**Is the Pen Mightier Than the Sword? Exploring Urban and Rural Health in Victorian England and Wales Using the Registrar General Reports**

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## Abstract

In AD 1836, the General Register Office (GRO) was established to oversee the national system of civil registration in England and Wales, recording all births, deaths and marriages. Additional data regarding population size, division size and patterns of occupation within each division permit urban and rural areas (and those with both urban and rural characteristics, described here as 'mixed') to be directly compared to each other. The annual Reports of the Registrar General summarize the collected data, including cause of and age at death, which is of particular value to historical demographers and bioarcheologists, allowing us to investigate demographic patterns in urban and rural districts in the nineteenth century.

Overall, this paper aims to highlight how this documentary evidence can supplement osteological and paleopathological data to investigate how urbanization affected the health of past populations. It examines the data contained within the first Registrar General report (for 1837-8), in order to assess patterns of mortality of diverse rural, urban, and mixed populations within England and Wales at a point in time during a period of rapid urbanization. It shows that urban and mixed districts typically had lower life expectancy and different patterns in cause of death compared to rural areas. The paper briefly compares how the documentary data differs

from information regarding health from skeletal populations, focusing on the city of London, highlighting that certain age groups (the very young and very old) are typically underrepresented in archeological assemblages and reminding us that, while the paleopathological record offers much in terms of chronic health, evidence of acute disease and importantly cause of death can rarely be ascertained from skeletal remains.

**#. 1 The Industrial Revolution**

In the course of human history, there have been two major economic and social transitions that have led to dramatic changes in human society and health. The first is the Neolithic Revolution, commencing in the Fertile Crescent circa 10,000 BC, which is associated with the adoption and intensification of agriculture. Humans for the first time became reliant upon food production rather than food collection, and this placed us upon a path of monumental social change from which we could never return. The second is the beginning of the Industrial Revolution in the eighteenth century, a transition that would lead to the creation of the modern world. These economic transformations impacted all aspects of human life, from population size and density, to general health and well-being. While the adoption and development of agriculture was a long-term process spanning several millennia, the Industrial Revolution is startling in terms of the rapidity with which it occurred. Within the span of two centuries, human society was dramatically altered, as machines replaced human labor, and the rise of the modern city began. It is in this period that urbanization truly commenced in Britain, and this process was associated with a significant demographic shift in population from rural to urban centers (Woods et al., 1992; Luckin, 2015). This population movement is associated with increasing population size and density, with large numbers of people living within a relatively small geographic space. This is in direct opposition to settlement patterns throughout most of Britain's long history, which was characterized by small human populations living in large rural/agricultural landscapes. The focus of this chapter is to examine how these different rural and urban settlement patterns translate into differing patterns of morbidity and mortality for populations in England and Wales[1] during this enormous cultural transition.

[1] This paper focusses on documentary data that relate to England and Wales specifically, however throughout we discuss broader research which relate to Britain as a whole, and in some cases, more specifically to England.

Though the exact date of the start of the Industrial Revolution in Britain is debated by historians, it is generally held to have commenced in the 1780s and gained momentum in the nineteenth century (Hobsbawm, 1996). The period of greatest intensity occured between roughly the late eighteenth century and AD 1840, and in less than a century, human life in Europe and the United States was forever transformed. Harnessing the power of steam and water to provide energy for machines and factories occurred first in Britain (Allen, 2009). The British Industrial Revolution was a positive response to the global economy of the seventeenth and eighteenth centuries, and began a process that would disseminate to the rest of Europe and then to the Americas and the rest of the world (Allen, 2009). Britain during the height of the colonial period was uniquely placed to lead this economic transformation. The enormous de-population resulting from repeated outbreaks of the bubonic plague from the fourteenth to the seventeenth centuries, resulted in labor being at a premium, and wages for the majority of the population increased substantially. Both in Britain and later in the United States, the productivity of individual workers was increased by the invention of labor-saving devices (Allen, 2000; 2009). This commitment to the development of agricultural and industrial machinery, specifically in Britain and America, resulted from the comparatively high wages for labor in those nations, and the desire to economize on labor costs. The abundance of natural resources and land also contributed to productivity and increased profit margins (Allen, 2009); for example, the abundance of coal reserves in Britain resulted in low fuel costs. The introduction of labor saving machinery, powered by cheap fuel, increased productivity while keeping wages high and allowing businesses to remain competitive on the open market (Allen, 2009). Industrial innovations developed in Britain in the eigthteenth century would set the stage for industrialization in the United States in the nineteenth century (Allen, 2009; David, 1975; Habakkuk, 1962; Temin, 1966). The economic historian Robert Allen (2009) argues that the majority of the remainder of Europe (with perhaps the exception of the Low Countries: Belgium, the Netherlands and Luxembourg) was characterized by low labor costs and high fuel costs, and thus there was not an economic incentive to invest heavily in labor-saving technology. The colonial Empire that Britain had developed in the proceeding centuries and the increase in intercontinental trade fueled British commerce and manufacturing. Thus, it is not surprising that the Industrial Revolution began first in Britain in the eighteenth century, a fact that laid the foundation for enormous demographic changes in settlement and land use. For the majority of the British population, the Industrial Revolution led to profound changes in everyday life, including considerable migration, particularly of young adults to urban areas, increased fertility rates, and increased environmental pollution and industrial threats. The potential impact of this economic transition upon human health was considerable, but the picture is complex and the stressors intertwined.

### #.2 Population Growth and Urbanization

The rise of the city in Britain was directly a result of the Industrial Revolution. While towns had existed in Britain since the Roman Period (first to early fifth centuries AD), it was overwhelmingly a rural country. In the mid-sixteenth century, most of the population was invested in agriculture, and cities were relatively rare and small (Whyte, 1999). By the mid-nineteenth century, the number of urban dwellers in England had risen to 50% of the population (Scott & Duncan, 1998). Rather than intrinsic growth within cities themselves, this occurred primarily through widespread migration of country-dwellers into towns and cities. Thus, it resulted from a British demographic shift, rather than from wide-scale migration from abroad.

These immigrants were composed of a disproportionate number of teens and young adults, who moved to urban areas for work as servants, apprentices, or (later) factory workers (Allen, 2009; David, 1975). Their rural upbringing equipped them with a more limited exposure to pathogens, particularly those that are density dependent, a factor that would make them extremely vulnerable to infectious pathogens like smallpox upon their arrival in the city (Roberts & Cox, 2003, pp. 333-40).

Two principal factors that must be carefully considered when evaluating changing levels of health in the past are the size and the spatial distribution of the population through time. Population size and density are crucial factors when investigating the impact of different disease categories in the past. While the estimation of population levels in the past are problematic, it has been suggested that the population of Britain was 5.5 million at the beginning of the eighteenth century, and roughly 9 million at the commencement of the nineteenth century (Razzell, 1994, p. 169). The population growth experienced in the nineteenth century largely resulted from an excess of births over deaths (Scott & Duncan, 1998).

[Insert Table 1]

Allen (2009) suggests that just 7% of the population lived in urban spaces in AD 1500, rising to 29% by 1800 (see Table 1). In a different study, Whyte (1999, p. 276) argues that in 1550, only 3.5% of the population of England lived in towns *larger than 10,000 people*, but by 1700 that number had grown to 13.3%, and to over 20% in 1800. It is generally agreed that by 1850, approxinmately 50% of the population lived in urban areas (Scott & Duncan, 1998;

Woods, 1992). This shift from a rural to an urban population is a direct result of a series of events directly linked to industrialization, including of agriculture and rural industry.

The rapid urbanization of Britain, particularly England, was intimately interlinked with improvements in agriculture. The decline of the rural population in the eighteenth century was related to innovations in agricultural technology in addition to changes in land organization, and the need for labor in towns and cities. In 1500, each individual farmer had to feed only about 1.33 people, but by 1800, a single farmer had to provide for three people on average (Allen, 2009). As the number of people invested in agriculture dropped, there were increases in both the urban and rural non-agricultural populations. The latter represents the beginnings of the ‘proto-industrial’ revolution, a phenomenon that saw the rise of manufacturing industries in the countryside (Coleman, 1983; Mendels, 1972). The rural non-agricultural segment of the population (those engaged in professions other than farming) was limited in 1500, but doubled by the nineteenth century (Allen, 2009, p. 17 and Table 1). The proto-industrial movement is characterized by small-scale production in workshops or homes typically located outside of the city boundaries. Merchants would commission these rural workers for piece work, provide the raw materials, and collect the finished product to be sold by them in larger regional markets and cities or shipped to other European regions. Over time, regions became highly specialized as the woolen industries emerged in Yorkshire, Birmingham focused upon the production of metal implements, and knitted and woven goods were produced in Leicestershire and Oxford. Many of these proto-industrial areas gave rise to large towns and cities, such as Birmingham, Leeds and Manchester, which expanded in size rapidly. Rural industries were found in many parts of Europe, but they were particularly dense in England (Allen, 2009, pp. 18-9).

The rise of cities in England in particular was also heavily influenced by increased trade and commerce. By the seventeenth century, the English and the Dutch dominated the European woolen industry, having driven out the Italians (Harte, 1997; Rapp, 1975). This success was in part a result of the reversion of good farmland to pasture for sheep after the pandemic of bubonic plague in the middle ages. In addition, Huguenots refugees from the continent brought with them valuable new skills to England, improving and diversifying English products (Goose, 2005). This rise in rural workshops from the late eighteenth century onwards correlates well with the increased representation of people living in rural areas but not engaged in agriculture.

Within bioarchaeology and medical history, the assumption has consistently been one of poorer health in the urban regions, with improved health and longevity in the rural areas. However, this view is too simplistic, as the binary division of urban/rural obfuscates the real social complexity. Movement was not unilateral, and movement from urban to rural communities has rarely been investigated. The work of Gowland et al. (2018) demonstrates significant migration of individuals (particularly older children and adolescents) from poor urban communities to the countryside, demonstrating that bilateral movement was present throughout this period. This movement from urban centers was not to supply the agricultural rural community, but instead was focused upon the supply of labor to the industries emerging in rural areas. An evaluation of health during this period is complicated by this bi-directional movement, as individuals moving to areas outside of the cities may not be identified as such. Thus, they are likely to be assessed as residing in rural areas in terms of the recording of morbidity asnd mortality, when in fact much of their formative years were spent in urban settings.

