
Smallpox in Oxfordshire, 1700–99, and the Implications of Familial Transmission Routes

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Abstract

This article explores the course of smallpox mortality in Oxfordshire in the eighteenth century and uses family reconstitution with parish register data to reconstruct two catastrophic smallpox epidemics in Banbury, in the north of the county. It makes observations on the nature of familial transmission of the disease through an examination of age incidence and susceptibility and explores the implications of parental immunity. The article concludes that infants and young children were most at risk of smallpox from the home environment and suggests that immunity to the disease in parents and older siblings was a key factor in reducing smallpox and overall infant mortality.

Introduction

The following memorandum was added to a burial record in the parish register of Ewelme, a village in south Oxfordshire with a population of around 490, after labourer John King and three of his children died of smallpox in May 1789.

The mother [Jane King] also and two other children caught the disorder [smallpox] but recover'd and the infection spread no further, the family all being remov'd to Pyrton Hill as soon as it broke out ... This woman, the mother mentioned above, was found dead in bed, having previously complained very little, her death may be attributed to the effects of smallpox, brought on or assisted by grief for her recent loss.¹

All three children were buried in the first two weeks of the month and their father approximately two weeks later. King's wife, Jane, was recorded to have died from 'mortification' and was buried on 14 June of the same year. This burial entry offers us a brief and poignant glimpse of familial distress when smallpox invaded a household. Jane King's grief over the loss of her three children Elizabeth (13) Sally (11) and Mary (6) all within a fortnight, followed by the death of her husband, John, two weeks later, proved to be too much for her and contributed to her own death.

The discussion that follows has two components that complement each other. First, it explores the impact of smallpox deaths by parish in Oxfordshire from 1700 and 1799 through an analysis of burial registers in order to gain a picture of the course of the disease

1 Oxfordshire History Centre (OHC), parish burial register transcript of Ewelme (2, 6, 14, 31 May, 17 June 1789).

in the county.² Second, the article scrutinises two severe smallpox epidemics in the market town of Banbury, in the north of the county, in 1718–9 and 1731–3 in order to investigate the nature of familial smallpox transmission. The study then draws together its findings to help determine the relationship between smallpox mortality, the nature of disease transmission and the impact of familial immunity on infants and young children.

Smallpox was one of the chief killer diseases in England from the end of the plague in the 1660s to the late eighteenth century. There was no effective curative treatment. The disease declined dramatically as a cause of death in England from the middle of the nineteenth century and was almost eliminated by 1900 through vaccination.³ Its effect on small rural communities never previously exposed to the disease was often catastrophic and hence memorable. In Bicester in east Oxfordshire the parish registrar draws attention to a particularly high number of smallpox burials which had occurred over 55 years earlier: ‘more burials this year [1762, unrelated to smallpox] than hath been since the year 1707 when there was 48 died of the smallpox’. The parish clerk of Burford in west Oxfordshire makes reference, some seven years after the event, to an epidemic which occurred in the town: an inscription inside the front cover of his notebook reads, ‘died at Burford of the small Pox 185 persons from April 10th 1758 to July 28th following’.⁴ Aside from parish documentation, the presence of smallpox in a small community is a constant thread running through personal correspondence, diaries and autobiographies, often written by parents or spouses, as they tried to manage the care of smallpox patients in the home. Elizabeth Leathes, a parson’s wife in Reedham, Norfolk, and her parents in Woodstock, Oxfordshire, referred to the threat, experience or prevention of smallpox in a total of 31 exchanges of correspondence between 1775 and 1787. These discussions were intense and protracted and far outnumbered observations on other eighteenth-century diseases.⁵ William Snooke wrote from Bourton in Gloucestershire in 1766 of his ‘inconceivable’ distress at the diagnosis of smallpox in his wife and in 1782 Betty Wright, aged 14, was ‘rendered one of the most deplorable objects literally flayed from head to foot’ as a result of the disease.⁶

- 2 The detail was gathered through a rigorous examination of all the surviving individual parish burial register transcripts from the 237 parishes known to be in existence for the county in the period 1700–99. Burial records are complete by 80 per cent or more in this period for 205 parishes, with another 32 being incomplete by 20 per cent or more. Four parishes have no surviving burial records. The city of Oxford, which experienced high smallpox mortality in 1710, 1728 and 1791, has not been covered in detail in this study. As an urban area, its patterns of periodicity of smallpox were different and it would require detailed analysis to provide a complete picture.
- 3 On the history of smallpox and its eradication see, for example, I. and J. Glynn, *The Life and Death of Smallpox* (London, 2005); P.E. Razzell, *The Conquest of Smallpox: the Impact of Inoculation on Smallpox Mortality in Eighteenth Century Great Britain* (Firle, 1977); G. Williams, *Angel of Death: the Story of Smallpox* (Basingstoke, 2010); H. Bazin, *The Eradication of Smallpox: Edward Jenner and the First and Only Eradication of a Human Infectious Disease* (London, 1999); J.N. Hays, *The Burdens of Disease: Epidemics and Human Response in Western History* (Piscataway, United States, 2000), pp. 120–7; D. Hopkins, *The Greatest Killer: Smallpox in History* (Chicago, United States, 2002).
- 4 OHC, parish burial register transcript of Bicester (1762); PAR Burford, e.1 ‘Register Book 1765’.
- 5 Norfolk Record Office, BOL/2, The Bolingbroke Collection. Correspondence of Mrs Elizabeth Leathes. All letters used from this collection have been kindly transcribed and provided by R. Michael James.
- 6 Private collection, letter W. Snooke to R. Hall 15/16 May 1766; T. Wright (ed.), *Autobiography of Thomas Wright of Birkenshaw* (London, 1864), pp. 152–3.

