Infant Mortality in England, 1538-2000: Stability and the Beginnings of Change, 1837-1910*

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Abstract

This paper, the third of four, discusses infant mortality during the Victorian and Edwardian periods, 1837-1910. It mainly uses sources generated by the civil registration of vital events, which was established in 1837, to identify trends and patterns, and more importantly, it discusses the beginnings of the secular decline in infant mortality that occurred during this period. The paper also includes examples of how research into this important topic can be carried out and it ends with suggestions for future research.

Introduction

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.[2] John Rickman,

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2 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.

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.[3] 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 infant mortality rates (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.[4] 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 legal consequences, especially with respect to the validity of property transfers.[5] 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.[6]

Thus, from 1 July 1837, every birth, death and marriage should have been recorded and a certificate of that event issued. 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.[7] One thing is certain though—whatever its shortcomings, civil registration was far superior to the

3 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.

4 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.

5 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.

6 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, https://doi.org/10.1017/S002204690004505X. Scotland followed suit in 1855 and Ireland in 1864.

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

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'.[8] 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'.[9] 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.[10]

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 after birth there were economic benefits in burying it as though it was stillborn as a funeral was not necessarily required.[11] 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:

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

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

10 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.

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

> 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.[12]

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.[13]

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.[14] 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.[15] In the following year the Registrar General thought that, 'the administration of the new Act has operated in a

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

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

14 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.

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

satisfactory manner'.[16] 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.

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.[17] 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.[18] 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'.[19] 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.[20] 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

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

17 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, https://doi.org/10.1080/00324728.1951.10416675; M.S. Teitelbaum, 'Birth underregistration in the constituent counties of England and Wales: 1841-1910', *Population Studies*, 28 (1974), pp. 329-43, https://doi.org/10.1080/00324728.1974.10405184.

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

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

20 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, https://doi.org/10.1080/00324728.1983.10408872.

per 1,000 live births (corrected) compared with 148 (registered).[21] 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.[22] 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.[23] The variations in neonatal mortality within registration 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.[24] 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.[25] 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.[26] The annual reports published

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

22 Galley, 'Infant mortality in England, 1538-2000: the parish register period', Figures 6 and 7, pp. 131 and 134.

23 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.

24 See the discussion in Galley, 'Infant mortality in England, 1538-2000: the parish register period', pp. 134-7.

25 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.

26 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

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 (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.[27] 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.[28] 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 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).[29] In 1848 no age breakdown was given, and it was not until 1888 that this information was replicated—and then only for England and Wales as a whole and London, not by RD.[30] 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 (MOH) reports occasionally published these data.[31]

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

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.

27 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.

28 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.

29 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.

30 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.

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

1870s.[32] 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).[33] 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'.[34] 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.[35] 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.[36] 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.[37]

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 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.[38] 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

32 Galley, 'Infant mortality in England, 1538-2000: trends, methods and sources', p. 36.

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

34 Registrar General, *Sixty-Fourth Annual Report of the Registrar General* (London, 1903), pp. lxix, BPP 1902 XVIII.

35 Registrar General, *Sixty-Ninth Annual Report of the Registrar General* (London, 1908), pp. xxxvi-xliv, BPP 1908 XVII.

36 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.

37 GRO publications can sometimes be frustrating to use especially when trying to construct time series of certain measures.

38 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.

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.[39] 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.[40] 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.[41]

The town, and from 1893, the city of Sheffield was contained within two RDs, Ecclesall Bierlow and Sheffield. As Table 1 shows, if these two RDs are combined to form a 'registration city' then the population of Sheffield 'registration city' is

39 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.

40 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.

41 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 1 **Population of Sheffield compared with Ecclesall Bierlow and Sheffield Registration Districts (RDs), 1841-1911**

Date	Sheffield city	Ecclesall Bierlow RD	Sheffield RD	Column (3) + column (4)	Column (5) – column (2)	Percentage difference
(1)	(2)	(3)	(4)	(5)	(6)	(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 (column (6)/column (2))*100. A boundary change on 31 October 1901 incorporated parts of Wortley and Rotherham RDs into the city of Sheffield, together with some parts of sub-districts in Sheffield and Ecclesall Bierlow 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.

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 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 possible to produce a 'registration city' that is a much closer, but not a perfect, match to the city itself.[42]

Figure 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.

42 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.

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.[43] 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 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'.[44] 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.

Patterns of infant mortality in the Victorian and Edwardian periods

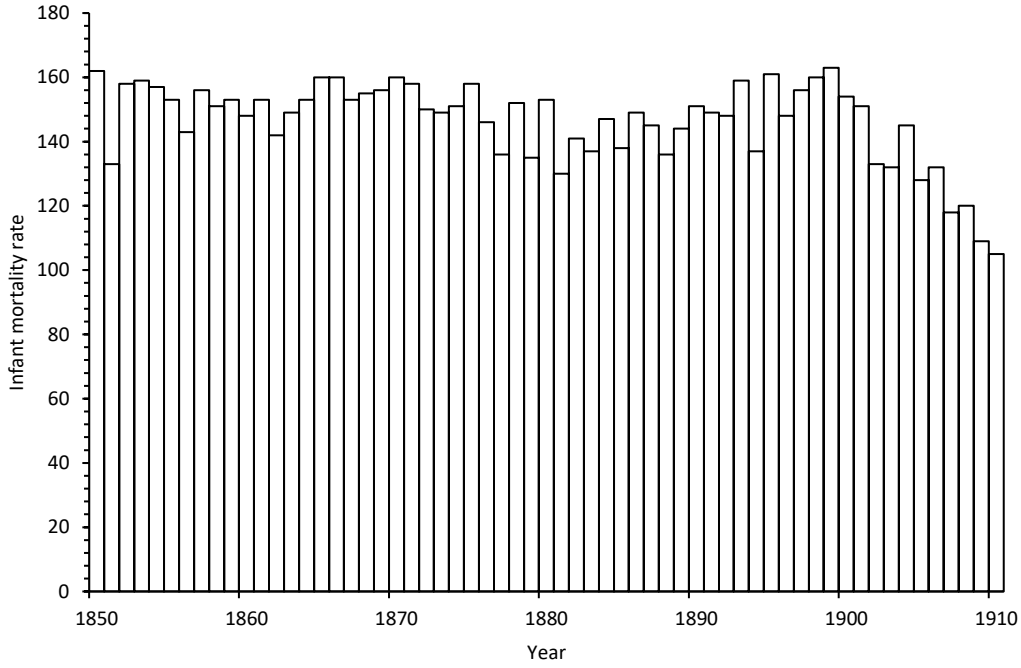
It is appropriate to begin with the national trend before examining finer scale variations. Figure 2 shows national IMRs between 1850 and 1910 presented in a form that an Edwardian demographer would recognise.[45] It reveals a rate that fluctuated, but was generally stable until 1900, followed by the beginnings of secular decline. Indeed, it was only once the data had been presented in this way that such

43 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.

44 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, https://doi.org/10.1080/1081602X.2019.1598463, 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).

45 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 2 **Infant mortality rates, England and Wales, 1850-1910**



Source: Registrar General's *Annual Reports* for the years 1850-1910.

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.[46]

Figure 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

46 Registrar General, *Sixty-Ninth Annual Report*, p. xxxvii.

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.[47]

Figure 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 9 in part 2 of this study (dealing with the parish register period), with large parts of southern England, Wales and the very north of England recording the lowest rates (shaded blue).[48] 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.[49] Figures 3a-

47 Registrar General, *Supplement to the Sixty-Fifth Annual Report, Part 1*, pp. 97-731.

48 Galley, 'Infant mortality in England, 1538-2000: the parish register period', p. 161.

49 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 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 Sarah Rafferty's paper in this issue of *Local Population Studies*: 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, https://doi.org/10.35488/lps106.2021.57; G. Mooney, 'Did London pass the "sanitary test"? Seasonal infant mortality in London, 1870-1914', *Journal of Historical Geography*, 20 (1994), pp.

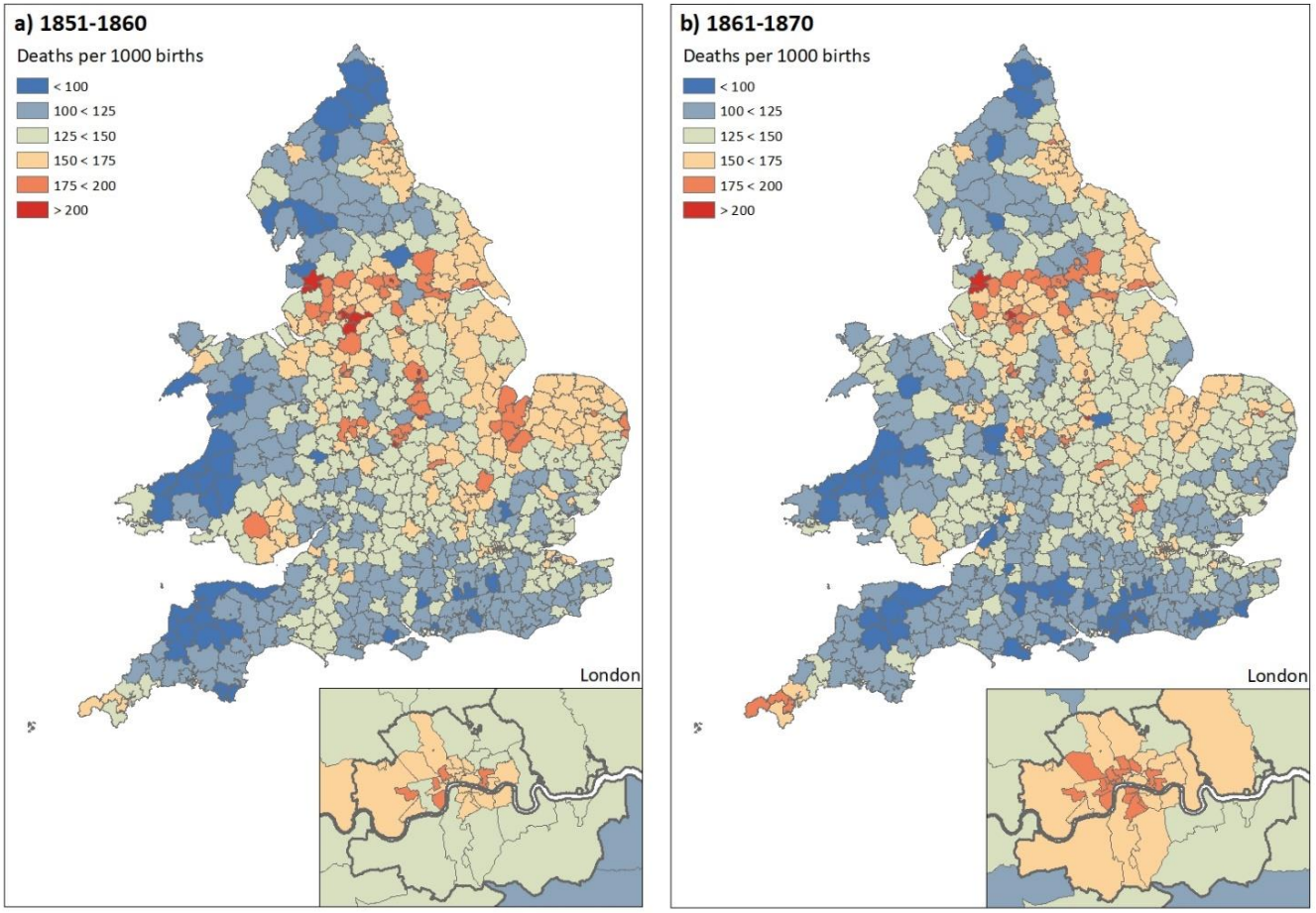
e therefore provide evidence of both continuity and change—the persistence of high infant mortality in urban and industrial environments together with a gradual improvement in many districts. The final map, Figure 3f, is dominated by blue and the intervals chosen to illustrate the level of variation 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.