**#.3 Approaches for Investigating Health in the Past**

The field of bioarchaeology has developed a wide range of techniques that allow for a sophisticated investigation of health and illness in the past. Through macroscopic, microscopic, genetic, chemical, and ancient DNA means, bioarchaeologists have mapped the course of human health over thousands of years, including a wide range of geographically-distinct populations (e.g. Steckel et al., 2018). Like all disciplines, bioarchaeology has inherent limitations, and this particularly relates to a far greater emphasis upon the evaluation of medical conditions that are visible in osseous material. In terms of the analysis of health in past populations, the field of bioarchaeology emphasizes the examination of principally skeletal material. However, there is a tacit awareness amongst practitioners that a large portion of the picture remains blank. In prehistoric groups, we must rely upon related archaeological and environmental evidence to inform us about issues of human behavior in the past. The evaluation of health and illness in the historic period is assisted by documentary evidence of events in the past, often witnessed first-hand by the authors, although we must consider that many of these writiers had a specific, often political, agenda. Documentary evidence provides researchers with a valuable 'emic' dimension to the investigation of human health, one in which the people of the past contribute to the assessment itself. However, the majority of these sources were written by people who were not members of the medical community. This fact can lead to profound difficulties in interpreting their observations, and it is often impossible to identify a specific pathogen in the descriptions. For conditions like bubonic plague and tuberculosis, diseases that had such a societal impact that they were regularly the topic of reflection, we have an enormous body of work at our disposal. However, the use of a wide range of different terms to refer to the same condition and discrepancies in descriptions of transmission, incubation, and symptoms can make the interpretation of these written works fraught with pitfalls. In order to reduce the likelihood of misinterpretation, it is perhaps more useful to rely, in particular, upon the products of medical practitioners. This in itself is also problematic, in that 'Germ Theory,' which forms the foundation of all modern medicine, was not truly established until the 1880s, and well into the twentieth century a considerable portion of the medical community was still supportive of the 'miasma theory' of disease origin and contagion. This explanation for the emergence of disease had dominated the Western medical philosophy since the Greco-Roman Period (fourth century BC). However, despite the late development of 'Germ Theory,' medical practitioners prior to the late nineteenth century still benefited from extensive training within the medical sciences and were well-versed in the diagnosis and symptomology of a wide number of pathological conditions, despite their less than stellar therapeutic success. The etiology of a number of diseases recorded, though, was well understood by medical practitioners, resulting in consistently accurate diagnoses (e.g., tuberculosis, smallpox, measles, whooping cough, scarlet fever). More difficult to interpret are the categories recording death by 'teething' (presumably linked to increased exposure to pathogens during weaning) or 'dysentery' (a non-specific term caused by a considerable number of pathogens). This information is still useful for formulating general epidemiological models of overall morbidity and mortality during the period, but it cannot assist the researcher in understanding the impact of specific pathogens upon different segments of the regional populations. Documentary evidence regarding the state of health of the population of Britain offers a significant, and different, perspective on the health differentials between rural and urban communities in the nineteenth century.

### #.4 The Registrar General Reports

The General Register Office for England and Wales (GRO) is responsible for the civil registration of births (baptisms), marriages, and deaths. From the early twentieth century, stillbirths were also recorded separately from neonatal mortality. The data generated by the GRO were of important practical value to commerce, government, and bureaucracy, as they were gathered "in order to furnish the means of tracing the descent of property, of calculating the expectation of life and the laws of mortality, and of ascertaining the state of disease and the operation of moral and physical causes on the health of the people and the progress of population" (Glass, 1973, p. 142-3).

The GRO was established in 1836 as a result of the Births and Deaths Registration Act of 1836, with civil registrations officially commencing on July 1, 1837. The Marriage Act of 1837 also assisted in formalizing the recording of vital statistics. Furthermore, the Births and Deaths Registration Act required the formal presentation of death certificates recording both the age of the deceased and the cause of death. Prior to this time, there was no official system of civil registration in place, as births, marriages, and deaths were typically recorded in the local parish registers of the Church of England. The establishment of parish registers occurred in the sixteenth century (formally in AD 1538) by decree of Henry VIII, who required each parish to keep a record of baptisms, marriages, and deaths (Roberts & Cox, 2003, p. 289-93). Since the seventeenth century, there was an increased presence of religious nonconformists and an inconsistent recording of births, marriages, and deaths in parish registers, so that by the nineteenth century, it was clear that a formal civil registration was necessary. The area encompassing England and Wales was organized into 25 divisions broken down into 619 registration districts (increased to 623 in AD 1851), based upon the recent Poor Law Unions.

Each district was supervised by a Superintendent Registrar with a number of sub-districts that were supervised by local registrars (Woods, 1995). The establishment of equivalent Scottish legislation did not occur until 1854, due to several failures of the Bill to pass there previously (Cameron, 2007). Until this time, the Church of Scotland maintained a system of parochial registration of births, marriages and deaths similar to that of the Church of England in England and Wales (Cameron, 2007). More accurate demographic and family data were also provided by the Census reports, the first one occurring in AD 1801, and the London Bills of Mortality which exist from the mid-seventeenth to the mid-nineteenth centuries and recorded the numbers of baptized and dying, age, and cause of death (Roberts & Cox, 2003, pp. 293-99).

The Public Health Act of 1848 established a Central Board of Health for the first time. The Public Health Act particularly focused upon issues such as the construction of sewers and improved drainage, the provision of safe, clean drinking water, the removal of all waste from houses, streets and roads, and the appointment of an official medical officer for each town (Parliament UK, 2013). In areas where the death rate was more than 23%, local boards of health were required to be established. Thus, the public health movement focused principally upon instituting environmental safeguards in cities, where the concentration of population translated into death rates exceeding 23% in many districts.

There is no question that there are problems with relying on the Registrar General Reports (Hardy, 1994). It is clear from some of the demographic data that individuals registering deaths may have rounded ages up to the nearest five or ten years, particularly for older individuals who may not have known their year of birth. Many causes of death were recorded as either ‘unknown’ or ‘old age’, and there is a clear rural/urban divide in the level of recording, with higher frequencies of both of these categories in rural populations (see below). There are certainly categories of disease (like ‘hysteria’ or ‘worms’) that would either not be recognized as categories of disease today or as causes of death. Some conditions, such as typhus and typhoid, were lumped into the same category until the diseases were reliably distinguished from each other in the Registrar’s Reports of the 1860s (Luckin, 2015). Inconsistencies in the manner of organizing and defining categories and changes to the presentation of data over time make it very difficult to compare reports from different years (Woods & Shelton, 1997). Furthermore, the reports cannot account for individuals who are recorded as residing in one district, but died in a hospital or care facility in another district (Luckin, 2015). Despite these limitations of the data, some of them can be overcome by focusing upon a single year of the General Registrar’s Report, in this case, the first report ever published for the year 1 July 1837 to 30 June 1838 (General Register Office, 1839). It is likely that in the case of some causes of death (i.e. dropsy, old age, generation), we may never adequately access the actual cause of the individual’s demise. However, despite the fact that physicians at this time functioned in a pre-Germ Theory discipline, there is no question that the diagnostic criteria and symptomology of particularly infectious pathogens, such as tuberculosis, scarlet fever, smallpox, and measles, were well-established, and we can place a reasonable level of faith in medical diagnoses of these conditions at the time. This also holds true for the frequencies of infant mortality, as there was a consistent commitment in the reports to the actual recording of infant deaths for both males and females. Even though the cause of death was often not recorded, or is difficult to interpret, an assessment of infant mortality can allow for a general understanding of the risks to survival of the young at this time in different regions of England and Wales.

We have used the report of 1837 to investigate differences in mortality and cause of death between rural and urban districts within England and Wales (see Table 2; a total of 335,055 deaths were recorded in this report). This gives us a window into the general state of health at the time and, unlike skeletal paleopathology, is not complicated by the longevity of cemetery use (Wood et al., 1992, although due to the high levels of migration, these data do not conform to the ideals set out in the Osteological Paradox). The demographic evidence also circumvents the problems presented by osteological age-at-death data (under-representation of infants in the archaeological record and over-representation of middle adults at the expense of mature adults in particular) due to differential preservation and recovery and biases in established age estimation methods (Buckberry, 2015; Grauer, 1991). It further allows for an analysis of sex-based patterns of death in nonadults which cannot be reliably determined in skeletal remains.

[Insert Table 2]

**#.5 Patterns in Health from the Registrar General Reports**

It is generally held that beginning in the latter part of the nineteenth century, life expectancy and the health of the population improved in general (Carpenter, 2009; Mooney, 2015; Roberts & Cox, 2003; Woods & Shelton, 1997). As previously noted, population growth was stimulated originally by high fertility rates, with a decline in infant mortality following in the nineteenth to twentieth centuries. However, this improvement occurred at different rates in different segments of the population and in different regions. Interestingly, life expectancy improved most notably between ages 2 and 25 years, while there was little to no improvement in longevity for infants or those over 35 years until after 1900 (Luckin, 1980; Woods & Woodward, 1984, p. 39; Woods 1992). This strongly implies that, in general, the life expectancy of children and young adults did not improve significantly until the latter nineteenth century onwards. Alternately, significant improvements were not in place to increase the life expectancy of newborns, infants or toddlers, and adults over the age of 45 years until the twentieth century. By 1911, It appears that in England, the national life expectancy had increased and the rural/urban divide had become reduced substantially (Woods 1992). This improvement in overall health is related to improvements in urban health, resulting from the establishment of a series of Public Health initiatives in the mid/late nineteenth century.

One indicator of overall health and well-being in a population is the level of infant mortality, which provides valuable insight into how successfully a society is able to buffer neonates and infants from the stressors in their environment. Stillbirth and neonatal mortality levels also provide insights into the nutritional and immunological health of the mother before and during pregnancy. The period after birth was particularly perilous for women in the past, and correlations can also sometimes be made between infant and maternal mortality levels (Lewis, 2017; Loudon, 1993). Women were at particular risk of dying from blood loss, puerperal (lying-in) fever and infection by a range of pathogens during and after delivery (Lewis, 2017; Loudon, 1993; Roberts & Cox, 2003, pp. 315-6). It appears that the maternal mortality rate changed very little throught the nineteenth century, estimated at 5 per 1000 births at the beginning of the century, and 4.9 in 1000 births at the end (Carter & Duriez, 1986; Roberts & Cox, 2003; pp. 315-17). Complicating this is the related issue of fluctuating fertility levels, which naturally have an important influence upon the levels of infant mortality. Fortunately for the period encompassing the emergence of Industry in Western Europe, standardized methods of recording births (baptisms), marriages, and deaths were developed in several nations, allowing demographers to establish general fertility rates for this period over a fairly wide geographic area (Woods, 2005).

A dominant explanation for the decline in infant mortality in England and Wales is the 'urban theory.' This theory asserts that in the latter nineteenth century, infant and maternal mortality declined first in urban centers, as a result of the increased investment in public health (Woods et al., 1988; 1989). Proponents of this position note that only 43 urban registration districts accounted for over half of the total number of deaths, and therefore "developments in only a handful of places would have radically affected national trends" (Woods et al., 1988, p. 358). They further note that mortality reductions in the larger cities "was a potent force in Victorian and Edwardian demography in that it served to keep British infant mortality…high by way of the level of urbanisation" (Woods et al., 1988, p. 359). They conclude that the highest rates of infant mortality decline occurred in urban areas, which were associated with the highest overall rates of infant mortality, and that "the timing of infant mortality decline was remarkably consistent throughout the country, regardless of district and social class" (Woods et al., 1989, p. 129). The rates would have remained elevated in the rural regions, as the advancement in water and air quality, waste disposal, and improvements in housing and work environments occurred later in time in the areas outside of the cities. Thus, declines in infant and maternal mortality are directly linked to the rise of the public health movement. There is no question that the establishment of widespread public health safeguards, particularly in urban areas, made an important contribution to the decline in urban infant and maternal mortality. The question revolves around whether infant and maternal mortality declined first in urban centers, as this model would predict. In recent years the ‘urban effect’ has been challenged by scholars who have argued that in the mid-nineteenth century, the highest infant mortality rates were found in the north of England and the midlands and the lowest rates found in the south and west (Lee, 1991), areas which correspond to our mixed districts. Contrary to the assertions of the ‘urban’ explanation for infant mortality decline, Lee notes that the rates did not decline uniformly, and there was no clearly marked hiatus around the beginning of the century (Lee, 1991, p. 56). Alternately, Lee argues that the decline in infant mortality began earlier in regions with the lowest rates (Lee, 1991). This position has been supported by Williams and Galley (1995, p. 412) who note that “The beginnings of the decline in infant mortality must now be extended back to at least the 1860’s, if not before. The stability of infant mortality in London and its volatility in the large towns has tended to cloud the national picture, but in many places the risks to infants seem to have gradually declined throughout the second half of the nineteenth century”. Thus it is possible that the national decline in infant mortality was not being driven by urban areas, as the largest and earliest declines are found in the rural portions of southeast England. Infant mortality in urban areas was slow to decline due to the specific stressors unique to the urban environment (Gregory, 2008).

