MORTALITY CHANGE IN HERMOUPOLIS, GREECE (1859-1940)

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Abstract

This thesis examines mortality decline from 1859 to 1940 in the city of Hermoupolis, on the Greek island of Syros. A demographic approach is employed to understand the mechanisms of mortality decline at both local and national levels. This study produces important new insights into Greek and Mediterranean urban historical demography and is the first comprehensive study of urban mortality in Greece, utilizing the largest and one of the longest time-series yet calculated from civil registration and census data.

Standard historical demographic methods were employed in this study along with the technique of nominal record linkage. A series of abridged life tables was constructed for the very first time for a Greek urban settlement, enabling the calculation of age-specific mortality rates and life expectancy. Cause-specific mortality analysis for the years 1916–1940 provided a deeper insight into the epidemiological profile of the city.

Hermoupolis experienced much higher mortality levels than the national average. The findings presented here suggest that early childhood mortality started to decline rapidly as a result of mass immunisations from the late nineteenth century onwards, with declines in early adulthood and infancy following.

This thesis has found that the second stage of Omran's epidemiological transition theory was still ongoing in the 1930s, with high prevalence of infectious diseases, especially of tuberculosis among young adults and diarrhoeal diseases among infants and young children. Exceptionally high mortality levels were also recorded during the 1918 influenza pandemic.

This thesis reinforces and confirms our limited knowledge about the timing of the mortality transition in Greece. It proposes that an urban penalty was clearly operating in the country even during the first decades of the twentieth century. Finally, this thesis suggests that a combination of factors was responsible for the mortality decline in Hermoupolis, including wider access to water, which even when it was not clean enough to drink, it nevertheless enabled improvements in personal hygiene among the residents of the city.

To my parents and my beloved grandparents,
Σάσα and Σήφη

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Chapter 1. Introduction

1.1 Introduction

Mortality started to decline among some populations in northern Europe as early as the eighteenth century. This decline accelerated in much of Europe throughout the nineteenth century and continued to do so in the first half of the twentieth century. Age-specific declines were discernible, with childhood and infant mortality starting later but experiencing the most significant declines partly due to their high levels. As a result, life expectancy rose at every age.

Urban mortality appears to have been significantly higher than that of rural areas. One reason for this was the high population density which facilitated the dissemination of epidemic diseases. Another was the rapid expansion of the population in cities and the lack of corresponding improvement in public health infrastructure which would have supported such an expansion. This urban-rural mortality gap seems to have narrowed significantly in the first decades of the twentieth century in most European populations and was then followed by an urban advantage.

Western Europe and North America have been almost exclusively the focus of previous historical studies of mortality patterns in the last two centuries. The trends in Spain and Italy have been explored, although to a significantly lesser degree. Only little evidence, however, is available about changes in mortality in modern Greece. That which does exist has been based on indirect techniques and extensive assumptions rather than on actual data.

The aim of this thesis is not only to quantify the patterns of mortality decline in a Greek population and particularly in the city of Hermoupolis on the Greek island of Syros, but also to better comprehend the pathways that facilitated such decline. This thesis contributes to the literature on mortality decline by being the first to provide an extensive study of a Greek urban setting. It is argued that the relatively small size of the city, when compared to other contemporary European urban centres, allows for a better understanding of the factors that influenced the mortality decline. This introductory chapter discusses the principal objectives of this thesis and sets out the main research questions. The first part of the introduction explores the patterns of mortality decline and also the reasons for this decline which, according to the literature, has been one of the most important gains in human history. Infant and childhood mortality declined prior to fertility in most advanced societies, which has been found to have been one of the main reasons for initiating the decline in population growth during demographic transition. Given the importance of infant and childhood mortality in this process, particular attention is paid to that subject.