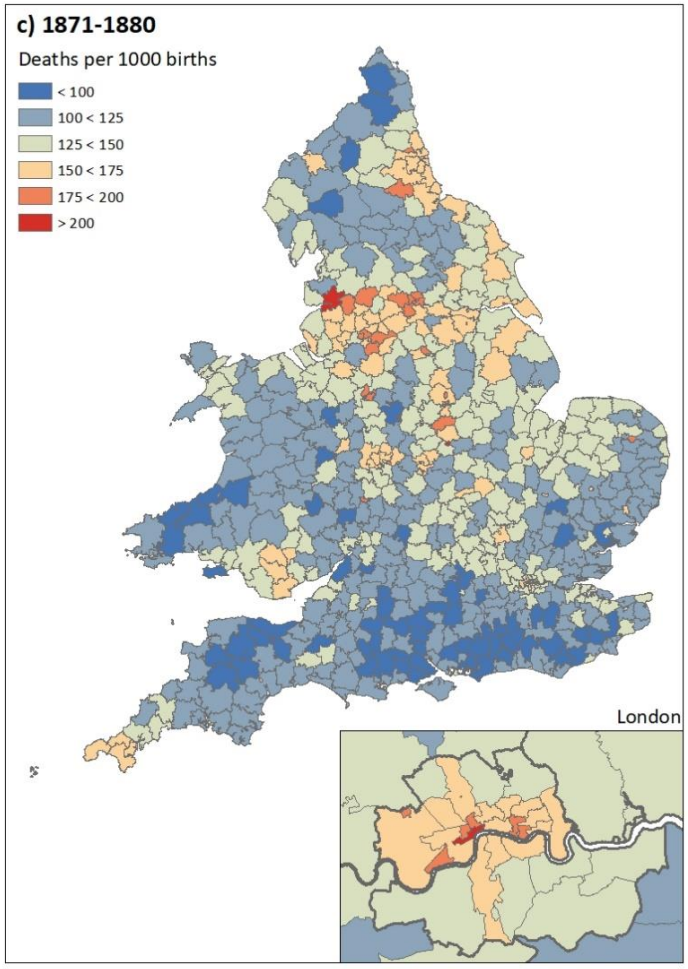
The patterns shown in Figure 3 become clearer if the numbers of RDs recording specific IMRs within each decade are examined (Table 2). While decadal rates smooth out annual variations, they enable longer-term trends to emerge. The range of rates shown in Table 2 is considerable at all times, although between 1851 and 1900 over two thirds of the 589 RDs recorded rates between 100 and 160. Table 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. This suggests that most RDs must have experienced decline between 1851 and 1890, even though Figure 2 showed that the national rate remained relatively stable. Table 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.

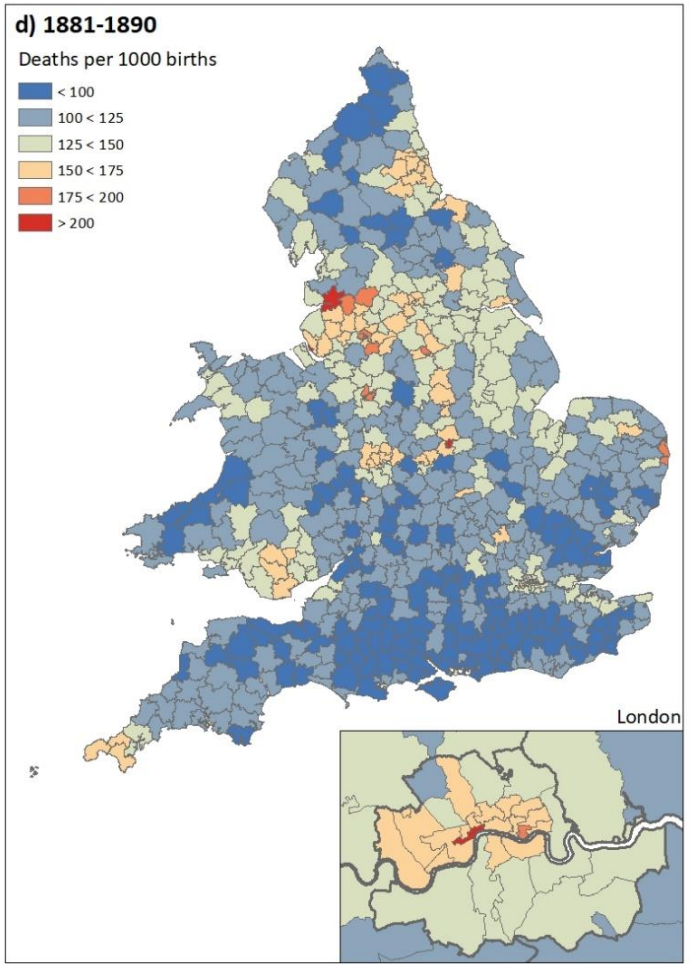
Table 4 examines what happened in the relatively few RDs suffering the highest IMRs. It shows every RD that recorded an IMR greater than or equal to 180 for each decade between 1851 and 1910. Most are large northern towns or districts adjacent to them, although Norwich and Yarmouth are prominent on the 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,

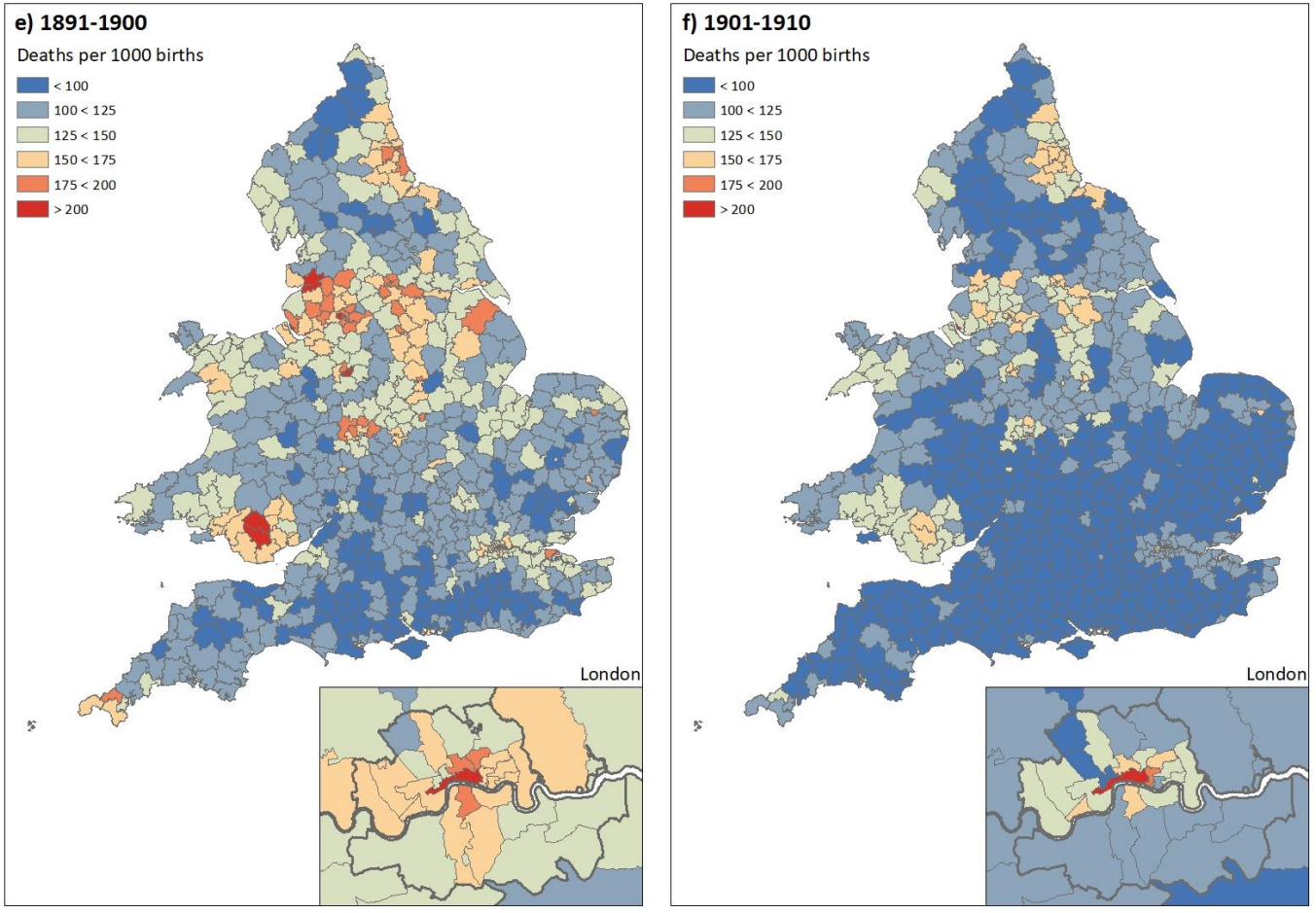
158-74, https://doi.org/10.1006/jhge.1994.1013; and T.A. Welton, 'The effects of migration in disturbing local rates of mortality as exemplified in the statistics of London and the surrounding country for the years 1851-60', *Journal of the Institute of Actuaries*, 16 (1872), pp. 153-86.

Figure 3 **Decadal infant mortality rate 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.

Table 2 **Number of registration districts recording specific infant mortality rates (IMRs) 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].

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 changes which makes comparison over time difficult.[50] 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.[51] In spite

50 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, https://doi.org/10.1080/0032472031000148746.

