

SOCIAL INTERVENTION AND THE DECLINE OF INFANT MORTALITY: BIRMINGHAM AND SHEFFIELD, c. 1870–1910

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Introduction

The beginning of the secular decline in infant mortality in England and Wales can be dated fairly precisely, since from 1900 substantial and sustained decrease in the national infant mortality rate (IMR) occurred and continued throughout the twentieth century. The causes of long-term infant mortality decline are relatively easy to understand in general terms and are related to the process of modernisation which resulted in lower levels of fertility, increased female status and improvements in child care practices, medical care, living standards and educational provision. However, it is still not clear why infant mortality began to decline at or around 1900, some 30 years later than childhood mortality.¹ The fact that decline occurred almost simultaneously in every English and Welsh Registration District (RD) tends to suggest that some exogenous factor was at work and with many local authorities introducing specific measures aimed at reducing IMRs at about the same time, the role played by social intervention in infant mortality decline has been the subject of considerable debate.² As yet few detailed local studies have been undertaken on this subject, although source material in the form of the under-used Medical Officer of Health (MOH) reports is readily available for most places. The main aim of this paper is therefore to examine the extent to which local initiatives were capable of influencing the IMR in the period before the First World War. It will also draw a number of tentative conclusions about the nature of infant mortality decline in an attempt to stimulate further debate.

Those individuals charged with implementing policies aimed at reducing IMRs were the MOHs. These officials were appointed in every sanitary authority as a consequence of the 1872 Public Health Act and part of their responsibilities was to produce an annual report for the Local Government Board.³ Unfortunately every annual report has not survived, some were not published and some may not even have been written; however, many contain a wealth of demographic material together with details of various initiatives introduced by the MOH. The reports did not need to conform to a set format and their quality varied considerably, reflecting the interests and dedication of individual

MOHs.⁴ The best ones provide an excellent picture of local patterns of infant mortality, while others hardly mention the problem. In general urban MOH reports contain far more information than rural ones and more importantly the statistics they report conform to municipal boundaries rather than the General Register Office's RDs. Taken *en masse* MOH reports are a unique source that can be used to investigate a wide variety of issues relating to the demographic and medical history of Victorian and Edwardian Britain.⁵ An appropriate means of beginning this investigation is therefore to compare two sets of MOH reports, and as the greatest problems with respect to high IMRs were encountered in the large cities, those for Birmingham and Sheffield have been chosen.⁶ Both cities suffered some of the highest IMRs and at some stage their MOHs sought to implement policies aimed at reducing these rates. While two case studies cannot hope to encompass the full range of experience, the measures introduced by Birmingham and Sheffield were nevertheless typical of those adopted in many British cities.⁷

Infant health initiatives in Birmingham

Birmingham appointed its first MOH, Alfred Hill, in 1872 and he continued in this post until 30 September 1903. Throughout his period of office Hill returned to the problem of infant mortality at regular intervals but, as Table 1 shows, his efforts appear to have been largely in vain since the IMR did not begin to decline until 1901. Reading through Birmingham's nineteenth-century MOH reports it is apparent that while infant mortality was mentioned in virtually every report it was often only in passing, and little indication is given that there was any systematic attempt to deal with the problem. For instance, the first report reveals that directions for the prevention of diarrhoea had been provided and posted in courts at risk of such diseases, while in 1875 it was remarked that diarrhoea should, 'properly (be) regarded as a preventable disease ... 72.3% of the deaths occur in children under 1'.⁸ The proposed means by which the problem could be tackled, other than through general sanitary improvements, was via greater maternal breastfeeding since, 'mothers are so ignorant of the true wants of infant life that they disregard all nature's teachings'.⁹ However, no indication is given as to how breastfeeding could be promoted.

The first thorough analysis of infant mortality appeared in the 1877 report.¹⁰ Infant deaths were reported by cause and season and the large number of summer diarrhoeal deaths highlighted.¹¹ Hill concluded, 'The principal cause of Infantile Mortality is to be found in improper feeding and careless nursing ... infants of the tenderest age are often deprived of the one special food which nature has provided for them, viz., the mother's own milk'.¹² In a depressing postscript Hill argued that little could be done to lower rates:

The evil of excessive and preventible infant mortality is one which cannot be dealt with by a sanitary authority except in a very partial degree, and in a general manner, it is more a social than a public sanitary problem, and it is only to be solved by better knowledge,

Table 1 Infant Mortality Rates in Birmingham, 1871-1910.

Year	IMR	Year	IMR	Year	IMR	Year	IMR
1871	190	1881	150	1891	171	1901	188
1872	166	1882	165	1892	166	1902	157
1873	181	1883	159	1893	198	1903	158
1874	178	1884	174	1894	164	1904	195
1875	196	1885	157	1895	182	1905	155
1876	160	1886	176	1896	197	1906	168
1877	164	1887	178	1897	214	1907	147
1878	170	1888	154	1898	190	1908	145
1879	150	1889	171	1899	193	1909	135
1880	172	1890	184	1900	199	1910	130

Note: Graphical representations of this type of data only began to appear at the beginning of the twentieth century. A tabular presentation illustrates the difficulties faced by the MOH in determining any trend and it is only with hindsight that the secular decline can be said to begin in 1901.

Source: Annual Reports of the Medical Officer of Health for Birmingham.

greater prosperity, and a higher morality in the class of society among who it presents itself.¹³

Hill effectively put the blame for high IMRs on the mothers themselves and he distanced himself from any responsibility. A final more enlightened section provided suggestions as to how the problem could be tackled:

It appears to me that an organised society of ladies to visit low-class homes and instruct women in a simple manner on the best mode of feeding and nursing children would be of immense service, whilst the establishment of nurseries or crèches, where infants could be properly taken care of while their mothers are at work away from home, would be a most valuable means of protecting children.¹⁴

Thus, as early as 1877 Hill had identified an appropriate strategy to deal with high IMRs, but it appears that he did not have the resources, the organisational structure or perhaps sufficient will to implement effective interventionist measures.