Smallpox in eighteenth century Oxfordshire

Eighteenth century Oxfordshire combines diverse local communities, some of the most severe smallpox epidemics in the country, and particularly well-maintained ecclesiastical records. The county town of Oxford, with its well-established major international university was described by an eighteenth century contemporary as ‘large, strong, populous and rich’.⁷ Little structural occupational change occurred in the city during the century, with most of its industry supporting the needs of the university.⁸ On the other hand, agriculture was the mainstay of the wider Oxfordshire economy. Banbury had a long-standing market economy. Burford and Witney in the west were also market towns, both centering on the cloth trade with the added economy of horse racing and its associated revenue for Burford.⁹ With a good network of major communication routes, towns such as these offered convenient staging places along coaching routes to London, Bath, Gloucester and the Midlands, and provided employment for associated traders such as coachmakers, blacksmiths and inn-keepers.¹⁰ In contrast, Cuxham, in the south of the county was a closed village dominated by Merton College, Oxford as the major landowner.¹¹ Furthermore, communities in the county varied considerably in size. Witney comprised a population in 1801 of 4,087, and Cuxham only 125.¹²

Detail from County Overseers Accounts suggests that local community action was important in slowing down the spread of the disease through the placing of smallpox sufferers in pest or isolation houses and cleansing of public streets.¹³ Evidence also indicates that parishes affected by smallpox mortality procured—or were provided with—financial support through private and inter-community donations. As well as ameliorating the burden of increased poor relief for the sick it is probable that these actions helped ensure a parish’s self-reliance, in confining its inhabitants within parish boundaries. Mechanisms such as these almost certainly helped to contain the disease and may explain why parishes in close proximity to high-fatality smallpox parishes often remained relatively unscathed. That said, numerous parishes in the county experienced severe outbreaks of smallpox in the period.

With the exception of Joan Moody’s work on the 1758 epidemic in Burford, little work has been done on the prevalence of the disease in the county, particularly in the parishes outside the bounds of the city.¹⁴ One of the earliest references to smallpox in Oxfordshire

7 <http://www.localhistories.org/oxford.html> (accessed 28 January 2017)

8 A. Crossley, J. Cooper and C. Colvin, ‘Early modern Oxford’, in A. Crossley (ed.) *A History of the County of Oxford, vol. 4: the City of Oxford* (London, 1979), pp. 74–180.

9 See S. Townley (ed.) *A History of the County of Oxford, vol. 14: Witney and Its Townships (Bampton Hundred part 2)* (London, 2004), pp. 77–88; R. and J. Moody, *A Thousand Years of Burford* (Burford, 2006), p. 62.

10 Townley, *Witney and Its Townships*, pp. 77–88.

11 S.A. Mileson, ‘Cuxham’, in S. Townley (ed.) *A History of the County of Oxford, vol. 18: Benson, Ewelme and the Chilterns (Ewelme Hundred)* (London, 2016), pp. 158–79.

12 The 1801 population figures are from W. Page (ed.) *The Victoria History of the County of Oxford, vol. 2* (London, 1907), pp. 213–24.

13 See R. A. Leadbeater, ‘Experiencing Smallpox in Eighteenth-Century England’ (Oxford Brookes Univ. PhD. thesis, 2016).

14 J. Moody, *The Great Burford Smallpox Outbreak 1758* (Burford, 1998).

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Table 1 Oxfordshire parishes affected by smallpox mortality: decadal totals

Years	Smallpox burials	Adults	Children	Age unknown	Number of parishes experiencing smallpox mortality
1700–09	48			48	1
1710–19	204	76	86	42	13
1720–29	22	16	6		9
1730–39	118	37	62	19	9
1740–49	36	23	13		12
1750–59	207	97	110		11
1760–69	40	33	7		14
1770–79	45	28	17		17
1780–89	65	36	20	9	27
1790–99	57	44	9	4	27

Note: Some parishes experienced smallpox mortality more than one year per decade.

Source: Oxfordshire parish burial register transcripts.

appears in the seventeenth century diaries and papers of Oxford historian, Anthony Wood.¹⁵ In 1654, Wood writes that ‘at Oxford, about autumn, the smallpox spread abundantly’; later in the century his diaries included regular references to the disease being prevalent in the city.¹⁶ Outside the city, Wood referred to a death from smallpox in Brize Norton, 14 miles west of Oxford, in 1676.¹⁷ Registers show that burials in Brize Norton in this year were slightly more than usual, although the total number was small (under 15). Generally, away from the city in the seventeenth century, the disease appears to have been mild, a Dr Plot noting in 1677, ‘here [in Oxfordshire] they [smallpox] are so favourable and kind that be the nurse but tolerably good, the patient seldom miscarries’.¹⁸

Table 1 shows the number of parishes in Oxfordshire recording smallpox mortality between 1700 and 1799 in decadal totals. The table cannot provide an absolute interpretation of the incidence of smallpox burials, of course. However, burial entries recording accidental deaths and those from smallpox are two categories recorded consistently enough in the registers to indicate their significance within the community.¹⁹ Where records allow, adult and child smallpox burials have been categorised separately.

Epidemics with high smallpox mortality occurred in Banbury in 1718–9 and 1731–3, and in Burford in 1758, when approximately one eighth of a population of around 1,600 perished within a three-month period between April and July.²⁰ The spikes these outbreaks

15 Ibid., p. 39.

16 See C. Creighton, *A History of Epidemics in Britain: Volume 2, from the Extinction of Plague to the Present Time* (London, 1965), p. 437; Moody, *Great Burford Smallpox Outbreak*, p. 41.

17 Moody, *Great Burford Smallpox Outbreak*, p. 41.

18 C. Creighton, *History of Epidemics in Britain*, vol. 2. p. 467, quoting ‘Natural History of Oxfordshire’ (Oxford, 1677), p. 23.

19 For the total number of parishes in Oxfordshire, see C. Harris, *Oxfordshire Parish Registers and Bishop’s Transcripts* (Oxford, 2006), pp. 7–58.

20 For population, see Moody, *Great Burford Smallpox Outbreak*, p. 34.

created are evident in the decadal totals in Table 1. The number of parishes experiencing outbreaks increased significantly in the last two decades of the century but smallpox mortality per parish was generally low, with an average of just over two smallpox deaths per outbreak per decade. Prior to the 1760s, adults fared better than children in relation to smallpox deaths, with a ratio of 1 adult to 1.12 child smallpox deaths. After 1760, however, the number of child smallpox deaths fell considerably and the ratio of adult to child deaths was significantly reversed, at 2.66 adults to 1 child. It is likely that the absence of major outbreaks of smallpox after 1767 and the fall in smallpox mortality in children after the 1760s reflect the practice of inoculation. By the last decade of the century child smallpox deaths were minimal, comprising only a small proportion of the total number of smallpox burials.²¹

Chronological patterns of smallpox mortality

Thirteen outbreaks of smallpox in parishes in the county during the eighteenth century caused smallpox burials to amount to more than 50 per cent of total burials for that year. Eleven of these outbreaks occurred prior to 1767 (Table 2). After this date only Cuxham in 1772 and Kelmscott in 1791 are in this category, and they were both parishes with populations of under 150, so the percentages are likely to be influenced by small numbers.