1.2 Mortality patterns in Europe (mid-19th -mid-20th c.)

Even though mortality in the most advanced European countries was at much lower levels and declined more rapidly than in less developed European countries, Schofield and Reher argued that this transition occurred across the continent in a very short period of time, in a similar way to that of fertility transition.[1] These declines across Europe had strengthened the attenuation of epidemic crisis mortality since the mid-nineteenth century (a notable exception was the 1918/19 influenza pandemic), which, as a result, increased the visibility of degenerative diseases.[2] The decrease and subsequent elimination of wide annual fluctuations in mortality brought about significant declines in mortality. According to Vallin, “fluctuations in mortality may be regarded as ‘crises’ which interrupt the ‘normal’ regime of mortality”.[3] By excluding such years from our calculations, the mean level of mortality stabilizes close to the ‘normal’ levels.[4] This was the time also when most countries experienced great increases in life expectancy, leading to much higher survival chances for infants, to the point where most of them actually reached late adulthood.[5]

Mortality decline was also envisaged as an epidemiologic transition by Abdel Omran. Omran’s theoretical framework is in accordance with Notestein’s demographic transition theory, which argues that historical populations experienced a shift from the pre-modern regime of high fertility and mortality to much lower levels during the modern regime, highly influenced by the economic development of each country.[6] Omran’s study was based on the idea that “during the transition, a long-term shift occurs in mortality and disease patterns whereby pandemics of infection are gradually displaced by degenerative and man-made diseases as the chief form of morbidity and

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[1] R. Schofield & D. Reher, ‘The decline of mortality in Europe’, in R. Schofield, D. Reher & A. Bideau (eds), *The decline of mortality in Europe* (Oxford: Clarendon Press, 1991), p.6.
[2] Ibid., p.6; J. Vallin, ‘Mortality in Europe from 1720 to 1914. Long-term trends and changes in patterns by age and sex’, in R. Schofield, D. Reher & A. Bideau (eds), *The decline of mortality in Europe* (Oxford: Clarendon Press, 1991), p.43.
[3] Vallin, ‘Mortality in Europe’, p.43.
[4] Ibid.
[5] G. Caselli, ‘Long-term trends in European mortality’, *Studies on Medical and Population Subjects,* 56 (London: HMSO, 1991), pp.1-2.
[6] F. Notestein, ‘Population: The long view’, in T. Schultz (ed.), *Food for the World* (Chicago: University of Chicago Press, 1945).

primary cause of death".[7] Three mortality patterns were distinguished during this process:

(1) the *age of pestilence and famine*, during which mortality is high and fluctuating, with an average life expectancy at birth (e_0) between 20 and 40 years,

(2) the *age of receding pandemics*, when mortality falls gradually, whereas e_0 rises steadily from about 30 to about 50 years. As a result, populations grow, and,

(3) the *age of degenerative and man-made diseases*, during which mortality continues to decline and finally stabilises at very low levels. The disappearance of infectious diseases increases the visibility of degenerative diseases, and man-made diseases become more and more common. Life expectancy at birth increases until it exceeds 50 years of age. At this stage, fertility contributes extensively to population growth.[8]

A fourth stage of the epidemiologic transition was proposed by Olshanky and Ault which is referred to as the *age of degenerative diseases*. During this stage, e_0 increases without any interruption, death rates decline mainly at advanced ages, cause-specific mortality patterns by age remain unchanged, and "the age distribution of deaths for degenerative causes are shifted progressively toward older ages".[9] Omran also recognized an additional fourth stage to his theory, during which e_0 increases until the age of 80 or 85, cardiovascular diseases initially stabilize and then decrease, and finally new diseases (including HIV) appear, replacing older diseases.[10]

In all three Scandinavian countries (Sweden, Norway and Denmark), as shown in Figure 1.1, e_0 was the highest in Europe throughout the period under study, exceeding 50 years in the first decade of the twentieth century and about 65 years by 1940. England and Wales and France experienced very similar trends until the 1910s, when both reached 50 years. From the 1920s onwards, England and Wales surpassed France, exceeding it consistently by four years. Germany and the Netherlands exhibited the lowest levels of e_0 in Northern Europe, less than 40 years in the mid-

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[7] A.R. Omran, 'The epidemiologic transition: A theory of the epidemiology of population change', *Milbank Memorial Fund, Blackwell Publishing*, 83, 4 (2005), p.736.