In subsequent years a small section of Birmingham's MOH reports was always devoted to infant mortality, but it often lacked detail and was limited in scope. Each year Hill noted how variations in IMRs could be linked with the

prevalence of Autumnal diarrhoea and in 1884 there was even a thorough discussion of the relationship between temperature and diarrhoea mortality.¹⁵ In general though, there was no discussion of other causes of infant death in the reports. In 1888 Hill admitted that, 'Our amount of Infantile Mortality continues to be, in fact, the principal regrettable feature in our mortality statistics'.¹⁶ By 1889 as the IMR had failed to decline Hill simply noted without explanation that, 'the record of Infant Mortality for the past year is by no means a good one'.¹⁷ Later in 1890 the IMR was, 'not very satisfactory' and Hill seemed perplexed as to why this was:

the great loss of infant life is deplorable. It is, I think, probable that there is something connected with the social condition of our labouring classes, and the very wide-spread employment of women in the town, to which the large Mortality in infants is to be attributed, but what these particular conditions are I cannot with certainty determine.¹⁸

These persistent high rates led to the Council requesting an enquiry into infant mortality in 1891 and this was included as part of the 1892 report.¹⁹ Due to the delay in the Council requesting the report Hill was only able to trace 1,222 of the 2,504 infants who had died in 1891 (49 per cent), a fact that mars much of the subsequent analysis. Hill analysed IMRs by ward, cause of death, housing condition, mother's employment and whether or not the infant had been breast-fed. He noted that sanitary conditions appear to have little influence on the IMR, but his main conclusions were virtually identical to those of 1877. In particular he assigned the main cause of high IMRs to maternal neglect:

This neglect may be of two kinds: the culpable neglect of those who know how to manage children properly, but fail to do so; and neglect arising out of ignorance. As regards the former it is difficult to see what is to be done regarding it, except the infliction of punishment when discovered and proved, which is very difficult. To remedy the neglect arising from ignorance several means suggest themselves. Among them should be mentioned the teaching of the principles which should govern the management of young children, both in health and sickness, to girls in elementary schools; free lectures to women on the same subject; and the issue of a handbill giving concise directions as to feeding and nursing infants to persons who register births.²⁰

Hill ended the report by arguing that, while it may appear from the preceding analysis that Birmingham occupied an exceptionally bad position with respect to its IMR, 'our City was but little worse than the large towns as a whole'.²¹ Subsequent reports again failed to follow up these ideas and throughout the 1890s little attention was directed towards the problem with the sections on infant mortality generally repeating previous ones, sometimes verbatim. Hill noticed the increasing number of infant diarrhoea deaths and, 'handbills and posters giving instructions as to the precautions to be taken to prevent

Diarrhoea' were issued every year.²² In 1897 when the IMR was at its highest (214 per 1,000) an embarrassed Hill made no direct mention of it, hiding it away as part of a larger table.²³ By the end of the 1890s as diarrhoea deaths continued to rise, increasing IMRs to 'unusually high' levels, Hill's reports merely continued to repeat the conclusions of previous ones.²⁴

Two conclusions may be drawn from reading Birmingham's nineteenth-century MOH reports. First, even though one of the MOH's chief responsibilities was to prevent unnecessary deaths—and approximately one in three of all deaths in Birmingham in this period were those of infants—issues relating to infant health generally received low priority.²⁵ Second, while Hill had correctly identified many of the factors responsible for high IMRs he appears to have been unable to exert much influence over them. Underpinning all of Hill's actions was his belief, which he shared with most of his contemporaries, that the key to reducing levels of mortality lay in improving the sanitary environment. This is why much effort was expended on attacking infantile diarrhoea, the one infant disease that was universally considered to be preventable. Hill's beliefs were reinforced by the fact that in Birmingham, as elsewhere, the general death rate was used to measure the extent of sanitary progress and this had fallen steadily, from 24.8 deaths per 1,000 living in 1873 to 17.2 in 1903.²⁶ Commenting on this phenomenon in 1882 Hill argued,

Such a result of ten years of sanitary progress seems to clearly establish the value of preventive medicine, and enables some idea to be formed of the enormous advantage to be gained by the development of a branch of medical science, which at present is only in its infancy.²⁷

Hill's reliance on the death rate meant that less importance was attached to the IMR, even though it had been recorded annually from 1876.²⁸ Moreover, when Hill sought to explain Birmingham's high IMR, he did so by comparing it with rates in other large towns (for instance, in 1892 Birmingham was placed fifth out of the ten largest towns).²⁹ This practice tended to impart a gloss onto Birmingham's appallingly high IMR since it implied that high IMRs were a natural feature of all large towns. Thus, even though Hill had correctly identified how changes to child management practices could reduce IMRs, he did little to ensure that such reforms were implemented, believing instead that sanitary reform would eventually cause the IMR to decline.

It was not until April 1899, with the IMR refusing to decline, that Hill returned to his 1877 recommendations and appointed four female health visitors.³⁰ Their responsibilities included helping tenants, 'make their homes as healthy and as comfortable as possible' by improving general sanitary conditions.³¹ They had no special remit to reduce IMRs, but part of their duties was to, 'give hints to mothers on the feeding' of their children.³² Armed with specially prepared handbills about how to prevent diarrhoea, of which about 3,000 were distributed during the 1899 epidemic, they were directed to visit as many cases of the disease as possible and give advice on nursing and diet. Hill admitted that the four health visitors, 'were unable to deal with more than a small part

of the large number of houses invaded' and they probably made little overall impact given that their roles were essentially reactive rather than proactive.³³ The number of health visitors was increased to eight in 1900 and 12 in 1902 and their duties were expanded to include the promotion of breastfeeding and general cleanliness when dealing with babies.³⁴ By 1902, with the IMR at last beginning to decline, Hill was still stressing the importance of sanitary improvement:

I am convinced that the greater cleanliness now enforced in the town has had a considerable share in the reduction ... Everything that conduces to greater cleanliness, both personal, domestic and public, is calculated to reduce the prevalence of diarrhoea.³⁵

John Robertson succeeded as MOH on 30 September 1903 and immediately greater emphasis was placed on reducing infant deaths in the annual reports. One of Robertson's first tasks was to write a report, commissioned by the town council, on the means of reducing infant mortality throughout the city.³⁶ This report, published in June 1906, provides a model for the types of analyses that could be undertaken by an Edwardian demographer. It surveyed the extent of infant mortality throughout the city, highlighting both spatial and social variations. Robertson asserted that infant mortality was, 'the most important subject engaging the attention of Sanitary Authorities at the present time', whilst at the same time he acknowledged that, 'all our efforts in the past have been productive of practically no reduction in infant mortality'.³⁷ He also posed the question, 'Is Birmingham doing as much as other large towns in the direction of reducing infant mortality?'³⁸ Robertson noted the extent of preventable deaths, especially those caused by poor feeding and diarrhoea:

My own investigations into the causes which are in operation in producing fatal illness from diarrhoea show that this disease is nearly fifty times more frequent in poor class districts than among the middle and upper classes.³⁹

He also believed,

that a good deal of the difference which occurs in various districts in the amount of infant mortality is due to local customs, certain methods of feeding and rearing infants being handed down from mother to daughter in particular areas, which probably exert a powerful influence for good or evil as the case may be.⁴⁰

At the end of the report Robertson summarised seven measures that were being undertaken in Birmingham: five related to improving the sanitary environment (three to poor and dirty housing and two to personal hygiene); the others were tackling poverty, and improving the quality of the milk supply.⁴¹ With the exception of poverty, in each case Robertson made specific recommendations as to how improvements could be made. In the 1905 annual report Robertson had broadened the attack on infant mortality by arguing that

in addition to infantile diarrhoea, infectious diseases such as measles, whooping cough, TB, bronchitis and pneumonia were largely preventable in infants, as were 'the conditions producing premature birth and congenital debility', which were influenced by the 'mal-nutrition of the mother and improper living'.⁴² Robertson realised that in order for IMRs to be reduced a wide range of issues needed to be considered and these were addressed by the continued implementation of a range of educational and sanitary measures.⁴³ Thus, by 1906 a serious commitment had been finally made by the MOH to tackle the problem of high infant mortality.