Table 2 Oxfordshire parishes with smallpox burials forming more than half of all burials, 1700–99

Year	Parish	Smallpox burials	Total burials in year	Smallpox burials as percentage of total burials
1707	Bicester	48	76	63.2
1714	Eynsham	24	33	72.7
1715	Eynsham	18	28	64.3
1719	Banbury & Neithrop	72	122	59.0
1724	Islip	12	19	63.2
1733	Banbury & Neithrop	80	132	60.6
1758	Burford	185	247	74.9
1758	Kencott	4	6	66.7
1759	Kencott	3	5	60.0
1764	Goring	9	17	52.9
1765	Goring	7	11	63.6
1772	Cuxham	9	10	90.0
1791	Kelmscott	3	3	100.0

Source: Oxfordshire parish burial register transcripts.

21 Any natural decline in the virulence of smallpox in the late eighteenth century has been rejected by demographic historians. Indeed some research suggests the opposite: see R. Davenport, L. Schwarz and J. Boulton, 'The decline of adult smallpox in eighteenth-century London', *Economic History Review*, 64 (2011), pp. 1,291 and 1,310.

The period of decline in the ratio of smallpox burials to all burials corresponds closely with the take-up of inoculation in the region. Inoculation, or variolation against the disease was introduced into England in the early 1720s, reportedly by the wife of the British Ambassador in Turkey, Lady Mary Wortley-Montagu (herself a victim of the scarring after-effects of the disease) after observing the practice first-hand in that country.²² A detailed analysis of the take-up of inoculation in the Oxfordshire region is beyond the remit of this paper, but research indicates that the practice in Oxfordshire and its contiguous counties was extensive, well-organised, demand-led and aimed at as large a market as possible.²³ Cuxham is a particularly interesting case where we have details of a smallpox survey of 121 inhabitants carried out during the outbreak in 1772, providing some reliable evidence on the contribution of inoculation towards saving lives in the parish. The survey reveals that 49 parishioners (adults and children) had ‘natural’ smallpox with 9 fatalities (approximately one in five dying of smallpox) whilst 29 parishioners were inoculated, with no deaths.²⁴

Tables 1 and 2 only represent smallpox deaths. Incidence of the disease was likely to be far higher, and in parishes with many cases but few fatalities, the incidence of smallpox will be far from fully reflected in the burial registers. Several factors influenced case-fatality percentages including age-specific incidence and conditions of susceptibility: young children were often particularly vulnerable and substantiated evidence indicates that pregnant women were also susceptible to severe forms of smallpox.²⁵ A smallpox case-fatality rate of between 15 and 25 per cent in provincial towns in England between 1721 and 1730 has been estimated.²⁶ Separate calculations show that in 1723–4 in Aynho, a small village in Northamptonshire with a population of around 350, 133 smallpox cases were confirmed during a 15-month outbreak with 25 deaths. This makes a case fatality of 18.8 per cent.²⁷

Smallpox in Banbury

We now turn to the two epidemics in Banbury in more detail. Lying some 23 miles north of Oxford, the parish was one of the most populous in the county with a population rising to over 3,000 by the end of the eighteenth century.²⁸ Banbury enjoyed a flourishing agrarian economy, led by the demand for wool and supported by specialist food production. As

22 Razzell, *Conquest of Smallpox*, pp. 1–3; Williams, *Angel of Death*, pp. 89, 94.

23 Leadbeater, ‘Experiencing Smallpox’.

24 OHC, Cuxham Marriage Register. Appendix B. Small Pox 1772. ‘The Names of the several Persons who had the Small Pox in the Natural Way, or by Inoculation, at Cuxham, beginning Aug 1772’.

25 P.E. Razzell, *Population and Disease: Transforming English Society, 1550–1850* (London, 2007), p. 185. On the effect of pregnancy, see A.R. Rao, *Smallpox* (Bombay, India, 1972), pp. 120–29 (available at <https://www.nlm.nih.gov/nichsr/esmallpox/rao.pdf> (accessed 11 February 2017)).

26 Case fatality in adults could be higher than that in children, however. See, for example, the Rev. David Some (1725), ‘that of young Children that have it one in six or seven commonly die of it; and of grown Persons, at least one in three’, (quoted in Razzell, *Conquest of Smallpox*, p. 132). See also C.W. Dixon, *Smallpox* (London, 1962), p. 196.

27 Royal Society, Cl.P./23ii/87, ‘Account of those who had ye smallpox from September 1723 – December 1724’. See also Leadbeater, ‘Experiencing Smallpox’, p. 125.

28 Page, *Victoria History of Oxfordshire*, pp. 213–24; Razzell, *Population and Disease*, pp. 181, 185.

an active trade centre, the parish also participated in a high level of social activity, factors which probably contributed to a higher risk of contagion and subsequent disease than in some more remote areas. The two epidemics in Banbury occurred prior to any evidence of inoculation practice in the region. Although Wortley-Montagu was influential in promoting inoculation amongst the aristocracy in the late 1720s, in England generally the period up to the 1740s was one of hesitation and controversy over the practice. It is most unlikely that the inhabitants of Banbury had been touched by inoculation by the time of the second epidemic in 1731–3. In fact, it is only in the 1760s that we see evidence of the practice in the town.