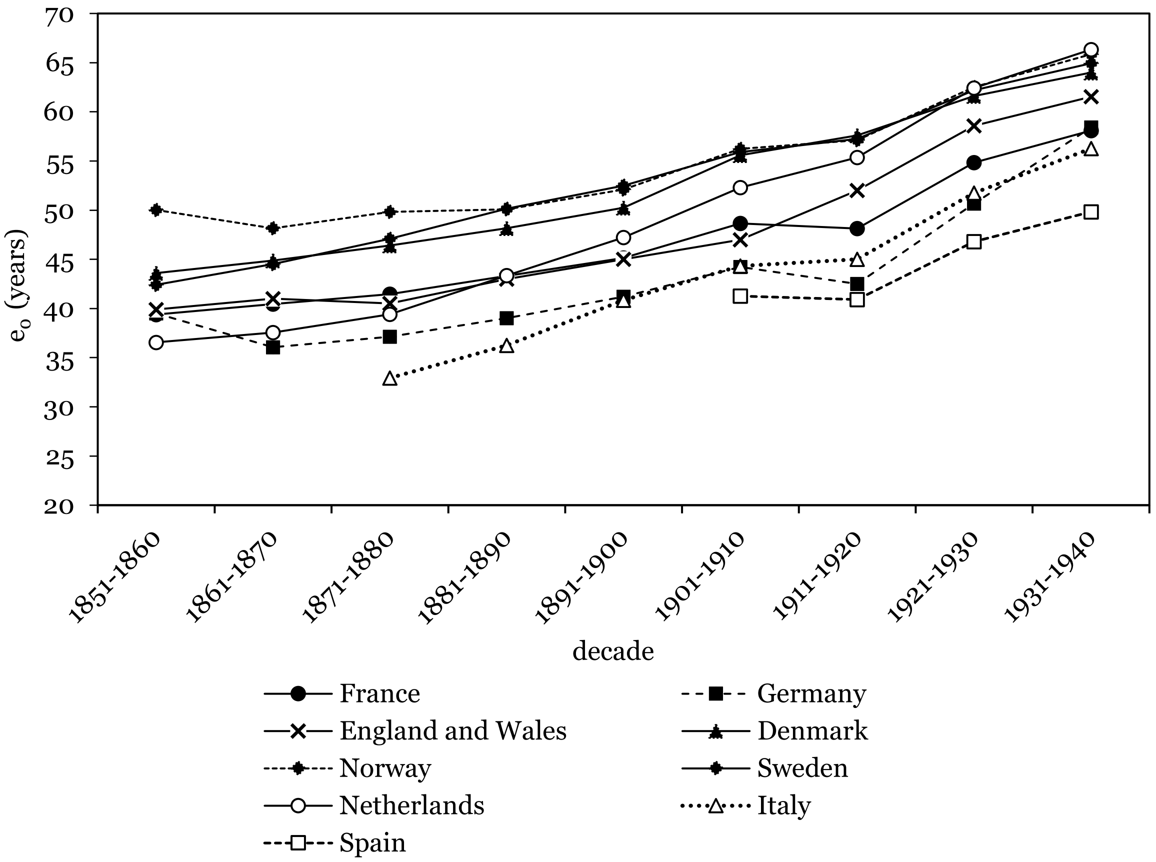
[8] Ibid., pp.737-38.

[9] S.J. Olshansky & A.B. Ault, 'The fourth stage of the epidemiologic transition: the age of delayed degenerative diseases', *The Milbank Quarterly,* 64, 3 (1986), pp.360-61; M. Lussier, R. Bourdeau & R. Choinière, 'Does the recent evolution of Canadian mortality agree with the epidemiologic transition theory?', *Demographic Research*, 18, 19 (2008), p.535.

[10] A.R. Omran, 'The epidemiologic transition theory revisited thirty years later', *World Health Statistics Quarterly*, 51 (1998), pp.99-119, cited by Lussier *et al.*, 'Does the recent evolution', p.533.

nineteenth century. Although e_0 in the Netherlands had improved substantially by the 1880s, reaching the highest levels within Europe by 1940, the German rate remained at somewhat low levels until 1920, when it exhibited a continuous and steep increase. The lowest levels of e_0 in Europe were found in Spain and Italy, where e_0 was still only 40 years at the turn of the century. In the following decades, e_0 in Italy rose much faster than in Spain, reaching 50 years in 1920 whilst the latter approached similar levels by the late 1930s.[11] Eastern European countries experienced very similar patterns to those in Southern Europe; Bulgaria for instance reached 48 years in 1930.[12] One of the main outcomes of this process, therefore, was the reduction of the regional differences both within individual countries and also within Europe.[13]

Figure 1. 1 Average life expectancy at birth (e_0) for both sexes in selected European countries, 1851-1940



Sources: The data for the construction of the graph were obtained from Floud *et al.*, *The changing body*, p.244; Human Mortality Database: www.mortality.org – access in July 2018.