As the IMR began to decline the causes of variations within the city came to the fore. For instance, in 1906 Birmingham's overall IMR was 168, but individual wards varied from 268 in St Bartholomew's, located in the centre of the city and largely populated by working-class families, to 117 in Edgbaston and Balsall Heath, which were suburban and contained more artisan and middle-class families.⁴⁴ Such inequalities persisted and in 1908 Dr Jessie Duncan was appointed to address this issue. She first examined the relationship between infant mortality and the industrial employment of women and then she produced reports on infant mortality in two of Birmingham's worst wards, St George's and St Stephen's.⁴⁵ Duncan visited the homes of all newly born babies in these wards, gave advice on care and feeding, obtained information about the mother's circumstances and invited the mother to an 'Infant Consultation' where her baby could be weighed and inspected.⁴⁶ A health visitor then visited each infant every week for the first five weeks and then afterwards at monthly intervals. If the infant became sick or if artificial feeding was introduced then Duncan made a return visit. Clearly considerable effort was expended in identifying 'at risk' infants and mothers were given every encouragement to attend the consultation sessions. Duncan even began a class for expectant mothers.⁴⁷ In addition to the work of Duncan, at least five similar schemes, operating in the districts experiencing the highest IMRs, were running by 1910 and proposals were made to extend this work to other parts of the city.⁴⁸ The health visitors appeared to be making an impact, but time was needed to achieve results. In the two wards where Duncan worked, St George's and St Stephen's, respective IMRs in 1910 were 140 and 163 which compared favourably with rates of 213 and 232 in 1904; however, in spite of all Duncan's efforts IMRs in these two wards increased to 191 and 200 in 1911 due to the very hot summer of that year, a situation that was repeated in many urban districts.⁴⁹ Throughout the 1900s infant mortality declined in every ward in Birmingham, but it is striking that all the outer wards experienced lower IMRs and greater rates of decline than the inner wards, as Table 2 shows.⁵⁰ Moreover, all the efforts to reduce IMRs were targeted at the inner wards, which were dominated by working class families and the outer wards—where most of the better-off families lived—were virtually ignored. Thus, it would appear that the middle classes managed to experience infant mortality decline with the benefit of little or no intervention. Even within working-class districts those families deemed to be better-off were excluded from subsequent visiting.⁵¹ Clearly, while health visiting must have brought benefits to some working-class families, these benefits need to be placed

within the context of generally declining IMRs throughout the city and, more importantly, it should be noted that these various initiatives did not prevent a severe diarrhoea epidemic from breaking out in 1911.

It is difficult, if not impossible, to assess how the various measures introduced in Birmingham affected its IMR. The evidence, albeit circumstantial, appears to show that before 1900—even though Hill had correctly identified many of the factors responsible for high IMRs—direct intervention was minimal and it had little impact on the IMR. After 1900 slow progress appears to have been made as the IMR declined at the same time that greater efforts were made by the MOH and the health visitors to influence the rate. This evidence needs however to be tempered by the fact that IMRs were also declining, at a faster rate, among large sections of Birmingham's population where little intervention appears to have taken place. Thus, it would appear safe to conclude that intervention can provide, at best, only a partial explanation of Birmingham's declining IMR.

Infant health initiatives in Sheffield

The quality of Sheffield's MOH reports are disappointing, especially when compared with Birmingham's. The first report for 1873 gives the percentage of deaths under one to annual births for the years 1871–1873, a list of weekly infant deaths and a discussion of the causes of diarrhoea.⁵² In 1875 Sheffield's IMR was also reported by sub-district.⁵³ The formats of the 1876 and 1877 reports were virtually identical to that of 1875, but no reports for 1878–84 were published. When Dr Griffiths, Sheffield's first MOH, left office his successor, Thomas Hime, was only engaged on an annual basis at half the salary of his predecessor, although he was allowed to undertake some private practice. These conditions, particularly the one relating to the annual nature of the contract, were not approved by the Local Government Board which meant that they withheld their contribution towards his salary. Relations between the MOH and the council were strained and while there is nothing to suggest that annual reports were not compiled, none have survived and eventually, in 1884, Hime resigned.⁵⁴ Sinclair White took over in 1885. He used the death rate to measure sanitary progress, but he also noted that, 'The infantile mortality is a capital index by which to gauge the healthiness or otherwise of a district'.⁵⁵ White ascribed the main causes of high infant mortality to improper feeding and insufficient ventilation and he promoted the formation of voluntary organisations to tackle these problems through improving education.⁵⁶ Despite White's assertion about the importance of the IMR, relatively little information was provided about infant mortality in the annual reports and decline did not begin until 1902, as shown in Table 3. This general neglect of infant mortality continued into the 1890s with the formats of subsequent reports hardly changing, even when Theodore Thomson and Harvey Littlejohn succeeded as MOHs in 1888 and 1891 respectively. Throughout this whole period each report only provided the IMR, a comparison with IMRs in other large towns together with short discussions of illegitimate infant mortality and some causes of infant death.⁵⁷

Table 2 infant Mortality in Birmingham by Ward, 1904 and 1910.

	IMR		Decline	Per cent Decline
	1904	1910		
Inner Wards				
St Mary's	331	202	129	39
St Bartholomew's	263	201	62	24
St Stephen's	232	163	69	30
St Paul's	225	180	45	20
Neechells	219	156	63	29
Duddeston	217	150	67	31
St George's	213	140	73	34
Deritend	208	177	31	15
St Thomas'	196	152	46	22
Ladywood	192	123	69	36
Market Hall	187	148	39	21
St Martin's	185	148	37	20
			<i>Inner Ward Average</i>	27
Outer Wards				
Saltley	178	99	79	44
Rotton Park	178	100	78	44
All Saints	173	113	60	35
Balsall Heath	150	86	64	43
Bordesley	146	106	40	27
Edgebaston and Harborne	133	74	59	44
			<i>Outer Ward Average</i>	40
Whole City	195	130	65	33

Source: BirmMOH-1909, 19; 1910, 18.

Table 3 Infant Mortality Rates in Sheffield, 1885–1910.

Year	IMR	Year	IMR	Year	IMR
		1891	170	1901	202
		1892	167	1902	150
		1893	193	1903	181
		1894	157	1904	158
1885	164	1895	195	1905	166
1886	168	1896	171	1906	158
1887	179	1897	196	1907	145
1888	180	1898	195	1908	141
1889	175	1899	194	1909	119
1890	195	1900	200	1910	127

Source: Annual Reports of the Medical Officer of Health for Sheffield.