**#.6 A Point in Time: The 1837 Registrar General Report**

The Registrar General Report for 1837-38 (hereafter 1837) divides England into 24 divisions, with Wales, Monmouth, and Hereford comprising the 25$^{th}$ division (see fig. 1 and Table 3). In the 1837 report, the data were presented at registration division level, rather than by the smaller districts and sub-districts discussed above (General Register Office, 1839). Maps of the districts were not introduced until 1842 (Graham, 1842), which makes it somewhat difficult to identify which data relate to urban populations and which to rural ones in the 1837 report. The summary statistics for 1837 include the size of each division (in acres), plus the total population size and numbers of families engaged in agriculture, in ‘trade, manufacturing and handicrafts’ and ‘other’, based on the 1831 census data. We used these data (Table 3) to identify three broad types of divisions to facilitate comparison between rural and urban populations as follows. Those divisions with less than 1.5% of families employed in agriculture and with a population density of over 30 people per acre were identified as urban, and comprise the major cities of London and Birmingham (n=2). Those districts with over 30% of families employed in agriculture and with a population density of under 0.5 people per acre were deemed rural districts (n=16), although clearly not everyone living in these areas worked in agriculture. The remaining areas (n=7) typically have a low percentage of families employed in agriculture (less than 20%) and a low population density (ranging from 0.46 to 6.27 people per acre); we have named these ‘mixed’ divisions (see fig. 2). The mixed divisions all contain heavily industrialized areas – either cities, towns, or areas of heavy mining – but cover a larger geographic area than the two urban centers and, in two cases, include a large rural hinterland. Many of the individuals living in mixed divisions probably lived in urban centers[2]. Of key importance is the significance of the growing towns. For example, Division 20 – the West Riding of Yorkshire (except the northern part thereof and Leeds) – includes the city of Bradford, whose population increased by 700% between 1800 and 1850 (Luckin, 2015), as well as the large industrial towns of Dewsbury, Doncaster, Halifax, Huddersfield, Keighley, Rotherham, Sheffield, and Wakefield; it is likely that living conditions in these towns were especially poor during this period of rapid urbanization. Between 32.99% and 75.97% of the families in these seven ‘mixed’ divisions were

[2]It is important to note that these mixed divisions do not only represent the rural non-agricultural groups discussed earlier.

employed in trade, manufacturing, and handicrafts (see Table 3 and fig. 3). Data from the 25 divisions were combined into these three broader groups for the purpose of this paper.

[Insert Figure 1]

[Insert Table 3]

[Insert Figures 2 and 3]

Mortality patterns for the three types of district are similar, with very high infant mortality, high childhood mortality but evidence of longevity for those who survived the perils of childhood. Overall, life expectancy was highest in the rural areas, with lower rates of infant mortality and more individuals dying in the older decades. The lower number of deaths in the younger adult decades in rural areas is probably influenced by the migration of younger individuals into towns and cities for work. Surprisingly, life expectancy was lowest in the mixed communities compared to the two major urban centers, perhaps because the urban centers in the mixed regions struggled to meet the demands of the quickly expanding population, combined with the impact of increased migration into these towns, lowering the average age of the living adult population (see fig. 4 and Table 4). As expected, infant mortality was higher for males than females, reflecting the known pattern of excess male mortality (Drevenstedt et al., 2008); this held true for the three district types (fig. 5) and for all 25 districts. Approximately 1.71% of the females that died in 1837 died in childbirth; this was highest in the mixed districts (2.05%) and lowest in the rural districts (1.65%). Those who survived the risks of infancy and young childhood could expect, on average, to live into their 50s. Relatively few individuals lived until their 90s (0.79% of all individuals; 0.37% in urban divisions; 0.45% in mixed divisions; 1.02%

in rural divisions). The oldest documented age-at-death was 110, recorded in London (one female) and rural District 10 (one female). Three females were recorded as dying at 107 and four individuals (two males and two females) at 106 years. Age-at-death was recorded as unknown for 873 individuals; this is a higher percentage of deaths for urban than for rural and mixed populations (0.48%, 0.21%, and 0.24% of all recorded deaths, respectively).

[Insert Figure 4]

[Insert Table 4]

[Insert Figure 5]

The documentary data for age-at-death differs significantly from that presented by osteological data. We gathered age-at-death data from three major excavations of post-medeival cemeteries in London from the WORD[3] osteological database, namely Cross Bones, St Bride's Lower Cemetery Farringdon Street, and Chelsea Old Church (WORD database, 2019). The Cross Bones cemetery was in use from 1800 to 1853; 148 individuals were excavated and included in the WORD database (Brickley & Miles, 1999). St Bride's Lower cemetery was is use between 1770 and 1849; 542 individuals were excavated and recorded (Miles & Conheeney, 2005). Both of these represent poorer populations in London, Chelsea in comparison was (and remains) a more affluent area of London. The Chelsea Old Church cemetery was in use from 1712 to 1842; 198 individuals were excavated and recorded (Cowie et al., 2008). These populations do not represtent a single point in time and probably do not directly reflect the

[3] The Wellcome Osteological Research Database (WORD) provides skeletal data for cemetery populations curated by the Museum of London. These data are publically available: https://www.museumoflondon.org.uk/collections/other-collection-databases-and-libraries/centre-human-bioarchaeology/about-osteological-database

population of London in 1837; however, they do represent excavated bioarchaeological populations. The comparison between skeletal data and GRO data for London (fig. 6) reveals expected differences due to the nature of the different data sets, with infants and young children in particular under-represented and middle adults overrepresented in the archaeological data.

[Insert Figure 6]

The Registrar General Report for 1837 provided cause of death data, grouped into 11 broad categories (epidemic, nervous, respiratory, circulation, digestive, urinary, generation, locomotion, integumentary, ‘old age,’ and violent), plus a group for uncertain cause of death and a final unknown group (‘not specified’). These are then subdivided into 94 specific causes of death (discussed further below). As noted above, we must view these data with caution, as the diagnosis of disease and identification of cause of death were not as rigorous as today, yet we should not underestimate the skill of trained physicians of the time. Approximately 81.92% of all deaths were attributed to epidemic, nervous, and respiratory diseases, plus violent death (presumably predominantly accidental) and old age, with the remaining groups accounting for between 0.18 to 6.62% of all deaths (see Table 5 and fig. 7). There was a statistically significant difference between the three population groups for all causes of death ($\chi^2$ test, alpha set at 0.01).

As expected, more deaths were attributed to epidemic and respiratory disease in urban centers, and old age was cited as cause of death more frequently for the rural populations. Circulatory disease was given as cause of death far more often in urban areas than both rural and mixed regions, but the reasons for this are unclear. Both ‘uncertain’ cause of death and cause of ‘death ‘not specified’ are more common in the rural areas; this may reflect the lower density of doctors and sparse populations in these districts.

[Insert Table 5]

[Insert Figure 7]

However, for all of these, a detailed investigation demonstrates that between the different divisions making up the three broad population groups (rural, mixed, urban) there is a substantial variation in percentage of deaths attributed to each cause of death. Here we have focused on the four areas where we expected to see differences between the rural and urban areas: epidemics, respiratory disease, old age, and violence (see figs. 8-11). Epidemic disease (fig. 8) caused over 25% of deaths in London, the mixed areas of central Lancashire, Liverpool,West Derbyshire, Staffordshire, Shropshire and Worcestershire, and in the rural divisions of Devon and Somerset. The lowest percentage of deaths attributed to epidemic disease was 14.70% in Durham and North Yorkshire. Overall, the data show that although epidemics caused more deaths in cities and towns overall, they affected the whole country.

[Insert Figures 8 and 9]

For respiratory disease (fig. 9), it is clear that the picture is very mixed; the key difference is the higher percentage of deaths from respiratory disease in Birmingham (32.90%, the highest for any one region) is offset by the significantly larger population size of London, where respiratory disease was listed as the cause of 26.28% of deaths, producing an average of 26.64%

for the two urban districts. Respiratory disease was also a leading cause of death in the mixed areas of Manchester and Salford, Leeds and Lancashire, and the rural areas of Cornwall, Cheshire Shropshire and Staffordshire, and Norfolk and Suffolk, all of which attributed more deaths to respiratory disease than London. This supports the hypothesis that the Industrial north had particularly poor air quality (Mosley, 2008).

[Insert Figure 10]

Violent deaths (fig. 10) will have included accidental deaths. They were most common in mixed areas, in particular Staffordshire, Shropshire, and Worcestershire. Essex has the only substantially lower percentage of violent deaths in a rural area, reminding us of the risks of rural industry and agriculture.

[Insert Figure 11]

Deaths attributed to old age (fig. 11) would not include all of the oldest deaths recorded, but as expected they were more common in rural areas, where life expectancy was longer. Even Northumberland and Durham, the non-rural division with the highest percentage of deaths attributed to old age, had a lower percentage than any of the rural divisions.

The Registrar General Reports for 1837 record a huge amount of data for each division, separating the 13 main causes of death, discussed above, into 94 specific diseases. Only the specific diseases which relate to over 1% of deaths (n=23) will be considered here and are presented in Figure 12. Once again a mixed picture is presented, and perhaps the most unexpected results were that the lowest percentage of deaths from consumption (tuberculosis) were reported for the urban centers, that smallpox was most common in the mixed regions, and that violent deaths were least frequent in the urban centers. Some, but not all, infectious diseases were cited as cause of death more frequently in urban centers, including typhus/typhoid, pneumonia, measles, and whooping cough. Old age was the second most common listed cause of death, and was far higher in the rural areas; as noted above, this held true at a division-level analysis (see fig. 11).

[Insert Figure 12]

The rise of urbanism in post-medeival Britain was intimately tied to the rise of industry. Any analysis of the impact of this transformative social and economic event must take into consideration a myriad of complex elements of the natural and social environment. This study identifies important patterns in mortality and cause of death during the rise of industry in England and Wales and the consequent development of cities that would dominate the geographical landscape from that time onwards. It reveals clear evidence of shorter life expectancy and higher rates of typhus/typhoid fever, pneumonia, measles and whooping cough in urban areas copared to their rural hinterlands, but importantly show that the populations in mixed divisions, which typically include rapidly growing towns, also suffered from poor health, and in the case of violent deaths, smallpox and diarrhoea, worse than the two major urban centers.

