Mortality in town and countryside in early modern England

Dilece Connor and Andrew Hinde

Abstract

In this paper we test two hypotheses about mortality in early modern England: (1) that market towns had more frequent and more severe mortality crises than rural parishes; and (2) that the underlying level of mortality in market towns was higher than that in rural parishes. The data consist of annual burial totals for ten pairs of parishes, each consisting of one market town and a nearby rural parish, drawn from counties in all parts of England between the sixteenth and the early nineteenth centuries. Mortality crises are identified and their severity measured using a Poisson model, which has the advantage that it can be applied both to small and large parishes without the need for ad hoc adjustments or rules. The results show clearly that mortality crises were more frequent and severe in market towns than in rural parishes, a pattern which would be predicted by epidemiological theory. The evidence that underlying mortality in market towns was higher than that in rural parishes is not as clear cut, though there is a tendency for market towns to record higher levels.

Introduction

During the early modern period, mortality in England can be divided into two components. The first was an underlying level of *background mortality*, consisting of the deaths that took place from many different causes in an ordinary year. According to E.A. Wrigley and R.S. Schofield, this background mortality ran at a rate of about 23–25 per thousand in the late sixteenth century, rising in the mid-seventeenth century to close to 30 per thousand, at which level it remained until 1750.[1] The second element comprised periodic mortality peaks due to epidemic disease and (more rarely) subsistence crises, such as the plague epidemic of 1665 and the great mortalities of 1557–1560 and 1727–1730, which we shall refer to as *mortality crises*. At the national level, it has been shown that background mortality was by far the more important component. Although epidemics and famines are dramatic events, and for that reason attract the interest of historians and demographers, they accounted for fewer than one death out of every ten.[2]

National mortality trends and patterns, however, are just the sum of the mortality experience of the nation's localities, and research has shown that there were important

1 E.A. Wrigley and R.S. Schofield, *The population history of England 1541–1871: a reconstruction* (London, 1981), 531–3. For a summary of mortality patterns in early modern England, see A. Hinde, *England's population: a history since the Domesday survey* (London, 2003), 90–110.

2 Hinde, *England's population*, 97.

differences in mortality from place to place. Both the level of background mortality and the proportion of deaths attributable to epidemics and famines varied regionally, and within regions according to the physical environment. For example, Mary Dobson has shown that in south-eastern England the background mortality rate was related to the height of a place above sea level: coastal parishes in the Thames estuary had a crude death rate up to three times that of upland parishes.[3] It is also clear that background mortality was especially high in London and some other large towns, certainly higher than in the countryside.[4] Major urban areas were also subject to especially catastrophic peaks of mortality. In London, for example, the plague epidemics of 1563 resulted in around 17,000 additional burials, and the epidemics of 1603 and 1625 more than 25,000 extra deaths each.[5] Both these features of urban mortality can be seen as consequences of large numbers of people living in close proximity to one another in an era when sanitation was rudimentary and preventative and therapeutic medicine largely absent.

This paper explores possible differences in the mortality regimes between rural parishes and the many market towns that dotted the English countryside. Studies of urban-rural differentials in mortality have tended to focus on the larger urban settlements (especially London), and have often neglected the much more numerous smaller places that exhibited some urban characteristics. There were several hundred market towns in early modern England, with populations ranging from a few hundred souls to three or four thousand people.[6]

Mortality in town and countryside

There are several reasons to suppose that mortality crises during the early modern period might have been more frequent and more severe in urban areas than in the countryside. It is well known that by the sixteenth and seventeenth centuries plague had become largely an urban phenomenon, with major epidemics in London in 1563, 1603, 1625 and 1665, and lesser epidemics in other years.[7] Other towns and cities also suffered regularly from

3 M. Dobson, *Contours of death and disease in early modern England* (Cambridge, 1997), 139.

4 See J. Landers, *Death and the metropolis: studies in the demographic history of London 1670–1830* (Cambridge, 1993); C. Galley, *The demography of early modern towns: York in the sixteenth and seventeenth centuries* (Liverpool, 1998); and P.J. Corfield, *The impact of English towns 1700–1800* (Oxford, 1981), 109–23.

5 P. Slack, *The impact of plague in Tudor and Stuart England* (London, 1985), 151.

6 For a list of the market towns in England in the sixteenth and early seventeenth centuries, see A. Everitt, 'The market towns', in P. Clark, ed., *The early modern town: a reader* (London, 1976), 168–204 (the relevant material in Everitt's paper was originally published in J. Thirsk, ed., *The agrarian history of England and Wales*, Vol. 4 (Cambridge, 1967), 467–90).