51 J. Robertson, *Annual Report of the Medical Officer of Health for Sheffield, 1900* (Sheffield, 1901), pp. 20-1.

Table 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].

of such issues, Table 4 shows that, even in the worst environments, some decline is evident before the 1890s and that after 1900 decline had occurred everywhere.

Table 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 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 2-4 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

Table 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					

Table 4 ***Continued***

Registration district	1851-1860	1861-1870	1871-1880	1881-1890	1891-1900	1901-1910
Loughborough	180					
Dewsbury		196	181			
Hunslet		194	185			
Luton		184				
Burnley		181	183	184	186	
Barnsley		181				
York		181				
Birmingham		180			200	
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].

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 2-5 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 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 5 **Infant mortality rates (IMRs) for selected groups of registration districts (RDs), 1851-1910**

Place	1851 -1860	1861 -1870	1871 -1880	1881 -1890	1891 -1900	1901 -1910	Percentage decline 1850s to 1880s	Percentage decline 1850s to 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].

Table 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.

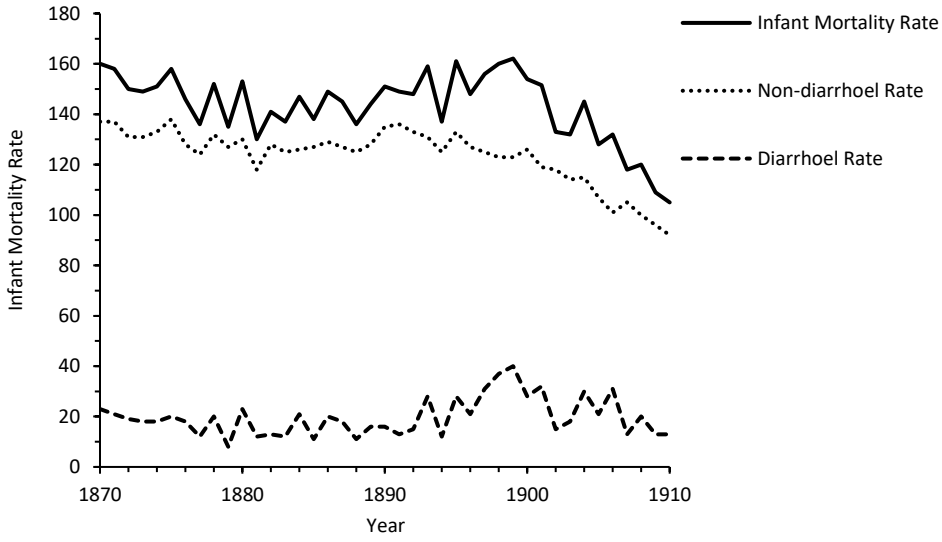
Sources: R. Woods, *Causes of Death in England and Wales, 1851-60 to 1891-1900: the Decennial Supplements* [computer files] Colchester, England, United Kingdom Data Archive [distributor], 1997. SN 3552, https://doi.org/10.5255/UKDA-SN-3552-1. Full details can be found on the PopulationsPast website, www.populationspast.org [accessed January 2021].

Table 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 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 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.[52] Given the rural-urban gradient in IMRs, increasing levels

52 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

of urbanisation counterbalanced the generally improving IMRs, even in the towns, and consequently the overall national rate remained relatively stable.

Figure 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.

The second question can be answered by reference to the complex group of gastro-intestinal diseases that caused infantile diarrhoea.[53] Figure 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

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, https://doi.org/10.1017/S0022050700034549; 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.

53 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, https://doi.org/10.1080/0032472031000143516. 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.

increase in diarrhoea deaths.[54] 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. 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.[55]

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.[56] 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 (16.8C)), 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.[57] The average temperature in 1896 was the same as in 1897, but rainfall was higher (8.7 inches) and diarrhoeal mortality a third lower at 21.[58] 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.[59] Table 7 shows the ten years with the highest diarrhoeal mortality, highest mean temperature in the third quarter of the year, and lowest

54 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.

55 Woods, *et al.*, 'Causes of rapid infant mortality decline, part 1', p. 360.

56 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.

57 Registrar General, *Seventy-Fourth Annual Report of the Registrar General* (London, 1913), Table XXII, p. xxxiv, BPP 1912-1913 XII.

58 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.

59 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.

Table 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.

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.[60] 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.[61] The exact interplay between these three

60 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. A discussion of infant mortality in 1911 will be included in paper 4 of this series of papers.

61 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

variables has yet to be determined. Moreover, the temperatures and rainfall reported by the Registrar General 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 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.[62]

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.[63] 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.[64] The rise in infantile diarrhoea deaths in the 1890s is not only important in distorting the pattern of infant

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.

62 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.

63 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.

64 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.

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

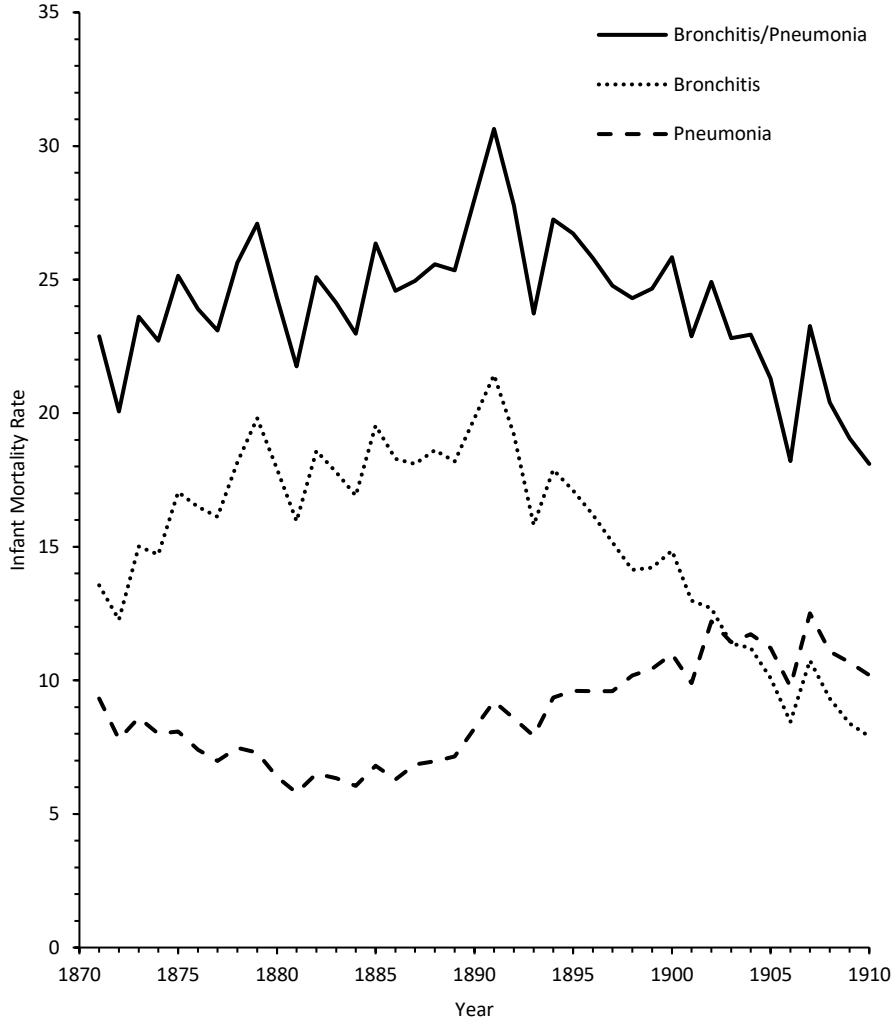
The third question mentioned above relates to the underlying causes of decline that have been identified throughout Tables 2-5. We have already seen how diarrhoea distorted the overall pattern of change and it might be thought that an analysis of other causes of death may provide an answer to this question. The Registrar General's annual reports 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.[65] We start by examining bronchitis and pneumonia (Figure 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 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 under the general heading of Diseases of the Respiratory Organs, but from 1901 it was listed together with other infectious diseases.[66] 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 5 confirms that there was some

65 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.

66 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.

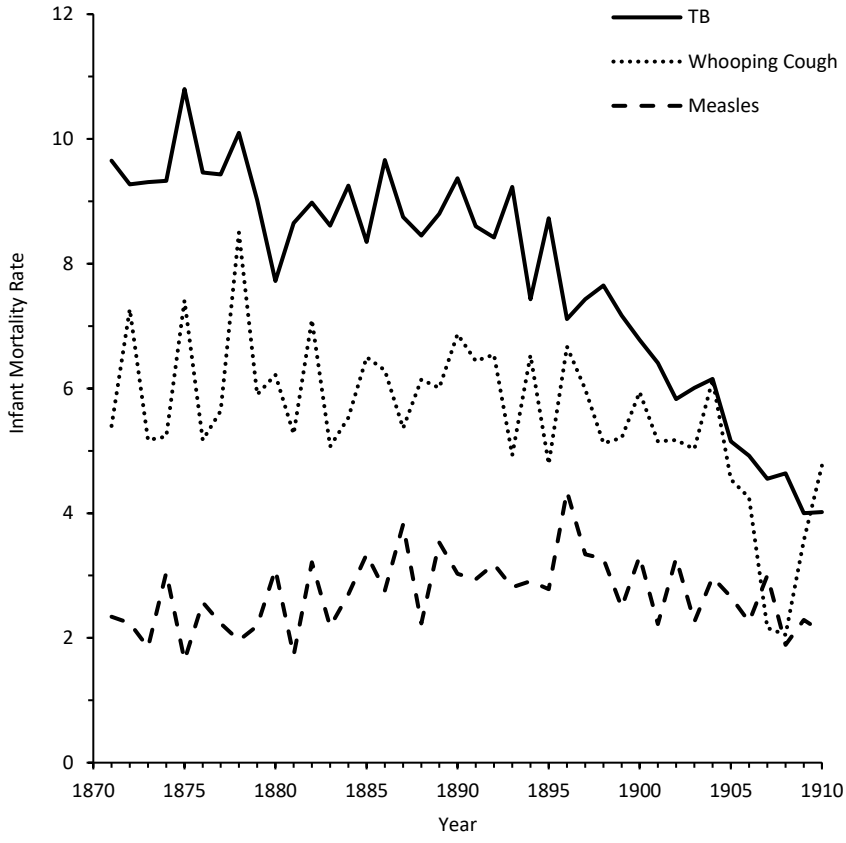
decline in this group of diseases from 1890. More intriguingly, Figure 5 also hints that there was a steady increase from 1870 which would be consistent with an increasing proportion of infants being born in urban areas and a greater likelihood of them being exposed to respiratory infections, although exactly what caused the change after 1890 is difficult to determine.