While these data provide important insights into age and cause of death, it does not provide a glimpse into the health experience of individuals on a daily basis; this is where skeletal paleopathology comes into its own. Data collected from the WORD database for three excavated London cemeteries have been used to calculate crude prevalence rates of skeletal diseases that can be compared to the cause of death data for London (see Table 6). For most of these conditions, people are unlikely to die from the chronic forms of disease seen in skeletal remains, thus it should not be suprising that the crude prevalence rates for gout, osteoarthritis and fractures are far higher for the skeletal remains. Indeed, the likelihood of gout or arthritis causing any deaths must be considered, reflecting the state of medical knowledge at the time. The low prevalence rate for TB compared with the percentage of deaths with consumption is also expected; we know that TB only affects the skeleton in c. 3-5%% of cases (Roberts & Buikstra, 2003, 89). The close similarity of percentage rates for carcinomas is also perhaps expected; without modern medical intervention these would almost certainly cause death, and in many cases have the potential to metastasize to bone. The most unexpected result here is for treponemal disease (in this nineteenth century British setting these are probably cases of syphilis, although we acknowledge that different forms of treponemal disease cannot be differentiated from osteological analysis alone). The significantly high rates of treponemal disease seen in the three London sites may well be influenced by the inclusion of Cross Bones; the crude prevalence at this cemetery – believed to be located close to the 'stews' (brothels) on Bankside and used as a burial ground for prostitues (Brickley & Miles, 1999, 5) – was 4.05%, compared with 0.9% at St Bride's Lower and 0% at Chelsea Old Church.

[Insert Table 6]

Chronic illness, the focus of paleopathology, particularly amongst young and middle adults, carried with it the ever-present threat of economic instability, amongst a population that was often financially unstable at the best of times. A further limitation of the GRO data is that they do not allow for useful conclusions to be made concerning the impact of class separation on the general length and quality of life at the time, something which could be tentatively explored using funerary evidence. To what extent did status differences play a significant role in improving the health of some individuals, while placing others at tremendous risk for illness and premature death? There are some environmental stressors, such as air quality, that lead to patterns of illness and death that transcend class distinctions.

**#.7 Conclusions**

The Registrar General's reports provide a very important snapshot into the health experience of the population of England and Wales at a pivotal time of enormous political, social, and environmental change. While there are limitations to the data set, it provides a valuable means of identifying legitimate differences between urban, mixed, and rural populations in the mid-nineteenth century. These differences are nuanced, and are probably intrinsically related to the specific industries that were prevalent in different regions, for example coal mining and violent deaths in the Mining parts of Shropshire, Staffordshire and Worcestershire, and respiratory disease in Birmingham, known as the 'City of 1000 Trades'. Overall they show the negative health impact that environmental contamination, particularly of the air and water, had upon individual health in both urban and mixed areas. The rise of industry is accompanied by an unprecedented migration of people into towns and cities and the subsequent rise of urban centers on the British landscape. Cities have the worst death rates for typhus/typhoid, pneumonia, measles, and whooping cough in the year 1837-8, and it remained so until the medical revolution of the late nineteenth century. Rural areas seem to have offered better health outcomes, with lower levels of infant mortality and increased levels of longevity compared to urban and mixes areas, but the percentage of deaths from some diseases, notably tuberculosis, were highest in the combined rural areas. Indeed, the percentage of deaths of young adults from phthisis (normally equated to pulmonary tuberculosis) was noted as very variable in rural districts between 1861 and 1870, with high mortality rates in East Anglia, the north Pennines and especially west Wales (Woods & Shelton, 1997, p. 98), challenging the perception that tuberculosis was an urban disease. We should also consider that while many people undoubtedly had tuberculosis, many would die from other conditions, something which may have been more common in urban areas; we cannot equate tuberculous mortality with tuberculous morbidity.

While broad patterns of mortality can be identified using the crude population types ascertainable from the GRO divisions used in the earliest reports (including that for 1837), it is clear that patterns of disease and mortality are complex and influenced by a convergence of multiple environmental and social stressors. The poor health outcomes for rapidly expanding cities and towns in comparison to the data for London suggest that a lack of infrastructure played a significant role, alongside pollution and industrial activity. Later GRO reports present mortality data at the district level (between 614 and 623 districts) rather than at the division level (n=25, with the whole of Wales representing a single division). Robert Woods and Nicola Shelton (1997) investigated mortality for 1861-1870 and 1891-1900 at the registration district level, revealing more detailed patterns in life expectancy and cause of death.

The rapid expansion of towns and cities at a time when there was little infrastructure to accommodate an ever-increasing urban population laid the foundation for a health crisis, particularly in terms of infectious disease, and diseases resulting from the contamination of water or poor air quality. It was a perfect storm caused by the synergistic interaction of factors like over-crowding, air pollution, poor nutrition, contaminated water, and insufficient housing. Each agent becoming ever more potent as they combined to produce a worse effect than each could create individually. This is the time where we find the urban slum, described in some horrid detail by the writers Dickens and Gaskell. The information contained within the GRO reports offer credence to those fictional depictions of urban and rural life in the nineteenth century, and the high price of poor health that many people paid for this economic transition.

An important caveat to this analysis is that it is clear that a simple division between urban and rural populations in any geographic division obfuscates the complexity of the true picture. There are significant differences in illness and mortality between urban and rural populations. However, this picture becomes more complex as we see the development of the proto-industrial centers and the expansion of towns and cities in the previously rural areas. These ‘mixed’ populations, characterized by large geographic areas with large populations focused in towns or cities, provide a different pattern of health than either the cities or the rural agricultural areas, with the worst life expectancy overall and particularly high rates of death due to violence in the Mining parts of Shropshire, Staffordshire and Worcestershire and the smallest proportion of deaths attributed to old age in Manchester and Salford and in Liverpool and West Derby. This is a very important observation to emphasize, as it cautions against the division of populations into simply urban and rural in skeletal studies and the expectation that rural populations will be 'healthier'. Equally we cannot ignore urban to rural migration, particularly of improvished children and adolescents indentured in mills and factories within rural districts (Gowland et al., 2018). This recognition of the transition between urban and rural can lead to a more sophisticated understanding of how both urbanism and industrialization influenced health in England and Wales in the nineteenth century.

Overall this study has highlighted poorer life expectancy and higher frequencies of epidemic and respiratory causes of death in urban environments compared to mixed and rural divisions in the 1837 Registrar General's report. However, it has also highlighted that the rural/ urban divide is part of a continuum rather than a binary division. This pattern is in part due to the complex nature of industry in the late eighteenth and nineteenth century, with rural mills and factories scattered throughout the countryside, epitomised by Arkwright's[4] mill in Cromford, Derbyshire. While we have identified broad, statistically significant, differences in mortality and cause of death between rural, urban and mixed populations in 1837-8, the picture is clearly more variable when the 25 divisions are compared. This pattern is likely to be more complex for later periods, when data are available for all of the 619 registration districts. This complexity is likely to be relevant in other studies, including those considering modern urbanization. We urge researchers to pay careful attention to local patterns and specific circumstances alongside the broader patterns of health differences in urban and rural communities, including the phenomenon of two-way migration. For 1837, however, it appears that urban environments, and areas of

[4] Richard Arkwright is known as a father of the modern industrial factory system and developed the water powered spinning frame and a rotary carding machine.

increasing urbanization, had poorer health outcomes than seen for the rural population, despite the presence of industry in all areas.

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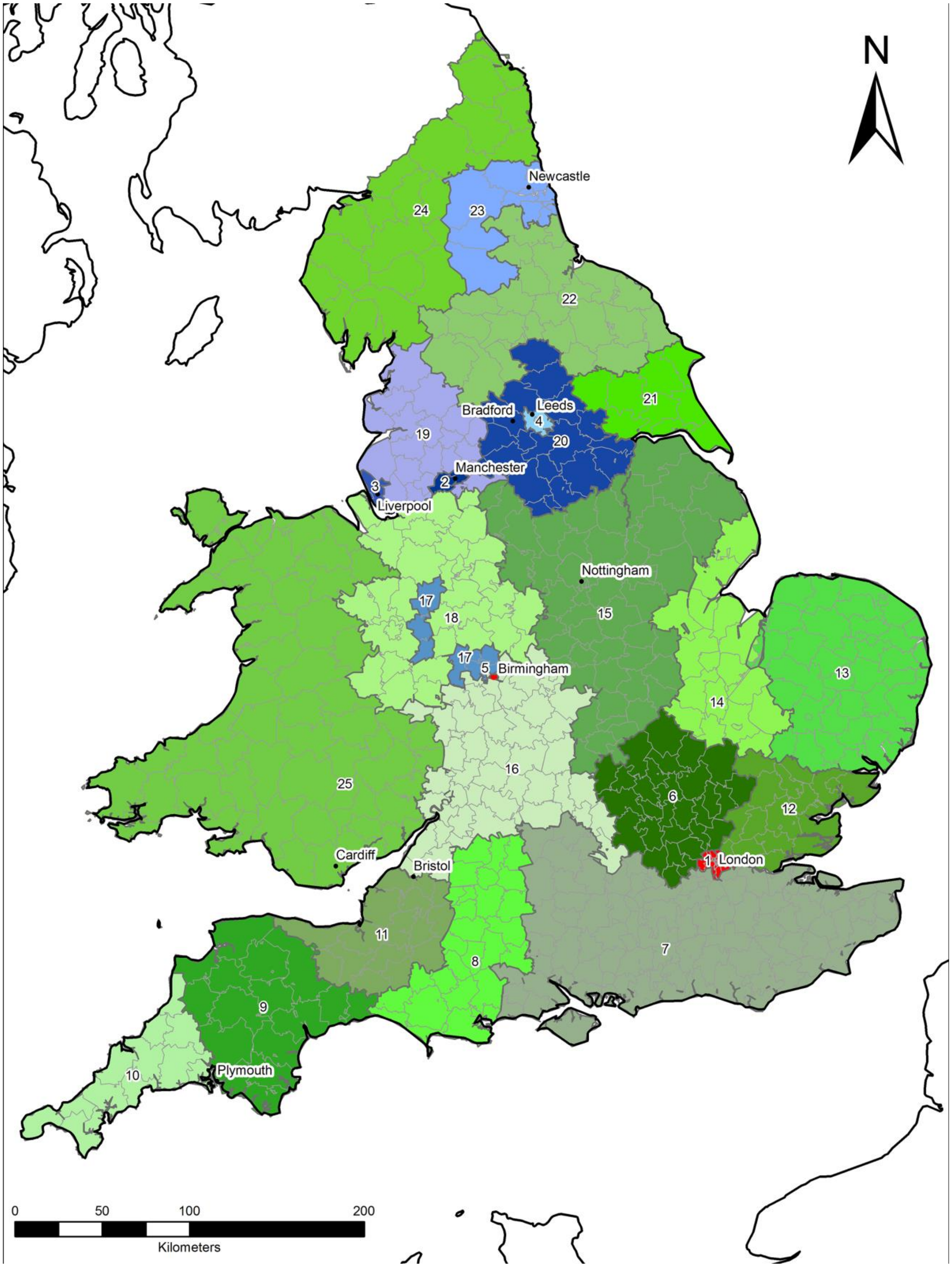


Figure 1. Map of the 25 division in England and Wales (after Reid et al., 2018). The 1837 registrar general report only provides data at the level of these divisions.

