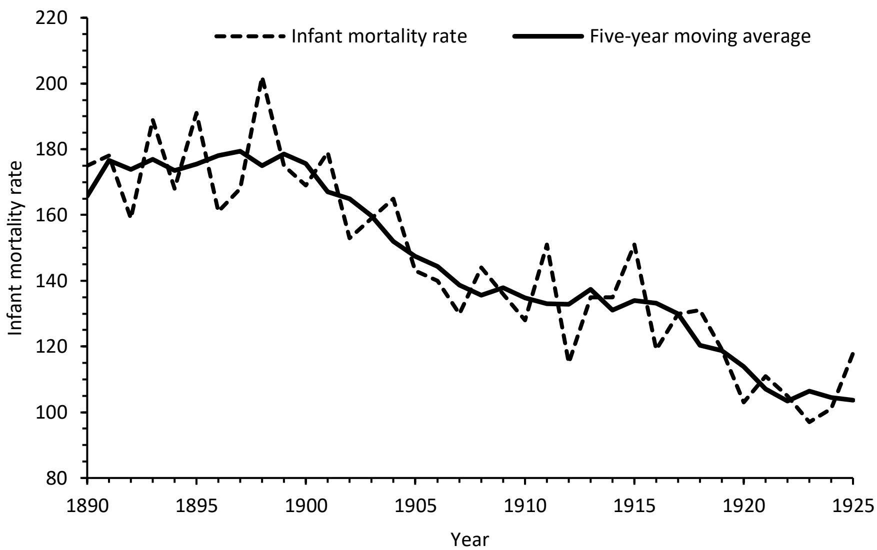
> In Sunderland the Health Committee appointed the first health visitor in 1904, and allocated to her one of the poorest slum districts. There was then no notification of births, but a list was obtained weekly from the district registrars. We were working at a great disadvantage, for the infants on these lists were several weeks old, often more than six weeks, before we could know of their existence. In October, 1907, however, the Corporation obtained Parliamentary powers for the compulsory notification of births for a period of four years, the question of continuing notification to be considered at the end of this period. The Local Government Board would not allow us to proceed with our local Act, so far as it related to notification of births, after the expiration of the four years, so the Corporation adopted the Notification of Births Act in August, 1911. In 1907 two additional health visitors were appointed, and the town was

1 H. Renney, 'A discussion of maternity and child welfare', *Public Health* (May 1916), pp. 180-6, here at p. 186. Parents had up to six weeks to register a birth so there was an inevitable interval before the MOH could be notified of a birth.

> divided for the purpose of infantile visitation into three districts, a health visitor being allocated to each. From the year 1904 the health visitor had been engaged in the visitation of infants under one year of age, and frequently gave health talks at mothers' meetings and other societies.[1]

Thus, there was a steady increase in infant welfare work undertaken in the town and it appears to have been carried out more efficiently, but it still remains difficult to evaluate how each initiative made an impact on the IMR (Figure 4.17). The decline in infant mortality began, as in many places, quickly at the turn of the century, it slowed during the early 1910s and then accelerated afterwards. This can be seen best by the five-year moving average which smooths out annual variations. While the MOH noted 1904, 1907 and 1911 as being key dates, Figure 4.17 does not reveal any obvious sudden changes, but this is not necessarily to be expected as there was always likely to have been a lag between advice offered and advice acted upon and it was probably the cumulative effect of this advice, coupled with growing public awareness of what could be done to reduce infant mortality, that was of key importance.

Figure 4.17 Infant mortality rates in Sunderland, 1890-1925



Source: E. Thorp, *Annual Report on the Sanitary Condition of Sunderland, for the Year 1926* (Sunderland, 1927), p. 36.

The problem of disentangling the factors influencing infant mortality is complicated by the reliance on official publications or secondary studies rather than primary source material and this becomes increasingly the case over the course of the century as the publications produced by the GRO and its successor, ONS, no longer sought to shape policy and instead became a means by which statistics were reported. The sheer wealth of material available also creates problems since, even with the aid of considerable digital archives, there is a limit

1 Renney, 'Discussion of maternity and child welfare', pp. 182-3.

to the amount of data that an individual, or a group of individuals, can process. Moreover, with data confidentiality, the so-called '100-year rule', being applicable for most of the century, the challenge remains to discover new, relevant family-level data. As Alice Reid has shown, considerable advances can be made towards providing a fuller understanding of infant mortality in this period when such sources exist and can be examined and analysed. Local MOH reports, few of which have been examined in detail, contain a wealth of data on this and many other relevant subjects and their further exploitation will no doubt prove rewarding.

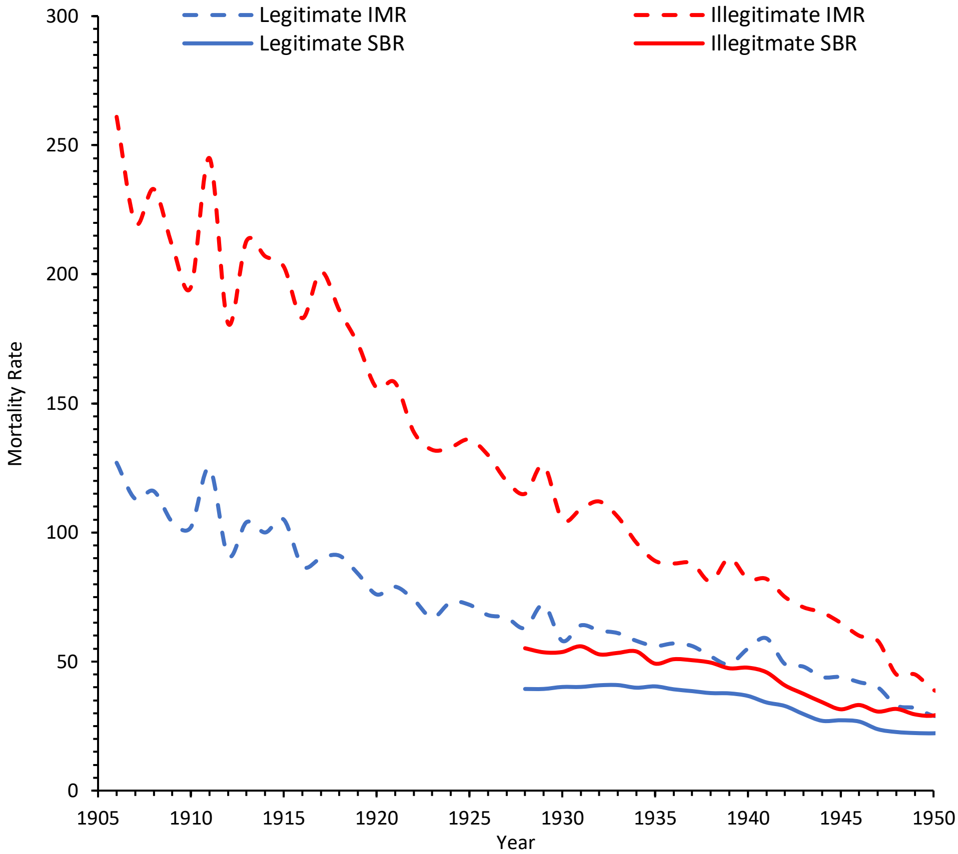
The framework developed in Chapter 3, coupled with the factors listed in Table 4.2 above, outline how a better understanding of the influences associated with declining infant mortality during the twentieth century can be achieved. The three-fold grouping of threats, inherited disorders, infection and injury still applies, with infections making up the bulk of infant deaths during the first half of the century. As these began to be controlled, neonatal deaths, many of which had a pre-natal cause, gradually began to assume greater importance as they were harder to reduce because many of their causes remained unknown. Violent deaths were always of minor importance, but those caused by birth injuries gradually diminished. As far as interventions are concerned some, such as vaccinations for the common childhood diseases of diphtheria, whooping cough and measles, are easy to assess given that these causes of death were relatively well-defined. Other types of intervention remain more intractable and the fact that these acted in conjunction with each other may mean that it is impossible to disentangle the precise effect of any one single factor. However, two important influences on infant mortality, illegitimacy and breastfeeding, seem especially worthy of further consideration. Figure 4.18 shows illegitimate stillbirth rates and IMRs during the first half of the twentieth century. As appears to have been the case in previous centuries, in 1900 the illegitimate IMR was about twice the legitimate rate. However, as was apparent during the Second World War, this differential narrowed considerably so that by 1950 the illegitimate rate had reduced to 39 with the legitimate rate being 28 (28 per cent lower). Illegitimate and legitimate stillbirth rates also declined, but the differential only narrowed slightly (from 1.36 times in 1928 to 1.31 times in 1950). There was certainly no reduction in the stigma attached to illegitimacy during the first half of the twentieth century, but it seems those maternal and environmental factors that weighed so heavily against the survival of illegitimates must have lessened. The growth of adoption, both formal and informal, especially after 1918, should also not be ruled out as a contributing factor and the impact of illegitimacy on infant mortality needs investigating in much greater detail.[1]

The other factor that has been the focus of so much discussion in this book is breastfeeding. Around the beginning of the twentieth century maternal breastfeeding was promoted as the means by which infant deaths, especially from diarrhoea, could be reduced and the targeting of specific high-risk mothers was seen by many to be the key to reducing IMRs in those predominantly working-class areas that suffered the most. Useful, precise data on the extent and duration of breastfeeding are hard to discover, but Valerie Fildes thought that breastfeeding rates were very high in most working-class districts in London between 1900 and 1920, at least in the first few months of life.[2] Data about breastfeeding rates can be found in MOH reports, although these are often surveys of living infants or reported

1 See J. Keating, *A Child for Keeps: the History of Adoption in England, 1918-45* (Basingstoke, 2008) for a general discussion of adoption in this period.

2 V. Fildes, 'Breast-feeding in London, 1905–19', *Journal of Biosocial Science*, 24 (1992), pp 53-70.

Figure 4.18 Legitimate and illegitimate stillbirth rates (SBR)s and infant mortality rates (IMR)s, England and Wales, 1905-1950



Sources: Infant mortality rates, Registrar General, *The Registrar General's Statistical Review of England and Wales for the Year 1951, Part 1* (London, 1953), p. 5; stillbirth rates, Office of National Statistics, *Review of the Registrar General on Deaths in England and Wales, 2000, Childhood, Infant and Perinatal Mortality Statistics,* Series DH3 no. 33 (London, 2002), p. 108.

feeding methods at time of death.[1] Consequently, they are difficult to interpret. It would seem, therefore, that the initial decline in infant mortality was aided by longer periods of breastfeeding, lower levels of supplementary feeding and perhaps better hygiene, although this needs to be confirmed with additional data. However, over the course of the twentieth century, breastfeeding rates declined and artificial and supplementary feeding increased as the notion of 'scientific motherhood' gained hold. Breastfeeding rates probably reached their nadir at or about 1960, although they recovered afterwards so that now breastfeeding rates are higher even though they are not necessarily prolonged.[2] It is however difficult to discover

1 See Greenwood, *Annual Report upon the Health of Blackburn for the Year 1908*, p. 35 for example.
2 G. Thorvaldsen, 'Was there a European breastfeeding pattern?', *History of the Family*, 13 (2008), pp 283–95, here at p. 293. For mid-century Britain see J.W.B. Douglas, 'The extent of breastfeeding in Great Britain

exact data on breastfeeding rates beyond 1920, but as IMRs, and diarrhoea deaths in particular, declined MOHs appeared to be no longer concerned about this issue.[1] It must therefore have been the case that households developed both the knowledge and ability to effectively sterilise infant feeding bottles and this counteracted the negative effects of artificial feeding. Once again more quantitative and qualitative data are required to fully delineate these patterns and it is also necessary to discover the reasons why mothers were so willing to abandon breastfeeding.

In many ways more is known about infant mortality during the twentieth century than in other periods. It is certainly the case that sufficient data exists so that patterns and trends can be described in considerable detail. However, much less is known about how and why change came about and the way that many of the factors listed in Table 2 operated still remains obscure. While in some instances this may always remain the case, further progress is still possible into the causes of infant mortality decline and the following section gives some indication of how further research can be undertaken.