Figure 5 **Bronchitis and pneumonia infant mortality rates, England and Wales, 1871-1910**



Source: Registrar General's *Annual Reports* for the years 1870-1910.

Figure 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.

When it comes to an examination of other diseases the situation becomes more complicated. Figure 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.[67] 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.[68] However, such 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.[69] 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.[70] The 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.

67 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).

68 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 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.

69 Registrar General, *Thirty-Fourth Annual Report*, pp. 146-7; Registrar General, *Seventy-Third Annual Report,* p. 290.

70 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, https://doi.org/10.1111/ehr.12964; and Woods and Shelton, *Atlas of Victorian Mortality*, pp. 83-92.

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 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.[71] 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.[72] 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.[73] 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.[74] 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:

71 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.

72 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.

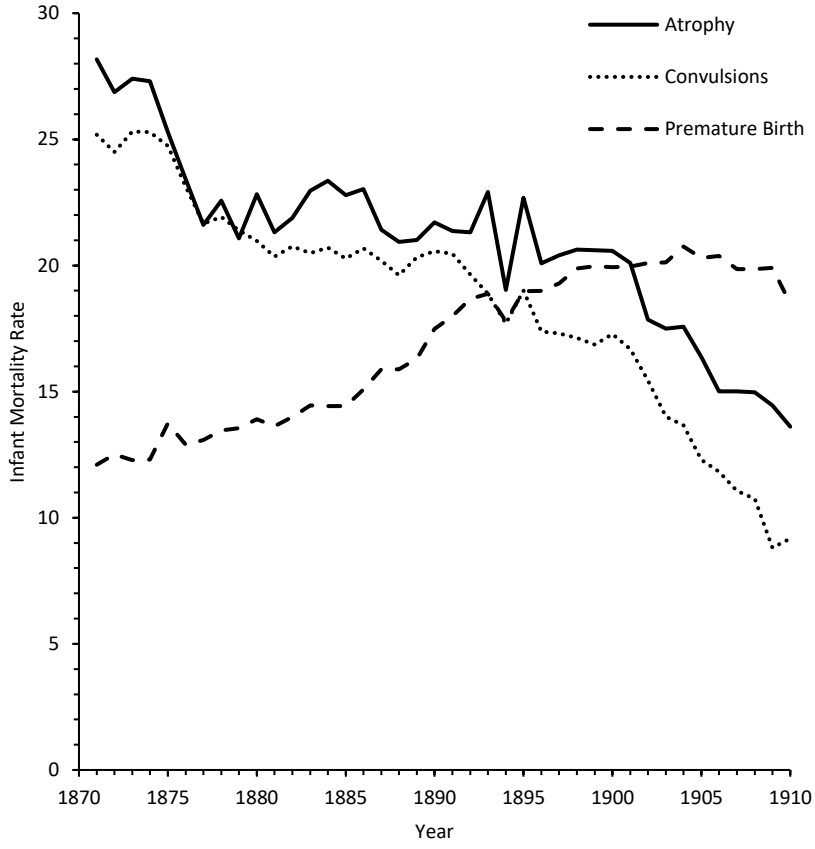
73 In 1910, Arthur Newsholme noted that 'probably a considerable amount of transference between (deaths within) these three headings has occurred', A. Newsholme, *Supplement to the Thirty-Ninth Annual Report of the Local Government Board 1909-10 Containing a Report by the Medical Officer on Infant and Child Mortality* (London, 1910), pp. 27-30, quotation on p. 27.

74 Registrar General, *Thirty-Fourth Annual Report*, pp. 146-7; Registrar General, *Seventy-Third Annual Report*, pp. 298-9.

> 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.[75]

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.

Figure 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.

75 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.

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'.[76] These statements are 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.[77] 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.[78] 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*.[79]

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,

76 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, https://doi.org/10.1093/shm/7.3.472. 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.

77 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, https://doi.org/10.1111/j.0954-6820.1974.tb00996.x; 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, https://doi.org/10.1093/oxfordjournals.pubmed.a024463; 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, https://doi.org/10.1097/01.paf.0000097857.50734.c3.

78 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, https://doi.org/10.1080/01615440.1996.10112730.

79 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.

diarrhoea or both could have appeared on the certificate and this death could have appeared under either cause in the published returns.[80] 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 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.[81]

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*.[82] He noted that some facts are well established:

80 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'.

81 Hinde and Harris, 'Mortality decline', pp. 377-403.

82 Woods, *Demography of Victorian England and Wales*, pp. 247-309.

> 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.[83]

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.[84] 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.[85]

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 enumerators books.[86] 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 thousand births, Class II (intermediate, excluding scholars) 106.4, Class III (skilled workmen) 112.7, Class IV (intermediate)

83 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.

84 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.

85 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, https://doi.org/10.1080/0032472031000147506.

86 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, https://doi.org/10.1093/shm/5.1.71.

121.5 and Class V (unskilled workmen) 152.5.[87] 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.[88] 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.[89] 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.[90] 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'.[91] 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.[92] While their analysis is only of 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.

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

87 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.

88 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, https://doi.org/10.2307/590433, for a discussion of how these classes were constructed.

89 Registrar General, *1911 Census of England and Wales, Vol. XIII Fertility of Marriage, Part I* (London, 1917), p. iv, BPP 1917-1918 XXXV.

90 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.

91 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, https://doi.org/10.1080/0032472031000148526.

92 Garrett *et al.*, *Changing Family Size in England and Wales*, p. 198.

that in early childhood (ages 1-4 years), began to decline from the 1860s (Figure 8). While Tables 2-5 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 (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.[93] 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'.[94] 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.[95] According to Hardy, it was 'one of the first diseases to have an active preventive policy directed against it'.[96] 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.[97] Instead, infection rates hardly changed, but case fatality rates decreased considerably and the most plausible

93 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.

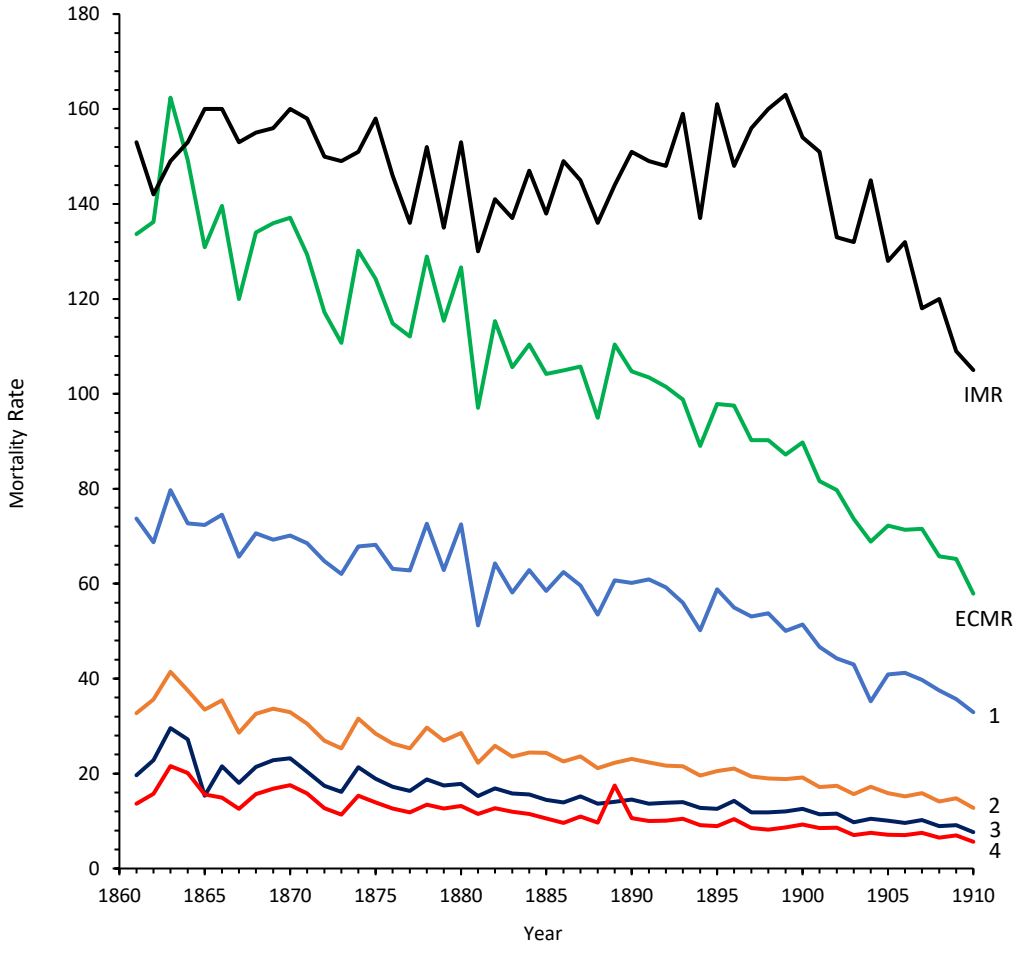
94 Woods and Shelton, *Atlas of Victorian Mortality*, p. 65.

95 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.

96 Hardy, *Epidemic Streets*, p. 56.

97 Hardy, *Epidemic Streets*, p. 79.

Figure 8 **Infant mortality rate (IMR) and early childhood mortality rate (ECMR), 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 (IMR). 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*.

explanation for this is that scarlet fever appears to have undergone a significant decline in its virulence.[98]

Smallpox was all but eradicated by 1900 as vaccination became increasingly more effective.[99] There were also declines in tuberculosis and respiratory deaths and, in contrast to infants, there was also a decrease in deaths caused by diarrhoea and dysentery amongst children aged 1-4 years.[100] 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.[101] By contrast, mortality from some diseases, notably measles and whooping cough, hardly changed between 1861 and 1900 and deaths from diphtheria more than doubled.[102] As we have already noted, interpreting nineteenth-entury 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

98 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, https://doi.org/10.1016/S1473-3099(17)30693-X.

99 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.

100 Woods and Shelton, *Atlas of Victorian Mortality*, pp. 72-90. Woods, *Demography of Victorian England and Wales*, p. 340.

101 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.

102 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.

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.[103] Likewise, better housing conditions, at least for some, 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.[104] 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 early childhood mortality remains 'one of the most important, complicated, interesting and yet neglected aspects of the epidemiology of Victorian England'.[105]

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.[106] 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).[107] 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

103 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'.

104 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.

105 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.

106 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.

107 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.

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'.[108] 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 and health service attention on those mothers and children most at risk in areas with the highest childhood mortality rates.[109]

Thus Woods 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 registration district (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

108 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).