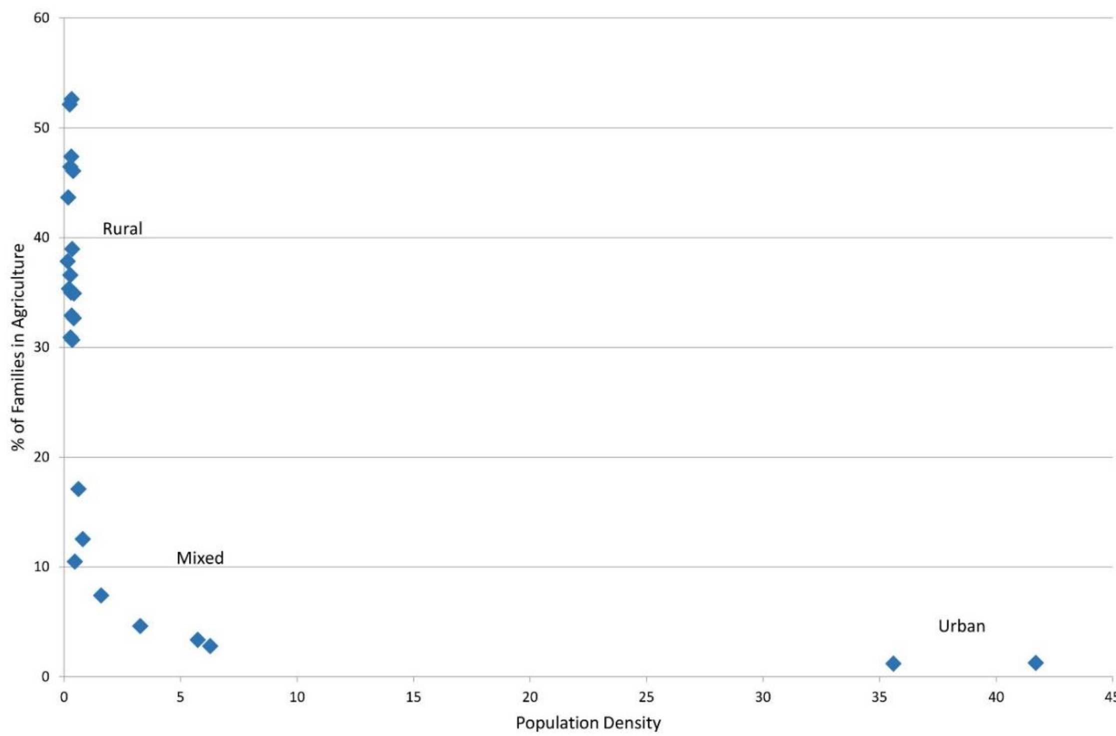


Figure 2. Identification of rural, urban and "mixed" groups using percentage of families in agriculture and population density.

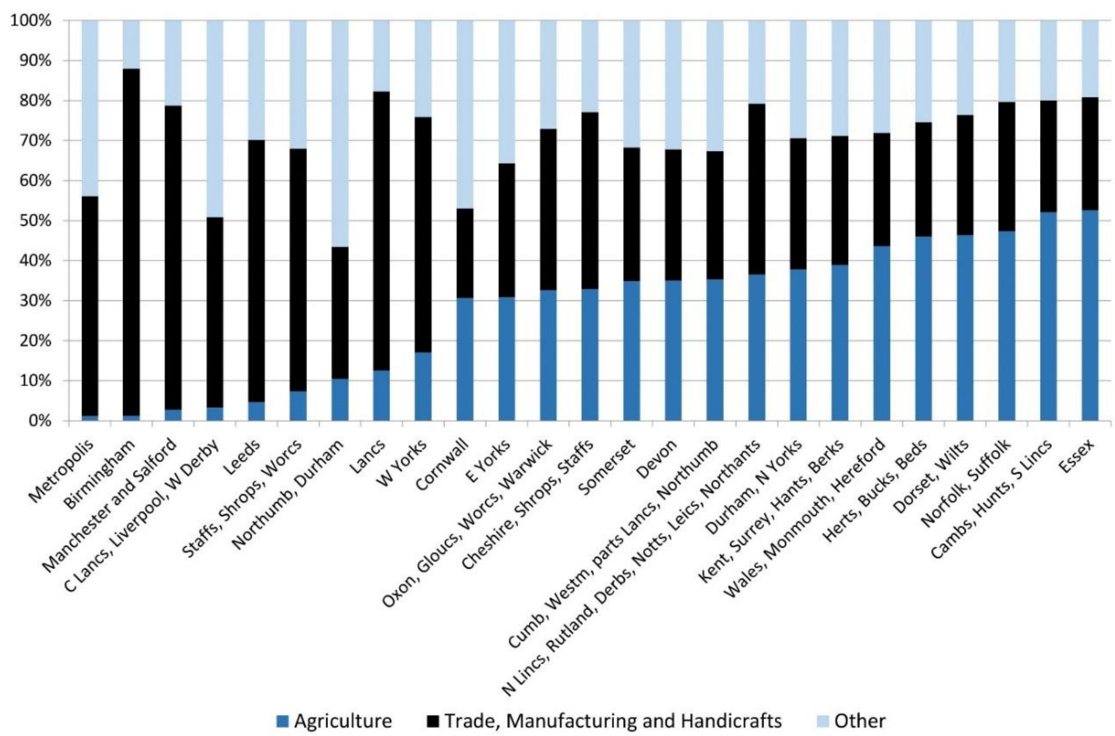


Figure 3. Percentage of families in agriculture, in trade, manufacturing and handicrafts, and "other."

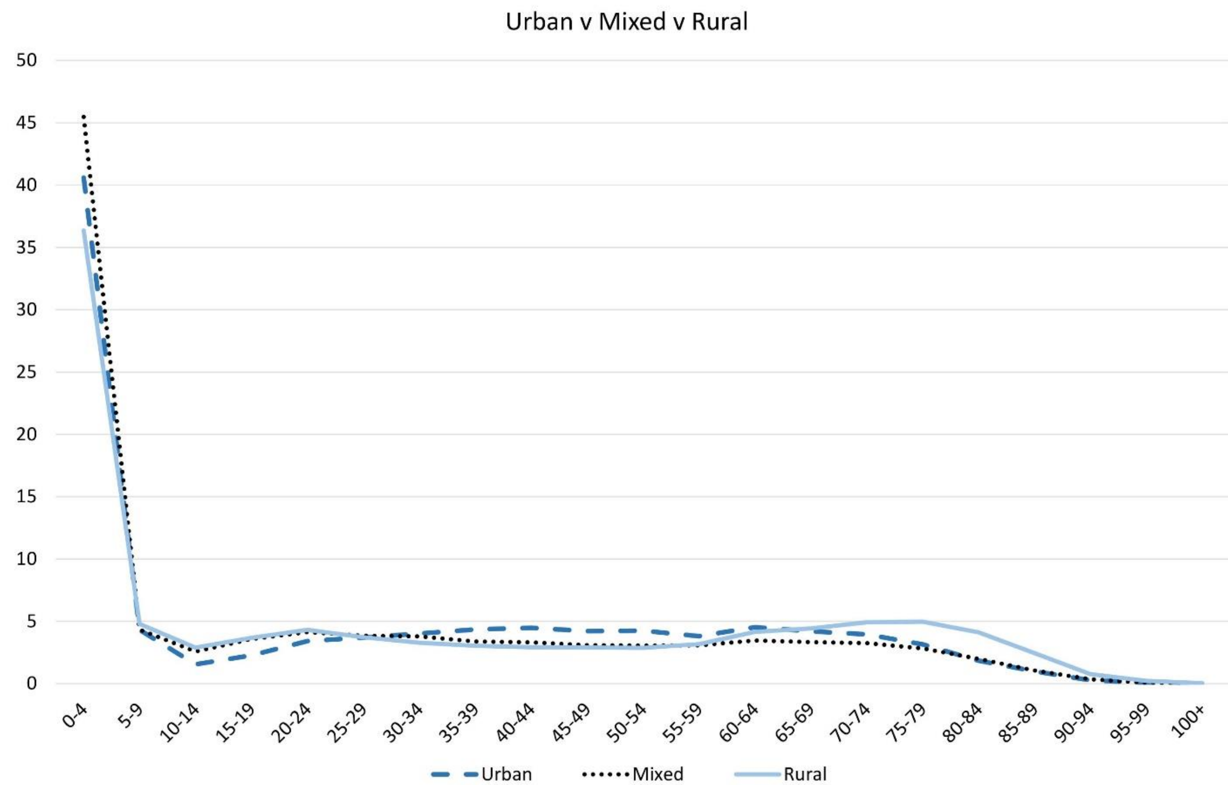


Figure 4. Age-at-death curve for urban, mixed, and rural populations.

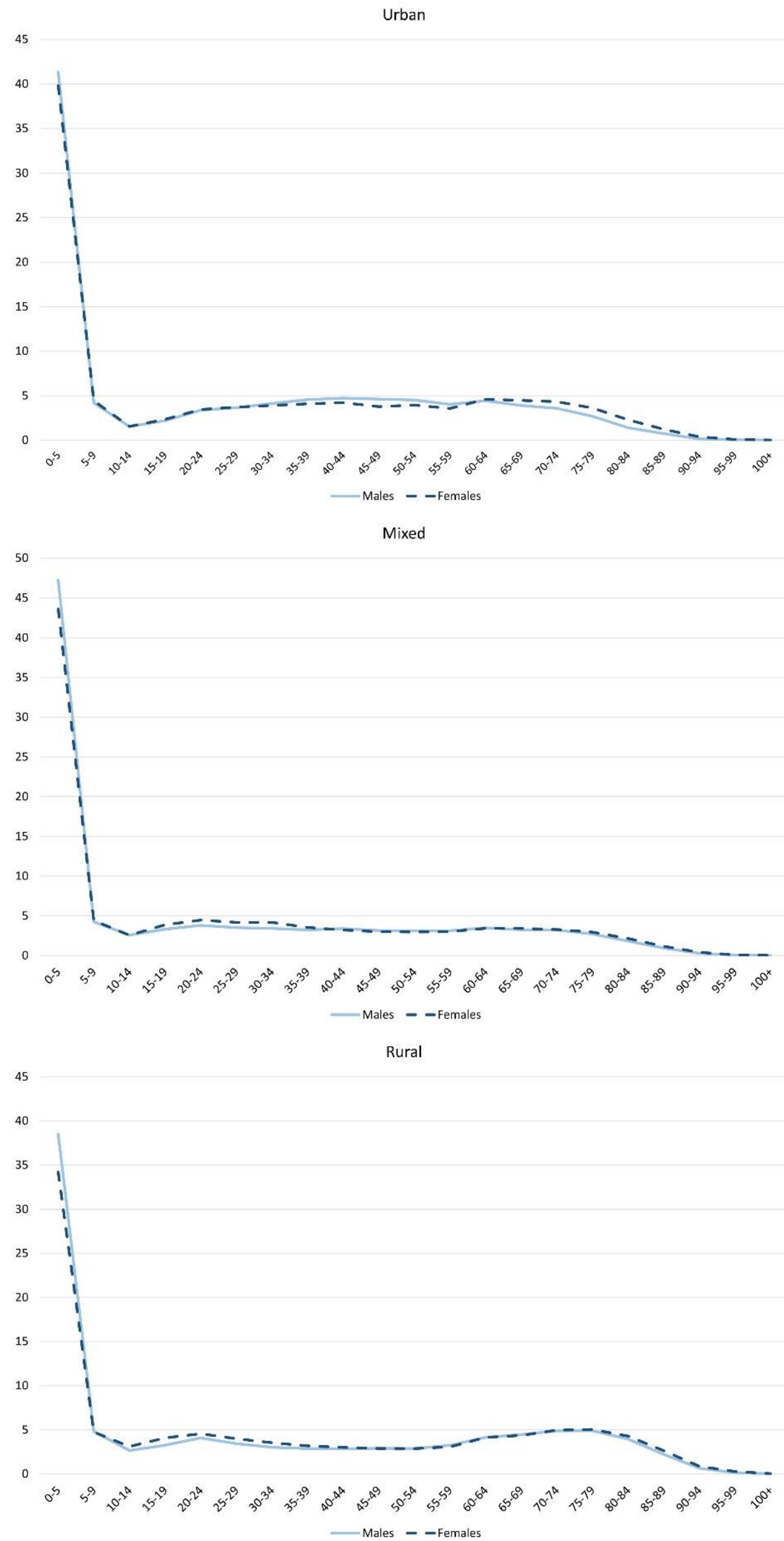


Figure 5. Comparison of male and female mortality for urban, mixed, and rural populations