By the mid-1890s the annual reports contain little evidence to suggest that much was being done to reduce IMRs, even though the main causes of infant deaths were reported year by year:

This appalling mortality amongst young children is no doubt largely preventible, occurring chiefly in children of the poorest class, and being due to exposure, deficient and unsuitable nourishment, and, to a certain extent, insanitary surroundings.⁵⁸

John Robertson, prior to his appointment in Birmingham, succeeded as MOH in 1897. He also provided similar levels of information to his predecessors, although he did draw attention to, 'the very high mortality among young children ... I believe that to a very large extent this high Mortality is due to ignorance and carelessness on the part of parents and guardians'.⁵⁹ The first sign of intervention occurred in 1898 when two female inspectors were appointed and the problem of high infant mortality was first seriously addressed in 1899:

From information obtained from medical practitioners and from personal and other inspections, one can state, without fear of exaggeration, that at least a thousand healthy infants die every year in Sheffield before they reach the age of one year on the account of the ignorance of their parents. The problem of successfully preventing this enormous waste of infant life is one of the most important, and at the same time one of the most difficult which

sanitary authorities have to deal with. ... Some attempt has been made during the year to deal with this question by distributing printed instructions on the feeding and rearing of infants. ... The visits made by the two Women Sanitary Inspectors to the houses in the poorer districts will aid the work of instruction in this direction.⁶⁰

Breast-feeding was to be encouraged where possible and efforts were made to reduce the risk from cow's milk, although the MOH accepted that little could be done officially, the female inspectors having only limited impact, and the artisan classes 'alone can protect themselves'.⁶¹

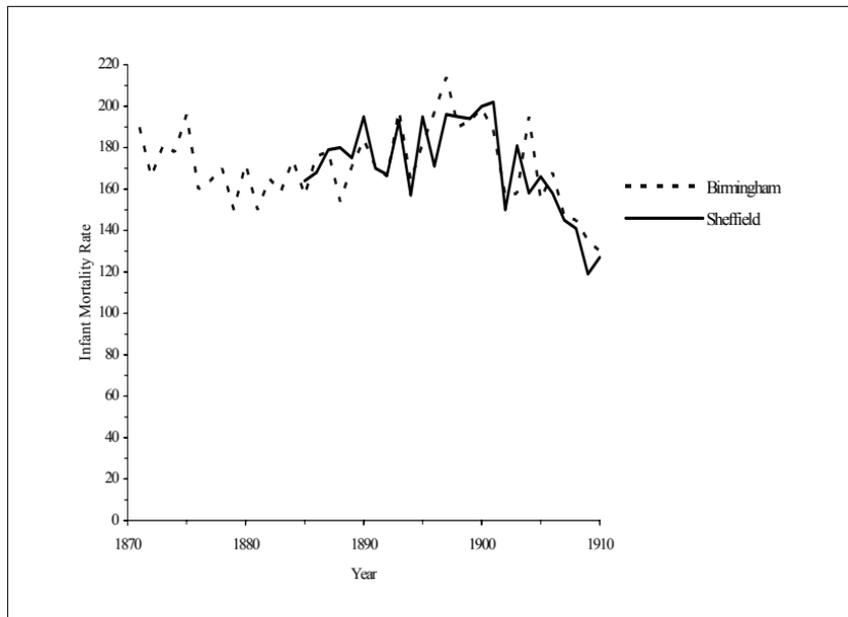
In 1900 four additional women inspectors were appointed and by 1904 their duties had expanded from general house visits to advising mothers who had just given birth about the feeding and rearing of infants, the control of whooping cough and general child welfare.⁶² They also focussed on cleanliness and the milk supply, although their work was hindered because they did not have access to a list of all the births in their districts.⁶³ It is again difficult to assess the impact of the health visitors, the MOH certainly considered their work valuable, but the policies they and the MOH advocated took time to achieve results. A good illustration of this point was the continued use of the long-tubed feeding bottle. In 1899 Robertson had discovered why long-tubed bottles were generally used in preference to the less dangerous boat shaped bottles:

In regard to one of the points in the handbill relating to the type of bottle for feeding infants, it has been found that one of the reasons why tube bottles are so universally used in Sheffield is that they are sold by retail chemists cheaper and at a greater profit than those recommended in the leaflet.⁶⁴

Measures were immediately taken to change the practice, but success did not occur overnight: 'The long tube bottles continue gradually to go out of favour. In 1904 the portion of boat-shaped to long-tubed bottles was 12 to 10; in 1905 it was 15 to 10; and in 1906, 24 to 10'.⁶⁵ As in Birmingham, considerable effort was placed on investigating and attempting to combat infantile diarrhoea. Graphs of diarrhoea deaths appeared in the annual reports and it was concluded, 'that a very large amount of carelessness exists in the feeding and rearing of infants'.⁶⁶ In October 1906 a special committee on infantile mortality was set up, but it appears to have been limited in scope with its main recommendations being to improve maternal education, partly with the assistance of the 'Motherhood League', and the setting up of a scheme to provide dried milk for bottle-fed infants during the diarrhoea season.⁶⁷ By 1908 15 women inspectors were employed in Sheffield: they visited homes, educated mothers and helped to reduce diarrhoea deaths, partly through infant depots which had been set up for the distribution of dried milk.⁶⁸

Some parallels may now be drawn between the infant health work being done in Birmingham and Sheffield. In both cities the main means of measuring

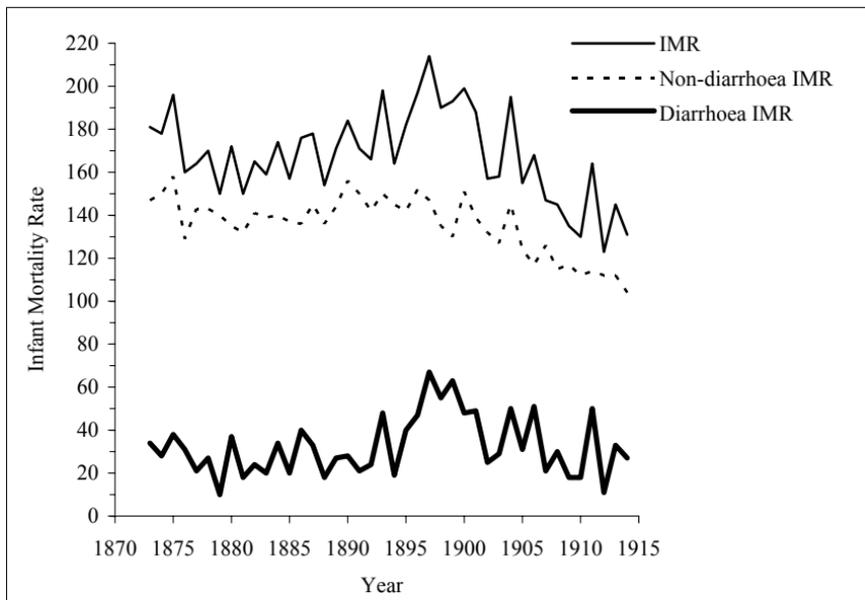
Figure 1 Annual infant mortality rates, Birmingham and Sheffield, 1870–1910.