109 Woods, *Demography of Victorian England and Wales*, pp. 305-6.

have undertaken in-depth local studies.[110] 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.[111] Paul Atkinson and his colleagues extended this work and also sought to provide explanations for the patterns they observed.[112] 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,[113] 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.[114] 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 with socio-economic variables.[115] 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

110 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.

111 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, https://doi.org/10.1080/00045600802224406. 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'.

112 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, https://doi.org/10.1111/ehr.12488; 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, https://doi.org/10.4054/DemRes.2017.36.44. 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, https://doi.org/10.1080/01615440.2014.995390, examines newspaper evidence to explain differential patterns of infant mortality in three Suffolk RDs.

113 R. Millward and F. Bell, 'Infant mortality in Victorian Britain: the mother as medium', *Economic History Review*, 54 (2001), pp. 699-733, https://doi.org/10.1111/1468-0289.00209.

114 Atkinson *et al.*, 'Patterns of infant mortality', p. 1,288.

115 Some of these are discussed in Gregory, 'Different places, different stories', pp. 775-6.

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.[116]

Table 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.[117] 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.[118] 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.[119] Thus, there remains the possibility that some of the patterns shown in Table 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 registration sub-district (RSD) that would be classified as urban by Atkinson and his colleagues (Table 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

116 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, https://doi.org/10.1179/fch.2003.6.2.006.

117 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.

118 Likewise, Exeter recorded steady decline throughout the period while the three 'Plymouth' districts recorded increases during the 1890s.

119 Registrar General, *Supplement to the Forty-Fifth Annual Report*, pp. 185-95.

Table 8 **Infant mortality rates in Devon registration districts, 1871-1910, ordered by the rates 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 km^2 in 1891. Districts are classified as urban if their population density was greater than 183 persons per km^2. '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).

Table 9 **Infant mortality rates (IMRs), Devon registration districts with 'urban' sub-districts, 1871-1901**

Registration district (RD) and sub-district	1891		Infant mortality rate				Difference
	Popul-ation density	Popul-ation	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	**257**	**8,545**	**138**	**124**	**108**	**113**	**25**
Dartmouth	**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

Table 9 ***Continued***

Registration district and sub-district	1891		Infant mortality rate				Difference
	Popul-ation density	Popul-ation	1871	1881	1891	1901	1871-1901
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	-

Notes: 'Urban' sub-districts are in boldface. Population density is given in persons per km^2. 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. Gaps in the data are the result of boundary changes.

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]. Colchester, England, United Kingdom Data Archive [distributor], 2020. SN 8613, https://doi.org/10.5255/UKDA-SN-8613-1.

had higher IMRs than the purely rural sub-districts, they were nevertheless low when compared with cities and industrialising towns.[120] 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.[121] The IMR in Barnstaple RSD is much higher than the other rural sub-districts and consequently

120 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 8 and 9 are not strictly comparable since those in Table 8 are calculated from the decennial supplements, while those in Table 9 are calculated from the quarterly returns over a five-year period up to the relevant census.

121 The population of Ilfracombe town was 7,692 in 1891, Registrar General, *1891 Census of England and Wales Vol. 1*, p. 70.

it had an important influence on the overall 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 8, many contained urban elements even if these were not sufficient to alter the overall character of the district. Of course, Tables 8 and 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 9), and this means that when time series are constructed like is not always being compared with like. Nevertheless, the results from Tables 8 and 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.[122] 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.[123] 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.[124] 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 8 and 9, this suggests that their wages were not necessarily reflective of the vast majority of family incomes within this county.

122 Atkinson *et al.*, 'Patterns of infant mortality', p. 1,279.

123 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).

124 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.

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 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)'.[125] 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.[126] 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.[127] 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

125 Millward and Bell, 'Mother as medium', p. 714. Note that no reference is given for the 'some' who claim this relationship to be true.

126 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'.

127 A. Hinde, 'Sex differentials in phthisis mortality in England and Wales, 1861–1870', 20 (2015), pp. 1-27, https://doi.org/10.1080/1081602X.2015.1051077; 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, https://doi.org/10.51964/hlcs9331.

coal use explains roughly one-third of the urban mortality penalty for infants'.[128] 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 absent and, for their thesis to hold, they would need to confirm that their arguments are consistent with the patterns shown in Figure 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.[129] 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'.[130] 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.

128 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, https://doi.org/10.1111/ecoj.12522.

129 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.

130 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, https://doi.org/10.1017/S0268416002004083. 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.

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.[131] Of course, each of these is an important influence on infant welfare, but by themselves they cannot fully explain the patterns observed above. For example, the employment of mothers outside of their home 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'.[132] 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

131 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, https://doi.org/10.1353/jsh/12.2.248; 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, https://doi.org/10.1080/00324728.1973.10405708; 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. 443–460, https://doi.org/10.1093/shm/hkl041; 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.

132 Garrett *et al.*, *Changing Family Size in England and Wales*, p. 130.

> babies. In fact it may be more true to say that, as today, babies were bad for women's work.[133]

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.[134] 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.[135]

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 medical officer of health reports to build up a picture of infant mortality in the Canbury area of Kingston-upon-Thames.[136] 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

133 Garrett *et al.*, *Changing Family Size in England and Wales*, p. 132. See pp. 128-33 for a wider discussion.

134 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, https://doi.org/10.1017/S0268416000002290. 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.

135 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).

136 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, https://doi.org/10.1017/S0268416007006297, 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, https://doi.org/10.1179/fch.2004.7.2.006.

child-care practices' made worse in the hot dry summers of the late 1890s.[137] Such conclusions confirm that the urban penalty was experienced even in relatively small towns.[138] 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.[139] 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

137 French and Warren, 'Infant mortality in the Canbury area', p. 272.

138 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.

139 T. James, 'Neonatal mortality in Northamptonshire: Higham Ferrers 1880-1890', *Family and Community History*, 6 (2003), pp. 129-39, https://doi.org/10.1179/fch.2003.6.2.007; 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, https://doi.org/10.1179/fch.2003.6.2.005; A. Clark, 'Family migration and infant mortality in rural Kent, 1876-1888', *Family and Community History*, 6 (2003), pp. 141-50, https://doi.org/10.1179/fch.2003.6.2.008 ; Davies, 'Faith Street'.

occurred in the town of Sheffield.[140] 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 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.[141] 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'.[142] 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.[143] 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'.[144] 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'.[145] 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.

140 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.

141 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.

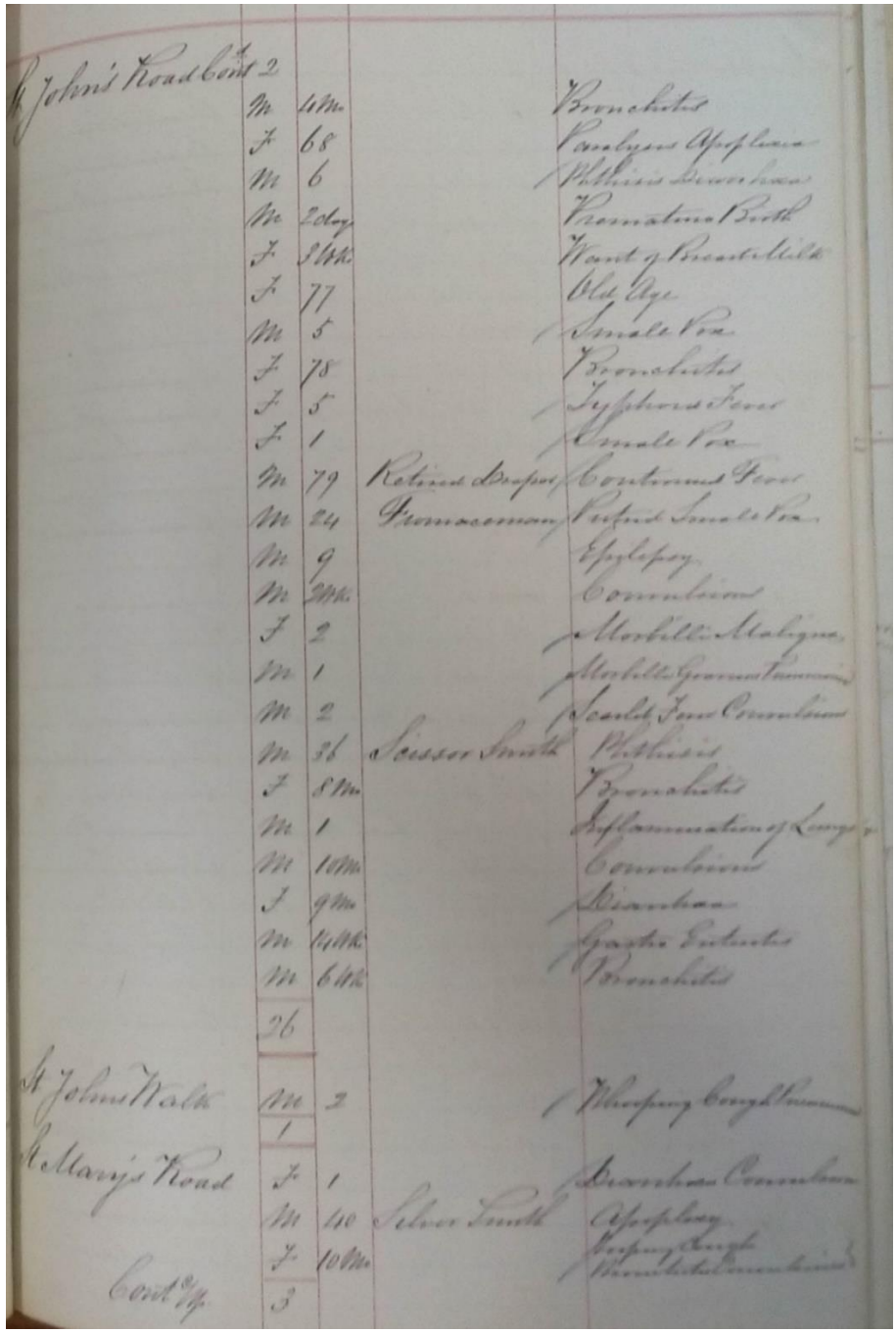
142 Williams, 'Reporting and classification of causes of death', p. 62.

143 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.

144 Sanders, *Sanitary State*, p. 4.

145 Sanders, *Sanitary State*, p. 3.

Figure 9 Extract from the Sheffield death register, 1871



Note: Last entry reads 'F(emale) 10 Mo(nths) Hooping Cough Bronchitis Convulsions'.

Source: Sheffield Archives: MD7191/12, p. 266.

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 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 there were 17.9 per cent in 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 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.[146] 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.[147] 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

146 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.

147 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.