Issues

The issues that need to be addressed are similar to those listed at the end of the third paper in this series.[2] The 100-year confidentiality 'rule' also means that the sources readily available for the twentieth century are also similar and indeed the challenge remains to discover new ones that are able to shed light on the causes of infant mortality decline. With the broad outlines of change being well understood, it would seem that at present the greatest progress can be achieved by examining the reasons for variation between different places, within social groups and in the pace of change. Indeed, throughout the whole of the period 1538-2000 much of the focus of these series of papers has been placed on the variety of local experience. However, all local studies also need to acknowledge and account for the fact that the secular decline in infant mortality was both a national and indeed an international phenomenon. With this in mind what follows gives some indication of the types of research that can be readily undertaken.

(1) While most places recorded increases in infant mortality in 1911 there were considerable local variations and, as Table 10 showed for Lancashire, apparently similar towns sometimes had very different experiences. An analysis of the reasons why these variations occurred should prove illuminating both with respect to the effectiveness of local sanitary measures and the precise way in which climate

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in 1946, with special reference to health and survival of children', *Journal of Obstetrics and Gynaecology of the British Empire*, 57 (1950), pp. 335-61. Much of the discussion of changes in breastfeeding rates during the twentieth century has focused on America; see R.D. Apple, *Mothers and Medicine: a Social History of Infant Feeding, 1890-1950* (Madison, 1987); J.H. Wolf, *Don't Kill Your Baby: Public Health and the Decline of Breastfeeding in the Nineteenth and Twentieth Centuries* (Columbus, OH, 2001), although both books provide little quantitative evidence of breastfeeding rates. S.M. Crowther, L.A. Reynolds and E.M. Tansey (eds), *The Resurgence of Breastfeeding, 1975-2000*, Wellcome Witnesses to Twentieth Century Medicine 35 (London, 2009), pp. xxii-xxvii discusses reasons for the decline in breastfeeding rates, while the rest of the volume addresses the reasons why rates increased after 1975.

1 The benefits of breastfeeding both for the infant and mother are well established. For a recent discussion see C.G. Victora, R. Balh, A.J.D. Barros, G.V.A. Franca, S Horton, J. Krasevec, S. Murch, M.J. Sankar, N. Walker and N.C. Rollins, 'Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect', *The Lancet*, 387 (10,017) (2016), pp. 475-90.

2 See pp. 000-00.

influenced mortality rates.

(2) It would also be useful to examine local variations in 1904 and 1906, years with excess diarrhoea deaths, along with other years such as 1921 and 1933 when the climate was challenging, but mortality did not appear to increase. It is also necessary to discover the extent to which specific improvements in infant welfare provision, such as the introduction of health visiting, affected a community's response to these climatic threats.

(3) The impact of the two world wars is worthy of further investigation. Intuitively many have assumed that these events should be associated with increases in infant mortality, but this was not the case. It is therefore necessary to examine any initiatives that were undertaken during both wars to reduce IMRs and to discover the extent which these were directly related to the wars or merely the continuation of previous infant welfare measures.

(4) The 1930s also warrant further investigation to see whether the infant mortality decline that is evident at the national level is also apparent to the same degree in the most depressed parts of the country where unemployment rates were very high. It would also be interesting to examine whether other demographic measures such as fertility, which was low during this decade, and mortality rates at higher ages were similarly affected.

(5) Given that much of the decline in infant mortality during the first half of the century occurred within the post-neonatal component, an examination of early childhood mortality (1-4 years) should be able to indicate whether similar factors were responsible for both declines.

(6) It has been argued that direct infant welfare promotions were only partially responsible for the 'maternal awakening' that many see as key to the secular decline in infant mortality. More needs to be done to understand how issues relating to infant health and infant feeding were more widely disseminated. As a first step in this process newspapers and women's magazines could be searched for information on these topics.

(7) More needs to be discovered about infant feeding practices. MOH reports sometimes include details and an examination of a wider range of annual reports for the first two decades of the century would enable a comparison to be made with those calculated by Valerie Fildes for London. It would also be interesting to discover exactly when maternal breastfeeding rates began to decline and how an adverse effect on IMRs was averted.

(8) Causes of death became increasingly accurate and reliable over the course of the twentieth century and, while taking into account changes in reporting practices and the adoption of the ICD classification system, a detailed analysis of these data could give an insight into exactly when certain diseases began to be controlled, although some medical knowledge is required to decipher the ever-increasing complexity of the terms that were used.

(9) An examination of the changing differential between illegitimate and legitimate IMRs should shed further light on the reasons for infant mortality decline.

(10) Additional sources, similar to those used by Alice Reid, need to be discovered that give details of the socio-economic position of the mother and her infant. These may include health visitor records, archives of voluntary groups working in the field of infant welfare and hospital records.

(11) In the short term at least, MOH reports probably have the greatest potential to provide insights into the secular decline in infant mortality. These reports contain a wealth of data and as yet their potential has not been fully realised.

Bibliography

Adair, R. (1996) *Courtship, Illegitimacy, and Marriage in Early Modern England* (Manchester, Manchester University Press)

Anon, (1765) 'Some account of a small volume, just published, under the title of, A comparative view of the state and faculties of man, with those of the animal world', *Gentleman's Magazine*, 35, p. 418

Antonovsky, A. and J. Bernstein (1977) 'Social class and infant mortality', *Social Science and Medicine*, 11, pp. 453-470

Apple, R.D. (1987) *Mothers and Medicine. A Social History of Infant Feeding, 1890-1950* (Madison, University of Wisconsin Press)

Appleby, A.B. (1980) 'Epidemics and famine in the little ice age', *Journal of Interdisciplinary History*, 10, pp. 643-63

Armstrong, D. (1986) 'The invention of infant mortality', *Sociology of Health and Illness*, 8, pp. 211-32

Arnot, M. (1994) 'Infant death, child care and the state: the baby-farming scandal and the first infant life protection legislation of 1872', *Continuity and Change*, 9, pp. 271-311

Ascott, D.E., F. Lewis and M. Power (2006) *Liverpool 1660-1750. People, Prosperity and Power* (Liverpool, Liverpool University Press)

Ashby, H.T. (1915) *Infant Mortality* (Cambridge, Cambridge University Press)

Astbury, L. (2017) ' "Ordering the infant": caring for newborns in early modern England', in S. Cavallo and T. Storey (eds) *Conserving Health in Early Modern Culture* (Manchester, Manchester University Press), pp. 80-103

Atkins, P.J. (2003) 'Mother's milk and infant death in Britain, circa 1900-1940', *Anthropology of Food*, 2, pp. 1-9

Atkinson, P., B. Francis, I. Gregory and C. Porter (2017) 'Patterns of infant mortality in rural England and Wales, 1850–1910', *Economic History Review*, 70, pp. 1268-90

Atkinson, P., B. Francis, I. Gregory and C. Porter (2017) 'Spatial modelling of rural infant mortality and occupation in 19th century Britain', *Demographic Research*, 36, pp. 1337-60

Bacon, J.C. (1983) 'Overheating in infancy', *Archives of Diseases in Childhood*, 58, pp. 673-4

Bailie, H.W. (no date) *Report of the Health of the County Borough of Belfast for the Year 1911* (Belfast, Belfast Council)

Bakeo, A.C. (2006) 'Investigating variations in infant mortality in England and Wales by mother's country of birth, 1983–2001', *Pediatric and Perinatal Epidemiology*, 20, pp. 127-39

Barker *et al*., L. (2019) 'Historic hydrological droughts 1891–2015: systematic characterisation for a diverse set of catchments across the UK', *Hydrology and Earth System Science*, 23, pp. 4583–602

Barker, D.J.P. (1994) *Mothers, Babies, and Disease in Later Life* (London, BMJ Publishing)

Beach, B. and W.W. Hanlon (2018) 'Coal smoke and mortality in an early industrial economy', *The Economic Journal*, 128, pp. 2652–75

Beaton, I. (1861) *The Book of Household Management* (London, S.O. Beeton)

Beaver, M.W. (1973) 'Population, infant mortality and milk', *Population Studies*, 27, pp. 243-54

Beilby-Cook, R. (ed.) *The Parish Registers of St Martin Coney Street, York, 1557-1812*, Yorkshire Parish Registers Series, 36 (1909)

Bentley, B. (1965) 'Health and politics: The British Physical Deterioration Report of 1904', *Bulletin of the History of Medicine*, 39, pp. 143-53.

Berry, B.M., and R.S. Schofield (1971) 'Age at baptism in pre-industrial England', *Population Studies*, 25, pp. 453-63

Bideau, A., B. Desjardins and H.P. Brignoli (eds) (1997) *Infant and Child Mortality in the Past* (Oxford, Clarendon Press).

Birch, T. (1759) *A Collection of the Yearly Bills of mortality, from 1657 to 1758 Inclusive* (London, A. Millar)

Bland, R. (1791) 'Some calculations of the number of accidents or deaths which happen in consequence of parturition; &c.', *Philosophical Transactions of the Royal Society*, 71, pp. 355-71

Boulton, J. (1992) 'The Marriage Duty Act and parochial registration in London, 1695-1706' in K. Schürer and T. Arkell (eds) *Surveying the People* (Oxford, Leopard's Hill Press), pp. 222-52

Boulton, J. (2014) 'Traffic in corpses and the commodification of burial in Georgian London', *Continuity and Change*, 29 (2014), pp. 181-208

Boulton, J. and R. Davenport (2015) 'Few deaths before baptism: Clerical policy, private baptism and the registration of births in Georgian Westminster: a paradox resolved', *Local Population Studies*, 94, pp. 28-47

Bourgeois-Pichat, J. (1952) 'An analysis of infant mortality', *Population Bulletin of the United Nations*, 2, pp. 1-14

Boylston, A. (2014) 'John Haygarth's 18th-century 'rules of prevention' for eradicating smallpox', *Journal of the Royal Society of Medicine*, 107, pp. 464-9

Bozzoli, C., A. Deaton and C. Quintana-Domeque (2009) 'Adult height and childhood disease', *Demography*, 46, pp. 647–69

Brändström, A. (1988) 'The impact of female labour conditions on infant mortality: A case study of the parishes of Nedertorneå and Jokkmokk, 1800-96', *Social History of Medicine*, 1, pp. 329-58

Britton, M. (1974) 'Diagnostic errors discovered on autopsy', *Acta Medica Scandinavia*, 196, pp. 203-10

Browne, J. (1847) *The History of the Edifice of the Metropolitan Church of St Peter York, Volume 1 Text, Volume 2 Plates* (London, Longman)

Brownlee, J. (1917) 'The relation of infantile mortality to mortality in subsequent life', *Journal of the Royal Statistical Society*, 80, pp. 222-48

Brunton, L. (1905) 'The report of the Inter-Departmental Committee on Physical Degeneration', *Public Health*, 19, pp. 274-92

Brush, S. (2004) 'When were babies baptised? Some Welsh evidence', *Local Population Studies*, 72, pp. 83-7

Buchanan, I. (1985) 'Infant feeding, sanitation and diarrhoea in colliery communities, 1880-1991', in D. Oddy and D. Miller (eds) *Diet and Health in Modern Britain* (London, Croom Helm), pp. 148-77

Bryder, L. (1987) 'The First World War: healthy or hungry?', *History Workshop Journal*, 24 (1987), pp. 141-57

Bryder, L. (1988) *Below the Magic Mountain. A Social History of Tuberculosis in Twentieth-century Britain* (Oxford, Oxford University Press)

Bryder, L. (2019) 'Mobilising mothers: The 1917 National Baby Week,' *Medical History*, 63, pp. 2-23

Buchan, W. (1769) *Domestic Medicine* (Edinburgh, Balfour, Auld and Smellie)

Buck, A. (1996) *Clothes and the Child* (Bedford, Ruth Bean Publishers)

Burn, J. S. (1862) *The History of Parish Registers in England 2nd edition* (London, Russell Smith)

Butler, N.R. and D.G. Bonham (1963) *Perinatal Mortality. The First Report of the 1958 British Perinatal Survey under the Auspices of The National Birthday Trust Fund* (Edinburgh, E.S. Livingstone Ltd).