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[11] Caselli, 'Long-term trends', pp.1-2; Schofield & Reher, 'The decline of mortality', p.4; R. Floud, R.W. Fogel, B. Harris & S.C. Hong, *The changing body: health, nutrition and human development in the western world since 1700* (Cambridge: Cambridge University Press, 2011), pp.248-49; P.G. Lunn, 'Nutrition, immunity and infection', in R. Schofield, D. Reher & A. Bideau (eds), *The decline of mortality in Europe* (Oxford: Clarendon Press, 1991), pp.242-48.

[12] Caselli, 'Long-term trends', p.5: Due to the lack of available publications in English concerning Eastern/Balkan countries prior to 1950, this study makes only limited references to their patterns.

[13] Schofield & Reher, 'The decline of mortality', p.4.

A main characteristic of the mortality regime in the nineteenth century were the great discrepancies between rural and urban populations. Rapid urbanization in the eighteenth and nineteenth centuries transformed cities into 'urban graveyards'.[14] Cities therefore faced an 'urban penalty' which reduced survival probabilities for their inhabitants and resulted in a great number of deaths, most significantly among infants.[15] The main conditions responsible for excess urban mortality included the very high population density leading to the rapid spread of infectious diseases; the lack of sanitary reforms and especially the lack of adequate water and sewage disposal; and the great number of migrants arriving in the cities, bringing both new foci of infection and new victims.[16] Migration is said to have been a very special factor in increasing urban mortality in the nineteenth century because the migrants arriving from healthy rural environments were more susceptible to the 'danger' arising from unhealthy urban conditions. However, migrants were also found to be a very important element for the development of those urban centres, contributing to the increase of the population as they replaced those residents who died early.[17] More specifically, these healthy migrants were responsible for the somewhat low levels of adult mortality in the unhealthy environments of Paris and East Belgium in the nineteenth century, when compared to their national figures.[18] Another significant reason for the urban-

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[14] A.F. Weber, *The growth of cities in the nineteenth century: a study in statistics* (New York: MacMillan, 1899), pp.343-67.
[15] S.H. Preston & E. van de Walle, 'Urban french mortality in the nineteenth century', *Population Studies*, 32, 2 (1978), p.279; G. Kearns, 'The urban penalty and the population history of England', in A. Brandström & L.-G. Tedebrand (eds), *Society, health and population during the demographic transition* (Stockholm: Amlqvist and Wisksell International, 1988), pp.222-23; S.H. Preston & M.R. Haines, *Fatal years, child mortality in late nineteenth-century America* (Princeton: Princeton University Press, 1991), pp.97-98; S. Szreter & G. Mooney, 'Urbanization, mortality and the standard of living debate: new estimates of the expectation of life at birth in nineteenth-century British cities', *Economic History Review*, 51, 1 (1998), p.92; M.R. Haines, 'The urban mortality transition in the United States, 1800-1940', *Annales de démographie historique*, 101, 1 (2000), p.34; R.I. Woods, 'Urban-rural mortality differentials: an unresolved debate', *Population and Development Review*, 29, 1 (2003), p.43; D.S. Reher, 'In search of the 'Urban penalty': Exploring urban and rural mortality patterns in Spain during the Demographic transition', *International Journal of Population Geography*, 7 (2001), pp.105-06; L. Cain & S.C. Hong, 'Survival in 19th century cites: the larger the city, the smaller your chances', *Explorations in Economic History*, 46, 4 (2009), pp.450-63; D. Ramiro Farinas & M. Oris (eds), 'Introduction', *New approaches to death in cities during the health transition* (New York: Springer, 2016), pp.5-6.
[16] J.G. Williamson, 'Urban disamenities, dark satanic mills and the British standards of living', *Journal of Economic History*, 41 (1981), p.77; Haines, 'The urban mortality transition', p.35.
[17] A. Sharlin, 'Natural decrease in early modern cities: a reconsideration', *Past and Present*, 79, 1 (1978), p.138.
[18] G. Alter & M. Oris, 'Childhood conditions, migration and mortality: Migrants and natives in 19th-century cities', *Social Biology*, 52, 3/4(2005), p.187; L. Kesztenbaum & J.L. Rosenthal, 'The health cost

rural mortality differential was the existence of hospitals and foundling hospitals in urban centres, which increased the number of deaths in the cities: the rural sick were treated in the urban hospitals.[19]