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 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.[148] 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'.[149] As far as understanding how this single death fits into the wider causes of infant mortality during the nineteenth century, reference to Figure 4 in the first of these series of papers is useful.[150] 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 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.[151] In this instance we must therefore consider the primary cause of death to be whooping cough.

For this small-scale study three sample 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 10 shows the distribution of infant deaths in Sheffield for the three years 1861, 1866 and 1871.[152] 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

148 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].

149 Williams, 'Reporting and classification of causes of death', p. 65.

150 Galley, 'Infant mortality in England, 1538-2000: trends, methods and sources', p. 50.

151 Vaccination against whooping cough became available from the 1950s.

152 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.

Table 10 **Distribution of infant deaths, 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.

for this period and suggest that the age structure of infant mortality during the Victorian and Edwardian periods was relatively stable.[153] 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.[154] In the three sample years 'convulsions' was included in 60 per cent of all infant deaths given multiple causes. Thus, the national decline in convulsions deaths seen in Figure 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.[155] 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

153 Galley, 'Infant mortality in England, 1538-2000: the parish register period', Table 3, p. 50. See 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.

154 These examples are from Sheffield Archives MD 7191/2, pp. 51, 57.

155 The GRO could also have encouraged doctors not to use 'convulsions' or instructed their clerks to classify causes of death in a different way.

and these both came from the workhouse in 1871.[156] 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 11.[157] 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) the 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 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 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

156 Sheffield Archives MD 7191/12, pp. 187-8. These were classified under debility.

157 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 11 **Distribution of infant deaths, Sheffield death registers, 1861, 1866 and 1871 combined**

Cause of death	Age at death (cumulative percentages in brackets)						
	0 days	0 weeks	0 months	1-2 months	3-5 months	6-11 months	Under 1 year
Premature birth	178 (45.6)	287 (73.6)	366 (93.8)	18 (98.5)	2 (99.0)	4 (100.0)	390
Atrophy	48 (6.7)	101 (20.4)	270 (37.9)	217 (68.7)	116 (84.7)	109 (100.0)	712
Convulsions	73 (8.1)	208 (23.1)	403 (44.8)	189 (65.9)	124 (79.6)	183 (100.0)	899
Diarrhoea	0 (0.0)	1 (0.0)	91 (12.1)	227 (42.4)	203 (69.5)	229 (100.0)	750
Respiratory diseases	1 (0.1)	2 (0.3)	55 (5.8)	205 (25.9)	244 (50.3)	498 (100.0)	1,002
Smallpox	0 (0.0.)	0 (0.0)	10 (10.9)	23 (35.9)	21 (58.7)	38 (100.0)	92
Whooping cough	1 (0.3)	1 (0.3)	5 (2.0)	42 (16.0)	64 (37.9)	182 (100.0)	293
Measles	0 (0.0)	0 (0.0)	1 (1.8)	2 (5.3)	4 (12.3)	50 (100.0)	57
Scarlet Fever	1 (2.0)	1 (2.0)	1 (2.0)	6 (13.7)	9 (31.4)	35 (100.0)	51
Diphtheria	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (12.5)	7 (100.0)	8
Tuberculosis	0 (0.0)	1 (0.5)	13 (6.6)	43 (28.3)	59 (58.1)	83 (100.0)	198
Syphilis	0 (0.0)	0 (0.0)	2 (4.8)	19 (50.0)	15 (85.7)	6 (100.0)	42
Hydrocephalus	0 (0.0)	0 (0.0)	3 (3.8)	3 (7.7)	24 (38.5)	48 (100.0)	78
Violence	3 (13.0)	3 (13.0)	9 (39.1)	6 (65.2)	4 (82.6)	4 (100.0)	23
Other	39 (6.4)	72 (11.8)	173 (28.4)	100 (44.8)	107 (62.3)	230 (100.0)	610
Total	344 (6.6)	677 (13.0)	1,402 (26.9)	1,100 (48.1)	997 (67.2)	1,706 (100.0)	5,205

Table 11 ***Continued***

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 diseases—'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 mouth 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.

mainly affected post-neonatal infants, is also shown to be an important cause of death.[158] 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.[159] Table 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 8 and 9 have demonstrated the problems associated with analysing nineteenth-century cause of death data, especially for infants. Similar

158 It is very rare for tuberculosis to be passed on to a foetus in utero.

159 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.

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.[160]

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.[161] 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 situation continued even after the appointment of a medical officer of health following the implementation of the 1872 Public Act.162 It is to this issue that we now turn.

Medical Officer of Health reports

The origins of the medical officers of health (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

160 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, https://doi.org/10.1080/00324728.1972.10405908 and the discussion in Woods, *Demography of Victorian England and Wales*, pp. 312-59.

161 This should be possible for Scotland as a consequence of the Digitising Scotland project, see https://digitisingscotland.ac.uk/ [accessed 1 January 2021].

162 Galley, 'Social intervention and the decline of infant mortality'.

and maintain such diseases'.[163] 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.[164] 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*'.[165]

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.[166] 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 their work too assiduously.[167] 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

163 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.

164 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.

165 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.

166 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, https://doi.org/10.2105/AJPH.85.6.856.

167 Chave, *Recalling the Medical Officers of Health*, p. 104.

the sanitary sciences, who had to rely for much of their income on private practice.[168] 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.[169] 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.[170]

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

168 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, https://doi.org/10.2307/2340454, who said that many MOHs were 'men of narrow outlook'.

169 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, https://doi.org/10.1017/S0025727300067417. Scottish medical officers of health reports for 1891 can be found at https://scotlandsplaces.gov.uk/search/results?st=medical%20officer [accessed January 2021].

170 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.

about infant mortality.[171] 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 with other towns together with a wide-ranging discussion of infant feeding practices.[172] 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.[173] 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.[174] 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'.[175] 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.[176] Daily diarrhoea deaths for all ages combined were also given from July to October

171 https://archive.org/details/medicalofficerofhealthreports?&and[]=year%3A%221895%22 [accessed January 2021]. The MOH was M.R.J. Behrendt.

172 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).

173 Note that the IMRs for Liverpool given in Table 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.

174 Hope was appointed assistant MOH in 1883 aged 26 years. He became full time MOH in 1894 and retired in 1924.

175 W.S. Trench, *Report on the Health of Liverpool during the Year 1867* (Liverpool, 1868), p. 5.

176 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.

alongside comprehensive weather information.[177] 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 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).[178]

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',[179] 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.[180]

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

177 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.

178 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.

179 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.

180 J.S. Taylor, *Report on the Health of Liverpool during the Year 1885* (Liverpool, 1886), p. 6.

'infantile' mortality in all his reports.[181] 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.[182] 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.[183] 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, together with some comparison with other large towns.[184] 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.[185]

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:

181 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.

182 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.

183 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.

184 E.W. Hope, *Report on the Health of Liverpool during the Year 1894* (Liverpool, 1895), pp. 10-14 and after p. 111.

185 E.W. Hope, *Report on the Health of Liverpool during the Year 1895* (Liverpool, 1896), p. 20. This section is only two pages long.

> 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.[186]

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'.[187] 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 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.[188]

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

186 Hope, *Report on the Health of Liverpool during the Year 1895*, p. 20.

187 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.

188 E.W. Hope, *Report on the Health of Liverpool during the Year 1897* (Liverpool, 1898), p. 40.

> 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".[189]

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'.[190]

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*.[191] 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]'.[192] 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.[193] 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'.[194] 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 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

189 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).

190 Hope, *Report on the Health of Liverpool during the Year 1897*, p. 107.

191 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.

192 Hope, 'Observations on Autumnal diarrhoea', p. 661.

193 Hope, 'Observations on Autumnal diarrhoea', p. 661.

194 Hope, 'Observations on Autumnal diarrhoea', p. 661.

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.[195] 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'.[196] 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.[197]

195 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'.

196 E.W. Hope, *Report on the Health of Liverpool during the Year 1899* (Liverpool, 1900), p. 144.

197 E.W. Hope, *Report on the Health of Liverpool during the Year 1900* (Liverpool, 1901), p. 12.

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, 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.[198]

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'.[199] 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'.[200] 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.[201] 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

198 Hope, *Report on the Health of Liverpool during the Year 1900*, p. 13.

199 Hope, *Report on the Health of Liverpool during the Year 1900*, pp. 13-4.

200 Hope, *Report on the Health of Liverpool during the Year 1900*, pp. 14.

201 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.

to 1901, but there is no follow up discussion.[202] 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'.[203] 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.[204] The 1902 and 1903 reports are almost identical to the 1901 report with the section on infant mortality being repeated word for word.[205] 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.[206] 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.[207] 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'.[208] Later Hope describes how the work

202 E.W. Hope, *Report on the Health of Liverpool During the Year 1901* (Liverpool, 1902), pp. 19, 25-9.

203 Hope, *Report on the Health of Liverpool during the Year 1900*, p. 149.

204 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 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.

205 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.

206 E.W. Hope, *Report on the Health of Liverpool during the Year 1904* (Liverpool, 1905), p. 21.

207 Hope, *Report on the Health of Liverpool during the Year 1904*, p. 161 and pp. 158-64 for a fuller discussion.

208 E.W. Hope, *Report on the Health of Liverpool during the Year 1905* (Liverpool, 1906), p. 42. The graph is placed immediately afterwards.

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'.[209] 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.[210]

Hope also said that the inspectors were 'welcomed by the parents, and in almost every case the advice given is carefully followed'.[211]

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 profession, and has made itself very apparent amongst all classes of the public'.[212] 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:

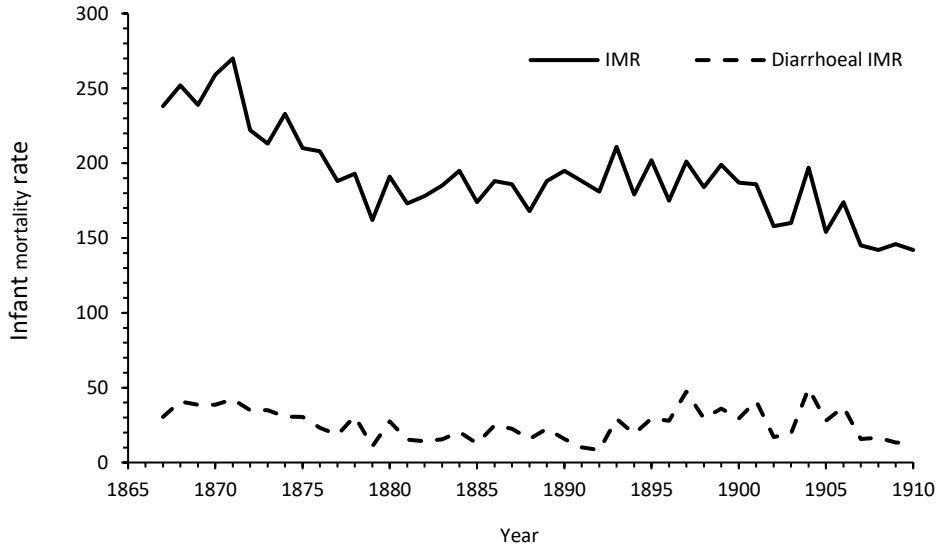
> The removal of insanitary slums, and the erection of proper dwellings in their place.
> The improvements in scavenging and cleansing, and the removal of all refuse likely to harbour flies.
> The substitution of small sanitary ashbins for large and foul ashpits.
> The provision of an unrestricted water 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.