7 That the plague became increasingly urban does not mean epidemics no longer struck the countryside. Rural epidemics occurred right up to the disappearance of plague in the 1670s, for example the well known epidemic of 1665 in the Derbyshire village of Eyan: see P. Race, 'Some further consideration of the plague in Eyam, 1665/6', *Local Population Studies*, 54(1995), 56–65; and L. Bradley, 'The most famous of all English plagues: a detailed analysis of the plague of Eyan, 1665–6' in *The plague reconsidered: a new look at its origins and effects in sixteenth and seventeenth century England* (a *Local Population Studies* supplement) (Matlock, 1977), 63–94.

outbreaks of the disease, for example Norwich in 1579, 1584–1585, 1589–1592, 1603 and 1625, and Exeter in 1570, 1591 and 1625.[8]

Both Norwich and Exeter, however, were among the six or seven largest provincial towns in England, and we know much less about the frequency and severity of plague epidemics in smaller urban centres.[9] However, we do know that the typical English market town was 'the focus of the rural life around it. Its square and taverns provided the meeting place for yeomen and husbandmen, not only to buy and sell, but to hear the news, listen to sermons, criticise the government, or organize insurrection'.[10] The many comings and goings meant that the populations of market towns were more likely to be exposed to infections than were people living in more isolated rural parishes.[11] In the case of epidemic diseases of the kind that might produce mortality crises, the crowded nature of the towns would probably encourage a rapid spread through the population, so that the diseases were more likely to gain a hold than they might be in more sparsely populated localities. In a comparison of the mortality of three Shropshire parishes in the seventeenth century, Sylvia Watts noted that Whitchurch had both a lower rate of population growth and more frequent mortality crises than Wem or Wellington, a fact which she attributes to Whitchurch's being 'a thoroughfare town on an increasingly busy route to Chester', and a centre of long-distance trade, as well as being more overcrowded than the other two parishes.[12]

P.J. Corfield has suggested that death rates 'tended … to be higher in the larger towns than in the smaller ones', but some kind of 'urban effect' should be identifiable even in small towns.[13] Background mortality is affected by the urban environment and, although the impact of this in a small town would be less than that in, say, London, it seems likely that there would be *some* impact. Leslie Clarkson mentioned the contrasting physical environments of town and village, stressing the poor disposal of sewage and the polluted water of the towns, and suggesting that towns were more conducive to mortality crises than villages: in the towns 'everything worked in favour of high mortality. Poor people lived in congested houses and were particularly susceptible to epidemics … Towns were dirty, water supplies were tainted, and sewerage was disposed of inadequately or not at all'.[14]

8 Slack, *Impact of plague*, 115–8, 129–30.

9 Other large provincial towns included Bristol, Colchester, Newcastle, Salisbury and York: see P. Clark and P. Slack, *English towns in transition 1500–1700* (Oxford, 1976), 9.

10 Everitt, *Market towns*, 186.

11 L. Clarkson, *Death, disease and famine in pre-industrial England* (Dublin, 1975), 10.

12 S. Watts, 'Some aspects of mortality in three Shropshire parishes in the mid-seventeenth century', *Local Population Studies*, 67 (2001), 23; see also Dobson, *Contours of death*, 500.

13 Corfield, *Impact of towns*, 110.

14 Clarkson, *Death, disease and famine*, 9 (see also 107–10). Clarkson also claimed that town-dwellers were more vulnerable than countryfolk when there were shortages of food, because they were compelled to buy food at markets at inflated prices.

The purpose of this paper is to compare mortality in market towns and rural villages in England between 1538 and 1837, in order to assess whether these potential differences in the mortality regimes of the two environments are borne out. In other words, we attempt to test two hypotheses about mortality in early modern England: (1) that market towns had more frequent and more severe mortality crises than rural parishes; and (2) that the underlying level of mortality in market towns was higher than that in rural parishes.

Choice of market towns and rural parishes to compare

Our analysis compares ten pairs of market towns and nearby rural parishes in different counties, selected so that the length and breadth of England are represented. The parishes were drawn from the 404 parishes which provided the data for Wrigley and Schofield's aggregative analysis of the population history of England.[15] To be chosen, a parish was required to have a burial register which extended from the sixteenth century until at least 1812, and which had few, if any, years with missing data or years in which the burials data have been imputed.[16] A list of the market towns and rural parishes is given in Table 1. Details of the years for which the data are available in each selected parish are given in Appendix 1.