Cadogan, W. (1749) *An Essay upon Nursing and the Management of Children, from their Birth to Three Years of Age* (London, J. Roberts)

Caffin, S.W. (1952) 'Infantile mortality rates', *Population Studies*, 6, pp. 106-9

Cage, R.A. and J. Foster (2002) 'Overcrowding and infant mortality: a tale of two cities', *Scottish Journal of Political Economy*, 49, pp. 129-49

Campbell, J.M. (1917) The Carnegie United Kingdom Trust Report on the Physical Welfare of Mothers and Children. England and Wales Vol. 2 (Liverpool, Carnegie Trust)

Carmichael, A.G. and A.M. Silverstein (1987) 'Smallpox in Europe before the 17th century: virulent killer or benign disease?', *Journal of the History of Medicine and Allied Sciences*, 42, pp. 147–68

Chadwick, E. (1842) *Report on the Sanitary Condition of the Labouring Population of Gt Britain* (London, HMSO)

Chadwick, E. (1860) 'Address', *Transactions of the National Association for the Promotion of Social Science*, pp. 574-606

Chalmers, A.K. (1912) *Report of the Medical Officer of Health of the City of Glasgow* (Glasgow, Glasgow Council)

Chave, S. (1974) 'The Medical Officer of Health 1847-1974', *Proceedings of the Royal Society of Medicine*, 67, pp. 1243-7

Chave, S. (1987) *Recalling the Medical Officers of Health* (London, Oxford University Press)

Chisholm, J.S. (1978) 'Swaddling, cradleboards and the development of children', *Early Human Development*, 2/3, pp. 255-75

Clark, A. (2013) 'Family migration and infant mortality in rural Kent, 1876-1888', *Family & Community History*, 6, pp. 141-50

Clark, G. (1984) 'Infant clothing in the eighteenth century: a new insight', *Costume*, 28, pp. 47-59

Clark, G. (1987) 'A study of nurse children, 1550-1750', *Local Population Studies*, 39, pp. 8-23

Clark, G. (1988) *The Nurse Children of London, 1540-1750: a Population Study* (unpublished D.Phil. thesis, University of Reading)

Clark, P. and J. Hosking (1993) 'Population estimates of English small towns', *Centre for Urban History, University of Leicester Working* Paper

Claypon, J.E. (1920) *The Child Welfare Movement* (London, G. Bell and Sons Ltd)

Cliff, A., P. Haggett and M. Smallman-Raynor (1990) *Measles: an Historical Geography of a Major Human Viral Disease from Global Expansion to Local Retreat, 1840-1990* (Oxford, Oxford University Press)

Collins, F. (ed.) (1887) *The Parish Register of Kirkburton, co. York Vol. 1, 1541-1654* (Exeter, no publisher)

Collins, F. (ed.) (1899) *The Register of St Michael le Belfrey, York part 1, 1565-1653*, Yorkshire Parish Registers Series, 1

Collins, F. (ed.) (1901) *The Parish Register of St Michael le Belfrey, York part 2 1653-1778*, Yorkshire Parish Registers Series, 11

Collins, F. (ed.) (1915) *The Parish Register of St Mary Bishophill Junior, York, 1602-1812*, Yorkshire Parish Registers Series, 52

Corsini, C. and P.P. Viazzo (eds) (1993) *The Decline of Infant Mortality in Europe 1800-1950. Four National Case Studies* (Florence, UNICEF, Instituto degli Innocenti di Firenzi)

Corsini, C. and P.P. Viazzo (eds) (1997) *The Decline of Infant and Child Mortality. The European Experience: 1750-1990* (Dordrecht, Martinus Nijhoff)

Coster, W. (2000) 'Tokens of innocence: infant baptism, death and burial in early modern England', in B. Gordon and P. Marshall (eds) *The Place of the Dead. Death and Remembrance in Late Medieval and Early Modern Europe* (Cambridge, Cambridge University Press), pp. 266-87

Coster, W. (2001) *Family and Kinship in England 1450-1800* (Harlow, Longman)

Coulson *et al.*, J. (eds) *The Oxford Illustrated Dictionary* 2nd ed. (Oxford, Oxford University Press)

Cox, J.C. (1910) *The Parish Registers of England* (London, Methuen)

Crawford, P. (1986) ' "The sucking child": Adult attitudes to child care in the first year of life in seventeenth-century England', *Continuity and Change*, 1, pp. 23-51

Crawford, P. (2004) *Blood, Bodies and Families in Early Modern England* (Harlow, Pearson, Longman)

Creighton, C. (1894) *A History of Epidemics in Britain, Volume 2* (Cambridge, Cambridge University Press)

Crook, A.D.H. (1956) 'Population and boundary changes, 1801-1981' in C. Binfield *et al.* (eds) *The History of the City of Sheffield 1854-1993* (Sheffield, Sheffield Academic Press), pp. 482-3

Crowther, S.M., L.A. Reynolds and E.M. Tansey (eds) *The Resurgence of Breastfeeding, 1975-2000* (Wellcome Witnesses to Twentieth Century Medicine, 35, 2009),

Cullen, M.J. (1974) 'The making of the Civil registration Act of 1836', *Journal of Ecclesiastical History*, 25, pp. 39-59.

Cummins, N. (2017) 'Lifespans of the European elites, 800-1800', *Journal of Economic History*, 77, pp. 406-39

Cunningham, C. (1977) 'Christ's Hospital: Infant and child mortality in the sixteenth century', *Local Population Studies*, 18, pp. 37-40

Cunningham, H. (2006) *The Invention of Childhood* (London, BBC Books)

Daly, C., J.A. Heady and J.N. Morris (1955) 'Social and biological factors in infant mortality. III The effects of mother's age and parity on social-class differences in infant mortality', *The Lancet*, (26 February), pp. 445-8

Daniell, C. (1997) *Death and Burial in Medieval England* (London, Routledge)

Davenport, R. (2016) 'Urban family reconstitution—a worked example', *Local Population Studies*, 96, pp. 28-49

Davenport, R. (2019) 'Infant-feeding practices and infant survival by familial wealth in London, 1752–1812', *The History of the Family,* 24, pp. 174-206

Davenport, R. (2020) 'Urbanization and mortality in Britain, *c.*1800-50', *Economic History*

Review, 73, pp. 455-85

Davenport, R., J. Boulton and L. Schwartz (2016) 'Urban inoculation and the decline of smallpox mortality in eighteenth-century cities—a reply to Razzell', *Economic History Review*, 69, pp. 188–214

Davenport, R., M. Satchell and L. Shaw-Taylor (2018) 'The geography of smallpox before vaccination: a conundrum resolved', *Social Science & Medicine*, 206, pp. 75-85

Davenport, R., L. Schwartz and J. Boulton (2011) 'The decline of adult smallpox in eighteenth-century London', *Economic History Review*, 64, pp. 1,289-314

Davies, L. (2003) 'Faith Street, South Kirby – 'That troublesome place': Infant mortality in a Yorkshire coal-mining community, 1894-1911', *Family & Community History*, 6, pp. 121-7.

Davies, S. and R. Noon (2014) 'The rank-and-file in the 1911 Liverpool General Transport Strike', *Labour History Review*, 79 (2014), pp. 55-81

Davin, A. (1978) 'Imperialism and motherhood', *History Workshop*, 5, pp. 9-65

DeGroot, G. (2014) *Back in Blighty. The British at Home in World War 1* (London, Vintage), pp. 128-33

Devis, T. and C. Rooney (1999) 'Death certification and the epidemiologist', *Health Statistics Quarterly*, 1, pp. 21-33

Dewey, P.E. (1988) 'Nutrition and living standards in wartime Britain' in R. Wall and J. Winter (eds) *The Upheaval of War* (Cambridge, Cambridge University Press), pp. 197-220

Dobson, M. (1997) *Contours of Death and Disease in Early Modern England* (Cambridge, Cambridge University Press)

Dorling, D. (2006) 'Infant mortality and social progress in Britain, 1905-2005', in E. Garrett *et al.* (eds) *Infant Mortality A Continuing Social Problem* (London, Ashgate), pp. 213-28

Douglas, J.W.B. (1950) 'The extent of breastfeeding in Great Britain in 1946, with special reference to health and survival of children', *Journal of Obstetrics and Gynaecology of the British Empire*, 57, pp. 335-61

Douglas, J.W.B. and J.M. Bloomfield (1958) *Children Under Five* (London, Allen & Unwin)

Drake, M. (1962) 'An elementary exercise in parish register demography', *Economic History Review*, 14, pp. 427-45

Drake, M. (ed.) (1982) *Population Studies from Parish Registers* (Matlock, Local Population Studies)

Drake, M. (2006) 'Surely they made a difference? Health visitors in Birmingham and Sheffield in the 1900s', *Local Population Studies*, 76, pp. 63-9

Drife, J. (2008) 'Can we reduce perinatal mortality in the UK', *Expert Reviews in Obstetrics and Gynaecology*, 3, pp. 1-3.

Drixler, F. (2013) *Mabiki. Infanticide and Population Growth in Eastern Japan, 1660-1950* (Berkeley, University of California Press)

Drury, C. and T.W. Hall (eds) (1917) *The Parish Register of Sheffield in the County of York, part 2*, Yorkshire Parish Registers Series, 60

Dudfield, R. (1912) 'Diarrhoea in 1911', *Proceedings of the Royal Society of Medicine*, 5 (1912), pp. 99-148

Duffy, E. (2001) *The Voices of Morebath* (New Haven, Yale University Press)

Duncan, S.R., S. Scott and C.J. Duncan (1994) 'Smallpox epidemics in cities in Britain', *Journal of Interdisciplinary History,* 25, pp. 255-71

Dwork, D. (1987) *War is Good for Babies & Other Young Children* (London, Tavistock Publications)

Dyer, A. (1985) 'Epidemics of measles in a seventeenth-century English town', *Local Population Studies*, 34, pp. 35-45

Dyhouse, C. (1978) 'Working-class mothers and infant mortality in England, 1895-1914', *Journal of Social History*, 12 (1978), pp. 248-67

Edmonds, T.R. (1836) 'On the mortality of infants in England' *The Lancet*, 25 (30 January), pp. 690-4

Edvinsson, S. and A. Janssens (2012) 'Clustering of deaths in families: infant and child mortality in historical perspective', *Biodemography and Social Biology*, 58, pp. 75-86

Engineer, A. (2001) 'The Society of Medical Officers of Health: Its history and its archive', *Medical History*, 45, pp. 97-114.

Eyler, J.M. (1976) 'Mortality statistics and Victorian health policy: program and criticism', *Bulletin of the History of Medicine*, 50, pp. 335-55

Eyler, J.M. (1979) *Victorian Social Medicine. The Ideas and Methods of William Farr* (Baltimore, Johns Hopkins Press)

Eyler, J.M. (1997) *Sir Arthur Newsholme and State Medicine* (Cambridge, Cambridge University Press)

Farr, W. (1859) 'On the construction of life-tables, illustrated by a new life-table of the healthy districts of England', *Transactions of the Royal Society*, 149, pp. 837-78

Ferguson, A.H., L.T. Weaver and M. Nicolson (2006) 'The Glasgow Corporation milk depot 1904–1910 and its role in infant welfare: An end or a means?', *Social History of Medicine*, 19 pp. 443–60

Field, C.D. (2008) 'A shilling for Queen Elizabeth: The era of state regulation of church attendance in England, 1552-1969', *Journal of State and Church*, 50, pp. 213-53

Fildes, V. (1980) 'Neonatal feeding practices and infant mortality during the 18th century', *Journal of Biosocial Science*, 13, pp. 313-24

Fildes, V. (1982) 'The age of weaning in Britain 1500-1800', *Journal of Biosocial Science*, 14, pp. 223-40

Fildes, V. (1986) *Breast, Bottles and Babies* (Edinburgh, Edinburgh University Press)

Fildes, V. (1988) *Wet Nursing* (Oxford, Blackwell)

Fildes, V. (1992) 'Breastfeeding in London, 1905-19', *Journal of Biosocial Science*, 24, pp. 53-70

Fildes, V. (1995) 'The culture and biology of breastfeeding: an historical review of western Europe' in P. Stuart-Macadam and K.A. Dettwyler (eds.) *Breastfeeding: Biocultural Perspectives* (New York: Aldine de Gruyter), pp. 101-26

Fildes, V. (1998) 'Infant feeding practices and infant mortality in England, 1900-1919', *Continuity and Change*, 13, pp. 251-80

Finlay, R. (1980) 'Distance to church and registration experience', *Local Population Studies*, 24, pp. 26-37

Finley, R. (1981) 'Parish registers. An introduction', *Historical Geography Research Series*, 7

Finlay, R. (1981) Differential child mortality in pre-industrial England: The example of Cartmel, Cumbria, 1600-1750', *Annales de Demographie Historique*, 17, pp. 67-80

Finlay, R. (1986) 'Population growth and suburban expansion', in A.L. Beier and R. Finlay (eds) *The Making of the Metropolis. London 1500-1700* (Harlow, Longman), pp. 37-59

Finlay, R. (1991) *Population and Metropolis: The Demography of London 1580-1650* (Cambridge, Cambridge University Press)

Flanders, J. (2003) *The Victorian House* (London, Harper Collins)

Flinn, M. (ed.) (1977) *Scottish Population History* (Cambridge, Cambridge University Press).