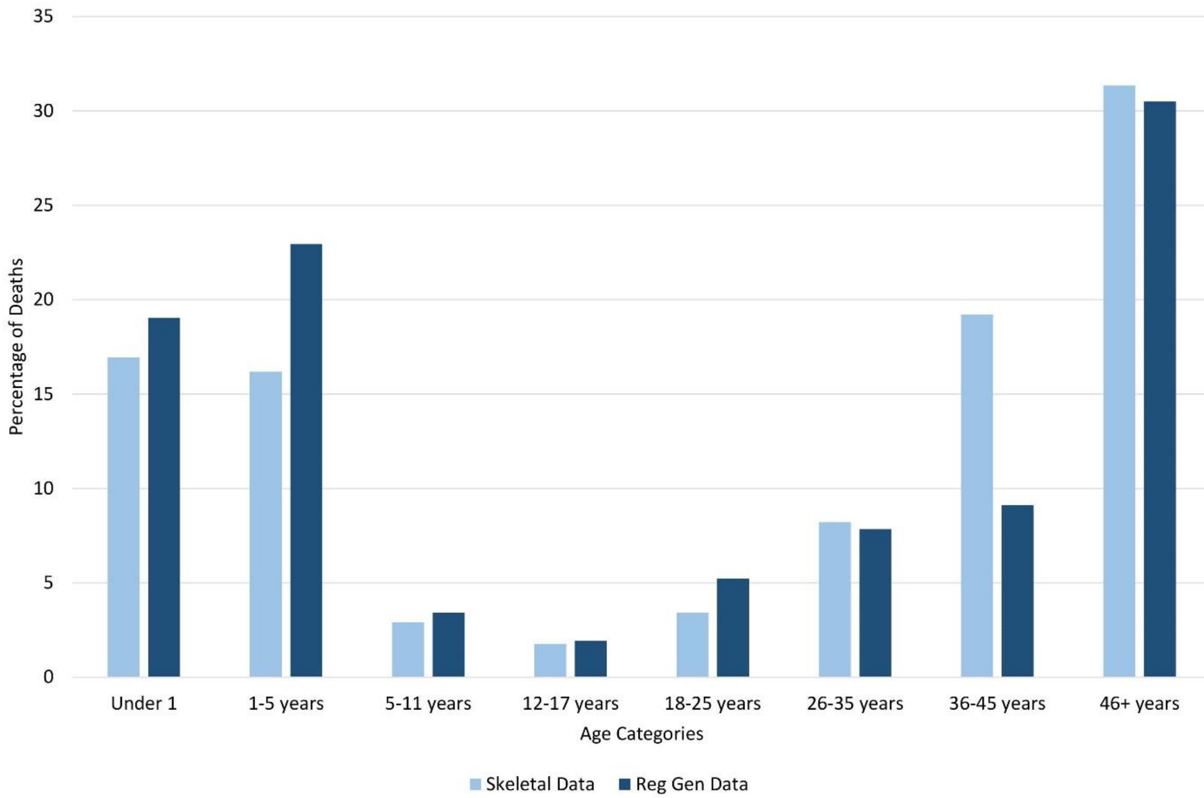


Figure 6. Comparison of age-at-death profile for skeletal data and GRO data for London.

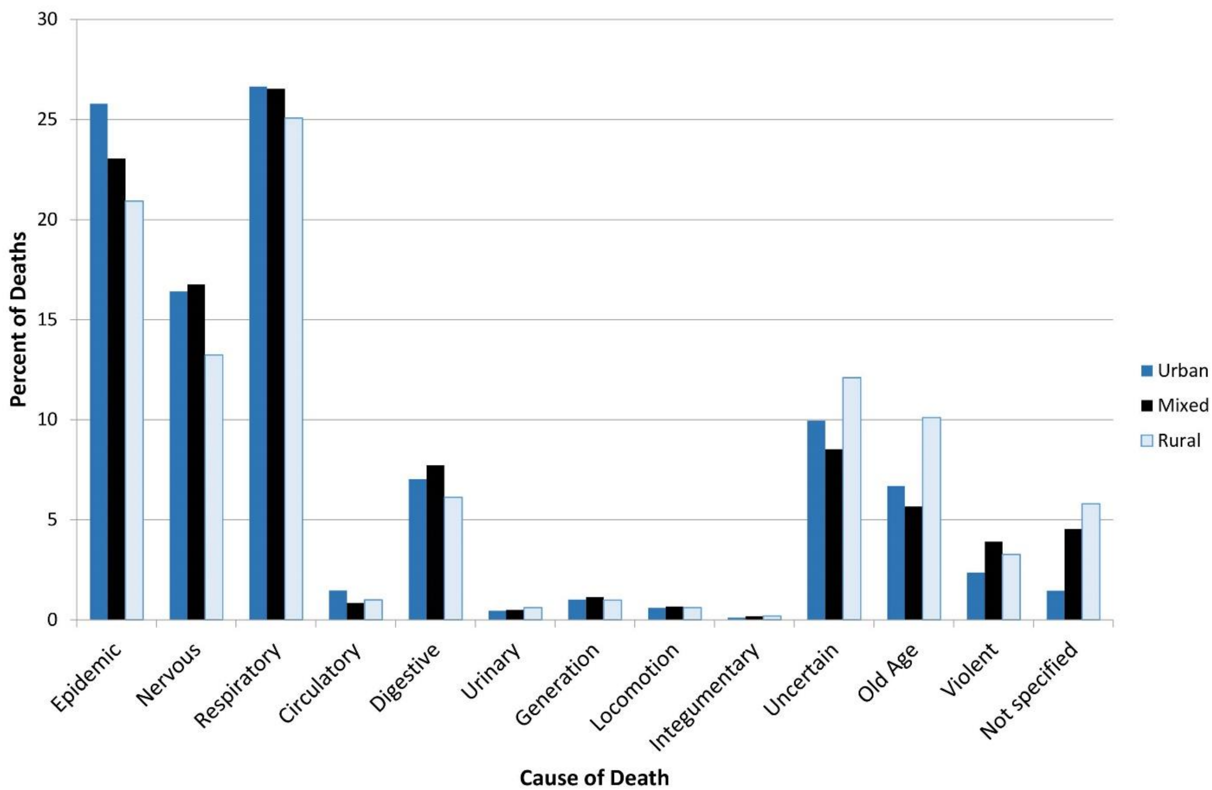


Figure 7. Comparison of cause of death in urban, mixed, and rural populations.

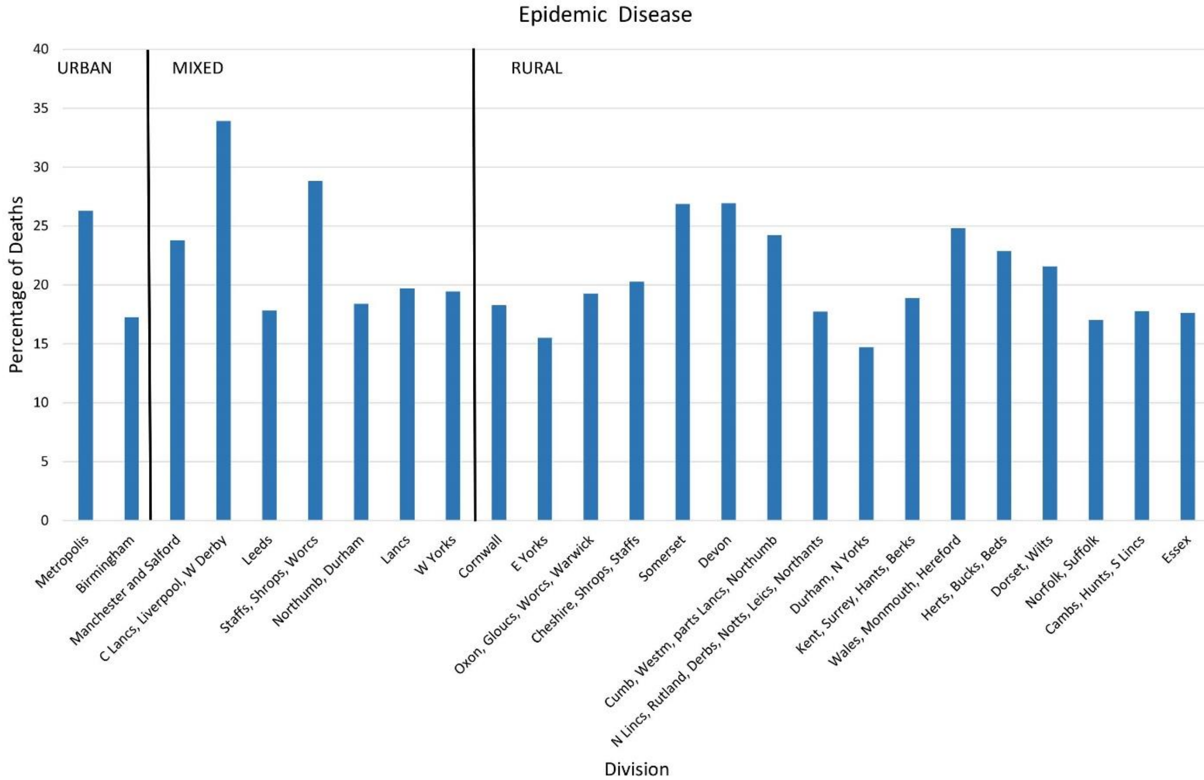


Figure 8. Percentages of deaths attributed to epidemic disease in the 25 divisions.
Divisions organized from smallest to highest percentage of families in agriculture, thus, the most urban populations are on the left and the most rural on the right.