Banbury parish burial registers record 119 people as dying of smallpox in 1718–9 and a further 93 in 1731–3. It is likely that many more people experienced the disease non-fatally but were yet capable of transmitting it. Smallpox transmission was greatly influenced by the frequency and intimacy of contact with others, with a risk of infection through casual contact of 9.7 per cent, rising sharply to 75 per cent in homes where smallpox was present.²⁹

Table 3 illustrates the mortality profile of the two smallpox epidemics. As might be expected, children comprised the largest group of fatalities in both epidemics, adding to general findings on their susceptibility to disease. By applying this preliminary parish register analysis to the family reconstitution already carried out by the Cambridge Group for the History of Population and Social Structure (CAMPOP) we can construct an analysis of smallpox at a family level.³⁰ The majority of people who died of smallpox in the two epidemics can be traced within the full family reconstitution by extracting the names of those who died of smallpox from the parish burial registers and matching them with their families and burial dates. These people can be grouped into 75 and 62 nuclear families for the 1718–9 and 1731–3 epidemics respectively.³¹ From this information we can investigate the nature of familial transmission of the disease.

Adults, overall, were less affected in the second outbreak (Table 3). The number of men, particularly, who died of smallpox fell considerably.³² This fall is further emphasised by the

29 Scientific Group on Smallpox Eradication, 'Smallpox Eradication', World Health Organisation Technical Report Series No. 393 (Geneva, 1968), p. 17. http://whqlibdoc.who.int/trs/WHO_TRS_393.pdf (accessed 11 February 2017); Dixon, *Smallpox*, pp. 196, 310–12, 314, 319.

30 E. A. Wrigley, R. S. Davies, J. E. Oeppen and R. S. Schofield, *English Population History from Family Reconstitution 1580–1837* (Cambridge, 1997). CAMPOP employed Anglican parish registers from 26 parishes where the records were of high quality, using the technique of family reconstitution, to help explain demographic trends in mortality. Banbury was one of the 26.

31 Eighteen smallpox deaths in 1718–19 and 14 in 1731–3 cannot be linked to a nuclear family using the technique of family reconstitution. These were people with no observable life events other than their deaths. Families are defined as those in a common household with shared surnames. Although burial registers may identify servants and apprentices in particular households, generally parish registers and family reconstitution do not allow the identification of other kin who may be sharing a household. Seventy families in 1718–9 and 59 in 1731–3 had living children at beginning of each epidemic. Five were childless, that is they had had children who died before each epidemic or were born afterwards.

32 The total number of people who made up the families affected by smallpox mortality were as follows: 1718–19, men: 63, women 61, children 239; 1731–3: men 56, women 55, children 214.

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Table 3 Smallpox deaths in Banbury 20 August 1718–19 July 1719 and 19 December 1731–29 October 1733

Date	Men		Women		Children		Total
	Number	%	Number	%	Number	%	
August 1718– July 1719	28	24	23	19	68	57	119
December 1731– October 1733	13	14	20	22	60	65	93

Note: Children are identified as 'son/daughter of' in parish registers.

Source: Banbury burial register transcripts.

fact that four of the men who died of the disease in the second outbreak were likely to have been in-migrants (no life events in their families are recorded in parish registers prior to the end of the first outbreak in 1719) and therefore probably not exposed first time around. It is likely, therefore, that the fall in men affected in the second epidemic was due to immunity to the disease, occurring only 13 years after a previous outbreak. Furthermore, only a very small proportion of the families who were resident in the parish during both epidemics were mortally affected twice. Only 3 out of 75 families experienced smallpox deaths in both outbreaks and all those deaths were of children aged under five years at the time of death, who were therefore were born after the first visitation of the disease.

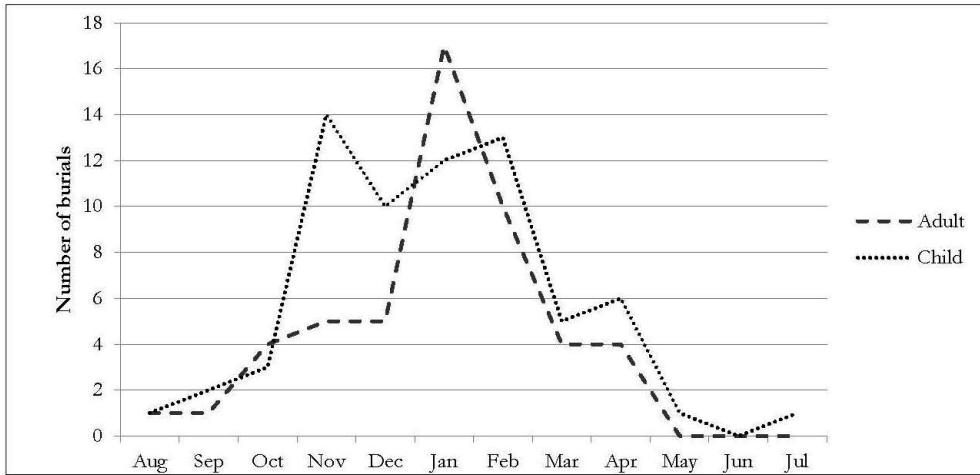
Transmission pathways

In most of the families affected by smallpox mortality, infection appeared to pass from parent to child. In 1718–9, in 10 out of 12 cases where there were both parental and child smallpox deaths the parental death occurred first, whilst in 1731–3 five out of eight parents died before their children.³³ In all but three cases intervals between deaths were short and the probability of re-infection into the family was low. A factor which could complicate the picture would be if there was any correlation between the length of sickness and age of the sufferer. However, we know from data on case incidence in Aynho that children did not appear to have suffered for shorter or longer periods than adults. In that parish, duration of illness averaged 13 days with the number of people being sick for over 20 days split approximately evenly between adults and children.³⁴ Furthermore, in both Banbury epidemics the patterns of smallpox deaths in young children were similar; the large majority of young children died in the later stages of the outbreaks, when the disease was well-established within local communities. In 1718–9 only 3 out of the 29 under-fives who died of smallpox were buried in the first eight weeks and in 1731–3, only 1 out of 37 in the first

33 The percentage of adults compared to children in the two smallpox samples prior to the outbreaks was almost identical (adults approximately 34 per cent, children 66 per cent).