It might be argued that by selecting only parishes with a more or less complete run of data we are eliminating parishes which suffered particularly badly from epidemics, on the grounds that the chaos produced by severe epidemics tended to lead to breaks or inconsistencies in the recording of burials. To the extent that this is true, it will make it more difficult for us to confirm our first hypothesis, in that if towns suffered more frequent and severe epidemics than rural parishes, and epidemics did provoke gaps in the burial series, a smaller proportion of towns than rural parishes will be eligible for inclusion in our analysis, and we shall have selected those towns which suffered less badly than average from epidemics.

The rationale for comparing pairs of market towns and nearby rural parishes is that it provides a crude control for the disease environment and other geographical and climatic factors which might affect the incidence of mortality crises. In her study of mortality in south-east England, Dobson noted that mortality levels between towns and villages were different, but that the difference was not all associated with population size; rather it was a result of different locations, migration, the nature of the environment and other geographical features.[17]

15 Wrigley and Schofield, *Population history of England*.

16 In three cases it was not possible to find a register with no year's data missing. However the number of years of missing data was never more than six (see Appendix 1).

17 Dobson, *Contours of death*, 110–1, 126–9.

Table 1 Market towns and rural parishes in the study

County	Market town Name	Pop. in 1811	Rural parish Name	Pop. in 1811
Buckinghamshire	Aylesbury	3,447	Wing	937
Cheshire	Frodsham	4,098	Gawsworth	757
Cumberland	Wigton	4,051	Bridekirk	1,552
Durham	Darlington	5,820	Whitburn	843
Essex	Romford	3,244	Ardleigh	1,186
Gloucestershire	Michin-hampton	3,246	Avening	1,602
Hampshire	Ringwood	3,269	Aldershot	498
Herefordshire	Ledbury	3,191	Eaton Bishop	381
Hertfordshire	Hitchin	3,608	Aldenham	1,127
Kent	Gravesend	3,119	Benenden	1,322

Source: Data on 404 parishes collected on behalf of the Cambridge Group for the History of Population and Social Structure and made available by the Local Population Studies Society (lps@herts.ac.uk). See R.S. Schofield, *Parish register aggregate analyses* (Hatfield, 1998).

The data for the selected parishes have been made available in electronic format.[18] Accompanying the tables of numbers of burials are details of the characteristics of each parish, which include a statement of whether or not the parish was a 'market town' in 1640 and 1700. The parishes classified as market towns in this study were all reported in the data set to have been market towns in both 1640 and 1700. None of the rural parishes was so classified in either of those years.

Methods

Mortality crises

In a recent article, Andrew Hinde reviewed methods of identifying mortality crises in England during the parish register era using the Church of England burial registers.[19] He pointed out that deciding what constituted and did not constitute a crisis was to some extent a matter of the judgement of the individual researcher. Although this is not in itself a bad thing, it does create inconsistencies in the literature in the decision rules adopted. Different criteria are used by different researchers, and different recommendations about how to apply the rules are appropriate for large and small parishes.

This paper necessarily involves a comparison of the frequency and severity of mortality crises in large and small parishes (market towns and nearby rural parishes), and it is

18 R.S. Schofield, *Parish register aggregate analyses* (Hatfield, 1998). This pamphlet includes a CD-ROM containing the data. It may be obtained from Local Population Studies General Office, School of Humanities, University of Hertfordshire, College Lane, Hatfield, Hertfordshire AL10 9AB.

19 A. Hinde, 'A review of methods for identifying mortality "crises" using parish register data', *Local Population Studies*, 84 (2010), 82–92. The current article is the 'future article' mentioned in the last sentence of Hinde's paper.

important to identify the crises using the same approach in each. Accordingly in this section we describe a method of identifying mortality crises which can be applied equally to large and small parishes.

The objective of the exercise is to identify whether or not the number of deaths in a parish in a particular period was sufficiently high that there is strong reason to doubt that it was due to random fluctuations around an underlying or background mortality level. In order to be able to test this, we first need to identify what the background level of mortality is, and, specifically, to work out how many deaths there should have been in a 'normal' year in the parish in question as a result of background mortality. We work with annual data covering the period from the sixteenth or early seventeenth centuries until the nineteenth century.

Estimating the background mortality in each parish involves calculating some kind of 'average' death rate or an underlying trend. Since burial register data only provide information about the number of burials, we measure the underlying trend using the 'average' annual number of burials. There is evidence that the general disease or mortality environment changed over time, so that the rate of background mortality was lower, for example, in the late sixteenth century than it was in the late seventeenth century.[20] Because of this, we estimate the mean 'expected' annual number of burials in a year using a 25-year moving average centred on the year in question.