By 1940, most European cities had been transformed from graveyards into healthy places as death rates declined more rapidly in cities than in the countryside, followed by an urban advantage or at least insignificant discrepancies between urban and rural areas.[20] Significant gains in life expectancy at all ages, but especially in infancy, resulted from reductions in mortality due to infectious, digestive and respiratory diseases. Cities benefited from higher living standards, better public health and sanitation and better health provision as more effective health institutions were established.[21]

Although scholars have examined and proposed different determinants – including improved nutrition, public health, personal sanitation and advances in medical technology – which might have contributed to this remarkable transition over the past centuries, there remain conflicting views regarding the importance of each factor. It has been said, however, that mortality decline cannot be investigated as an individual phenomenon without taking into account other variables such as social, economic, cultural, geographical and even climatological factors.[22]

Initially, mortality decline was attributed to improvements in medical therapy.[23] The discoveries of Louis Pasteur and Robert Koch in the late nineteenth century on the identification of pathogens and the prevention and treatment of infectious diseases had, however, only a very limited effect on the decline of mortality. Until the 1940s, the germ theory could only teach people how to avoid specific germs and how to avoid

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of living in a city: The case of France at the end of the 19th century', *Explorations in Economic History*, 48 (2011), p.223.

[19] B.A. Revuelta Eugercios & D. Ramiro Farinas, 'Understanding infant mortality in the city: exploring registration and compositional effects. Madrid, 1905-1906', in D. Ramiro Farinas & M. Oris (eds), *New approaches to death in cities during the health transition* (New York: Springer, 2016), pp.19-42; D. Ramiro Farinas, 'Mortality in hospitals and mortality in the city in nineteenth- and twentieth-century Spain: the effect on the measurement of the urban penalty mortality rate of the outsiders in urban health institutions', in J. Henderson, P. Horden & A. Pastore (eds), *The impact of hospitals, 300-2000* (Oxford: Peter Land AG, 2007), p.405; G. Mooney, B. Luckin & A. Tanner, 'Patient pathways: solving the problem of institutional mortality in London during the later nineteenth century', *The Society for the Social History of Medicine*, 12, 2 (1999), p.247.

[20] J. Vögele, *Urban mortality change in England and Germany, 1870-1913* (Liverpool: Liverpool University Press, 1998), p.7; Ramiro & Oris, 'Introduction', p.6.

[21] Riley, *Rising life expectancy*, p.120.

[22] Schofield & Reher, 'The decline of mortality', p.17.

[23] Vögele, *Urban mortality change*, p.5.

infecting others.[24] This was also pointed out by McKeown et al., who showed that mortality due to infectious diseases had already declined well before the main advances in medicine took place.[25] Easterlin added that the only beneficial practices prior to the twentieth century had been the use of quarantining and the development of inoculation and later vaccination against smallpox.[26]

The most highly debated hypothesis associated the decline of mortality with increasing standards of living. After having excluded alternative explanations, McKeown attributed the greatest part of the mortality decline to improved living standards and especially to nutrition. He argued that sanitary reforms were only responsible for a quarter of the mortality decline in England and Wales in the second half of the nineteenth century. His results generated considerable controversy and stimulated further work on the possible relationships between public health measures and medical intervention. Improved nutrition, according to McKeown, was the main reason for the reduction in mortality due to air-borne diseases, mainly tuberculosis – which accounted for almost half of the deaths at the time – together with pneumonia and bronchitis.[27] Harris attempted to re-evaluate McKeown's thesis. Using evidence from existing estimates of mortality levels in England and Wales produced by Woods, Szreter and Mooney and by Bell and Millward, he argued that improving wages, expenditure and food consumption may explain the improvement of mortality rates in certain areas of England and Wales during the nineteenth century, although they failed to do so in the country as a whole.[28] More recent studies have also linked the role of increasing incomes, better nutritional status and more effective resistance to a disease environment, prolongation of life expectancy and increases in height.[29]

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[24] Immunization was only effective for specific diseases: for example, Edward Jenner introduced vaccination against smallpox in 1796. Riley, *Rising life expectancy*, p.96.