Flinn, M. (1981) *The European Demographic System 1500-1820* (Brighton, Harvester Press)

Forbes, T. (1971) *Chronicle from Aldgate* (New Haven, Yale University Press)

Foster, W. (various) *Annual Report on the Health of the Urban Sanitary District of Newport, Isle of Wight* (Newport, Newport Council)

Fraser, M. (1929) 'New Zealand – infant mortality rates and still-births', *Journal of the Royal Statistical Society*, 92, pp. 428-44

Frazer, W.M. (1934) *Report on the Health of the City of Liverpool in the Year 1933* (Liverpool, Liverpool Council)

Frazer, W.M. (1947) *Duncan of Liverpool* (London, Hamilton)

Freemantle *et al*., N. (2009) 'What factors predict differences in infant and perinatal mortality in primary care trusts in England? A prognostic model', *British Medical Journal*, (4 August), b2892

French, C. (2004) 'Infant mortality in Asylum Road, Kingston upon Thames, 1872-1911: an exercise in microhistory', *Family and Community History*, 7, pp. 141-55

French, C. and J. Warren (2004) 'Medical Officers of Health and infant mortality: the case of Kingston-upon-Thames in the late nineteenth and early twentieth century', *Local Population Studies*, 73, pp. 61-72

French, C. and J. Warren (2007) 'Infant mortality in the Canbury area of Kingston upon Thames, 1872-1911', *Continuity and Change*, 22, pp. 253-78

Gairdner, W.T. (1860) 'On infantile death rates, in their bearing on sanitary and social science', *Transactions of the National Association for the Promotion of Social Science*, pp. 632-48

Galley, C. (1991) *Growth, Stagnation and Crisis: The Demography of York, 1561-1700* (unpublished PhD. thesis, University of Sheffield)

Galley, C. (1993) ' "One face, one voice, one habit, and two persons!" The survival of twins in early modern society', *Local Population Studies*, 51, pp. 73-6

Galley, C. (1994) 'A never-ending succession of epidemics? Mortality in early-modern York', *Social History of Medicine*, 7, pp. 29-57

Galley, C. (1998) *The Demography of Early Modern Towns. York in the Sixteenth and Seventeenth Centuries* (Liverpool, Liverpool University Press)

Galley, C. (2004) 'Social intervention and decline of infant mortality: Birmingham and Sheffield, *c.*1870-1910', *Local Population Studies*, 73, pp. 29-50.

Galley, C. (2005) 'An exercise in Dade parish register demography: St Olave, York, 1771-1785', *Local Population Studies*, 74, pp. 75-83

Galley, C. (2006) 'George Newman – a life in public health', in E. Garrett *et al.* (eds) *Infant Mortality A Continuing Social Problem* (London, Ashgate), pp. 17-31

Galley, C. (2006) 'Health visitors: How much difference did they make? A reply to Michael Drake', *Local Population Studies*, 76 (2006), pp. 69-75

Galley, C. (2008) 'The stillbirth rate in early modern England', *Local Population Studies*, 81, pp. 75-83

Galley, C., E. Garrett, R. Davies and A. Reid (2011) 'Living same-name siblings and British demography', *Local Population Studies*, 86, pp. 15-36

Galley, C., E. Garrett, R. Davies and A. Reid (2011) 'Living same-name siblings and English demography', *Local Population Studies*, 87, pp. 70-7

Galley, C., E. Garrett, R. Davies and A. Reid (2012) 'Living same-name siblings and English historical demography: a final comment', *Local Population Studies*, 88, pp. 82-3

Galley, C. and A. Reid (2014) 'Maternal mortality', *Local Population Studies*, 93, pp. 68-78

Galley, C. and N. Shelton (2001) 'Bridging the gap: Determining long-term changes in infant mortality in pre-registration England and Wales', *Population Studies*, 55, pp. 65-77

Galley, C., N. Williams and R. Woods (1995) 'Detection without correction: problems in assessing the quality of English ecclesiastical and civil registration', *Annales de Démographie Historique*, pp. 161-83

Galley, C. and R. Woods (1999) 'On the distribution of deaths during the first year of life', *Population: An English Selection*, 11, pp. 35-60

Garrett, E., A. Reid and S. Szreter (2006) 'Residential mobility and child mortality in early twentieth century Belfast' in D. Fariñas and M. Oris (eds) *New Approaches to Death in Cities During the Health Transition* (Switzerland, Springer), pp. 55-76

Garrett, E., A. Reid, K. Schürer and S. Szreter (2001) *Changing Family Size in England and Wales. Place, Class and Demography, 1891-1911* (Cambridge, Cambridge University Press)

Gazeley, I. and A. Newell (2012) 'The end of destitution: evidence from urban British working households 1904–37', *Oxford Economic Papers*, 64 (2012), pp. 80–102

Gibson, J. and R. Couzens (trans.) (1988) *Baptism and Burial Registers of Banbury, Oxfordshire part four 1813-1838*, Banbury Historical Society, 22

Gibson, J.A. (various) *Annual Report on the Health of the Rural Sanitary District of the Isle of Wight* (Newport, Isle of Wight Council)

Gibson, J.R. and T. McKeown (1951) 'Observations on all births (23,970) in Birmingham, 1947. III. Survival', *British Journal of Social Medicine*, 5, pp. 177-83

Gibson, J.R. and T. McKeown (1952) 'Observations on all births (23,970) in Birmingham, 1947. VII. Effect of changing family size on infant mortality', *British Journal of Social Medicine*, 6, pp. 183-7

Glass, D.V. (1951) 'A note on the under-registration of births in Britain in the nineteenth century', *Population Studies*, 5, pp. 70-88;

Glass, D.V. (1973) *Numbering the People. The Eighteenth-century Population Controversy and the Development of Census and Vital Statistics in Britain* (Farnborough, Saxon House)

Glass, D.V. (1973) *The Population Controversy: a Collective Reprint of Material Concerning the 18th Century Controversy on the Trend of Population in England and Wales* (Farnborough, Saxon House)

Glass, D.V. (ed.) (1973) *The Development of Population Statistics* (Farnborough, Gregg International)

Gourbin, C. and G. Masuy-Stroobant (1995) 'Registration of vital data: are live births and stillbirths comparable all over Europe?', *Bulletin of the World Health Organization*, 73, pp. 449-60

Gower, G.W.G.L. (1877) *A Register of all Christenings, Burials & Weddings within the Parish of Saint Peters upon Cornhill* (London, Publications of the Harleian Society Registers Volume 1)

Graunt, J. (1964) 'Natural and political observations made upon the bills of mortality (1662)', reprinted in *Journal of the Institute of Actuaries*, 90, pp. 1-61

Greenhalgh, A. (no date) *Annual Report of the Medical Officer for the Year 1911* (Accrington, Accrington Council)

Greenwood, A. (1909) *Annual Report upon the Health of Blackburn for the Year 1908* (Blackburn, Blackburn Council)

Greenwood, F.J. (1914) 'Women as sanitary inspectors and health visitors' in E.J. Morley (ed.) *Women workers in seven professions* (London, Routledge), pp. 221-34

Greenwood, M. *Some Pioneers of Social Medicine* (London, Oxford University Press)

Gregory, I. (2008) 'Different places, different stories: infant mortality decline in England and Wales, 1851–1911', *Annals of the Association of American Geographers*, 98, pp. 773-94

Griffiths, C. and A. Brock (2003) 'Twentieth century mortality trends in England and Wales', *Health Statistics Quarterly*, 18, pp. 5-17

Griffiths, F. (various) *Annual Report of the Health of Sheffield* (Sheffield, Sheffield Council)

Grigson, C. (2015) ' "A universal language" William Hunter and the production of *The anatomy of the human gravid uterus*', in E.G. Hancock, N. Pearce and M. Campbell (eds) *William Hunter's World. The Art and Science of Eighteenth-century Collecting* (Farnham, Ashgate), pp. 59-80

Groves, J. (various) *Annual Report on the Health of the Rural Sanitary District of the Isle of Wight* (Newport, Isle of Wight Council)

Guy, W.A (1882) 'Two hundred and fifty years of small pox in London', *Journal of the Statistical Society of London*, 45, pp. 399-443

Haines, M.R. (1995) 'Socio-economic differentials in infant and child mortality during mortality decline: England and Wales, 1890-1911', *Population Studies*, 49, pp. 297-315.

Hamlin, C. (1995) 'Could you starve to death in England in 1839? The Chadwick-Farr controversy and the loss of the "social" in public health', *American Journal of Public Health*, 84, pp. 856-66

Hamlin, C. (1998) *Public Health and Social Justice in the Age of Chadwick. Britain, 1800-1854* (Cambridge, Cambridge University Press)

Hanawalt, B.A. (1995) *Growing up in Medieval London. The Experience of Childhood in History* (Oxford, Oxford University Press)

Harding, V. (2002) *The Dead and the Living in Paris and London, 1500-1670* (Cambridge, Cambridge University Press)

Hardy, A. (1993) *The Epidemic Streets. Infectious Disease and the Rise of Preventive Medicine, 1856-1900* (Oxford, Clarendon Press)

Hardy, A. (1994) ' "Death is the cure of all diseases": Using the General Register Office cause of death statistics for 1837-1920', *Social History of Medicine*, 7 (1994), pp. 472-92

Harris, B. (2004) *The Origins of the British Welfare State. Social Welfare in England and Wales, 1800-1945* (Basingstoke, Palgrave Macmillan)

Hart, E.J. (1906) *The Register of the Parish of Hackness co. York*, Yorkshire Parish Registers Series, 25

Hart, N. (1998) 'Beyond infant mortality: Gender and stillbirth in reproductive mortality before the twentieth century', *Population Studies*, 52, pp. 215-29

Hastings, S.G., I. Gregory and P. Atkinson (2015) 'Explaining geographical variations in English rural infant mortality decline using place-centered reading', *Historical Methods*, 48, pp. 128-40

Hatton, T.J. (2011) 'Infant mortality and the health of survivors: Britain, 1910–50', *Economic History Review*, pp. 951–97

Haygarth, J. (1774) 'Observations on the bill of mortality, in Chester, for the year 1772. By Doctor Haygarth', *Philosophical Transactions of the Royal Society*, 64, pp. 67-78

Haygarth, J. (1775) 'Bill of mortality for Chester for the year 1773', *Philosophical Transactions of the Royal Society*, 65 (1775), pp. 85-90

Haygarth, J. (1778) 'Observations on the population and diseases of Chester, in the year 1774. By J. Haygarth M. D.', *Philosophical Transactions of the Royal Society*, 68 (1778), pp. 131-54

Haygarth, J. (1784), *An Inquiry how to Prevent the Small-pox. And Proceedings of a Society for Promoting General Inoculation at Stated Periods, and Preventing the Natural Small-pox in Chester*,