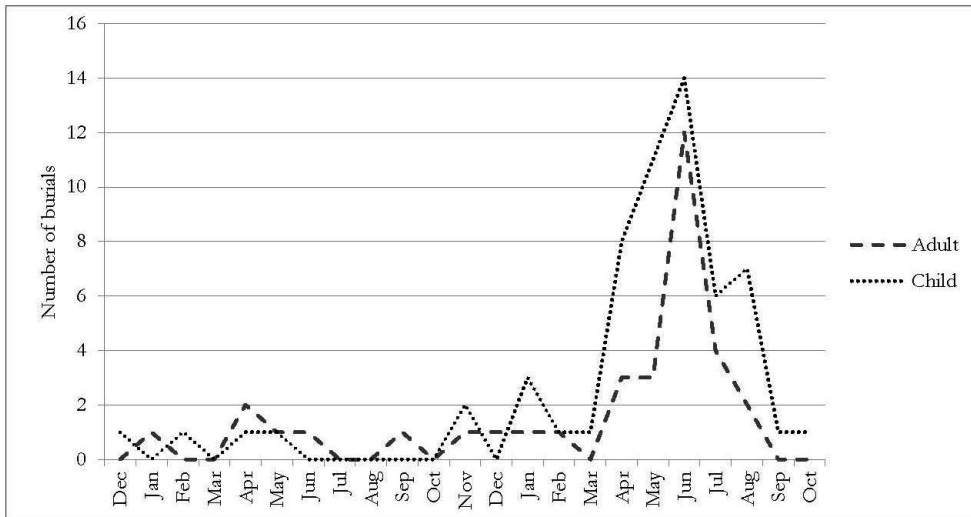
34 Royal Society, 'Account of those who had thye smallpox'. Duration of illness is unknown in 7 out of 132 cases.

Figure 1 Adult and child smallpox burials in Banbury, August 1718–July 1719



Source: Banbury burial register transcripts.

Figure 2 Adult and child smallpox burials in Banbury, December 1731–October 1733

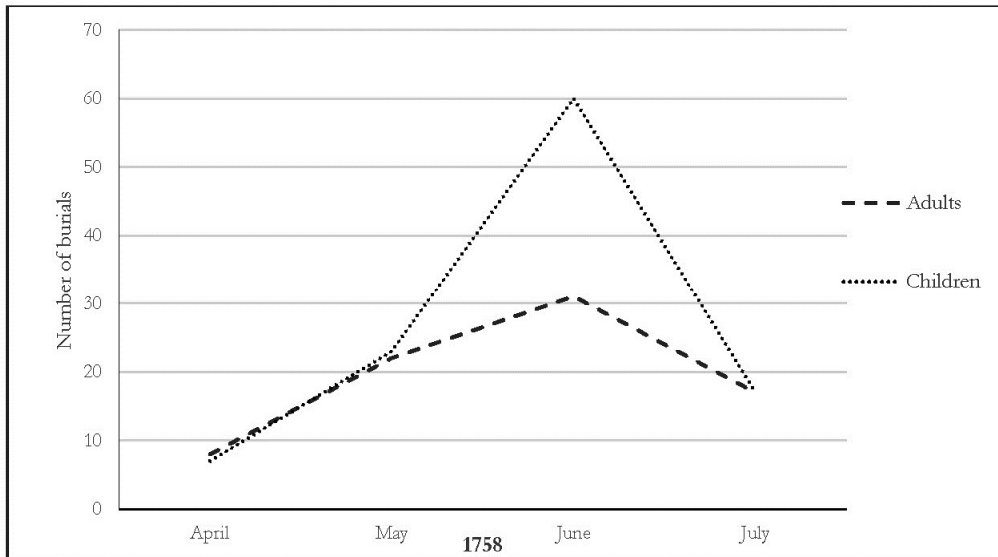


Source: Banbury burial register transcripts.

eight weeks. This pattern is similar to that of Aynho in 1723–4 where the first child in the under-five age group was recorded sick with smallpox seven weeks into the outbreak and the first death in this group occurred approximately one month later.³⁵ These details indicate that transmission for young children was through familial links.

³⁵ Royal Society, 'Account of those who had thye smallpox'.

Figure 3 Smallpox burials in Burford, 1758



Source: Burford burial register transcripts.

Figures 1, 2 and 3 provide further evidence to support this conclusion. The graphs show the course of the two epidemics in Banbury and one in Burford in 1758 in relation to adult and child smallpox mortality. In Banbury in 1718–9, although children were the first to be affected, we do not see a peak in mortality until three months into the outbreak. A similar picture emerges in the second outbreak in 1731–3 when child mortality peaked 15 months into the outbreak. Here, this scenario also applied to adults, however (Figure 2) when insignificant numbers were fatally affected in the first 15 months. This is unsurprising as the outbreaks were only 12 years apart. Many adults had been exposed previously, and as we shall see, as parents they thus provided safer home environments for their young children.

Figure 3 shows the course of the epidemic in Burford in 1758. Children were not severely affected until one month into the three-month period.

Returning to Banbury and taking infants alone, the delay in smallpox deaths was more pronounced than that of children overall. In the first epidemic only 3 out of 17 of these deaths occurred in the first three months of the epidemic; the remaining 14 occurred later, with the majority of these in 1719. In 1731–3 the delay in infant deaths was even more marked. Infant mortality rose dramatically during the later stages of the disease in 1733, with only one infant smallpox death in 1732, the remaining 11 (92 per cent) occurring in the final eight months of the 23-month outbreak. (No infants were noted as being affected by smallpox in Aynho in 1723–4.) Infants were a particularly susceptible group due to their limited robustness against infection. Immunity against the disease acquired from immune mothers *in utero* waned quickly after birth, regardless of breast-

feeding.³⁶ However, this group appears to have been least vulnerable to transmission outside the home, being infected by other family members because their deaths occurred during the later stages of the outbreaks. It is also possible that efforts were made by families to isolate infants and young children from the wider community when an epidemic was present. As their greatest risk appears to be from within the home environment, levels of immunity in parents and older siblings were an important factor in the transmission of the disease.