[25] T.R. McKeown & R.G. Record, 'Reasons for the decline of mortality in England and Wales during the nineteenth century', *Population Studies*, 16 (1962), pp.97-8; T.R McKeown, R.G. Brown & R.G. Record, 'An interpretation of the modern rise of population in Europe', *Population Studies*, 26 (1972), p.349.

[26] R.A. Easterlin, 'How beneficent is the market? A look at the modern history of mortality', *European Review of Economic History*, 3, 3 (1999), pp.263-64.

[27] T.R. McKeown, *The modern rise of population* (London: Edward Arnold Ltd, 1976), p.153.

[28] B. Harris, 'Public health, nutrition, and the decline of mortality: the McKeown thesis revisited', *Social History of Medicine*, 17, 3 (2004), pp.396-97; R. Woods, 'The effects of population redistribution on the level of mortality in nineteenth-century England and Wales', *Journal of Economic History*, 45 (1985), p.648; Szreter & Mooney, 'Urbanization, mortality', p.104; F. Bell & R. Millward, 'Public health expenditures and mortality in England and Wales, 1870-1914', *Continuity and Change*, 13, 2 (1998), pp.242-43. R. Woods, *The demography of Victorian England and Wales* (Cambridge: Cambridge University Press, 2000), pp.362, 369.

[29] R.W. Fogel, *The escape from hunger and premature death, 1700-2100* (Cambridge: Cambridge University Press, 2004), pp.40-42; Floud *et al.*, *The changing body*, p.137.

A large body of the literature, however, suggested that the amelioration of the 'urban penalty' and the very high levels of mortality was due to the success of sanitary reforms rather than simply a general improvement in living standards and diet.[30] Szreter argued that the mortality decline in England and Wales in the 1870s was mainly a result of a successful public health movement, although he found that improving nutrition and living standards did play an important role in this decline.[31] A recent study, which re-examined the mortality decline in England and Wales during the second half of the nineteenth century, concluded that public investments in the sanitation infrastructure (water supply, sewerage system, street paving and cleaning) were responsible for about 60 per cent of the reduction in urban mortality at this period.[32] Harris and Hinde recently suggested that the initial increase in sanitary investment mainly in the urban areas in England and Wales was connected with the onset of mortality decline from waterborne diseases in the 1860s and 1870s, while further increases in sanitary expenditures at the turn of the twentieth century led to further declines from these diseases.[33] Furthermore, the very high levels of mortality – mainly among infants – in Germany declined significantly at the turn of the twentieth century as a result of the sanitary reform there.[34] Preston and van de Walle found that regional differences in mortality in nineteenth-century France depended on the local sanitary environment.[35]

Several studies have also investigated the impact of individual sanitary innovations – mainly water supply and sewerage system – on the decline in mortality. Kesztenbaum and Rosenthal showed that the expansion of the sewerage system increased expectancy of life initially in the most affluent neighbourhoods of Paris in the late-

[30] A. Hardy, *The epidemic streets: infectious disease and the rise of preventive medicine, 1856-1900* (Oxford: Clarendon Press, 1993), p.3; G. Mooney, 'Professionalization in public health and the measurement of sanitary progress in nineteenth-century England and Wales', *The Social History of Medicine*, 10, 1 (1994), p.2; S. Szreter, 'The importance of social intervention in Britain's mortality decline *c.*1850-1914: a reinterpretation of the role of public health', *Social History of Medicine*, 1, 1 (1988), pp.2-3.
[31] Szreter, 'The importance of social', pp.26, 36.
[32] J. Chapman, 'The contribution of infrastructure investment to Britain's urban mortality decline 1861-1900', *Economic History Review*, 7, 1 (2018), p.233.
[33] B. Harris & A. Hinde, 'Sanitary investment and the decline of urban mortality in England and Wales, 1817-1914', *The History of the Family*, 24,2 (2019), p.28; A. Hinde & B. Harris, 'Mortality decline by cause in urban and rural England and Wales, 1851-1910', *The History of the* Family, 24,2 (2019), p.17.
[34] Vögele, *Urban mortality change*, p.188.
[35] Preston & van de Walle, 'Urban french mortality', pp.290-91.