Source: Annual MOH Reports for Birmingham and Sheffield

levels of mortality remained the death rate well into the twentieth century, both sets of reports show that efforts to reduce infant deaths centred around preventing epidemic diarrhoea, blame for infant deaths was frequently directed towards mothers and in the early twentieth century efforts were made to improve maternal education. In particular John Robertson did much to highlight issues relating to infant health and when he moved from Sheffield to Birmingham the former's loss was definitely the latter's gain. Both cities also started to employ health visitors towards the end of the nineteenth century, but the task they faced was enormous and only limited amounts of progress had been achieved by 1914.⁶⁹ Yet in spite of these similarities it is clear that Birmingham was far more active than Sheffield in implementing interventionist policies. Sheffield's MOH reports are much less detailed than Birmingham's and they reveal less apparent concern to deal with the problem of high IMRs. Nothing comparable to Hill's studies of 1877 and 1891 occurred in Sheffield, nor was there Duncan's relatively sophisticated attempts to identify and target 'at risk' babies. However, if IMRs in both cities are compared then the overall patterns of decline are revealed to be virtually identical (see Figure 1). Indeed, the patterns are sufficiently similar to suggest that factors other than purely local ones must also have been important.

Figure 2 Annual infant mortality rates, Birmingham, 1873–1914.

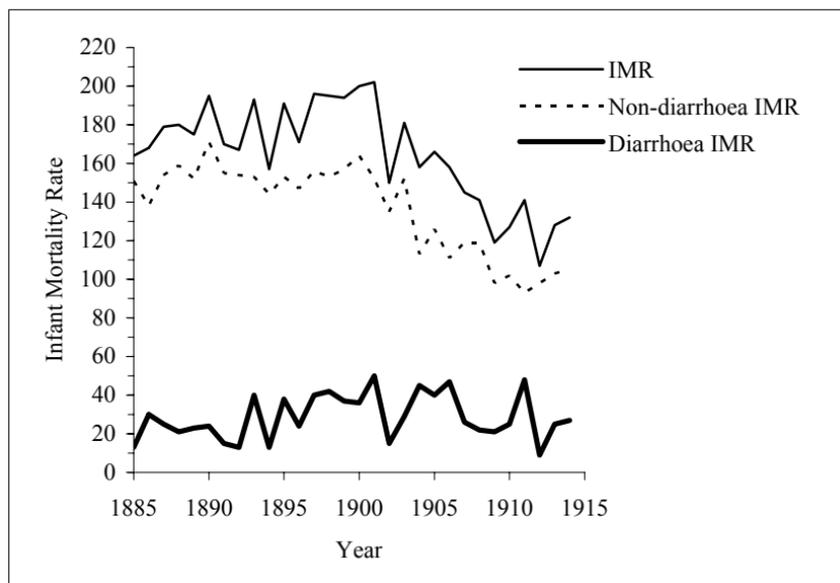


Source: Annual MOH Reports for Birmingham

Given that the main thrust of the MOH's preventive strategy was directed towards epidemic diarrhoea it is worthwhile investigating how successful both cities were in combating this disease. While some cause of death data for infants was unreliable in this period and diarrhoea is more of a symptom than a true cause of death, such deaths were easy to identify and the data contained in the MOH reports can be considered to be broadly reliable. Figures 2 and 3 decompose IMRs in Birmingham and Sheffield into their diarrhoea and non-diarrhoea components.⁷⁰ The diarrhoea mortality rate was generally higher in Birmingham, although in both cities the effects of this one disease were sufficient to alter the overall pattern of infant mortality. Non-diarrhoea rates show greater stability until 1900, after which steady decline occurred, while diarrhoea rates fluctuated from year to year. The intensity of these epidemics increased during the 1890s, some decline is evident after 1900, but substantial epidemics still occurred in 1904, 1906 and 1911 in both cities. The link between diarrhoea and hot, dry weather during the third quarter of the year had been noted from the 1870s,⁷¹ and part of the overall decline in infant mortality during the early 1900s can be put down to the relative coolness of the summers in some of these years.⁷²

While much effort has been expended in investigating the causes of decline from 1900, the reasons why infant mortality increased during the 1890s has

Figure 3 Annual infant mortality rates, Sheffield, 1885–1914.



Source: Annual MOH Reports for Sheffield

attracted less attention. The series of hot, dry summers during the 1890s were certainly detrimental to infant health, yet equally hot summers during the 1870s and 1880s proved less fatal. Arthur Newsholme believed that during the late nineteenth century there had been, 'a great increase of artificial feeding of infants, though no exact data are ascertainable on this point'.⁷³ According to a report commissioned by William Farr in 1870, 'among the married poor suckling is evidently the rule', while, 'among the upper classes it would appear that the tendency for mothers not to suckle their children is on the increase'.⁷⁴ The rise of artificial feeding during the 1890s could therefore be an interesting example of the working classes copying behaviour from their so-called 'betters' that had a detrimental effect on their health, since artificially fed infants were at greater risk of succumbing to diarrhoea than those who were breast-fed. Moreover, it is likely that working-class mothers living in less sanitary environments found it more difficult to maintain the high degree of cleanliness necessary to ensure successful artificial feeding.⁷⁵ Data about artificial feeding and the precise way it was carried out are hard to obtain and none appears to exist covering the whole of the period 1880–1910. Commercial baby foods began to appear at this time and, while few working class families would have been able to afford proprietary brands, plenty of cheaper substitutes such as various forms of pap and condensed or cow's milk were readily available.⁷⁶ Unfortunately, little evidence about infant feeding has survived from

Birmingham and Sheffield and, whatever the truth may be, efforts to combat infantile diarrhoea in both cities failed to prevent substantial increases from occurring during the 1890s and only a limited degree of success can be claimed by 1911 when another epidemic struck during the hottest summer of the period.

This straightforward comparison of MOH reports from Birmingham and Sheffield has identified the measures relating to infant health that were adopted by the MOH. It has proved less useful in assessing the relative successes of these measures. The inevitable delay between the introduction of a measure and its effective implementation has been clearly illustrated and sufficient evidence has been assembled to demonstrate that direct intervention by itself was not responsible for the changing patterns of infant mortality in Birmingham and Sheffield.