Age incidence of infection

Tables 4 and 5 show the age incidence of child smallpox deaths in relation to the children living in the smallpox families at the beginning of each epidemic.³⁷ In the 1718–9 outbreak (Table 4), the age group with the highest proportion dying of smallpox (65.4 per cent) is clearly the infants under one year.³⁸ Children in this age group were twice as likely to die of smallpox as those in any other childhood age group. There is no common trend across the whole age spectrum, however. In the 1718–9 epidemic the chances of children dying of smallpox diminished from age 15 years onwards, although it is necessary to be cautious because it is unlikely that all family members in these age groups still lived at home. However, Table 4 shows that the risk of smallpox mortality in the age group 10–14 years was higher than that of the age groups either side. This pattern has also been found in other studies of smallpox; the apparent susceptibility of those aged 11–15 years was claimed by historian J. Smith in 1987 to be ‘somewhat puzzling’.³⁹ On assessing the transmission of smallpox, C. W. Dixon referred to those in the 15–25 age group as ‘interfamily disseminator[s] of infection’.⁴⁰ Moreover, Dixon’s research also shows that incidence (as opposed to mortality) in the unvaccinated peaked in the 10–15 year age group, based on samples from Dewsbury, Yorkshire in 1904, Gloucester in 1923 and in Aynho in 1723–4 (although in these cases total population cohort sizes are unknown).⁴¹

It is suggested in this paper that children in the 10–14 year age group were also key familial disseminators of smallpox. These children were making their first reconnaissances away from the family home, both socially and as casual wage earners, and were therefore newly exposed to distinct forms of contagious disease in the wider environment. This suggestion is supported by research by Wallis, Webb and Minns, who found that, although children

36 On the susceptibility of infants to smallpox, see Razzell, *Conquest of Smallpox*, p. 104. Also see Davenport, *et al.*, ‘Decline of adult smallpox’, p. 1,306.

37 Ages are taken mainly from the date of baptism.

38 The total of 17 infants includes three with assumed or ‘dummy’ birth dates: they have been allocated parallel birth and burial dates by the rules of family reconstitution, where no date of birth or baptism is recorded in parish registers. Even allowing for the maximum number of errors (all three dummy birth dates being incorrect), the percentage of smallpox deaths in this age group is still 53.8, thus remaining considerably higher than in all the other age groups.

39 J.R. Smith, *The Speckled Monster* (Chelmsford, 1987), p. 64.

40 Dixon, *Smallpox*, p. 314.

41 *Ibid.*, pp. 314, 318–22.

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Table 4 Age incidence of smallpox, Banbury 1718–9

Age (years)	Child deaths from unknown cause (in the same period)	Number of child smallpox deaths 20 August 1718–26 July 1719 in traceable families	Number of children in all smallpox families at beginning of epidemic	Number of surviving children in smallpox families at end of epidemic	Percentage of age group dying of smallpox
Infants (under 1)	1	17	26	8	65.4
1		3	11	8	27.3
2		4	18	14	22.2
3		1	9	8	11.1
4		5	15	10	33.3
5–9		10	51	41	19.6
10–14	1	12	44	31	27.3
15–19		5	26	21	19.2
20 or more*		5	38	33	13.2
Age unknown		2	2		
Total	2	64	240	174	26.7

Note: * Some of the 'children' in the over 20 years age group may not have been fully integrated into their family units and so we should not regard them as being fully representative of cases of familial transmission. The same applies, although possibly to a lesser extent, to the 15–19 year age group.

Source: Derived from Banbury burial register transcripts and family reconstitution.

were apprenticed mainly from the age of 14 years onwards, child labour also occurred among those aged under 15 years while they remained resident in the family.⁴² In Banbury, this younger group, being both vulnerable and independent, yet living in close familial contact, were key vectors in the inter-family dissemination of smallpox infection. There may also be a connection between infants and siblings with regard to older children providing some care for infant siblings, although, as yet, there is insufficient evidence to support this hypothesis.

We see slightly different patterns in the second epidemic (Table 5) where infant smallpox deaths were more muted, although they still accounted for over 50 per cent of infants in smallpox families. It is possible that the number of infant smallpox deaths was higher, as five infant deaths from other causes during the epidemic may have been due to undiagnosed smallpox. However, even if this were the case, the proportion of infant deaths from smallpox did not rise significantly above that of children aged 1–2 years.

A possible explanation for the lower proportion of infant deaths in the second outbreak concerns levels of immunity in parents and siblings. This is an important aspect of the

42 P. Wallis, C. Webb and C. Minns, 'Leaving home and entering service: the age of apprenticeship in early modern London', *Continuity and Change*, 25, pp. 377–404. Age at leaving home could depend on family factors such as the occupation or status of the father and family income. Wallis *et al.* estimate an age range of 14–17 years with a mean age of just under 17 years.

Table 5 Age incidence of smallpox, Banbury 1731–3

Age (years)	Child deaths from unknown cause(in the same period)	Number of child smallpox deaths 19 December 1731–29 October 1733 in traceable families	Number of children in all smallpox families at beginning of epidemic	Number of surviving children in smallpox families at end of epidemic	Percentage of age group dying of smallpox
Infants (under 1)	5	12	22	5	54.5
1		12	16	4	75.0
2		4	12	8	33.3
3		7	15	8	46.7
4		2	11	9	18.2
5-9		10	50	40	20.0
10–14		3	41	38	7.3
15–19		3	20	17	15.0
20 or more*	2	2	25	21	8.0
Age unknown		2	2		
Total	7	57	214	150	26.6

Note: * Some of the ‘children’ in the over 20 years age group may not have been fully integrated into their family units and so we should not regard them as being fully representative of cases of familial transmission. The same applies, although possibly to a lesser extent, to the 15–19 year age group.

Source: Derived from Banbury burial register transcripts and family reconstitution.

disease when epidemics occurred twice within a family’s lifespan. If older family members were immune due to exposure first time around, they could safely maintain households and attend their children without the risk of infecting vulnerable members of the family. Furthermore, in the second outbreak smallpox mortality among children aged 10 years and over dropped significantly. Again, the immunity factor may be significant. All the children aged over 15 years and some in the 10–14 year age group were born before or during the first outbreak. Some of these children may have experienced the disease in infancy or early childhood and therefore presented less of a risk of acting as vectors in their household.