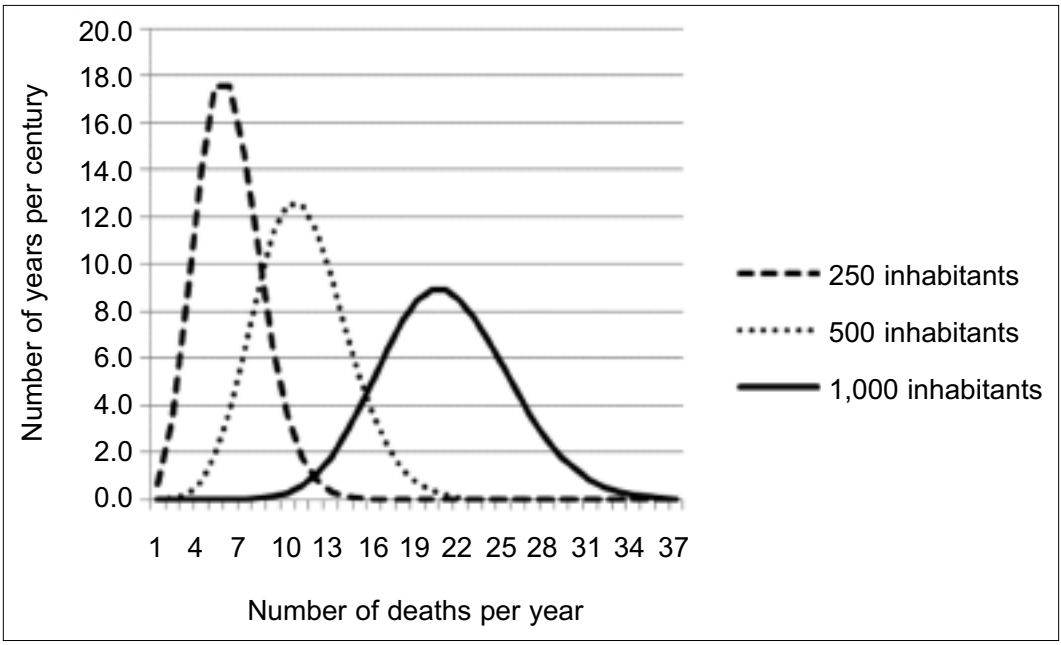
Underpinning the method is a *model* of the background mortality. We use the model to work out what the distribution of deaths over time in a parish should be if the model accurately describes the mortality regime. Then we compare the observed distribution of deaths over time in the parish with that expected on the basis of the model. If the numbers of deaths in each year are within the range predicted by the model, we conclude that mortality in the parish did, indeed, happen according to the model. If, on the other hand, there are large differences between the observed and expected numbers of deaths in some years, we conclude that the model does not accurately describe the mortality operating in the parish in those years.

The model of background mortality considers deaths in a parish to follow what is known as a Poisson process.[21] According to this process, deaths occur one at a time, but may occur at any time. One way to imagine it is to suppose that every inhabitant has the same chance of dying in any given year. Let us suppose that this chance is 20 per thousand. Each year Death, the Grim Reaper, visits the parish and, using a random number generator, generates a random number between 1 and 999 for each person. He then takes all those unfortunate inhabitants who have been given random numbers between 1 and 20, and

20 Hinde, *England's population*, 99–103.

21 Named after the French mathematician Siméon-Denis Poisson (1781–1840). There are some textbooks describing the Poisson process, but they are all quite mathematical. One of the shorter and more accessible introductions is in P.W. Jones and P. Smith, *Stochastic processes: an introduction* (London, 2001), 109–23.

Figure 1 Numbers of years per century with specific numbers of deaths: three hypothetical parishes with a crude death rate of 20 per thousand per year



spares the rest of the population. Clearly, it is possible that in a parish of, say, 500 inhabitants, there will be years when no-one will be given a random number between 1 and 20, and the number of deaths will be zero, though this is quite unlikely. It is also possible, but even more unlikely, that *everyone* will be unlucky enough to be allocated a number between 1 and 20, and all will perish.