209 Hope, *Report on the Health of Liverpool During the Year 1905*, p. 88.
210 Hope, *Report on the Health of Liverpool During the Year 1905*, p. 88. In Sheffield (see Table 10) about a third of all infant deaths took place within the first six weeks.
211 Hope, *Report on the Health of Liverpool During the Year 1905*, p. 88.
212 E.W. Hope, *Report on the Health of Liverpool During the Year 1906* (Liverpool, 1907), p. 18.

> 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.[213]

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.[214] 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.

Figure 10 **Infant and diarrhoeal mortality rates, Liverpool, 1867-1910**



Source: Liverpool Medical Officer of Health reports (various years).

213 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.

214 E.W. Hope, *Report on the Health of Liverpool During the Year 1907* (Liverpool, 1908), pp. 22-4.

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 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 was the measure that was the focus of much of Hope's efforts (Figure 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.[215] 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 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 and whatever advice had been disseminated by the health visitors clearly proved insufficient to combat the effects of a hot, dry summer.[216] 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

215 The IMR reported in Figure 10 is for the city as a whole, not just the RD which was reported in Table 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.

216 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.

investigation: notably the spatial variations that emerged throughout the city during the nineteenth century and the effectiveness of the various intervention strategies.[217] Both of these issues will be explored by examining how they were addressed by MOHs in other places.

(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. [218] 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.[219] 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.[220] 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.[221] 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 become more general of late, it would, perhaps

217 The unexplained decline before 1880 is also worthy of further investigation.

218 T. Hillier, *First Annual Report of the Medical Officer of Health for St Pancras, Middlesex during 1856* (London, n.d.), p. 3.

219 T. Hillier, *Third Annual Report of the Medical Officer of Health for St Pancras, Middlesex during 1858* (London, n.d.), pp. 12-3.

220 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.

221 T. Hillier, *Ninth Annual Report of the Medical Officer of Health for St Pancras, Middlesex during 1864* (London, n.d.), p. 4.

> be safer to take the deaths among infants and compare them with the deaths of all ages.[222]

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.[223]

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'.[224] 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.[225] 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

222 T. Stevenson, *Twenty-First Annual Report of the Medical Officer of Health for St Pancras, Middlesex during 1876* (London, n.d.), p. 2.

223 Stevenson, *Twenty-First Annual Report*, p. 13.

224 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.

225 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.

rate remaining close to 150 for much of the period.[226] 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.[227] In 1898 a small amount of space was devoted to the prevention of diarrhoea, 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.[228] The next report only contains a table showing IMRs by sub-districts without any follow up discussion[229] and the 1900 report begins with a set of tables detailing the district's vital statistics from 1856-1900 which includes numbers dying from certain diseases, the total number of deaths at ages under one year and IMRs.[230] 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.[231] 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.[232] 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

226 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.

227 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.

228 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.

229 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.

230 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.

231 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.

232 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.

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.[233] 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.[234] 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.[235] 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 a comparison between rates in St Pancras, London and England and Wales as a whole.[236] 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.[237]

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.[238]

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

233 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.

234 Sykes, *Forty-Ninth Annual Report*, p. 112.

235 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.

236 Sykes, *Fiftieth Annual Report*, pp. 27-37.

237 Sykes, *Fiftieth Annual Report*, p. 37.

238 Sykes, *Fiftieth Annual Report*, p. 39.

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'.[239] 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.[240] 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.[241] 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.[242]

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 48 hours. [243] This resulted in notifications from 299

239 Sykes, *Fiftieth Annual Report*, p. 41.

240 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.

241 Sykes, *Fiftieth Annual Report*, p. 25. This was despite the law stating that births had to be registered within 42 days.

242 Sykes, *Fiftieth Annual Report*, p. 24.

243 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, https://doi.org/10.1093/sochis/6.1.25. 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

mainly working-class families which together with 1,034 midwife notifications meant that these families could be given early visits.[244] 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 (see Figure 10, which shows 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'.[245]

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'.[246] 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'.[247]

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 1909 and 88 per cent in 1910.[248] Visits were targeted at those deemed to

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).

244 Sykes, *Fifty-First Annual Report*, p. 25.

245 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'.

246 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.

247 Sykes, *Fifty-Second Annual Report*, p. 24.

248 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.

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.[249]

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 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 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 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 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

249 Sykes, *Fifty-Fifth Annual Report*, p. 29.

Table 12 Age distribution of infant deaths with infant mortality rates (per 1,000 live births), 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.

Table 13 Infant mortality rates by cause of death, St Pancras 1905 and 1910

Cause of death	Rate		Difference
	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
Tuberculosis	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	28.0

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.

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.[250] 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.

250 Sykes, *Fifty-First Annual Report*, pp. 37-8.

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 discussed above, 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.[251] 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 three of the children died from improper feeding and two from diarrhoea associated with teething'.[252] 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.[253] In 1906 a comprehensive breakdown of infant deaths by age and cause was given, but there was no follow-up discussion.[254] 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

251 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.

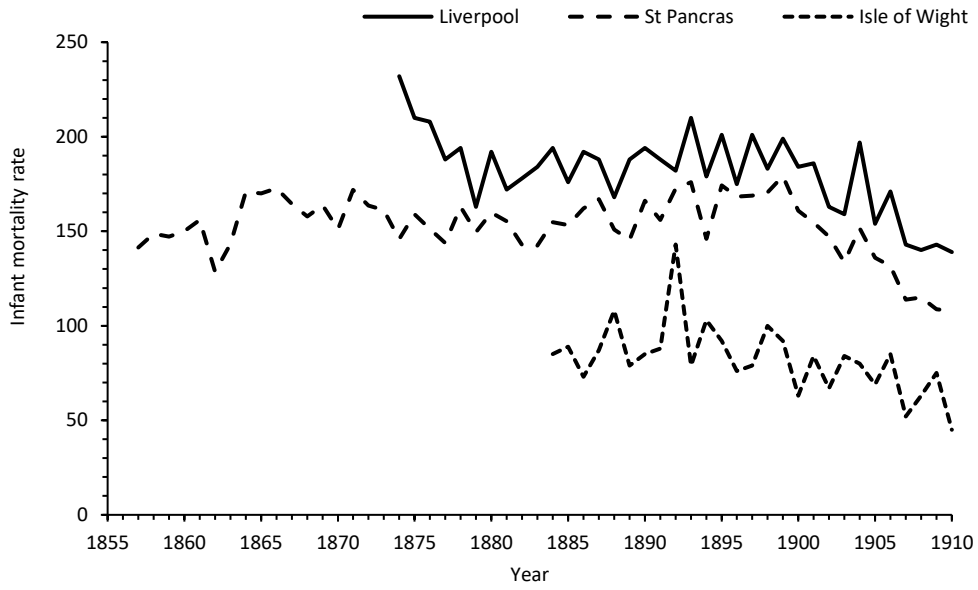
252 J. Groves, *Annual Report on the Health of the Rural Sanitary District of the Isle of Wight for the Year 1887* (Newport, n.d.), p. 12. Likewise, in 1888 J. Groves, *Annual Report on the Health of the Rural Sanitary District of the Isle of Wight for the Year 1888* (Newport, n.d.), p. 12 noted two 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'.

253 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.

254 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.

districts and small towns'.[255] Overall then, there is nothing in these rural reports to suggest that the MOH made any specific efforts to reduce IMRs.[256]

Figure 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).

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

255 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.

256 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.

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 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 2-5)—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 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.[257] 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, 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.[258] MOHs could make a difference, but before 1910 their ability to influence rates was limited.

257 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).

258 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

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.[259] 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' (Figure 12).[260] One significant detail was changed in the nineteenth century reconstruction. In the medieval boss Jesus is being breast-fed while in the Victorian 'copy' 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. Does Figure 12 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?[261] 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.[262] 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

similar to that in St Pancras a significant proportion of infants would not have received any benefits from health visiting.

259 J. Browne, *The History of the Edifice of the Metropolitan Church of St Peter York, Volume 1 Text, Volume 2 Plates* (London, 1847).

260 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.

261 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.

262 Williams and Galley, 'Urban-rural differences', Figure 4, p. 417.

Figure 12 **York Minster nativity roof boss, pre- and post-1840**

Sources: The picture of the pre-1840 boss is from J. Browne, *The History of the Edifice of the Metropolitan Church of St Peter York, Volume 2 Plates* (London, 1847), p. 216; the post-1840 boss is an original photograph.

Figure 13 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.

poor could be reduced. Figure 13, dating from the early twentieth century, starkly 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.[263] 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.[264]

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.[265]

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'.[266] 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:

263 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.

264 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, https://doi.org/10.1017/S0021932000006799; V. Fildes, 'Infant feeding practices and infant mortality in England, 1900-1919', *Continuity and Change*, 13 (1998), pp. 251-80, https://doi.org/10.1017/S0268416098003166.

265 Registrar General, *Thirty-Fourth Annual Report*, p. 226.

266 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 Galley, 'Infant mortality in England, 1538-2000: the parish register period', pp. 191-2 for a discussion of the administration of purges to the new-born.

> 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.[267]

Judith Flanders argues that many advice books promoted the convenience of bottle feeding and from the 1860s formula milk became increasingly available.[268] Flanders is wrong however 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'.[269] 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.[270]

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

267 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'.

268 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. https://doi.org/10.1136/adc.28.141.416.

269 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).

270 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.