However, we need to know more about the proportions of adults and children affected by smallpox mortality who were present in the community at the time of the first outbreak and remained so some 13 years later. Of the 62 smallpox families in the 1731–3 epidemic, 43 had life events recorded in registers across the timespan of both epidemics (we can call these ‘resident’ families). Although infants fared well generally in the second epidemic, probably due to the immunity of parents and older siblings, certain points stand out when we look at the composition of infant smallpox deaths in the second epidemic in the two distinct groups: ‘resident’ and ‘in-migrant’ families. Table 6 shows the breakdown of all infant smallpox deaths by these two groups. In the ‘resident’ families, infants generally fared well in the second epidemic. Only 4 out of a total of 11 infants died of smallpox from this group. The number of infant smallpox deaths was higher in the ‘in-migrant’ group in which

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Table 6 Composition of infants from ‘resident’ and ‘in-migrant’ families experiencing smallpox mortality: Banbury, 1731–3

	‘Resident’ families	‘In-migrant’ families	Total
Number of families	43	19	62
Infant smallpox deaths	4	8	12
Percentage of total infant smallpox deaths	33.3	66.7	100
Infant deaths from other causes	3	2	5
Infant survivors	4	1	5
Total number of infants	11	11	22

Note: ‘Resident’ families were present at the time of the 1718–9 epidemic, ‘in-migrant’ families are those for which we have no evidence that they were present at the time of the 1718–9 epidemic.

Source: Derived from Banbury burial register transcripts and family reconstitution.

8 out of 11 infants died of the disease.⁴³ The ‘in-migrant’ families only comprised 19 out of 62 families yet 8 out of 12 infant smallpox deaths came from these families. From these figures it appears that ‘resident’ families, comprising the majority, presented less of a risk of smallpox to their infants due to the likely immunity of parents who were not, therefore, liable to transmit the disease.⁴⁴

The 10–14 year age group is worthy of further consideration in the light of Dixon’s research on high levels of incidence in this group. Smallpox transmission was greatly influenced by the frequency and intimacy of contact with others, being most likely in the close association of the family group. Supposing a risk of infection at around 80 per cent in the 0–30 year age group in households where smallpox was present, and a smallpox mortality incidence of between 15 and 25 per cent, Table 7 shows the probable number of non-fatal smallpox attacks (241) in the smallpox families.⁴⁵ Returning to the age breakdown of all the children in the two sets of families (Tables 4 and 5), we can now look more closely at the 10–14 year olds. Table 8 is an estimate of the proportion of this group likely to be smallpox survivors in Banbury in the period up to the mid-1730s. (A later, less severe outbreak of smallpox occurred in Banbury in the 1740s when seven adults and five children died of the disease.) Although our conclusions must be somewhat speculative given the small number of cases available, Table 8 indicates that the proportions of survivors from the two outbreaks in this age group were 52 and 73 per cent respectively. The higher proportion of

43 Three infants in 1718–19 and two in 1731–3 died from other causes during the outbreaks. It is possible that smallpox was the cause of these deaths which may have occurred before the onset of the characteristic rash. Deaths due to convulsions, particularly, have been cited as missed cases of smallpox particularly as convulsions were often an early symptom. Cases of misdiagnosis should not be over-stated, however. As early as the seventeenth century the link between convulsions and smallpox in infants was known and once an epidemic was present in a community early symptoms allowed diagnosis. See Dixon, *Smallpox*, p. 88; Leadbeater, ‘Experiencing Smallpox’, pp. 170–2.

44 This was at a time when inoculation was barely known and not widely practised. Later migrants to urban areas may have possessed immunity through inoculation in their original parishes.

45 Dixon, *Smallpox*, pp. 310–11, 314, 319. Figures based on attacks in the unvaccinated in Gloucester in 1893.

Table 7 Smallpox attacks in children in families with child smallpox deaths: Banbury, 1718–9 and 1731–3

	1718–9	1731–3
Number of children in families affected by smallpox mortality	240	214
Fatal attacks	64	57
Number of cases (assuming 80 per cent likelihood of infection)	192	171
Probable number of non-fatal attacks	128	114

Note: This table assumes case fatality for both outbreaks at 33.3 per cent, which is typical, given the age profile of the cohort.

Source: Derived from Banbury burial register transcripts and family reconstitution.

Table 8 Smallpox attacks in 10-14 year age group in families with child smallpox deaths: Banbury, 1718–9 and 1731–3

	1718–9	1731–3
Total number in age group	44	41
Number infected (assuming 80 per cent likelihood of infection)	35	33
Number of smallpox deaths	12	3
Number of survivors	23	30
Percentage surviving	52%	73%

Source: Derived from Banbury burial register transcripts and family reconstitution.

survivors in the second outbreak may reflect the fact that some children in this age group had gained immunity due to the previous outbreak which had occurred some 13 years previously. This is an interesting point which contributes to the current debate on smallpox and overall mortality in the eighteenth century. In their work on smallpox mortality in eighteenth-century London, Davenport, Schwarz and Boulton have argued that it was not until after 1760 that an increasing proportion of migrants into the city were survivors of childhood smallpox and so were immune. However, the figures above suggest that a proportion of this age group in Banbury acquired life-long immunity to the disease considerably earlier in the century.⁴⁶

Impact of parental smallpox mortality on children

In 1718–9, 14 fathers and 13 mothers died of smallpox and there was only one family in which both parents died. Only one fatally-affected mother had an infant who also died of the disease. Given the probability of close contact between mother and child and the likely dependence on breast milk this infant death is unsurprising. Twenty per cent of children in families with paternal deaths and 10 per cent of children in families with maternal smallpox deaths also died. In the 1731–3 outbreak, 6 fathers and 13 mothers died of smallpox and no families experienced the death of both parents. In this second outbreak, the propor-

⁴⁶ See Davenport *et al.*, 'Decline of adult smallpox', p. 1,289.

tion dying in families with paternal and maternal deaths is reversed; 8 per cent of children in families with paternal deaths also died and 17 per cent of children in families with maternal deaths.