Conclusion: explaining infant mortality decline

The annual reports of the MOH are an important but rather neglected source for the study of local populations, and their wider examination will lead to the unearthing of much valuable information. The evidence they contain needs to be treated with caution, however, since they were compiled by individuals who were convinced that sanitary reform was the key to improving health. Moreover, according to John Brownlee many MOHs, unlike John Robertson, were 'men of narrow outlook' and it is not surprising to discover that they expressed a wide variety of views as to the causes of infant mortality decline.⁷⁷ In 1923 James Wheatley, county MOH for Shropshire, conducted a survey amongst his colleagues aimed at identifying the main factors responsible for the recent decrease in infant mortality.⁷⁸ He found that in analysing replies from MOHs in 44 towns,

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.⁷⁹

A similar analysis of 42 county MOHs showed that,

twenty-three give child welfare work as the chief cause, one antenatal 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.⁸⁰

While the majority mention child welfare work, these replies just about encompass the entire range of factors that have been posited to account for the fall in infant mortality and this lack of consensus suggests that even by 1923 the MOHs had still not developed a consistent set of policies aimed at driving down the IMR. It therefore seems safe to conclude, as was the case in

Birmingham and Sheffield, that MOHs had little influence over the initial stages of decline, especially given that trends in almost all English and Welsh RDs were identical.⁸¹

The most perceptive comments on the infant health movement remain those published by Sir Arthur Newsholme in *Fifty Years in Public Health*.⁸² 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: 'The directions as to methods of feeding infants, when artificial feeding became necessary, having been regarded as recommendations of artificial in lieu of breastfeeding'.⁸³ The attack on infantile diarrhoea yielded results only after 1901 when MOHs began to target the disease, but the main effect of the special work of the health visitors and child welfare centres was, 'to be seen chiefly in the years following 1905 or even 1908'.⁸⁴ Newsholme further argued that of equal importance in reducing infant mortality were the indirect improvements brought about by the greater emphasis placed on child welfare in this period:

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.⁸⁵

Using evidence from Bristol and Huddersfield, Newsholme showed that while Bristol did not appoint health visitors until 1912, Huddersfield was very active in introducing a variety of measures, yet IMRs in both towns declined at similar rates.⁸⁶ The initial benefits of health visiting probably arose as much from the greater knowledge they spread about hygiene and child care rather than their ability to prevent individual deaths and this would explain why those living in better urban environments achieved the greater benefits. Writing in 1939, George Newman also firmly attributed the decline of infant mortality to improved maternal enlightenment,

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.⁸⁷

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. It is therefore not surprising that the middle classes managed some of the greatest improvements in infant health with some groups achieving IMRs of less than 50 by 1911.⁸⁸ Similar, but smaller improvements

may also have occurred as a consequence of work done during the nineteenth century and this, together with increasing suburbanisation which resulted in greater numbers of the better-off escaping the consequences of less insanitary environments, may have led to widening social differentials in infant mortality in this period. The effectiveness of the various measures adopted, both direct and indirect, would also have varied from household to household as many infant deaths were clustered within certain families, and this in part may help to explain the complex relationship between class and place in accounting for variations in IMRs throughout the country.⁸⁹

Almost by chance, the activities of the infant health movement achieved national prominence as a consequence of many recruits to the British Army during the Boer War (1899–1902) being discovered to be physically unfit for service. The Government launched an enquiry with wide terms of reference and the resulting Physical Deterioration Report published in 1904 noted that, ‘infantile mortality in this country has not decreased materially during the last twenty-five years, notwithstanding that the general death rate has fallen considerably’ and it 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’.⁹⁰ The Report investigated various issues relating to infant health and it devoted considerable space to the ways in which IMRs could be reduced. Its publication stimulated considerable discussion of child welfare issues and George McCleary, MOH for Battersea, 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’.⁹¹ It is therefore not surprising that in both Birmingham and Sheffield greater effort to implement child welfare schemes occurred around this date. Real progress also began to be made once it became accepted that individual mothers could make a significant impact in ameliorating the detrimental effects of a poor environment.⁹² Such an approach underlies George Newman’s book, *Infant mortality: a social problem*. Newman examined a hierarchical set of influences on infant mortality relating to the mother, her child and the environment and he concluded that the problem was mainly one of motherhood.⁹³ Later the health of the mother was realised to be an important influence on her baby’s survival chances and those at greatest risk began to be targeted more effectively.⁹⁴ During the first decades of the twentieth century the infant welfare movement slowly gained momentum and the underlying causes of infant mortality were identified and addressed; however, of greater importance, at least in the early stages, was the informal dissemination of information resulting from work done by a variety of individuals and organisations.

The preceding analysis has suggested that four broad phases in the infant welfare movement can be identified:

1. Infant mortality first began to be measured accurately during the 1870s, but despite of a number of notable studies, from the 1870s to the early 1890s infants were generally neglected by MOHs. Instead MOHs

viewed their principal role as combating infectious disease through sanitary reform and they implicitly assumed that this would bring about infant mortality decline.

2. During the 1890s it gradually became obvious that IMRs had not fallen and some urban MOHs began to recognise the contribution of infantile diarrhoea, especially in artificially fed infants, to explaining this phenomenon.
3. From the late 1890s a variety of initiatives primarily aimed at tackling preventable diarrhoea deaths began to be introduced. These included the appointment of female health visitors and various measures to educate mothers in the feeding and rearing of their babies. These initiatives were reinforced, following the publication of the Physical Deterioration Report in 1904, when infant health became an issue of national importance.
4. By the end of the 1900s as interventionist policies began to have some impact, the attack on infant mortality was broadened to include a wider range of causes of infant death and the link was established between the health of the baby and its mother. By 1910 the foundations of the early infant welfare movement had been laid, but its greatest achievements were not to occur until the following decades.

Thus, social intervention by itself was not responsible for the turning point in the national infant mortality series, although it became increasingly important as the twentieth century progressed. Infant mortality decline was a complicated process. A small measure of decline coinciding with that of marital fertility is evident in many places from the 1870s and it may have been that the various health initiatives introduced during the late nineteenth century brought indirect benefits to some infants with the middle classes being in the best position to achieve the greatest benefit.⁹⁵ The increase in IMRs during the 1890s caused in part by the hot summers clouds the picture, but all the available evidence tends to confirm Woods' view that the causes of underlying infant mortality decline are related to:

1. Fertility decline;
2. Improved female education and status;
3. Health of towns movement.⁹⁶

Part of the reason why a definitive account has yet to be given is that factors such as female status and environmental improvement remain difficult to quantify and it may not be until large numbers of birth and death certificates become available from the 1850s onwards that these issues become finally resolved. In the meantime, MOH reports can provide a rich seam of evidence for the local population historian and the examination of other series may be able to shed light on further aspects of the secular decline in infant mortality.