The actual number of deaths in the year will depend upon the distribution of the random numbers which the Grim Reaper generates—in the example just described it will depend specifically on how many people receive random numbers between 1 and 20. It is possible, using a simple formula, to calculate the distribution of the actual number of deaths which will be obtained. This distribution depends on the population of the parish and the underlying mortality rate. Consider a small parish of 250 inhabitants in which the average death rate is 20 per thousand per year. It turns out that in such a parish, in only one year every century will no-one be taken by the Grim Reaper. During each 100-year period, there will be 3 years with only one death, 8 years with two deaths, 14 years with three deaths, 17 or 18 years with four deaths, another 17 or 18 years with five deaths, 15 years with six deaths, 10 years with seven deaths, 6 years with eight deaths, 4 years with nine deaths, 2 years with ten deaths, and 2 years with more than ten deaths. Figure 1 shows this distribution of the numbers of years each century with specific numbers of deaths, together with the corresponding distributions for a parish of 500 inhabitants and a largish parish of 1,000 inhabitants. Notice that in the largest parish, the distribution looks very like the familiar bell-shaped Normal distribution. This is to be expected, as it can be shown

mathematically that the death process we have described will produce a distribution of numbers of deaths per year which becomes more and more like the Normal distribution as the average number of deaths per year increases. When the average number of deaths per year exceeds about 20 the difference between the observed pattern and a Normal distribution becomes negligible. A parish of 1,000 inhabitants with a crude death rate of 20 per thousand per year will have, on average, 20 deaths per year. Appendix 2 gives the percentages of years with 0 deaths, 1 death, 2 deaths and so on according to the Poisson model for average numbers of deaths per year from 1 to 20.

The process by which the Grim Reaper visits the parish each year and randomly numbers each inhabitant describes our model of background mortality. Its essential assumption is that each death is assumed to be *independent* of other deaths. This means that the Grim Reaper's random number generator is started afresh for each person, so that the chance that any given person in a parish receives a number between 1 and 20 does not depend on how many others in that parish have previously received such a number. This amounts to regarding death as an unpredictable, exogenous event, such that each death is the result of causes specific to that person, and unrelated to those of other people. The key characteristic of mortality crises, however, is typically that several, or many, people die within a short space of time of similar causes—the same epidemic disease, or the same subsistence crisis—so that deaths are *not* independent. To the extent that mortality in a parish is the result of crises like this, the distribution of deaths will differ from that predicted by our model. Specifically, there will tend to be a larger than expected number of years with large numbers of deaths.

Whether any given year constituted a mortality crisis in a particular parish is, therefore, worked out as follows. We begin by establishing what the expected number of deaths should be in the parish, using a 25-year moving average excluding the year in question. Then, using the model described above, we work out for that year two critical numbers of deaths. The first of these is the number of deaths which would only be exceeded one year in twenty if deaths were truly independent, and the Grim Reaper's random number generator was working as described in the preceding section. The second of these is the corresponding number of deaths which would only be exceeded one year in a hundred. If the actual number of burials recorded in the year in question exceeds the first of these numbers, we define that year to be a crisis year in the parish in question. If the actual number of burials recorded in the year exceeds the second of these numbers, we define that year to be a 'severe' crisis year in the parish in question. Table 2 shows the two critical numbers for background mortality ranging from 1 to 20 deaths per year.

Deaths are not completely independent of one another even in 'normal' years. For example, if a house burns down accidentally, it is possible that more than one inhabitant will die in the resulting conflagration. Because deaths from background mortality are related in this way, we really should adopt slightly more conservative criteria in order to be sure a year with an unusually high number of deaths was a crisis year. However, the

Table 2 Critical numbers of deaths which indicate a crisis year and a 'severe' crisis year for background mortality ranging from 1 to 20 deaths per year

Average number of deaths per year (background mortality)	Crisis indicated if number of deaths in a particular year is this value or more	'Severe' crisis indicated if number of deaths in a particular year is this value or more
1	4	5
2	6	7
3	7	9
4	9	10
5	10	12
6	11	13
7	13	15
8	14	16
9	15	18
10	16	19
11	18	20
12	19	22
13	20	23
14	21	24
15	23	26
16	24	27
17	25	28
18	26	29
19	27	31
20	29	32

non-independence of deaths in 'normal' years is likely to be modest, and for the purposes of comparing mortality in rural parishes and market towns may be ignored.

Background mortality

To compare the levels of background mortality in the market towns and rural parishes we use crude death rates. We collected details of the populations in 1801 of our 20 study parishes, and, for those parishes in which the burial series extended beyond 1812 we collected population totals from the 1811, 1821 and 1831 censuses.[22] To calculate crude death rates, we averaged the number of burials recorded in the census year and the four years either side of the census year (ignoring those years previously identified as crisis years), divided this by the census population and multiplied by 1,000.