(London, Printed by J. Monk for J. Johnson, no 72, St Paul's Churchyard, and P. Broster, Chester)

Heady, J.A., C. Daly and J.N. Morris (1955) 'Social and biological factors in infant mortality. II Variation of mortality with mother's age and parity', *The Lancet*, 265 (6860), pp. 395-7

Heady, J.A. *et al.* (1955) 'Social and biological factors in infant mortality. IV The independent effects of social class, region, the mother's age and her parity', *The Lancet*, 265 (6862), pp. 499-503

Heady, J.A. and M.A. Heasman (1959) *Studies on Medical and Population Subjects no. 15. Social and Biological Factors in Infant Mortality* (London, HMSO)

Heady, J.A. and J.N. Morris (1956) 'Social and biological factors in infant mortality. VI Mothers who have their babies in hospitals and nursing homes', *British Journal of Preventive Medicine*, 10, pp. 97–106

Heady, J.A. and J.N. Morris (1956) 'Social and biological factors in infant mortality. VII Variation of mortality with mother's age and parity', *Journal of Obstetrics and Gynaecology of the British Empire*, 66, pp. 577-91

Henry, L. (1967) *Manuel de Démographie Historique* (Paris, Librairie Droz)

Heysham, J. (1973) 'Collected bills of mortality for Carlisle, 1779-1787', reprinted in D.V. Glass (ed.) *The Development of Population Statistics* (Farnborough, Gregg International Reprints)

Hicks, J. and G. Allen (1999) 'A century of change: Trends in UK statistics since 1900', *House of Commons Library Research Paper*, 99/111, p. 1-34

Higgs, E. (2004) *Life, Death and Statistics* (Hatfield, Local Population Studies)

Hill, A. (1893) 'On the causes of infant mortality in Birmingham', *Practitioner*, 51, pp. 70-80

Hillier, T. (various) *Annual Report of the Medical Officer of Health for St Pancras, Middlesex* (no publisher given)

Hinde, A. (1995) *Demographic Methods* (London, Arnold)

Hinde, A. (2015) 'Sex differentials in phthisis mortality in England and Wales, 1861–1870', *The History of the Family*, 20, pp. 1-27

Hinde, A. and V. Fairhurst (2015) 'Why was infant mortality so high in eastern England in the mid nineteenth century?', *Local Population Studies*, 94, pp. 48-66

Hinde, A. and B. Harris (2019) 'Mortality decline by cause in urban and rural England and Wales, 1851-1910', *The History of the Family*, 24, pp. 377-403

Hogan, S. (2008) 'Breasts & the beestings: rethinking breast-feeding practices, maternity rituals, & maternal attachment in Britain & Ireland', *Journal of International Women's Studies*, 10, pp. 141-60

Högberg, U. and G. Broström (1985) 'The demography of maternal mortality – seven Swedish parishes in the nineteenth century', *International Journal of Gynaecology and Obstetrics*, 23 (1985), pp. 489-97

Hollingsworth, T.H. (1964) *The Demography of the British Peerage*, Supplement to *Population Studies*, 18

Hollingsworth, T.H. (1977) 'Mortality in the British peerage families since 1600', *Population*, 32, pp. 323-52

Holmes, F. (2003) *The Sickly Stuarts. The Medical Downfall of a Dynasty* (Stroud, Sutton Publishing)

Holt, T. (no date) *Report on the Public Health and Sanitary Administration for the Year 1911* (Burnley, Burnley Council)

Hope, E.W. (1899) 'Observations on Autumnal diarrhoea in cities', *Public Health*, 11, pp. 660-5

Hope, E.W. (1899) 'Summer diarrhoea', *Public Health*, 11, pp. 425-6

Hope, E.W. (various) *Report on the Health of Liverpool* (Liverpool, Liverpool Council)

Houlbrooke, R. (1988) *English Family Life 1576-1716* (Oxford, Blackwell)

Houlbrooke, R. (1998) *Death, Religion and the Family in England 1480-1750* (Oxford, Oxford University Press)

Howarth, W.J. (1905) 'The influence of feeding on the mortality of infants', *The Lancet* 166 (4273), pp. 210-3

Huck, P. (1994) 'Infant mortality in nine industrial parishes in northern England, 1813-1836', *Population Studies*, 48, pp. 513-26

Huck, P. (1997) 'Shifts in the seasonality of infant deaths in nine English towns during the 19th century: a case for reduced breast feeding?', *Explorations in Economic History*, 34, pp. 368-86

Hudson, E.C. (ed.) (1935) *The Registers of St Lawrence, York 1606-1812*, Yorkshire Parish Registers Series, 97

Huggett, J. and N. Mikhaila (2013) *The Tudor Child. Clothing and Culture 1485 to 1625* (Lightwater, Fat Goose Press)

Humphery-Smith, C.R. (ed.) (1984) *The Phillimore Atlas and Index of Parish Registers* (Chichester, Phillimore)

Imhof, A. (1984) 'The amazing simultaneousness of the big differences and the boom in the 19th century – some facts and hypotheses about infant and maternal mortality in Germany, 18th to 20th century?' in T. Bengtsson, G. Fridlizius and R. Ohlsson (eds) *Pre-industrial Population Change* (Stockholm, Almqvist and Wiksell), pp. 191-222

Imhof, A. (1996) *Lost Worlds. How our European Ancestors Coped with Everyday Life and why Life is so Hard Today* (Charlottesville, University Press of Virginia)

Jaadla, H., E. Potter and R. Davenport (2020) 'Infant and child mortality in early nineteenth-century England', *Economic History Review*, 73, pp. 991-1,022

James, T. (2003) 'Neonatal mortality in Northamptonshire: Higham Ferrers 1880-1890', *Family & Community History*, 6, pp. 129-39

Johnstone, C. and E.J. Hart (trans.) (1906) *The Register of the Parish of Hackness Co. York*, Yorkshire Parish Registers Series 25

Joint Committee of the Royal College of Obstetricians and Gynaecologists and the Population Investigation Committee (1948) *Maternity in Great Britain* (Oxford, Oxford University Press)

Jones, H.R. (1894) 'The perils and protection of infant life', *Journal of the Royal Statistical Society*, 57, pp. 1-98

Jones, R.E. (1976) 'Infant mortality in rural north Shropshire, 1561-1810', *Population Studies*, 30, pp. 305-17

Jones, R.E. (1980) 'Further evidence on the decline in infant mortality in pre-industrial England: north Shropshire, 1561-1810', *Population Studies*, 34, pp. 239-50

Kahn, H.A. and C.T. Sempos (1989) *Statistical Methods in Epidemiology* (Oxford, Oxford University Press)

Kanthack, E. (1907) *The Preservation of Infant Life. A Guide for Health Visitors* (London, H.K. Lewis & Co.)

Keating, J. (2008) *A Child for Keeps: the History of Adoption in England, 1918-45* (Basingstoke, Palgrave Macmillan)

Kemmer, D. (1997) 'Investigating infant mortality in early twentieth century Scotland using civil registers: Aberdeen and Dundee compared', *Scottish Economic and Social History*, 17, pp. 1-19.

Kendon, M. and J. Prior (2011) 'Two remarkable summers – 'perfect' 1911 and 'calamitous' 1912', *Journal of the Royal Meteorological Society*, 66, pp. 179-84

King, S. (1997) 'Dying with style: Infant death and its context in a rural industrial township 1650-1830', *Social History of Medicine,* 10 (1997), pp. 3-24

Knodel, J.E. (1988) *Demographic Behavior in the Past* (Cambridge, Cambridge University Press)

Knodel, J. and H. Kintner (1977) 'The impact of breast feeding patterns on the biometric analysis of infant mortality', *Demography*, 14, pp. 391-409

Lamagni, T. *et al.* (2018) 'Resurgence of scarlet fever in England, 2014–16: a population-based surveillance study', *The Lancet Infectious Diseases*, 18, pp. 180–7

Lambert, R. (1963) *Sir John Simon 1816-1904 and English Social Administration* (London, MacGibbon and Kee)

Lancashire Parish Register Society (1990) 'Registers of St Peter's, Ashton-under-Lyne, St Peter's Blackley and St Lawrence's Chorley', *Lancashire Parish Register Society*, 129

Landers, J. (1993) *Death and the Metropolis. Studies in the Demographic History of London 1670-1830* (Cambridge, Cambridge University Press)

Laurence, S. (2018) *The Hand that Rocked the Cradle. The Art of Birth and Infancy* (Norwich, Unicorn Press)

Law, C.M. (1967) 'The growth of urban population in England and Wales, 1801-1911', *Transactions of the Institute of British Geographers*, 49, pp. 125-43

Lawson, W. (1917) 'Infant mortality and the Notification of Births Acts, 1907, 1915', *Journal of the Statistical and Social Inquiry Society of Ireland*, 97, pp. 479-97

Lawton, R. (ed.) *The Census and Social Structure an Interpretive Guide to Nineteenth Century Censuses for England and Wales* (London, 1978)

Laxton, P. and N. Williams (1989) 'Urbanization and infant mortality in England: a long term perspective and review', in M. Nelson and J. Rogers (eds) *Urbanisation and the Epidemiological Transition, Reports from the Family History Group, Uppsala University*, 9, pp. 124-35

Leadbetter, R.A. (2017) 'Smallpox in Oxfordshire, 1700-99, and the implications of familial transmission routes', *Local Population Studies*, 98, pp. 12-29

Lebert, H. (1878) *A Treatise on Milk and Henri Nestlé's Milk Food, for the Earliest Period of Infancy and in Later Years* (Vevey, Nestlé)

Lee, C.H. (1991) 'Regional inequalities in infant mortality in Britain, 1861-1971: patterns and hypotheses', *Population Studies*, 45, pp. 55-65

Lee, R.D. and D. Lam (1983) 'Age distribution adjustments for English censuses, 1821 to 1931', *Population Studies*, 37, pp. 445-64.

Levene, A. (2005) 'The estimation of mortality at the London Foundling Hospital, 1741-99', *Population Studies*, 59, pp. 87-97

Levene, A. (2005) 'The mortality penalty of illegitimate foundlings and poor children in eighteenth-century England' in A. Levene, T. Nutt and S. Williams (eds) *Illegitimacy in Britain, 1700-1920* (Basingstoke, Palgrave Macmillan), pp. 34-49

Levene, A. (2006) 'What can Dade registers tell us about infant mortality in the later eighteenth century?', *Local Population Studies*, 76, pp. 31-42

Levene, A. (2007) *Childcare, Health and Mortality at the London Foundling Hospital, 1741-1800* (Manchester, Manchester University Press)

Levine, D. (1976) 'The reliability of parochial registration and the representativeness of family reconstitution', *Population Studies,* 30, pp. 107-30

Lewis, J. (1980) *The Politics of Motherhood. Child and Maternal Welfare in England, 1900-1939* (London, Croom Helm)

Lewis, J. (1986) 'The working-class wife and mother and state intervention, 1870-1918' in J. Lewis (ed.) *Labour and Love. Women's Experience of Home and Family 1850-1940* (Oxford, Blackwell), pp. 99-120

Lewis-Fanning, E. (1930) 'A survey of the mortality in Dr Farr's 63 healthy districts of England and Wales during the period 1851-1925', *Journal of Hygiene*, 30, pp. 121-53

Littlejohn, H. (various) *Annual Report on the Health of Sheffield* (Sheffield, Sheffield Council)

Lloyd, J.M. (2001) 'The "languid child" and the eighteenth-century man-midwife', *Bulletin of the History of Medicine*, 75, pp. 641-79

Løkke, A. (2018) 'Mrs Stone and Dr Smellie: British eighteenth-century birth attendance and long-run levels and trends in maternal mortality discussed in a north European context', *Population Studies*, 72, pp. 123-36

Loudon, I. (1991) 'On maternal and infant mortality', *Social History of Medicine*, 4, pp. 29-73

Loudon, I. (1992) *Death in Childbirth. An International Study of Maternal Care and Maternal Mortality 1800-1950* (Oxford, Oxford University Press)

Luckin, B. (2000) 'Pollution in the city' in M. Daunton (ed.) *The Cambridge Urban History of Britain. Volume III* (Cambridge, Cambridge University Press)

Lumb, G.D. (1906) *The Registers of the Parish Church of Rothwell c. York part 1 1538-1689*, Yorkshire Parish Registers Series, 27

Lynch, K.A. and J.B. Greenhouse (1994) 'Risk factors for infant mortality in nineteenth-century Sweden', *Population Studies*, 48, pp. 117-33

Macdonald, R.W. (1976) 'The parish registers of Wales', *National Library of Wales Journal*, 19, pp. 399-429

Macfarlane, A. (1970) *The Family Life of Ralph Josselin* (Cambridge, Cambridge University Press)

Macfarlane, A. (ed.) (1976) *The Diary of Ralph Josselin 1616-1683* (Oxford, The British Academy)

Macfarlane, A. (1977) *Reconstructing Historical Communities* (Cambridge, Cambridge University Press)

Macfarlane, A. and J. Maher (2004) 'Inequalities in infant mortality: trends by social class, registration status, mother's age and birthweight, England and Wales, 1976-2000', *Health Statistics Quarterly*, pp. 14-22

Macfarlane, A. *et al.* (2000) *Birth Counts. Statistics of Pregnancy & Childbirth* (Norwich, The Stationary Office)

Mallett, B. (1918) 'Vital statistics as affected by war', *Journal of the Royal Statistical Society*, 81, pp. 1-36

Marks, L.V. (1994) *Model Mothers Jewish Mothers and Maternity Provision in East London 1870-1939* (Oxford, Clarendon Press).