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NOTES

1. The best account of the secular decline in infant mortality is given in R. Woods, *The demography of Victorian England and Wales* (Cambridge, 2000), 247–309.
2. The role of social intervention in mortality decline has been discussed extensively: see S. Szreter, 'The importance of social intervention in Britain's mortality decline c.1850–1914: a re-interpretation of the role of public health', *Social History of Medicine*, 1 (1988), 1–37; S. Guha, 'The importance of social intervention in England's mortality decline: the evidence reviewed', *Social History of Medicine*, 7 (1994), 89–113; S. Szreter, 'Mortality in the eighteenth and the nineteenth centuries: a reply to Sumit Guha', *Social History of Medicine*, 7 (1994), 269–82.
3. S. Chave, *Recalling the medical officer of health* (London, 1987), 96.
4. In this respect they are different from the various publications of the General Register Office (GRO) which provide consistent, but often limited amounts of data for every RD throughout the country. Most studies of infant mortality in this period use GRO data in one form or another.
5. See A. Hardy, *The epidemic streets* (Oxford, 1993) for an example of how MOH reports have been used to illuminate London's epidemiological history.
6. On high IMRs in cities see N. Williams and C. Galley, 'Urban-rural differentials in infant mortality in Victorian England', *Population Studies*, 49 (1995), 401–20. For a discussion of political and social changes in Birmingham and Sheffield see D. Smith, *Conflict and compromise. Class formation in English society* (London, 1982). E.P. Hennock, *Fit and proper persons* (London, 1973), discusses local government in nineteenth-century Birmingham.
7. J. Robertson, *Special report of the medical officer of health of the city of Birmingham* (Birmingham, 1904), 32–7, gives details of measures introduced to reduce IMRs in 30 large towns.
8. *Annual report of the Medical Officer of Health for Birmingham, 1873* (Birmingham, 1874), 6 (hereafter BirmMOH-1873). For a discussion of mortality conditions in Birmingham in this period see R. Woods, 'Mortality and sanitary conditions in late-nineteenth-century Birmingham', in R. Woods and J. Woodward eds, *Urban disease and mortality in nineteenth-century England* (London, 1984), 176–202; R. Woods, 'Public health and public hygiene: the urban environment in the late nineteenth and early twentieth centuries', in R. Schofield *et al.* eds, *The decline of mortality in Europe* (Oxford, 1991), 239–43. Also see M. Niemi, 'Public health discourses in Birmingham and Gothenburg, 1890–1920', in S. Sheard and H. Power eds, *Body and city. Histories of urban public health* (Aldershot, 2000), 123–42. Quote is from BirmMOH-1875, 5.
9. BirmMOH-1875, 7.
10. BirmMOH-1877, 6–10.
11. BirmMOH-1877, 7.
12. BirmMOH-1877, 8.
13. BirmMOH-1877, 10.
14. BirmMOH-1877, 16.
15. BirmMOH-1884, 27–30.
16. BirmMOH-1888, 17–18.
17. BirmMOH-1889, 16–17.
18. BirmMOH-1890, 14 and 15. The link between mother's employment and infant mortality is a recurrent theme in the reports. However, the most detailed study published in 1906 found little correlation between the two: see BirmMOH-1906, 17–19.
19. BirmMOH-1892, 11–20. This was also published as A. Hill, 'On the causes of infant mortality in Birmingham', *Practitioner*, 51 (1893), 70–80.
20. BirmMOH-1892, 18–19.
21. BirmMOH-1892, 19.
22. BirmMOH-1896, 27.

23. BirmMOH-1897, 42-3.
24. BirmMOH-1899, 11.
25. J. Robertson, *Special report*, 3-4.
26. J. Robertson, *Special report*, 4.
27. BirmMOH-1882, 2. For other examples, see BirmMOH-1883, 19; BirmMOH-1886, 17-18; Woods, 'Public health', 239.
28. BirmMOH-1876.
29. BirmMOH-1892, 11.
30. BirmMOH-1892, 34.
31. BirmMOH-1892, 34.
32. BirmMOH-1899, 34.
33. BirmMOH-1899, 30.
34. BirmMOH-1900, 30; BirmMOH-1902, 33. For a description of the role of the female health visitor see F.J. Greenwood, 'Women as sanitary inspectors and health visitors', in E.J. Morley ed., *Women workers in seven professions* (London, 1914), 221-34.
35. BirmMOH-1902, 26. Also, see BirmMOH-1901, 20-1.
36. Robertson, *Special report*.
37. Robertson, *Special report*, 3 and 4.
38. Robertson, *Special report*, 6.
39. Robertson, *Special report*, 15.
40. Robertson, *Special report*, 7. Also, see BirmMOH-1904 which shows that of the 408 infants who died aged 6 months and below only 37 were exclusively breast-fed. A further 279 had been fed with the dangerous long-tubed bottle: see V. Fildes, 'Infant feeding practices and infant mortality in England', *Continuity and Change*, 13 (1998), 267-71.
41. Robertson, *Special Report*, 18-26.
42. BirmMOH-1905, 18.
43. BirmMOH-1906, 16-20.
44. BirmMOH-1906, 13.
45. J. Duncan, *Report on industrial employment of married women and infantile mortality* (Birmingham, 1910); J. Duncan, *Report on infant mortality in St George's and St Stephen's wards* (Birmingham, 1911; 1912). Duncan's first report on working mothers was carried out following a government initiative. It revealed that IMRs were higher in the group of mothers not industrially employed and while there was a tendency for employed mothers not to breast-feed their babies for as long as those who were not employed, the overall effects of employment were negligible. A more important factor was the level of poverty within families.
46. BirmMOH-1909, 21-2.
47. BirmMOH-1909, 22.
48. BirmMOH-1910, 19-21.
49. Duncan, *Infant mortality* (1912), 8.
50. This achievement is more impressive given that it becomes increasingly difficult to reduce rates from a low base. The very high IMR of 331 in 1904 for St Mary's appears to have been an anomaly since subsequent annual rates in this ward were 201, 207, 200, 208 and 208, BirmMOH-1909, 19. IMRs were generally not reported by ward in the nineteenth century.
51. BirmMOH-1909, 23.
52. *Annual report on the health of Sheffield for the year 1873* (Sheffield, 1874), 16-17, 28-9 (hereafter SheffMOH-1873). For a discussion of patterns of infant mortality in nineteenth-century Sheffield see N. Williams, 'Death in its season: class, environment and the mortality of infants in nineteenth-century Sheffield', *Social History of Medicine*, 5 (1992), 71-94.
53. SheffMOH-1875, 12.
54. For a short summary of the missing years see SheffMOH-1959, 201-6.
55. SheffMOH-1885, 14.
56. SheffMOH-1885, 11-12.
57. See for instance, SheffMOH-1886, 16-17; 1888, 20-1; 1891, 13-14.
58. SheffMOH-1893, 19.
59. SheffMOH-1897, 5. Robertson does not state what parents were thought to be ignorant of,

although 'it would appear advisable for the Sanitary Authority to use every means in their power to diffuse a knowledge of the laws of health'.