Any comparison made using crude death rates is apt to be confounded by differences in the age structure of the population. In this case, it might be objected that migration from rural areas to towns led to towns having a younger population than the countryside, which would tend to reduce their crude death rates. The age ranges in which differences

22 Population totals by parish for each of the first six population censuses (from 1801 to 151 inclusive) are provided in Census of Great Britain 1851, *Population tables I, Vol. I. England and Wales, Divisions I–VI*; and Census of Great Britain 1851, *Population tables I, Vol. II. England and Wales, Divisions VII–XI, Scotland*.

matter most are those in which deaths are most numerous, which means infants and the elderly (say 55 years and over for early modern populations). We do not have data on the age structure of local populations before 1841, but we can use the 1841 census to compare the age structure of our towns and rural populations in that year. In Buckinghamshire, for example, in the town of Aylesbury 11.7 per cent of the inhabitants were aged under five years, and 9.4 per cent aged 55 years and over; the corresponding percentages in the Cottesloe hundred (in which the village of Wing was located) were 13.9 and 10.5 per cent.[23] In Hampshire, the town of Ringwood had 13.2 per cent of its inhabitants aged under five years, and 13.1 per cent aged 55 years and over, compared with 14.1 per cent and 10.9 per cent in the Odiham division (which included Aldershot).[24] These age structure differences are small, and unlikely to have confounded the comparison.

Results

Table 3 shows the number of crisis years and the number of 'severe' crisis years recorded in the market towns and villages we have compared. In Buckinghamshire, the market

Table 3 Frequency of crisis years and 'severe' crisis years in market towns and rural parishes

County	Number of crisis years		Number of 'severe' crisis years	
	Market town	Rural parish	Market town	Rural parish
Buckinghamshire	39	21	29	12
Cheshire	49	24	31	13
Cumberland	25	21	20	8
Durham	29	25	22	14
Essex	46	22	27	15
Gloucestershire	33	26	20	16
Hampshire	42	17	36	6
Herefordshire	45	10	20	5
Hertfordshire	38	25	26	11
Kent	45	28	31	11
Totals	391	219	262	111

Note: The periods of investigation varied slightly from county to county but were the same for the market town and rural parish in the same county. The details are: Buckinghamshire 1577–1800 (224 years), Cheshire 1570–1800 (231 years), Cumberland 1617–1800 (184 years), Durham 1603–1800 (198 years), Essex 1574–1825 (252 years), Gloucestershire 1578–1823 (246 years), Hampshire 1594–1825 (232 years), Herefordshire 1602–1800 (199 years), Hertfordshire 1575–1825 (251 years), Kent 1571–1825 (255 years).

Source: Data on 404 parishes collected on behalf of the Cambridge Group for the History of Population and Social Structure and made available by the Local Population Studies Society (lps@herts.ac.uk). See R.S. Schofield, *Parish register aggregate analyses* (Hatfield, 1998).

23 Census of Population, 1841, *Age abstract: England and Wales* (London, 1843), 12–3.

24 Census of Population, 1841, *Age abstract*, 252–3 and 260–1.

Table 4 Estimated crude death rates in market towns and rural parishes, 1797–1835

County	Parish	1797 to 1805	1807 to 1815	1817 to 1825	1827 to 1835
Buckinghamshire	Market town (Aylesbury)	22	na	na	na
	Rural parish (Wing)	23	na	na	na
Cheshire	Market town (Frodsham)	21	na	na	na
	Rural parish (Gawsworth)	31	39	42	38
Cumberland	Market town (Wigton)	19	21	22	19
	Rural parish (Bridekirk)	11	na	na	na
Durham	Market town (Darlington)	23	19	20	21
	Rural parish (Whitburn)	21	na	na	na
Essex	Market town (Romford)	29	25	21	22
	Rural parish (Ardleigh)	23	18	15	18
Gloucestershire	Market town (Michinhampton)	17	17	12	12
	Rural parish (Avening)	9	11	10	10
Hampshire	Market town (Ringwood)	19	17	16	16
	Rural parish (Aldershot)	12	18	15	19
Herefordshire	Market town (Ledbury)	18	na	na	na
	Rural parish (Eaton Bishop)	17	17	13	21
Hertfordshire	Market town (Hitchin)	17	14	13	14
	Rural parish (Aldenham)	22	19	20	18
Kent	Market town (Gravesend)	25	28	22	21
	Rural parish (Benenden)	21	17	14	16

Sources: Census of Great Britain 1851, *Population tables I, Vol. I. England and Wales, Divisions I–VI* (London, Her Majesty's Stationery Office, 1854), II, 18, 22, 28 and 52, III, 22 and 56, IV, 12 and 18, and VI, 24, 30 and 32; and Census of Great Britain 1851, *Population tables I, Vol. II. England and Wales, Divisions VII–XI, Scotland* (London, Her Majesty's Stationery Office, 1854), VIII, 14 and 16, and X. 10, 22, 50 and 52. Data on 404 parishes collected on behalf of the Cambridge Group for the History of Population and Social Structure and made available by the Local Population Studies Society (lps@herts.ac.uk). See R.S. Schofield, *Parish register aggregate analyses* (Hatfield, 1998).