Roberts.[271] 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.[272] 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 14).[273] 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 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 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'.[274]

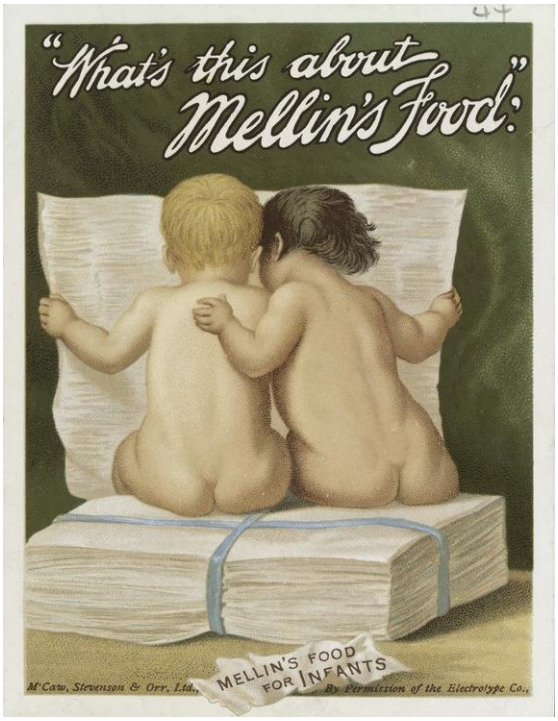
271 A.E. Roberts, 'Feeding and mortality in the early months of life; changes in medical opinion and popular feeding practice, 1850-1900' (unpublished Ph.D thesis, University of Hull, 1973).

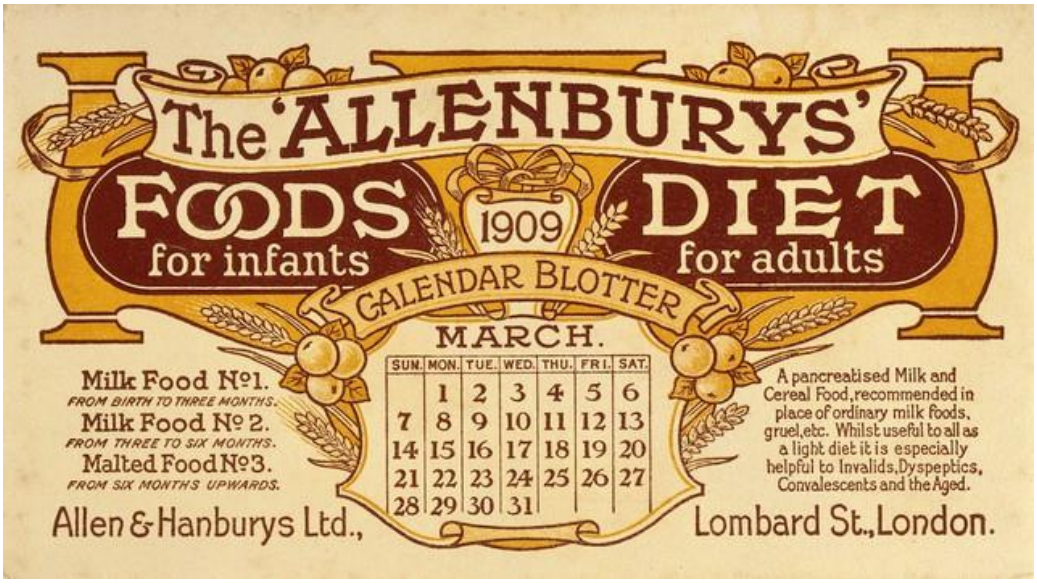
272 Roberts, 'Feeding and mortality', p. 24. Her thesis is devoid of tables or graphs.

273 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, https://doi.org/10.1093/pubmed/fdw024, which examines attitudes to infant feeding in the twenty-first century. A similar study of Victorian attitudes would be welcome.

274 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, https://doi.org/10.2307/2979418; W.J. Howarth, 'The influence of feeding on the mortality of infants', *The Lancet* (22 July 1905), pp. 210-3.

Figure 14 Victorian and Edwardian advertisements for infant foods





Source: © Wellcome Images

Table 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

Source: A. Newsholme, *Annual Report on the Health, Sanitary Condition, etc. of the County of Brighton for the Year 1904* (Brighton, 1905), p. 46.

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 14 shows that 63 per cent of infants in the enquiry were breastfed only, although an additional 13 per cent were given supplementary foods along with breast milk. Comparative figures for those that had died from diarrhoea were 8 and 6 per cent respectively. Table 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 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.[275] However,

275 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

Table 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.[276] Fildes' London data was culled from MOH reports so, as with Table 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.[277] 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'.[278] Evidence for breastfeeding rates amongst illegitimates seems especially lacking, but illegitimate IMRs were given for the country as a whole in 1906 (Table 15).[279] 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

9-12 months, who were recorded as being breastfed were also receiving supplementary foods (p. 47).

276 Fildes, 'Breastfeeding in London', p. 53.

277 Fildes, 'Infant feeding practices'.

278 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, https://doi.org/10.4000/aof.310, 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'.

279 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 15 **Illegitimate and legitimate 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
	< 1	1	2	3	<1	1	2	3	4	5	6	7	8	9	10	11	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	261.30
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.

and this pattern is consistent with some illegitimate infants being breastfed for the 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.[280]

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.[281]

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*.[282] 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'.[283] The attack on infantile diarrhoea yielded results only from

280 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.

281 Registrar General, *Sixty-Ninth Annual Report*, p. xxxvii. It is always difficult to identify when variation becomes permanent decline.

282 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.

283 Newsholme, *Fifty Years*, pp. 324-5, which summarises the work of Dr John Sykes, MOH for St Pancras.

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'.[284] 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 conscience, and the improvement in domestic sanitation and personal hygiene resulting from these more general sources of enlightenment and reform.[285]

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.[286]

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 13, 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

284 Newsholme, *Fifty Years*, p. 332.

285 Newsholme, *Fifty Years*, p. 335.

286 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.

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'.[287] 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:

> Infant 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.[288]

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.[289]

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

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287 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.

288 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.

289 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.

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 the IMR. 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.[290] 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 Europe, which suggests that similar underlying factors affected all these societies.[291]

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

290 See Galley, 'Infant mortality in England, 1538-2000: the parish register period', pp. 196-200 for a discussion of trends in the late eighteenth and early nineteenth centuries.

291 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).

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 15, adapted from a figure in the first of these series of papers, 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. [292] 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 15 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.[293] 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.[294] 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.[295] 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

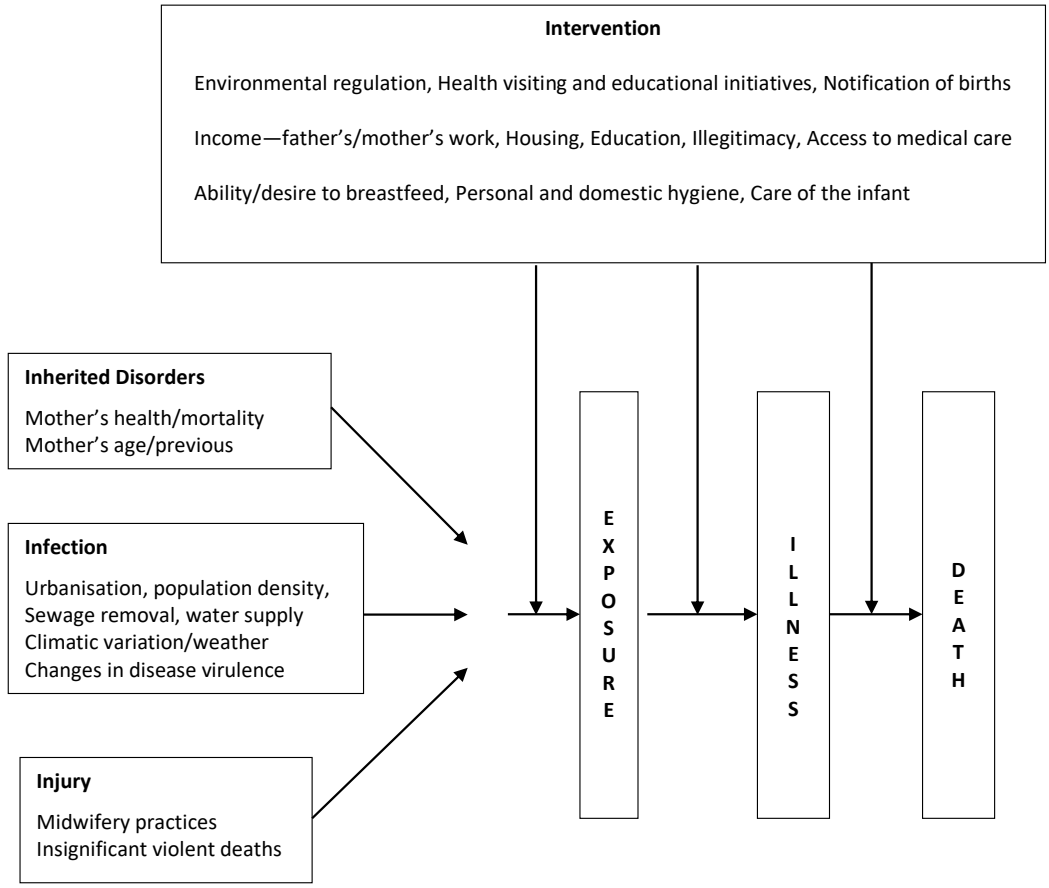
292 Galley, 'Infant mortality in England, 1538-2000: trends, methods and sources', p. 50.

293 See Galley, 'Infant mortality in England, 1538-2000: the parish register period', pp. 128-32 for a discussion of the usefulness of Bourgeois-Pichat's method for calculating endogenous mortality rates.

294 Registrar General, *Eighth Annual Report*, pp. 84-5, 154-5; Registrar General, *Ninth Annual Report*, p. 119; A. Macfarlane and M. Mugford (eds) *Birth Counts: Statistics of Pregnancy and Childbirth*, Vol. 2 (London, 2000), p. 29.

295 Post-neonatal mortality therefore declined by 36 per 1,000, Macfarlane and Mugford, *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 15 Determinants of infant mortality in the Victorian and Edwardian periods



this supposition, but the exact trend is unknown even though the evidence that does exist suggests little change occurred.[296] Likewise, injuries at birth, and those inflicted either deliberately or by accident, were low throughout the period and changed little (see Table 11 for example). Cases of infant neglect and infanticide were highlighted in the press, but they were rare and of little demographic importance.[297] Discussion

296 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.

297 According to R. Sauer, 'Infanticide and abortion in nineteenth-century Britain', *Population Studies*, 32 (1978), pp. 81-93, https://doi.org/10.1080/00324728.1978.10412793, here at p. 85,

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 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.[298]

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.[299] 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.[300] 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

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.

298 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.

299 See Mercer, *Infections*, for a discussion of the link between infections and chronic disease.

300 Galley and Woods, 'Distribution of deaths', pp. 40-1.

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.

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 (Figure 13), 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 vising 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 15 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 15, 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.[301]

(10) More research needs to be undertaken on infant mortality in small towns such as the Devon ones identified in Tables 8 and 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.[302] 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.[303] 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.[304] 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.

301 Morgan, 'Infant mortality, flies and horses'.
302 Hardy, *Epidemic Streets*.
303 Fildes, 'Breastfeeding in London'.
304 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.

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