60. SheffMOH-1899, 16-17.
61. SheffMOH-1899, 16-17.
62. SheffMOH-1904, 67-8.
63. SheffMOH-1902, 18. It was not until the Notification of Births Act came into force in February 1908 that visits could be made to all mothers of newly-born babies.
64. SheffMOH-1899, 50; Fildes, 'Infant feeding practices', 263-7.
65. SheffMOH-1906, 53.
66. SheffMOH-1902, 18.
67. SheffMOH-1906, ix.
68. SheffMOH-1908.
69. Using far better data from Derbyshire in the 1920s, Alice Reid concluded that even by this later date health visiting was producing only modest improvements in infant mortality: A. Reid, 'Health visitors and child health: did health visitors have an impact?', *Annales de Démographie Historique*, (2001), 117-37.
70. Woods, *Demography*, 275 compares Birmingham with England and Wales. Also, see *Seventy-fourth annual report of the Registrar General for 1911* (London, 1913), xxxiv.
71. BirmMOH-1872, 6.
72. On diarrhoea and hot weather see BirmMOH-1872, 6; on the role of cool summers see SheffMOH-1914, xvii.
73. A. Newsholme, 'Infantile mortality. A statistical study from the public health standpoint', *The Practitioner*, 75 (1905), 497. The *Report of the inter-departmental committee on physical deterioration*, B. P.P. (1904): Vol. 1, Report and appendix Cd 2175, 50 provides further supporting evidence: 'A decrease at present in breast-feeding is generally admitted to be the case in all classes of society, at any rate in the urban districts'. See also Fildes, 'Infant feeding practices', 252-3.
74. *Fifty-fourth Annual Report of the Registrar General for 1871* (London, 1873). This was also published as 'Report of the infant mortality committee', *Transactions of the Obstetrical Society of London*, 9 (1870), 132-49.
75. Many diarrhoea deaths were no doubt of weanlings, but the MOH reports are largely silent as to what recommendations were made about weaning. In 1906 the Birmingham MOH urged mothers not to wean during the hot summer months, see BirmMOH-1906, 53. In Sheffield exclusive maternal breast-feeding was recommended for the first six to seven months. This was to be followed by some proprietary infant preparation together with cow's milk until the infant was twelve months old. Feeding bottles should be cleaned with water and soda after every meal and boiled every day. These recommendations were taken to be an example of good practice and were reproduced in the Physical Deterioration Report: see *Physical deterioration*, Vol III, *Appendix and general index*, Cd 2186, appendix XVIII.
76. The easy availability of alternative infant foods may also have encouraged some mothers who experienced difficulties breast-feeding to begin artificial feeding. Woods, *Demography*, 285-91, shows that levels of maternal breast-feeding were high by European standards, but that many breast-fed infants were also given supplementary foods and this may have made them more susceptible to diarrhoea; see also W. Howarth, 'The influence of feeding on the mortality of infants', *The Lancet*, (22 July 1905), 213. R. Apple, *Mothers and medicine. A social history of infant feeding* (University of Wisconsin Press, 1987) charts the rise of artificial feeding in the USA from the 1890s, but a similar study for Britain has yet to be undertaken.
77. J. Brownlee, 'The relation of infantile mortality to mortality in subsequent life', *Journal of the Royal Statistical Society*, 70 (1917), 223.
78. J. Wheatley, 'Discussion of factors contributing to the recent decrease in infantile mortality', *British Medical Journal*, (27 October 1923), 754-9.
79. Wheatley, 'Recent decrease', 755.
80. Wheatley, 'Recent decrease', 755. Note that there is an arithmetical mistake in the original since Wheatley states that replies were received from only 40 county MOHs. Many of these 'causes' have been the subject of more recent studies: see for instance I. Buchanan, 'Infant feeding, sanitation and diarrhoea in colliery communities, 1880-1911', in D.J. Oddy and D.S. Miller eds.,

- Diet and health in modern Britain* (London, 1985), 148–77; N. Morgan, 'Infant mortality, flies and horses in later-nineteenth-century towns: a case study of Preston', *Continuity and Change*, 17 (2002), 97–132; R.I. Woods, P.A. Watterson and J.H. Woodward, 'The causes of rapid infant mortality decline in England and Wales, 1861–1921 part I', *Population Studies*, 42 (1988), 343–66.
81. Woods, *Demography*, Figure 7.5, 1.
 82. A. Newsholme, *Fifty years in public health* (London, 1935), 321–46. See Woods *Demography*, 281–9 for a discussion of Newsholme's approach to tackling infant mortality.
 83. Newsholme, *Fifty years*, 324–5 quoting the work of Dr Sykes, MOH for St Pancras.
 84. Newsholme, *Fifty years*, 332.
 85. Newsholme, *Fifty years*, 335.
 86. Newsholme, *Fifty years*, 335; see also C. Parton, 'The infant welfare movement in early twentieth century Huddersfield', *Journal of Regional and Local Studies*, 3 (1983), 69–77.
 87. G. Newman, *The building of a nation's health* (London, 1939), 318. Wheatley, 'Decrease in infantile mortality', 758, also concluded that the greatest improvements were brought about through better education.
 88. R. Woods, N. Williams and C. Galley, 'Infant mortality in England -1550–1950 - Problems in the identification of long-term trends and geographical and social variations', in C.A. Corsini and P. P. Viazzo eds., *The decline of infant mortality in Europe – 1800–1950 – four national case studies* (Florence, 1993), 46–7; Woods, *Demography*, 163–9.
 89. See the extensive discussion in E. Garrett *et al.*, *Changing family size in England and Wales* (Cambridge, 2001), 139–47. For Sheffield see Williams, 'Death in its season'.
 90. *Physical deterioration*, 44; also see Vol II, *List of witnesses and minutes of evidence* Cd 2210; Vol III, *Appendix*; L. Brunton, 'The report of the Inter-Departmental Committee on Physical Degeneration', *Public Health*, 19 (1905), 274–92; B. Bentley, 'Health and politics: the British physical deterioration report of 1904', *Bulletin of the History of Medicine*, 39 (1965), 143–53; A. Davin, 'Imperialism and motherhood', *History Workshop Journal*, (1978), 9–65; J. Lewis, *The Politics of motherhood* (London, 1980).
 91. G.F. McCleary, *The early history of the infant welfare movement* (London, 1933), 112 quoted in R.A. Meckel, *Save the babies* (Ann Arbor, 1980), 104. Also see, P. Wright, 'Babyhood: The social construction of infant care as a medical problem in England in the years around 1900', in M. Lock and D. Gordon eds., *Biomedicine examined* (Dordrecht, 1988), 299–329.
 92. Lewis, *Politics of motherhood*, chapter 3, 'Educating the mothers', 89–116; E. Pritchard, 'Infant mortality and the welfare movement', *Contemporary Review*, 120 (1920), 76–82; R. Millward and F. Bell, 'Infant mortality in Victorian Britain: the mother as medium', *Economic History Review*, 54 (2001), 699–733.
 93. G. Newman, *Infant mortality a social problem* (London, 1906), 257; Williams and Galley, 'Urban-rural differentials', 417.
 94. M. Drake, 'A study of infant life in Westminster', *Journal of the Royal Statistical Society*, 71 (1908), 678–86. See also Elderton's neglected, but important, study, E. M. Elderton, 'On the relative value of the factors which influence infant welfare', *Annals of Eugenics*, part I 1 (1925–6), 139–243; part II 1 (1925–6), 277–381; part III 3 (1928), 96–185.
 95. Williams and Galley, 'Urban-rural differentials'.
 96. Woods, *Demography*, 305–6.