town (Aylesbury) suffered 39 crisis years out of 224, of which 29 were 'severe' crisis years. The nearby rural parish of Wing had only 21 crisis years out of 224, and only 12 'severe' crisis years. It is clear even from a cursory examination of the table that rural parishes had fewer crisis years, and fewer 'severe' crisis years than market towns. Overall, the chance that a year would be a crisis year in a rural parish was only 56 per cent of the corresponding chance in a market town. The chance that a year would be a 'severe' crisis year in a rural parish was only 42 per cent of the corresponding chance in a market town.

The greater volatility of mortality in market towns, and their greater vulnerability to crises, occurred despite their often having higher background mortality rates. Table 4 compares the estimated crude death rates in market towns and rural parishes at the end of the eighteenth and beginning of the nineteenth centuries. The deaths figures are obtained as the average numbers of burials per year within each of the periods in question (ignoring years previously identified as 'crisis' years), and these are divided by population totals obtained from the 1801 census for the period 1797–1805, from the 1811 census for the

period 1807–1815, from the 1821 census for the period 1817–1825 and from the 1831 census for the period 1827–1835.

For five counties, a comparison is only possible for the 1797–1805 period, as the burial register series end in 1812. For the others, the comparison can be made for all four periods. The market town had higher background mortality than the neighbouring rural parish in Cumberland, Essex, Gloucestershire and Kent. In Cheshire and Hertfordshire the rural parish suffered heavier background mortality. In Buckinghamshire, Durham and Herefordshire there is little evidence of any difference between the two, and in Hampshire the relative mortality of the market town and the rural parishes changes over time, so that in 1797–1805 the market town has a higher crude death rate whereas the opposite is the case in 1827–1835. On balance, then, market towns tended to have higher underlying mortality than nearby rural parishes, but this was by no means a universal tendency.

Conclusions

Mortality crises were present in both the market towns and the respective rural villages in each county that was investigated within the period 1538 to 1837. The number of mortality crises varied considerably by county and parish, but there were more frequent mortality crises in market towns than in rural villages. This was evident in the comparisons made between the market town and respective rural village in all of the ten counties investigated.

As with mortality crises, 'severe' mortality crises were present in both the market towns and the respective rural villages in each county that was investigated within the period 1538–1837. The number of 'severe' mortality crises also varied by county and parish. When looking at the percentages, it was seen that in most counties, the percentage of 'severe' mortality crises in market towns was higher than the percentage of 'severe' mortality crises in the respective rural villages. The majority of the counties show that the market towns could be considered as having more severe crises than the respective rural villages.

The background level of mortality was also compared in the market towns and rural villages. In some counties, the level of background mortality in market towns and comparator rural villages was similar. In other counties there were differences, but the direction of the difference was not systematic. This suggests that the relative magnitude of underlying mortality in town and countryside depended on such factors as location, the extent of migration, and other physical features mentioned by previous researchers. On balance, however, market towns did have higher death rates than the rural parishes and therefore it can be concluded that there was some tendency for the background mortality in market towns to be higher than that in their rural hinterlands.

Appendix 1 The table in this appendix provides details of the time span for which burials data are available for each parish, and any years where the Cambridge Group adjusted or imputed the total number of burials.