Marland, H. (1993) 'A pioneer in infant welfare: The Huddersfield Scheme 1903-1920', *Social History of Medicine*, 6, pp. 25-50

Marmot *et al.*, M. (2008) 'Closing the gap in a generation: health equity through action on the social determinants of health', *Lancet*, (8 November), pp. 1661-9.

Marmot, M. (2004) 'Status syndrome', *Significance*, 1, pp. 150-4

Marmot, M. (2015) *The Health Gap. The Challenge of an Unequal World* (London, Bloomsbury).

Marsden, R.S. (1912) *Report on the Sanitary Condition of the County Borough of Birkenhead for the Year 1911* (Birkenhead, Birkenhead)

Marshall, J. (1837) *Mortality of the Metropolis* (London)

Martin, W.J. (1933) 'The estimation of infant mortality', *Journal of the Royal Statistical Society*, 96, pp. 481-6

Masuy-Stroobant, G. (2002) 'The determinants of infant mortality: how far are conceptual frameworks really modelled?', in R. Frank (ed.) *The Power of Explanatory Frameworks. Bridging the Gap between Empirical and Theoretical Research in the Social Sciences* (Dordrecht, Springer), pp 15-30

Masuy-Stroobant, G. (2010) '1911: Un été exceptionnel Belgique?', *Annales de Démographie Historique*, 120, pp. 179-97

Maudsley, G. and E.M.I. Williams (1996) ' "Inaccuracy" in death certification - where are we now', *Journal of Public Health Medicine*, 18, pp. 59-66

McCleary, G.F. (1904) 'The infants' milk depot: Its history and function', *The Journal of Hygiene*, 4, pp. 329-68

McCleary, G.F. (1904) 'The influence of antenatal conditions on infantile mortality', *The British Medical Journal* (13 August), pp. 321-3

McCleary, G.F. (1905) *Infantile Mortality and Infants Milk Depots* (London, P.S. King and Son)

McCleary, G.F. (1933) *The Early History of the Infant Welfare Movement* (London, H.K. Lewis)

McCleary, G.F. (1935) *The Maternity and Child Welfare Movement* (London, P.S. King & Son Ltd).

McCleary, G.F. (1960) *On Detective Fiction and Other Things Including Pickwick, Cambridge, Infant Mortality, Slums, Stevenson, Motherhood & Incentives* (London, Hollis & Carter)

McClintock, A.H. (ed.) (1876) *Smellie's Treatise on the Theory and Practice of Midwifery Vol. 1* (London, New Sydenham Society)

McKeown, T.R., R.G. Brown and R.G. Record (1972) 'An interpretation of the modern rise of population', *Population Studies*, 26 (1972), pp. 345-82

McNeill, C. (1942) 'Child health in Holland, England, and Scotland: sixty years of progress', *British Medical Journal*, (4 Apr), pp. 429-33

Meckel, R.A. (1980) *Save the Babies* (Ann Arbor, University of Michigan Press)

Mercer, A. (2014) *Infections, Chronic Disease, and the Epidemiological Transition a New Perspective* (Rochester, University of Rochester Press)

Miller, Erin (2006) 'Infant health in Wigan, England during the First World War' (2006) available at https://erinashleymiller.com/writing/the-effect-of-the-first-world-war-on-infant-health-in-wigan -england-abstract/ [accessed April 2021]

Millward, R. and F. Bell (2001) 'Infant mortality in Victorian Britain: The mother as medium', *Economic History Review*, 54, pp. 699-733

Mooney, G. (1994) 'Did London pass the "sanitary test"? Seasonal infant mortality in London, 1870-1914', *Journal of Historical Geography*, 20, pp. 158-74

Moore, S.G.H. (no date) *The Annual Report of the Urban Sanitary Authority of the County Borough of Huddersfield for the Year 1911* (Huddersfield, Huddersfield Council)

Morgan, N. (2002) 'Infant mortality, flies and horses in later-nineteenth-century towns: a case study of Preston', *Continuity and Change*, 17, pp. 97-132

Moriyama, I.M., R.M. Loy, and A.H.T. Robb-Smith (2011) *History of the Statistical Classification of Diseases and Causes of Death* (Washington, Centers for Disease Control and Prevention)

Morris, J.N. and J.A. Heady (1955) 'Social and biological factors in infant mortality. I Objects and methods', *The Lancet*, 265 (6859), pp. 343-9

Morris, J.N. and J.A. Heady (1955) 'Social and biological factors in infant mortality. V Mortality in relation to the father's occupation 1911-1950', *The Lancet*, 265 (6863), pp. 554-9

Morrison, S.L., J.A. Heady and J.N. Morris (1959) 'Social and biological factors in infant mortality. VIII Mortality in the post-neonatal period', *Archives of Diseases in Childhood*, 34, pp. 101-14

Mosley, W.H. and L.C Lincoln. (1984) 'An analytical framework for the study of child survival in developing countries', *Supplement to Population and Development Review*, 10, pp. 25-45.

Murphy, S.F. (various) *Annual Report of the Medical Officer of Health for St Pancras, Middlesex* (no publisher given)

Nashelsky, M.B. and C.H. Lawrence (2003) 'Accuracy of cause of death determination without forensic autopsy examination', *The American Journal of Forensic Medicine and Pathology*, 24, pp. 313-9.

Newman, G. (1906) *Infant Mortality a Social Problem* (London, Methuen)

Newman, G. (1907) *The Health of the State* (London, Headley Brothers)

Newman, G. (1931) *Health and Social Evolution* (London, Routledge)

Newman, G. (1933) *On the State of the Public Health. Annual Report of the Chief Medical Officer of the Ministry of Health for the Year 1932* (London, HMSO)

Newman, G. (1939) *The Building of a Nation's Health* (London, Macmillan)

Newman, G. (1941) *English Social Services* (London, Collins)

Newsholme, A. (1884) *Hygiene: A Manual of Personal and Public Health* (London, George Gill & Sons)

Newsholme, A. (1887) *School Hygiene. The Laws of Health in Relation to School Life* (London, Allen & Unwin)

Newsholme, A. (1890) *Lessons on Health: Containing the Elements of Physiology and Their Application to Hygiene* (London, W.H. Allen & Co.)

Newsholme, A. (1891) 'The vital statistics of the Peabody Buildings and other Artisans' and Labourers' Block Dwellings', *Journal of the Royal Statistical Society,* 54, pp. 70-99

Newsholme, A. (1899) *The Elements of Vital Statistics* (London, Allen and Unwin)

Newsholme, A. (1902) 'Infantile mortality A statistical study from the public health standpoint', *The Practitioner*, 75, pp. 489-500.

Newsholme, A. (1902) 'The public health aspects of summer diarrhoea', *The Practitioner*, 69, pp. 161-80

Newsholme, A. (1905) *Annual Report on the Health, Sanitary Condition, &c. of the County of Brighton for the Year 1904* (Brighton, Brighton Council)

Newsholme, A. (1910) *Supplement to the Thirty-ninth Annual Report of the Local Government Board 1909-10 Containing a Report by the Medical Officer on Infant and Child Mortality* (London, HMSO) (Cd. 5263)

Newsholme, A. (1913) *Supplement to the Forty-second Annual Report of Local Government Board 1912-13, Containing a Second Report by the Medical Officer on Infant and Child Mortality* (London, HMSO) (Cd. 6909)

Newsholme, A. (1913) *Supplement to the Forty-second Annual Report of the Local Government Board 1912-13 Containing a Second Report by the Medical Officer on Infant and Child Mortality* (London, HMSO) (Cd. 6909)

Newsholme, A. (1914) *Supplement to the Forty-third Annual Report of Local Government Board 1913-14, Containing a Third Report by the Medical Officer on Infant Mortality Dealing with Infant Mortality in Lancashire* (London, HMSO) (Cd. 7511)

Newsholme, A. (1915) *Supplement to the Forty-fourth Annual Report of the Local Government Board Containing a Report on Maternal Mortality in Connection with Childbearing and its Relation to Infant Mortality* (London, HMSO) (Cd. 8085)

Newsholme, A. (1916) *Supplement to the Forty-fifth Annual Report of the Local Government Board Containing a Report on Child Mortality at Ages 0-5, in England and Wales* (London, 1916) (Cd. 8496)

Newsholme, A. (1935) *Fifty Years in Public Health* (London, Allen & Unwin)

Newton, G. (2011) 'Infant mortality variations, feeding practices and social status in London between 1550 and 1750', *Social History of Medicine*, 24, pp. 260-80

Newton, G. (2011) 'Recent developments in making family reconstitutions', *Local Population Studies*, 87, pp. 84-9

Newton, G. and R. Smith (2013) 'Convergence or divergence? Mortality in London, its suburbs and its hinterland between 1550 and 1700', *Annales de Démographie Historique*, pp. 17-49

Nicolson, J. (2006) *The Perfect Summer: Dancing into Shadow in 1911* (London, John Murray)

Nissell, M. (1987) *People Count. A History of the General Register Office* (London, HMSO)

Nitsch, E.K., L.T. Humphrey and R.E.M. Hedges (2011) 'Using stable isotope analysis to examine the effects of economic change on breastfeeding practices in Spitalfields, London, UK', *American Journal of Physical Anthropology*, 146, pp. 619-28

Nixon, W.C.W. (1963) 'Forward' to N.R. Butler and D.G. Bonham, *Perinatal Mortality. The First Report of the 1958 British Perinatal Mortality Survey under the Auspices of the The National Birthday Trust Fund* (Edinburgh, E. & S. Livingstone Ltd.)