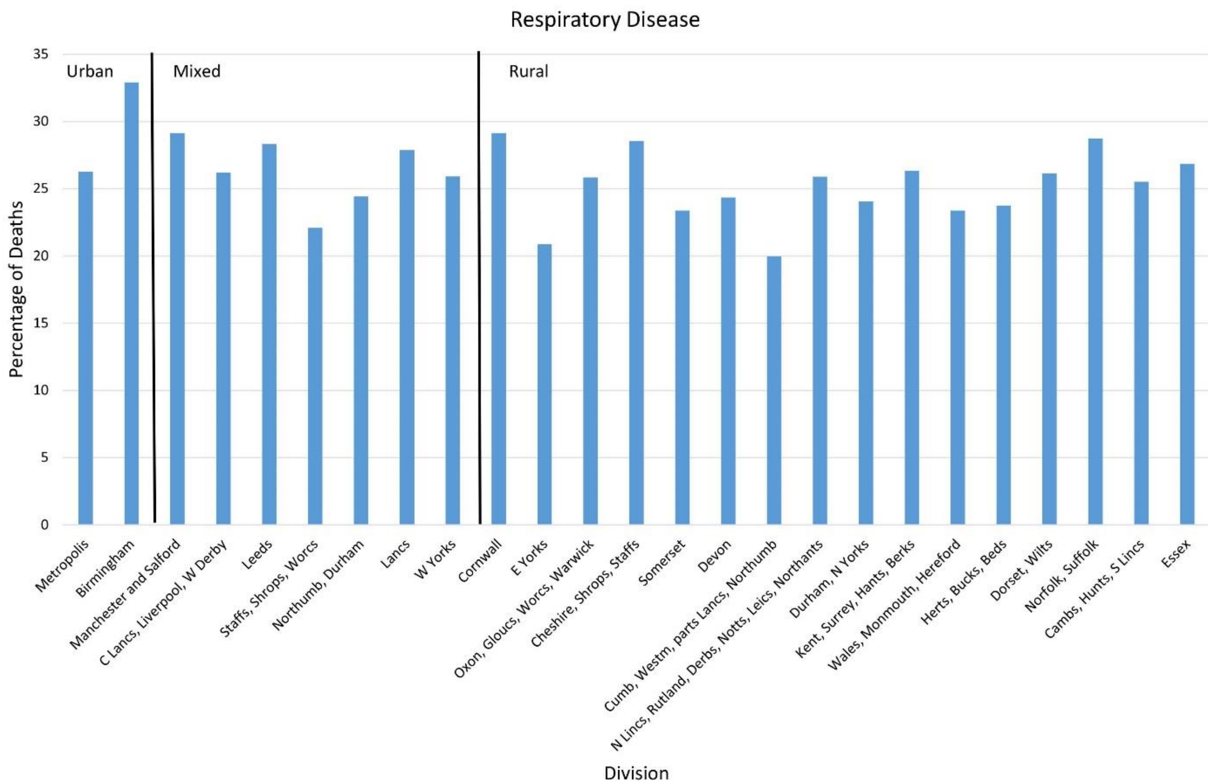


Figure 9. Percentages of deaths attributed to respiratory disease in the 25 divisions. Divisions organized from smallest to highest percentage of families in agriculture, thus, the most urban populations are on the left and the most rural on the right.

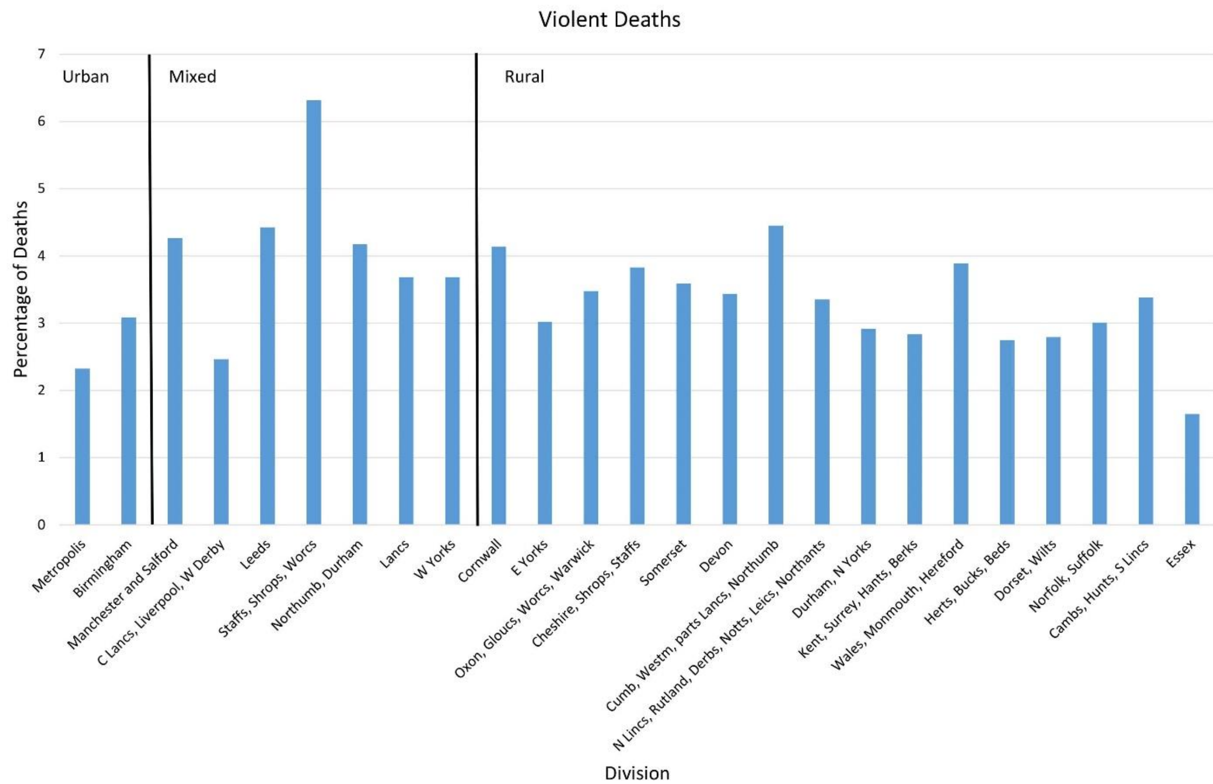


Figure 10. Percentages of deaths attributed to violence in the 25 divisions.
Divisions organized from smallest to highest percentage of families in agriculture, thus, the most urban populations are on the left and the most rural on the right.

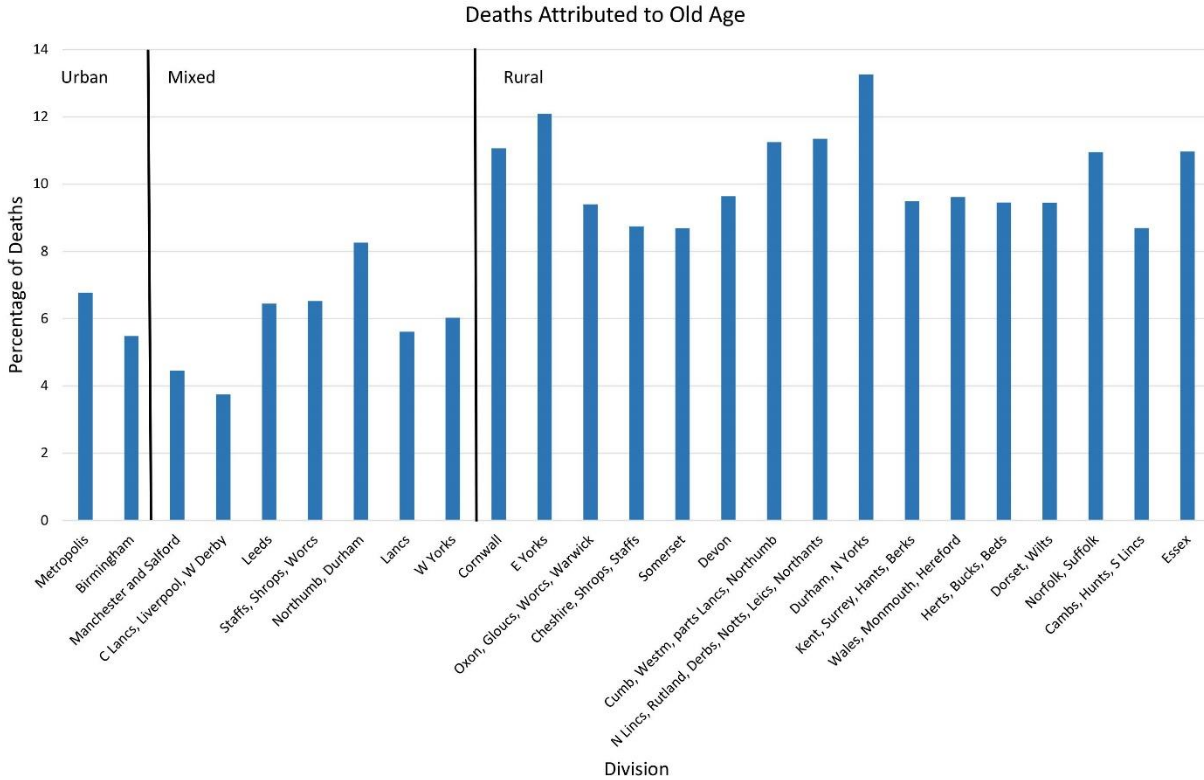


Figure 11. Percentages of deaths attributed to old age in the 25 divisions.
Divisions organized from smallest to highest percentage of families in agriculture, thus, the most urban populations are on the left and the most rural on the right.

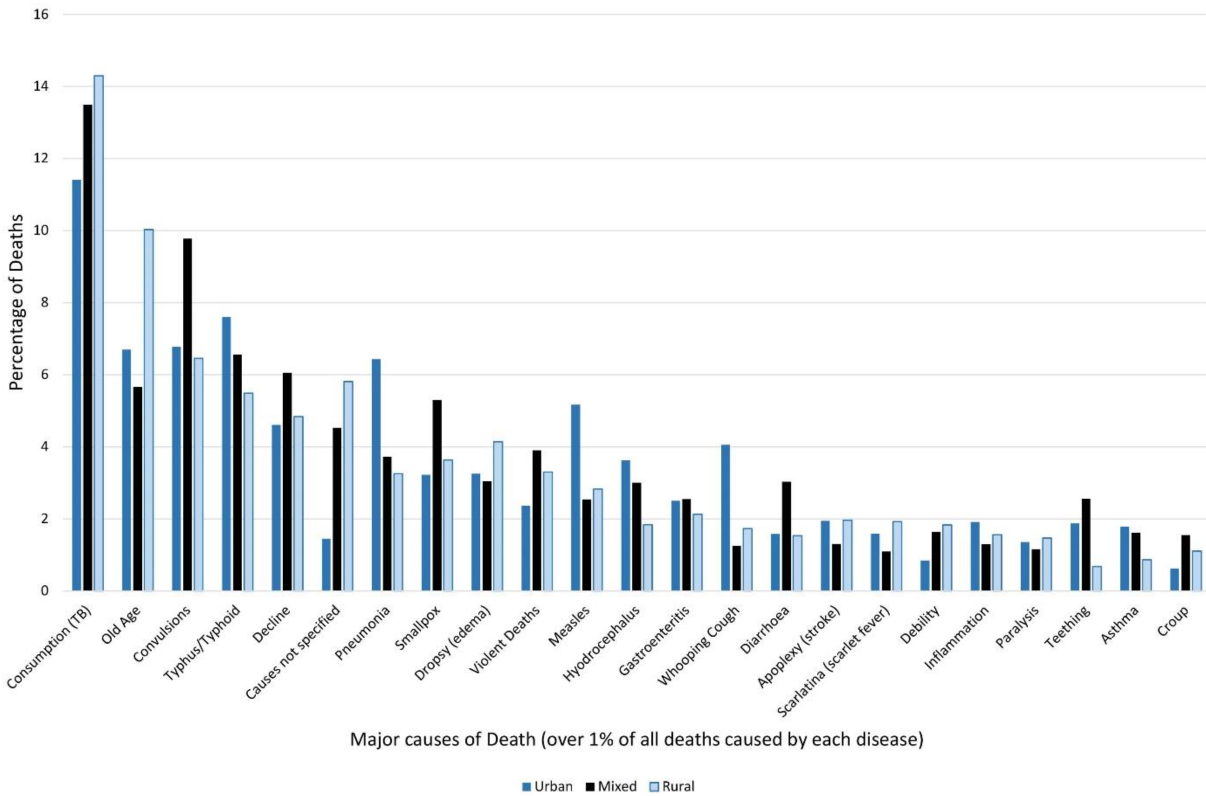


Figure 12. Major causes of death for urban, mixed, and rural areas.