County	Parish	Beginning and end of burial series	Years for which data have been adjusted or imputed	Years for which data are missing
Buckinghamshire	Aylesbury	1565–1812	1598–1600, 1643–1645, 1649, 1652–1655, 1783–1784	None
	Wing	1546–1812	1558–1561, 1563–1565, 1568–1571, 1754–1758, 1760–1762	None
Cheshire	Frodsham	1558–1812	1604–1606, 1609–1612, 1643–1647, 1649–1653, 1658–1661, 1725–1726	None
	Gawsworth	1557–1837	1665–1666	None
Cumberland	Wigton	1604–1837	1606–1609, 1622–1628, 1640–1644, 1649–1651, 1653–1654, 1658–1662, 1677, 1748	None
	Bridekirk	1584–1812	1589–1592, 1651–1653, 1679–1682, 1684–1686, 1691–1695	None
Durham	Darlington	1591–1837	1645–1650, 1668–1670, 1672, 1675	None
	Whitburn	1579–1812	None	None
Essex	Romford	1561–1837	1582–1596, 1599	None
	Ardleigh	1555–1839	1560–1567, 1569–1572, 1575–1576, 1579–1580, 1643–1696, 1700–1703	None
Gloucestershire	Minchinhampton	1558–1835	1564–1571, 1643–1650, 1653–1660, 1718–1720	None
	Avening	1557–1837	1569–1575, 1690–1691, 1735–1736	1559, 1562, 1565
Hampshire	Ringwood	1561–1837	1563, 1565–1570, 1617–1618, 1620–1624, 1674, 1684–1688	None
	Aldershot	1581–1839	None	1591–1592, 1599–1600, 1626–1627
Herefordshire	Ledbury	1556–1812	1643–1646, 1650–1651, 1660–1661, 1755–1756	None
	Eaton Bishop	1589–1837	1594–1603, 1642–1661, 1671–1673	1702
Hertfordshire	Hitchin	1562–1837	1574–1578, 1585–1586, 1651–1665	None
	Aldenham	1560–1839	1679–1681, 1686–1687, 1689–1692, 1694–1695, 1697–1698	None
Kent	Gravesend	1547–1837	1553–1555, 1557–1558, 1564–1565, 1567–1568, 1613, 1633, 1653–1656, 1662–1663	None
	Benenden	1558–1839	1644–1652	None

Source: Data on 404 parishes collected on behalf of the Cambridge Group for the History of Population and Social Structure and made available by the Local Population Studies Society (lps@herts.ac.uk). See R.S. Schofield, *Parish register aggregate analyses* (Hatfield, 1998).

Appendix 2 **The table in this appendix gives the percentages of years with 0 deaths, 1 death, 2 deaths and so on under the Poisson model for average annual death totals ranging from 1 to 20 deaths. In cases where there are more than 20 deaths per year on average, the Normal distribution can be used and a test for mortality crises based on the actual number of deaths being more than a certain number of standard deviations above the average.**

Percentage of years with	Average number of deaths per year																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
No deaths	37	14	5	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 death	37	27	15	7	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2 deaths	19	27	22	15	8	4	2	1	0	0	0	0	0	0	0	0	0	0	0	0
3 deaths	6	28	22	20	14	9	5	3	1	1	0	0	0	0	0	0	0	0	0	0
4 deaths	2	9	17	20	18	13	9	6	3	2	1	1	0	0	0	0	0	0	0	0
5 deaths	0	4	10	16	18	16	13	9	6	4	2	1	1	0	0	0	0	0	0	0
6 deaths	0	1	5	10	15	16	15	12	9	6	4	3	2	1	0	0	0	0	0	0
7 deaths	0	0	2	6	10	14	15	14	12	9	6	4	3	2	1	1	0	0	0	0
8 deaths	0	0	1	3	7	10	13	14	13	11	9	7	5	3	2	1	1	0	0	0
9 deaths	0	0	0	1	4	7	10	12	13	13	11	9	7	5	3	2	1	1	0	0
10 deaths	0	0	0	1	2	4	7	10	12	13	12	10	9	7	5	3	2	1	1	1
11 deaths	0	0	0	0	1	2	5	7	10	11	12	11	10	8	7	5	4	2	2	1
12 deaths	0	0	0	0	0	1	3	5	7	9	11	11	11	10	8	7	5	4	3	2
13 deaths	0	0	0	0	0	1	1	3	5	7	9	11	11	11	10	8	7	5	4	3
14 deaths	0	0	0	0	0	0	1	2	3	5	7	9	10	11	10	9	8	7	5	4
15 deaths	0	0	0	0	0	0	0	1	2	3	5	7	9	10	10	10	9	8	7	5
16 deaths	0	0	0	0	0	0	0	0	1	2	4	5	7	9	10	10	10	9	8	6
17 deaths	0	0	0	0	0	0	0	0	1	1	2	4	5	7	8	9	10	9	9	8
18 deaths	0	0	0	0	0	0	0	0	0	1	1	3	4	6	7	8	9	9	9	8
19 deaths	0	0	0	0	0	0	0	0	0	0	1	2	3	4	6	7	8	9	9	9
20 deaths	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	6	7	8	9	9
21 deaths	0	0	0	0	0	0	0	0	0	0	0	1	1	2	3	4	6	7	8	8
22 deaths	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	3	4	6	7	8
23 deaths	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	3	4	6	7
24 deaths	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	3	4	6
25 deaths	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	2	3	4
26 deaths	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	2	3
27 deaths	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	3
28 deaths	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
29 deaths	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
30 deaths	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
31 deaths	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
32 deaths	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0