O'Brien, E., P. Myles and C. Pritchard (2016) 'The portrayal of infant feeding in British women's magazines: a qualitative and quantitative content analysis', *Journal of Public Health*, 39, pp. 221–6

Odent, P.L.G. (2011) 'Early infant feeding and neonatal survival in Nepal: Breastfeeding, colostrum and discarding of the first milk', (unpublished PhD thesis, University College London)

Office of National Statistics (1998) *Birth Statistics FM 1 29* (London, HMSO)

Office of National Statistics (2001) *Mortality Statistics DH2 27* (London, HMSO)

Office of National Statistics (2002) *Review of the Registrar General on Deaths in England and Wales, 2000, Childhood, Infant and Perinatal Mortality Statistics,* Series DH3 no. 33 (London, Office of National Statistics)

Office of National Statistics (2006*) Mortality Statistics. Childhood, Infant and Perinatal DH3 37* (London, HMSO)

Office of National Statistics (2013) *The 20th Century Mortality File, 1901-2000* (ONS)

Outhwaite, R.B. (1995) *Clandestine Marriage in England 1500-1850* (London, The Hambleton Press)

Pamuk, E.R. (1985) 'Social class inequality in mortality from 1921 to 1972 in England and Wales', *Population Studies,* 39, pp. 17-31

Parkes, A.S. (1976) *Patterns of Sexuality and Reproduction* (Oxford, Oxford University Press)

Parton, C. (1983) 'The infant welfare movement in early twentieth century Huddersfield', *Journal of Regional and Local Studies,* 3, pp. 69-77

Peller, S. (1943) 'Studies on mortality since the renaissance', *Bulletin of the History of Medicine*, 13, pp. 427-61

Peller, S. (1948) 'Mortality, past and future' *Population Studies*, 1, pp. 405-56

Percival, T. (1803) *Medical Ethics: Or, a Code of Institutes and Precepts: Adapted to the Professional Conduct of Physicians and Surgeons* (London, John Churchill)

Perkins, J. (2010) 'Birth baptism intervals in 68 Lancashire parish registers, 1646-1917', *Local Population Studies*, 85, pp. 11-27

Perry, R. (1991) 'Colonizing the breast: Sexuality and maternity in eighteenth-century England', *Journal of the History of Sexuality*, 2 (1991), pp. 204-34

Peters, O.H. (1910) 'Observations upon the natural history of epidemic diarrhoea', *Journal of Hygiene*, 10 (1910), pp. 602-777

Pozzi, L. and D.R. Fariñas (2010) 'The heat wave of 1911. A largely ignored trend reversal in the Italian and Spanish transition?', *Annales de Démographie Historique*, 120, pp. 147-78

Pritchard, E. (1921) 'Infant mortality and the welfare movement', *Contemporary Review*, 120, pp. 76-82.

Proctor, R.J. (2011) 'Infant mortality: a study of the impact of social intervention in Birmingham 1873 to 1938' (unpublished Master of Philosophy thesis, University of Birmingham).

Rawcliffe, C. (1995) *Medicine & Society in Later Medieval England* (Stroud, Alan Sutton Publishing)

Rafferty, S.L. (2021) 'Can indirect measures and the medical officer of health reports "correct" distorted infant mortality rates reported by the Registrar General?' *Local Population Studies* 106, pp. 57-106

Razzell, P. (1993) 'The growth of population in eighteenth-century England: A critical reappraisal', *Journal of Economic History,* 54, pp. 743-71

Razzell, P. (2000) 'Evaluating the same-name technique as a way of measuring burial register reliability in England', *Local Population Studies,* 64, pp. 8-22

Razzell, P. (2011) 'Infant mortality in London, 1538-1850: a methodological study', *Local Population Studies*, 87, pp. 45-64

Razzell, P. (2011) 'Living same-name siblings in England, 1439-1851' *Local Population Studies*, 87, pp. 65-9

Razzell, P. (2011) 'The decline of adult smallpox in eighteenth-century London: a commentary', *Economic History Review*, 64, pp. 1,315-35

Razzell, P. (2012) 'Living same-name siblings and English historical demography: a commentary', *Local Population Studies*, 88, pp. 76-81

Razzell, P. (2016) *Mortality, Marriage and Population Growth in England, 1550-1850* (London, Caliban Books)

Redmonds, G. (2004) *Christian Names in Local and Family History* (Richmond, National Archives)

Registrar General (various years) *Registrar General's Statistical Review* (London, ONS)

Registrar General, (various) *Annual Reports of the Registrar General for England and Wales* (London, HMSO)

Registrar General, *Supplement to the Eighty-first Annual Report of the Registrar General of Births, Deaths and Marriages in England and Wales. Report on the Mortality from Influenza in England and Wales During the Epidemic of 1918-19* (London, HMSO) [Cdm. 700]

Reichmann, W.J. (1964) *Use and Abuse of Statistics*, (London, Pelican**)**

Reid, A. (2001) 'Health visitors and child health: Did health visitors have an impact?', *Annales de Démographie Historique*, pp. 117-37

Reid, A. (2001) 'Neonatal mortality and stillbirths in early twentieth-century Derbyshire, England', *Population Studies*, 55, pp. 213-32

Reid, A. (2002) 'Infant feeding and post-neonatal mortality in Derbyshire, England, in the twentieth century', *Population Studies*, 56, pp. 151-66

Reid, A. (2005) 'The effects of the 1918-1919 influenza pandemic on infant and child health in Derbyshire', *Medical History*, 49, pp. 29-54

Reid, A. (2005) 'The influences on the health and mortality of illegitimate children in Derbyshire, 1917-1922', in A. Levene, T. Nutt and S. Williams (eds) *Illegitimacy in Britain, 1700-1920* (Basingstoke, Palgrave Macmillan), pp. 168-89

Reid, A. (2006) 'Health visitors and "enlightened motherhood" ', in E. Garrett *et al.* (eds) *Infant Mortality A Continuing Social Problem* (London, Ashgate), pp. 191-210

Reid, A. (2017) 'Infant feeding and child health and survival in Derbyshire in the early twentieth century', *Women's Studies International Forum*, 60, pp. 111-9

Reid, A. and E. Garrett (2018) 'Mortality, work and migration. A consideration of age-specific mortality from tuberculosis in Scotland, 1861-1901', *Historical Life Course Studies*, 6 (2018), pp. 111-32

Reid, A., H. Jaadla and E. Garrett (2020) *Demographic and Socio-economic Data for Registration Sub-districts of England and Wales, 1851-1911.* [data collection]. (UK Data Service). SN: 8613

Reidpath, D.D. and P. Allotey, 'Infant mortality rate as an indicator of population health', *Journal of Epidemiology and Community Health*, 17 (2003), pp. 344–6

Rendle-Short, M. and J. (1966) *The Father of Child Care. Life of William Cadogan (1711-1797)* (Bristol, John Wright and Sons Ltd.)

Renney, H. (1916) 'A discussion of maternity and child welfare', *Public Health*, (May) pp. 180-6

Report of the Inter-departmental Committee on Physical Deterioration BPP (1904): Vol. I Report and Appendix (Cd. 2175), p. 44; Vol. II List of Witnesses and Minutes of Evidence (Cd. 2210); Vol III Appendix and General Index (Cd. 2186)

Reports of the Medical Officer of the Privy Council (various) (London, British Parliamentary Papers)

Roberts, A.E. (1973) 'Feeding and mortality in the early months of life; changes in medical opinion and popular feeding practice, 1850-1900' (unpublished Ph.D. thesis, University of Hull).

Roberts, C. and M. Cox (2003) *Health & Disease in Britain from Prehistory to the Present Day* (Stroud, Sutton Publishing)

Robertson, J. (1904) *Special Report of the Medical Officer of Health of the City of Birmingham* (Birmingham, Birminham Council).

Robertson, J. (1906) *Report of the Medical Officer of Health on the Health of the City of Birmingham for the Year 1905* (Birmingham, Birmingham Council)

Robinson *et al.*, T. (2019) 'The impact of New Labour's English health inequalities strategy on geographical inequalities in infant mortality: a time-trend analysis', *Journal of Epidemiology and Community Health*, 73, pp. 564–8

Rollason, A.A. (1899) *The Old Non-parochial Registers of Dudley* (Dudley, Herald Press)

Rollet, C. (2010) 'La canicule de 1911. Observations démographiques et médicaleset reactions politiques', *Annales de Démographie Historique*, 120, pp. 105-20

Ross, E. (1993) *Love & Toil. Motherhood in Outcast London, 1870-1918* (Oxford, Oxford University Press)

Routh, A. (1914) 'A lecture on ante-natal hygiene: its influence upon infantile mortality', *British Medical Journal,* (14 February), pp. 355-63.

Routh, C.H.F. (1863) *Infant Feeding and its Influence on Life, 2nd ed.* (London, J. Churchill and Sons)

Rowntree, B.S. (1901) *Poverty A Study of Town Life* (London, Macmillan and Co. Ltd)

Rusnock, A.A. (2002) *Vital Accounts. Quantifying Health and Population in Eighteenth-century England and France* (Cambridge, Cambridge University Press)

Rusnock, A.A. (2005) 'Quantifying infant mortality in England and France, 1750-1800' in G. Jorland, A. Opinel and G. Weisz (eds) *Body Counts. Medical Quantification and Historical & Sociological Perspectives* (Montreal & Kingston, McGill-Queen's University Press), pp. 65-86

Saito, O. (1997) 'Infant mortality and pre-transition Japan: levels and trends', in A. Bideau, B. Desjardins and H. Pérez Brignoli (eds) *Infant and Child Mortality in the Past* (Oxford, Clarendon Press), pp. 135-53

Sanders, G.L. (1962) *Sanitary State of the Town. Report to the Health Committee of the Town Council* (Sheffield, Sheffield Council)

Sardon, J.-P. (1983) 'Le mouvement saisonnier de la mortalite infantile: une mesure impossible?', *Population*, 38, pp. 763-79

Sartain, S. (2012) 'A sociological investigation of infant overlaying death', (unpublished PhD thesis, University of Edinburgh)

Sauer, R. (1978) 'Infanticide and abortion in nineteenth-century Britain', *Population Studies*, 32, pp. 81-93

Saxby, M.J. (2003) 'Ages at baptism in the parish of All Saints, Sudbury, 1809-1828: a new approach to their interpretation', *Local Population Studies*, 70, pp. 49-56

Schofield, R. (2005) 'Monday's child is fair of face': favoured days for baptism, marriage and burial in pre-industrial England', *Continuity and Change*, 20, pp. 93-109

Schofield, R.S. and E.A. Wrigley (1979) 'Infant and child mortality in England in the late Tudor and early Stuart period' in C. Webster (ed.) *Health Medicine and Mortality in the Sixteenth Century* (Cambridge, Cambridge University Press), pp. 61-95

Scholes, P. (1970) *The Oxford Companion to Music 10th edition* (Oxford, Oxford University Press)

Scott, S. and C.J. Duncan (2002) *Demography & Nutrition* (Oxford, Blackwell)

Sharp, J. (1999) *The Midwives Book* (edited by Elaine Hobby) (Oxford, Oxford University Press)

Sharpe, P. (2002) *Population and Society in an East Devon Parish. Reproducing Colyton 1540-1840* (Exeter, Exeter University Press)

Shaw, M. *et al.* (1999) *The Widening Gap. Health Inequalities and Policies in Britain* (Bristol, Policy Press)

Short, T. (1750) *New Observations on City, Town and Country Bills of Mortality* (London, Longman and Millar)

Slack, M. (1987) 'Non-conformist and Anglican registration in the Halifax area 1740-99', *Local Population Studies*, 38, pp. 44-5

Small, N. (2012) 'Infant mortality and migrant health in babies of Pakistani origin born in Bradford, UK', *Journal of Intercultural Studies*, 33, pp. 549-64

Smallman-Raynor, M. and A. Cliff (2012) *Atlas of Epidemic Britain* (Oxford, Oxford University Press)

Smith, R. and J. Oeppen (2006) 'Place and status as determinants of infant mortality in England c. 1550-1937' in E. Garrett *et al.* (eds) *Infant Mortality: a Continuing Social Problem* (London, Ashgate), pp. 53-78

Smith, S.M. (2013) ' "Who you are or where you are?": Determinants of infant mortality in Fulham 1876-1888', *Family & Community History*, 6, pp. 113-20

Smith, T.C. (1988) *Native Sources of Japanese Industrialization, 1750-1920* (Berkeley, University of California Press)

Speigelhalter, D. (2019) *The Art of Statistics. Learning from Data* (London, Pelican)

Steel, D. (1968) *National Index of Parish Registers, volume 1. Sources of Births, Marriages and Deaths before 1837* (London, Society of Geneaologists)

Stopforth Taylor, J. (various) *Report on the Health of Liverpool* (Liverpool, Liverpool Council)

Stride, P. (2008) 'St Kilda, the neonatal tetanus tragedy of the nineteenth century and some twenty-first century answers', *Journal of the Royal College of Physicians Edinburgh*, 38, pp. 70–7

Sussman, G.D. (1977) 'Parisian infants and Norman wet nurses in the early nineteenth century: a statistical study', *Journal of Interdisciplinary History*, 7, pp. 637-53

Sykes, J.F.J. (various) *Fiftieth Annual Report of Medical Officer of Health Report for St Pancras* (St Pancras, St Pancras Council)

Szreter, S. (1984) 'The genesis of the Registrar-General's social classification of occupations', *The British Journal of Sociology*, 35, pp. 522-46.