Table 1. Distribution of the population of England between urban and rural areas in 1500 and 1800 (After Allen 2000: 8-9, Allen 2009: 17).

| | **1500** | **1800** |
|---|---|---|
| Urban | 7% | 29% |
| Rural non-agricultural | 18% | 36% |
| Rural | 74% | 35% |

Table 2. Number of deaths recorded in the 1837 Registrar General Report, broken down by urban, mixed and rural districts and for the whole of England and Wales.

| **District** | **Urban Districts Combined** | | | **Mixed Districts Combined** | | | **Rural Districts Combined** | | | **England and Wales** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Age** | **Males** | **Females** | **All** | **Males** | **Females** | **All** | **Males** | **Females** | **All** | **Males** | **Females** | **All** |
| **0-1** | 5970 | 4992 | 10962 | 10794 | 8589 | 19383 | 23226 | 18317 | 41543 | 39990 | 31898 | 71888 |
| **1-4** | 5954 | 6076 | 12030 | 7354 | 7219 | 14573 | 16472 | 16071 | 32543 | 29780 | 29366 | 59146 |
| **5-9** | 1211 | 1235 | 2446 | 1634 | 1600 | 3234 | 4976 | 4784 | 9760 | 7821 | 7619 | 15440 |
| **10-14** | 445 | 435 | 880 | 994 | 931 | 1925 | 2749 | 3130 | 5879 | 4188 | 4496 | 8684 |
| **15-19** | 637 | 652 | 1289 | 1273 | 1404 | 2677 | 3366 | 4116 | 7482 | 5276 | 6172 | 11448 |
| **20-24** | 975 | 961 | 1936 | 1464 | 1621 | 3085 | 4212 | 4588 | 8800 | 6651 | 7170 | 13821 |
| **25-29** | 1055 | 1035 | 2090 | 1352 | 1519 | 2871 | 3557 | 4022 | 7579 | 5964 | 6576 | 12540 |
| **30-34** | 1190 | 1086 | 2276 | 1314 | 1516 | 2830 | 3124 | 3563 | 6687 | 5628 | 6165 | 11793 |
| **35-39** | 1318 | 1141 | 2459 | 1241 | 1286 | 2527 | 2970 | 3218 | 6188 | 5529 | 5645 | 11174 |
| **40-44** | 1363 | 1175 | 2538 | 1303 | 1169 | 2472 | 2935 | 3035 | 5970 | 5601 | 5379 | 10980 |
| **45-49** | 1336 | 1050 | 2386 | 1211 | 1091 | 2302 | 3000 | 2899 | 5899 | 5547 | 5040 | 10587 |
| **50-54** | 1304 | 1099 | 2403 | 1204 | 1078 | 2282 | 2966 | 2896 | 5862 | 5474 | 5073 | 10547 |
| **55-59** | 1164 | 992 | 2156 | 1205 | 1087 | 2292 | 3347 | 3095 | 6442 | 5716 | 5174 | 10890 |
| **60-64** | 1281 | 1281 | 2562 | 1343 | 1242 | 2585 | 4281 | 4169 | 8450 | 6905 | 6692 | 13597 |
| **65-69** | 1129 | 1247 | 2376 | 1250 | 1240 | 2490 | 4618 | 4402 | 9020 | 6997 | 6889 | 13886 |
| **70-74** | 1035 | 1205 | 2240 | 1239 | 1191 | 2430 | 5036 | 5007 | 10043 | 7310 | 7403 | 14713 |
| **75-79** | 779 | 1009 | 1788 | 1041 | 1071 | 2112 | 5048 | 5077 | 10125 | 6868 | 7157 | 14025 |
| **80-84** | 407 | 639 | 1046 | 699 | 784 | 1483 | 4083 | 4322 | 8405 | 5189 | 5745 | 10934 |
| **85-89** | 220 | 345 | 565 | 363 | 424 | 787 | 2310 | 2666 | 4976 | 2893 | 3435 | 6328 |
| **90-94** | 45 | 107 | 152 | 111 | 153 | 264 | 671 | 886 | 1557 | 827 | 1146 | 1973 |
| **95-99** | 15 | 26 | 41 | 26 | 34 | 60 | 161 | 294 | 455 | 202 | 354 | 556 |
| **100+** | 9 | 9 | 18 | 5 | 9 | 14 | 25 | 48 | 73 | 39 | 66 | 105 |
| **Unknown** | 162 | 113 | 275 | 115 | 61 | 176 | 270 | 152 | 422 | 547 | 326 | 873 |
| **Total** | **28842** | **27797** | **56639** | **38420** | **36258** | **74678** | **103133** | **100605** | **203738** | **170395** | **164660** | **335055** |

Table 3: Registration division details for 1837.

| Division Number | Division | Area in Acres | Population Density | % Agriculture | % Trade, Manufacturing, and Handicrafts | % Other | District Type |
|---|---|---|---|---|---|---|---|
| **1** | Metropolis (London) | 44,810 | 35.59 | 1.20 | 54.95 | 43.84 | Urban |
| **2** | Manchester and Salford | 37,797 | 6.27 | 2.80 | 75.97 | 21.24 | Mixed |
| **3** | Liverpool and W Derby | 38,060 | 5.73 | 3.36 | 47.54 | 49.10 | Mixed |
| **4** | Leeds | 41,520 | 3.27 | 4.63 | 65.59 | 29.78 | Mixed |
| **5** | Birmingham | 2,660 | 41.70 | 1.26 | 86.75 | 11.99 | Urban |
| **6** | Middlesex: Herts, Bucks, Beds (except London) | 1,323,888 | 0.39 | 46.06 | 28.53 | 25.40 | Rural |
| **7** | Hants, Berks, Sussex and parts Kent, Surrey | 3,861,100 | 0.35 | 38.95 | 32.22 | 28.83 | Rural |
| **8** | Dorset, Wilts | 1,407,913 | 0.27 | 46.44 | 29.93 | 23.63 | Rural |
| **9** | Devon | 1,691,575 | 0.30 | 35.00 | 32.80 | 32.19 | Rural |
| **10** | Cornwall | 866,474 | 0.35 | 30.68 | 22.38 | 46.94 | Rural |
| **11** | Somerset | 987,087 | 0.42 | 34.92 | 33.39 | 31.69 | Rural |
| **12** | Essex | 928,589 | 0.33 | 52.61 | 28.26 | 19.14 | Rural |
| **13** | Norfolk, Suffolk | 2,188,867 | 0.31 | 47.37 | 32.32 | 20.31 | Rural |
| **14** | Cambs, Hunts and parts of Lincs | 1,295,379 | 0.24 | 52.12 | 27.93 | 19.94 | Rural |
| **15** | Derbs, Leics, Northants, Notts, Rutland and parts of Lincs | 3,936,980 | 0.27 | 36.58 | 42.62 | 20.81 | Rural |
| **16** | Gloucs, Oxon, and parts of Worcs and Warwick | 2,355,462 | 0.41 | 32.65 | 40.26 | 27.08 | Rural |
| **17** | Mining parts of Shrops, Staffs and Worcs | 140,798 | 1.59 | 7.41 | 60.60 | 31.99 | Mixed |
| **18** | Cheshire and rest of Shrops, Staffs | 2,216,515 | 0.33 | 32.90 | 44.22 | 22.87 | Rural |
| **19** | Lancs (except Liverpool and Manchester) | 1,131,270 | 0.80 | 12.53 | 69.76 | 17.70 | Mixed |
| **20** | W Yorks (except Leeds) | 1,250,530 | 0.62 | 17.09 | 58.82 | 24.09 | Mixed |
| **21** | E Yorks including York | 730,945 | 0.27 | 30.91 | 33.43 | 35.66 | Rural |
| **22** | N Yorks, non-mining parts of Durham | 2,104,736 | 0.15 | 37.85 | 32.79 | 29.37 | Rural |
| **23** | Mining parts of Northumb, Durham | 688,708 | 0.46 | 10.50 | 32.99 | 56.52 | Mixed |
| **24** | Cumb, Westm, parts Lancs, Northumb | 1,590,448 | 0.21 | 35.35 | 31.99 | 32.66 | Rural |
| **25** | Wales, Monmouth, Hereford* | 5,707,400 | 0.18 | 43.66 | 28.28 | 28.06 | Rural |
| | England and Wales** | 36,995,200 | 0.38 | 28.66 | 42.16 | 29.18 | - |

*Area not given, but calculated. **Area given in square miles, but presented in acres here.

Table 4: Average life expectancy at birth, 1 year, 5 years and 20 years for urban, mixed and rural populations

| | Urban | | | Mixed | | | Rural | | |
|---|---|---|---|---|---|---|---|---|---|
| Life expectancy at: | Male | Female | All | Male | Female | All | Male | Female | All |
| Birth | 27.30 | 29.13 | 28.20 | 23.77 | 25.22 | 24.47 | 30.57 | 32.38 | 31.46 |
| 1 | 34.30 | 35.40 | 34.85 | 32.86 | 32.89 | 32.88 | 39.31 | 39.47 | 39.39 |
| 5 | 45.53 | 47.38 | 46.45 | 43.95 | 43.69 | 43.82 | 48.88 | 48.44 | 48.66 |
| 20 | 50.93 | 53.25 | 52.08 | 51.58 | 51.20 | 51.39 | 56.76 | 56.50 | 56.63 |

Table 5: Cause of Death for urban, mixed and rural groups.

| Cause of Death | Urban % | Mixed % | Rural % | All % | P |
|---|---|---|---|---|---|
| Epidemic | 25.79 | 23.05 | 20.93 | 21.88 | <0.001 |
| Nervous | 16.41 | 16.75 | 13.23 | 14.70 | <0.001 |
| Respiratory | 26.64 | 26.53 | 25.07 | 25.91 | <0.001 |
| Circulatory | 1.47 | 0.84 | 1.00 | 1.07 | <0.001 |
| Digestive | 7.04 | 7.72 | 6.12 | 6.62 | <0.001 |
| Urinary | 0.45 | 0.50 | 0.60 | 0.55 | <0.001 |
| Generation | 1.02 | 1.14 | 0.98 | 1.01 | <0.001 |
| Locomotion | 0.59 | 0.67 | 0.61 | 0.62 | <0.001 |
| Integumentary | 0.11 | 0.18 | 0.19 | 0.18 | <0.001 |
| Uncertain | 9.95 | 8.53 | 12.10 | 10.90 | <0.001 |
| Old Age | 6.70 | 5.66 | 10.11 | 8.53 | <0.001 |
| Violent | 2.37 | 3.90 | 3.26 | 3.26 | <0.001 |
| Not specified | 1.45 | 4.53 | 5.79 | 4.77 | <0.001 |

Table 6: Comparion of chronic health (as determined from skeletal remains from three London excavations) and cause of death (from the GRO data) for London.

| Skeletal Diagnoses | Crude Prevalence Rate (%) | Cause of Death (GRO) | Percentage of Deaths |
|---|---|---|---|
| TB | 0.8 | Comsumption | 10.68 |
| Treponemal Disease | 1.2 | Syphilis | 0.05 |
| Gout | 0.9 | Gout | 0.09 |
| Malignant Neoplasms | 0.6 | Carcinomas | 0.74 |
| Osteoarthritis | 17.7 | Arthritis | 0.35 |
| Fractures | 19.6 | Violent Deaths | 2.31 |