Overall, then, there appears to be little difference in the risk of death to children aged 1–14 years, irrespective of which parent died of smallpox. This is significant as it demonstrates shared parental responsibilities when children were sick, adding to more general findings that both parents took on caring roles and responsibilities.⁴⁷ Furthermore, although a dependence on breast milk was likely to be an important factor in the well-being of young children, the presence of mothers many not have been essential for their children's survival. In an examination of breast-feeding practices in the eighteenth century, Valerie Fildes has provided pictorial evidence of young children being spoon-fed by mother substitutes.⁴⁸ It is speculated that in Banbury caring substitutes or wet nurses were sourced when mothers fell ill with smallpox or families instigated isolation practices to protect children when parents were sick with smallpox. This is most likely by the early 1730s when pest houses for the isolation of people with infectious diseases were known to be in operation in the area. However, the extent to which pest houses were used is unclear, although it is logistically unlikely that all those in Banbury suffering from smallpox during the two epidemics remained in isolation throughout the course of their infection.

Approximately one in six of the population of Banbury lived in a family affected by smallpox mortality between 1718 and 1733. In 1718–9, 119 people experienced smallpox fatally and it is probable that many more experienced the disease non-fatally. For example, in Aynho, in 1723–4, only 19 per cent of sufferers from smallpox died of the disease.⁴⁹ By 1731 a pest house was in use in Banbury and the way in which the second epidemic was managed may have been different. However, there were striking similarities between the two epidemics in the percentages of children in the smallpox mortality families who succumbed to the disease; 26.8 and 26.6 respectively. This suggests consistent familial behaviour in relation to isolating the sick.

Conclusions

Most of the severe outbreaks of the disease in Oxfordshire, where smallpox burials comprised over 50 per cent of total burials, occurred before 1760. This is particularly marked in the trend in child smallpox deaths over the century. Children fared worse in the earlier part of the century with the ratio of child to adult smallpox deaths being reversed

47 See for example, H. Newton, *The Sick Child in Early Modern England, 1580–1720* (Oxford, 2012), pp. 17–18, 120–22, 156–62, 188–9; J. Bailey, *Parenting in England 1760–1830: Emotion, Identity, and Generation* (Oxford, 2012), pp. 37, 48, 131.

48 V. Fildes, *Breasts, Bottles and Babies: a History of Infant feeding* (Edinburgh, 1986), pp. 224–6. The two illustrations are by A. von Ostade in 1648 and Hogarth in 1738, and show infants being spoon-fed by mother substitutes, implying the use of breast milk substitutes in the form of 'pap' or 'panada' (a mixture of milk or water and cereal). It is unclear, however, whether this form of feeding was particularly responsible for high mortality rates in infants, pp. 217–19.

49 *Royal Society*, 'Account of those who had ye smallpox'.

after 1760. The disease was clearly being controlled more effectively during the later part of the century; inoculation programmes in the area were most probably a factor in this decline.

The first inoculations took place in Oxfordshire and surrounding counties in the late 1750s. Mass, or general inoculations, whereby a whole community would be treated, occurred in Banbury in 1760 and Burford in 1768.⁵⁰ The practice gained momentum until 1767 and by the late 1760s provision in the region was widespread.⁵¹ We know from local newspaper reports for example, that inoculators moved into a new area when one market was considered to be exhausted. A Mr l'Ony had been inoculating for 20 years in Essex, where, 'the practice of it [inoculation] has been so general, that few in Comparison remain now to be inoculated in that Part of the Country' when he set up a new enterprise in Amersham, Buckinghamshire in 1766.⁵² A Mr Sampson demonstrated the lucrative market in which he had been operating when he retired from inoculation practice in 1764:

[C. Sampson] now had ... leisure to attend his Shop ... which he has enlarged and completely fitted up. And has laid in a fresh Stock of Drugs and Medicines, the best of every kind.⁵³

We cannot be sure, of course, that the Oxfordshire region was representative of the country as a whole. It has been suggested, for example, that take-up levels of inoculation in the north of the country were lower than in the south and almost non-existent in Scotland.⁵⁴ That said, a direct outcome of the rise in smallpox inoculation was a consequential rise in the number of persons protected against the disease and incapable of spreading it further, leading to likely subsequent lower infection rates later in the century.

We conclude from the Banbury data that prior immunity was a key element in shaping the prevalence of smallpox. In this town, which suffered two epidemics within 12 years, fewer adults were fatally affected in the second outbreak. Men, particularly, survived the second outbreak with low levels of smallpox mortality, which is particularly striking as 50 per cent were likely to be in-migrants. Smallpox mortality results in the 10–14 year age group are also marked. In the first epidemic, a high incidence in this group is likely to reflect the vulnerability of those newly exposed to distinct forms of contagious disease in the wider environment. On the other hand, prior immunity in the second outbreak for some of this group had protected them from further attack.

In both Banbury outbreaks, infants and young children mainly experienced smallpox during the later stages of each outbreak. This indicates transmission routes from parents to children, suggesting that parents and older siblings were key vectors in familial transmission. This is supported by higher levels of infant smallpox mortality in an in-migrant group

50 See OHC, PAR21/2/A/1 'Banbury Vestry Minute Book' (14 October 1760); Moody, *Great Burford Smallpox*, pp. 20–23.

51 Leadbeater, 'Experiencing Smallpox'.

52 *Jackson's Oxford Journal*, 5 April 1766.

53 *Jackson's Oxford Journal*, 5 May 1764.

54 Razzell, *Population and Disease*, pp. 183–4; D. Brunton, 'Smallpox inoculation and demographic trends in eighteenth-century Scotland', *Medical History*, 36 (1982), pp. 403–29.

in the second outbreak where parents and older siblings may not have experienced smallpox previously.

The immunity of parents and siblings to smallpox was a key factor which had a likely effect on smallpox mortality in infants and young children, and later in the century, on overall levels of infant mortality. An added dimension, therefore, to discussions on the decline in infant mortality in the late eighteenth century must be the status of parental and sibling immunity to diseases such as smallpox.⁵⁵ Infants and young children were most at risk of smallpox from within the home environment. The conclusion that homes were safer places for young children when older family members were protected from an infectious disease is a serious consideration in the management of twenty-first century diseases.

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55 For discussions on the decline in infant mortality in the late eighteenth century, see, for example, J. Landers, *Death and the Metropolis: Studies in the Demographic History of London, 1670–1830* (Cambridge, 1999); Wrigley *et al.*, *English Population History*.