Taylor, J.S. (various) *Report on the Health of Liverpool* (Liverpool, Liverpool Council)

Taylor, W. (1954) 'The changing pattern of mortality in England and Wales. I. Infant mortality', *British Journal of Preventive & Social Medicine*, 8, pp. 1-9

Taylor-Robinson *et al.*, D. (2019) 'Assessing the impact of rising child poverty on the unprecedented rise in infant mortality in England, 2000–2017: time trend analysis'*, British Medical Journal Open*, 9, e029424, pp. 1-6.

Teitlebaum, M.S. (1973) 'Birth underregistration in the constituent counties of England and Wales: 1841-1910', *Population Studies*, 28, pp. 329-43

Tew, M. (1998) *Safer Childbirth. A Critical History of Maternity Care* 3rd edn (London, Free Association Books).

Thompson, B. (1984) 'Infant mortality in nineteenth-century Bradford', in R. Woods and J. Woodward (eds) *Urban Disease and Mortality in Nineteenth-century England* (London, Palgrave Macmillan), pp. 120-47

Thornton, A. (2014) *The First Booke of My Life*, edited by R.A. Anselement (Lincoln NE, University of Nebraska Press)

Thorvaldsen, G. (2008) 'Was there a European breastfeeding pattern?', *History of the Family*, 13, pp 283–95

Titmuss, R.M. (1938) *Poverty and Population* (London, Macmillan)

Titmuss, R.M. (1943) *Birth, Poverty and Wealth. A Study of Infant Mortality* (London, Hamish Hamilton)

Tomkins, A. (2010) 'Demography and the midwives: deliveries and their dénouments in north Shropshire, 1781-1803', *Continuity and Change*, 25, pp. 199-232

Townsend, P. and N. Davidson (1992) *Inequalities in Health. The Black Report* (London, Penguin)

Trench, W.S. (various) *Report on the Health of Liverpool* (Liverpool, Liverpool Council)

Trollope, A. (1868) *Dr Thorne,11th edition* (London, Chapman and Hall)

Trumbach, R. (1978) *The Rise of the Egalitarian Family* (New York, Academic Press)

Underwood, M. (1784) *A Treatise on the Diseases of Children* (London, printed for J. Matthews)

UNICEF (2008) *The State of the World's Children, 2009* (New York, UNICEF)

Vann, R.T. and D. Eversley (1992) *Friends in Life and Death* (Cambridge, Cambridge University Press)

Victora *et al.*, C.G. (2016) 'Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect', *The Lancet*, (30 Jan), pp. 475-90

Vilquin, E. (1978) 'La mortalité infantile selon le mois de naissance. Le cas de la Belgique au XIXe siècle', *Population*, 33, pp. 1137-53

Vögele, J. (2010) ' "Has all that has been done lately for infants failed?" 1911, infant mortality and infant welfare in early twentieth-century Germany', *Annales de Démographie Historique*, 120, pp. 131-46

Wadsworth, M. *et al.* (2006) 'Cohort profile: The 1946 National Birth Cohort (MRC National Survey of Health and Development), *International Journal of Epidemiology*, 35, pp. 49–54.

Wall, R. (2004) 'English population statistics before 1800', *The History of the Family*, 9, pp. 81-95

Waller, P.J. (1983) *Town, City, and Nation* (Oxford, Clarendon Press)

Walsh, F. (2017) ' "Every human life is a national importance" The impact of the First World War on attitudes to maternal and infant health', in D. Durnin and I. Miller (eds) *Medicine, Health and Irish Experiences of Conflict 1914–45* (Manchester, Manchester University Press), pp. 15-30

Webster, C. (1982) 'Healthy or hungry thirties?', *History Workshop*, 13, pp. 110-29

Weddell, G.E. (ed.) (1913) *The Parish Register of Howden 1725-1770* Yorkshire Parish Registers Series, 48

Welton, T.A. (1872) 'The effects of migration in disturbing local rates of mortality as exemplified in the statistics of London and the surrounding country for the years 1851-60', *Journal of the Institute of Actuaries*, 16, pp. 153-86.

West, F. (1974) 'Infant mortality in the East Fen parishes of Leake and Wrangle', *Local Population Studies*, 13, pp. 41-4

Wheatley, J. (1923) 'Discussion of factors contributing to the recent decrease in infantile mortality', *British Medical Journal*, (27 October), pp. 754-9

White, S. (various) *Annual Report on the Health of the Borough of Sheffield* (Sheffield, Sheffield Council)

White, W. (1782) 'Observations on the Bills of Mortality at York', Philosophical *Transactions of the Royal Society of London*, 72, pp. 35-43

Wickes, I.G. (1953) 'A history of infant feeding: part IV. Nineteenth century continued', *Archives of Diseases in Childhood*, 23, pp. 416-22

Williams, N. (1992) 'Death in its season: Class, environment and the mortality of infants in nineteenth-century Sheffield', *Social History of Medicine*, 5, pp. 71-94

Williams, N. (1996) 'The reporting and classification of causes of death in mid-nineteenth-century England: the example of Sheffield, *Historical Methods,* 29, pp. 58-71

Williams, N. and C. Galley (1995) 'Urban-rural differentials in infant mortality in Victorian England', *Population Studies*, 49, pp. 401-20

Wilson, C. (1984) 'Natural fertility in pre-industrial England, 1600-1799', *Population Studies*, 38, pp. 225-40

Winter, J. and J. Cole (1993) 'Fluctuations in infant mortality rates in Berlin during the and after the First World War', *European Journal of Population*, 9, pp. 235-63

Winter, J.M. (1977) 'The impact of the First World War on civilian health in Britain', *Economic History Review*, 30, pp. 487-507

Winter, J.M. (1979) 'Infant mortality, maternal mortality and public health in Britain in the 1930s', *Journal of European Economic History*, 8, pp. 439-62

Winter, J.M. (1982) 'Aspects of the First World War on infant mortality in Britain', *Journal of European Economic History*, 11 (1982), pp. 713-38

Winter, J.M. (1983) 'Unemployment, nutrition and infant mortality in Britain, 1920-50', in J. Winter (ed.) *The Working Class in Modern British History. Essays in Honour of Henry Pelling* (Cambridge, Cambridge University Press), pp. 232-56

Winter, J.M. (1985) *The Great War and the British People* (Basingstoke, Palgrave Macmillan), pp. 103-40

Winter, J.M., J. Lawrence and J. Ariouat (1993) 'The impact of the Great War on infant mortality in London', *Annales de Démographie Historique*, pp. 329-53

Wolf, J.H. (2001) *Don't Kill Your Baby. Public Health and the Decline of Breastfeeding in the Nineteenth and Twentieth Centuries* (Columbus, Ohio State University Press)

Woods, R. (1985) 'The effects of population redistribution on the level of mortality in nineteenth-century England and Wales', *Journal of Economic History*, 45, pp. 645-51

Woods, R. (2000) *The Demography of Victorian England and Wales* (Cambridge, Cambridge University Press)

Woods, R. (2003) 'Did Montaigne love his children? Demography and the hypothesis of parental indifference', *Journal of Interdisciplinary History*, 33, pp. 421-42

Woods, R. (2005) 'The measurement of historical trends in fetal mortality in England and Wales', *Population Studies*, 59, pp. 147-62

Woods, R. (2006) 'Mortality in eighteenth-century London: a new look at the bills', *Local Population Studies*, 77, pp. 12-23

Woods, R. (2006) 'Newman's *Infant Mortality* as an agenda for research', in E. Garrett *et al.* (eds) *Infant Mortality A Continuing Social Problem* (London, Ashgate), pp. 33-49

Woods, R. (2006) *Children Remembered. Responses to Untimely Deaths in the Past* (Liverpool, Liverpool University Press)

Woods, R. and C. Galley (2014) *Mrs Stone & Dr Smellie. Eighteenth-century midwives and their Patients* (Liverpool, Liverpool University Press)

Woods, R. and N. Shelton (1997) *An Atlas of Victorian Mortality* (Liverpool, Liverpool University Press)

Woods, R., P.A. Watterson and J.H. Woodward (1988) 'The causes of rapid infant mortality decline in England and Wales, 1861-1921 part 1', *Population Studies*, 42, pp. 343-66

Woods, R., P.A. Watterson and J.H. Woodward (1989) 'The causes of rapid infant mortality decline in England and Wales, 1861-1921, part 2', *Population Studies*, 43, pp. 113-32

Woods, R., N. Williams and C. Galley (1997) 'Differential mortality patterns among infants and other young children: The experience of England and Wales in the nineteenth century', in C.A. Corsini and P.P. Viazzo (eds) *The Decline of Infant and Child Mortality. The European Experience: 1750-1990* (The Hague, Kluwer Law International)

Woodward, D. (1974) 'Some difficult confinements in seventeenth-century Yorkshire', *Medical History*, 18, pp. 349-53

Woodward, D. (1975) 'The impact of the Commonwealth Act on Yorkshire parish registers', *Local Population Studies*, 14, pp. 15-31

Worth Estes, J. (1990) *Dictionary of Protopharmacology. Therapeutic Practices, 1700-1850* (Canton MA., Science History Publications)

Wright, A. (2003) 'Birth-baptism intervals in Whickham parish, Co. Durham c. 1770-1820', *Local Population Studies*, 77, pp. 81-7

Wright, P.W.G. (1988) 'Babyhood: the social construction of infant care as a medical problem in England in the years around 1900', in M. Lock and D. Gordon (eds) *Biomedicine Examined* (Dordrecht, Kluwer), pp. 299-329

Wrightson, K. (1975) 'Infanticide in earlier seventeenth-century England', *Local Population Studies*, 15, pp. 10-22

Wrigley, E.A. (1966) 'Family limitation in pre-industrial England', *Economic History Review*, 19, pp. 82-109

Wrigley, E.A. (1966) 'Family reconstitution' in E.A. Wrigley (ed.) *An Introduction to English Historical Demography* (London, Weidenfeld and Nicholson), pp. 96-129

Wrigley, E.A. (1972) 'Mortality in pre-industrial England: the example of Colyton, Devon, over three centuries' in D.V. Glass and Roger Revelle (eds) *Population and Social Change* (London, Edward Arnold), pp. 243-73

Wrigley, E.A. (1977) 'Births and baptisms: The use of Anglican registers as a source of information about the numbers of births in England before the beginning of Civil Registration', *Population Studies*, 31, pp. 281-312

Wrigley, E.A. (1985) 'Urban growth and agricultural change: England and the continent in the early modern period', *Journal of Interdisciplinary History*, 15, pp. 683-728

Wrigley, E.A. (1998) 'Explaining the rise in marital fertility in England in the 'long' eighteenth century', *Economic History Review*, 51, pp. 435-64

Wrigley, E.A. (2016) *The Path to Sustained Growth. England's Transition from an Organic Economy to an Industrial Revolution* (Cambridge, Cambridge University Press)

Wrigley, E.A. (2018) 'The general and the particular', *Local Population Studies*, 100, pp. 25-32

Wrigley, E.A. (2020) 'The interplay of demographic, economic, and social history', *Journal of Interdisciplinary History*, 50, pp. 495–515

Wrigley, E.A., R. Davies, J. Oeppen and R.S. Schofield (1997) *English Population History from Family Reconstitution 1580-1837* (Cambridge, Cambridge University Press)

Wrigley, E.A. and R.S. Schofield (1981) *The Population History of England, 1541-1871: A Reconstruction* (London, Edward Arnold)

York Minster, pre-1840 Roof Boss

Source: J. Browne, *The History of the Edifice of the Metropolitan Church of St Peter York, Volume 2 Plates* (London, 1847), p. 216.