nineteenth century.[36] Studies in the US also suggested that the introduction of water filtration and chlorination systems explained almost half of the decline in mortality in several American cities between 1900 and 1936.[37] Gallardo Albarrán found greater declines in mortality in Germany after the implementation of a sewerage system in several populations rather than improvements in water provision – which took place much earlier – due to water contamination or the exposure of citizens to excrement between 1877 and 1913.[38]

Given the significant role of infant and early-childhood mortality in the mortality decline everywhere in Europe but also elsewhere, the next section focuses on the large body of the literature which has described their patterns over time and posited reasons responsible for that decline.

1.3 Infant and childhood mortality

Infant and early childhood mortality rates have been proved to be significant indicators for the health of past populations, and since they are related to several factors (including poverty, inadequate food, lack of public health or hygiene) that affect the health of a population, they are often used as proxies for living standards in the past. In this section, they are discussed separately as they were found to have impacted differently the mortaliy decline of individual countries.

1.3.1 *Early childhood mortality patterns*

Falls in early childhood mortality, and subsequently infant mortality were found to have been responsible for the mortality decline in the late-nineteenth and early-twentieth centuries in Europe.[39] Although most European countries experienced declines in early childhood mortality in the mid- or late-nineteenth century, in Spain the very high levels of early childhood mortality were only reduced in the early twentieth century while infant mortality was consistently lower than childhood mortality.[40] This pattern of a higher rate of early childhood mortality than that of infants, which was also found in nineteenth-century Italy, has been called the

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[36] L. Kesztenbaum & J. Rosenthal, 'Sewers' diffusion and the decline of mortality: The case of Paris, 1880-1914', *Journal of Urban Economics*, 98 (2017), p.182.

[37] D. Cutler & G. Miller, 'The role of public health improvements in health advances: the twentieth-century United States', *Demography*, 42, 1 (2005), p.3.

[38] D. Gallardo Albarrán, 'Sanitary infrastructures and the decline of mortality in Germany, 1877-1913', *GGDC Research Memoranda*, 176 (2018), pp.27-28.

[39] Schofield & Reher, 'The decline of mortality', p.17.

[40] D. Ramiro Farinas & A. Sanz Gimeno, 'Childhood mortality in Central Spain 1790-1960: changes in the course of demographic modernization', *Continuity and Change*, 15, 2 (2000), p.242.

Mediterranean model.[41] Similar trends were observed in several urban and rural districts in England and Wales for specific periods of time during the nineteenth century.[42]

Due to the significant relationship between childhood mortality decline and the growth in life expectancy in Spain at the turn of the twentieth century, Ramiro and Sanz emphasized the centrality of the early childhood mortality decline in historical mortality studies, by suggesting that the use of early childhood mortality may offer a better understanding of the process of demographic modernization. Most studies use infant mortality as the main indicator to analyse childhood mortality, which at times or in certain geographical areas can be misleading as it did not always play the most central role.[43] More recently, Woods concluded, by re-evaluating the urban-rural differential in Japan and China, that early-childhood mortality should be the focus of attention when studying mortality, as it appears to be extremely sensitive to differences in population density.[44]

Furthermore, Ramiro and Sanz showed that the ratio between infant and early childhood mortality at the end of the nineteenth and in the early twentieth centuries was different from those in most European countries. Although mortality during childhood was much lower than that in infancy in most northern European countries, in the Mediterranean countries that difference was less pronounced.[45] Evidence from sub-Saharan Africa has linked the higher ratio ($q_0/{}_4q_1$) between infant and early childhood mortality to higher mortality due to infectious diseases, because these conditions are more likely to affect children than infants.[46] This has also been suggested in Spain, where high mortality among young children was associated with

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[41] L. Pozzi, 'The determinants of infant and childhood mortality: a complex tangle in the historical research', *Atti della XLI Riunione Scientifica della Società Italiana di Statistica* (2002), pp.77-86; Ramiro & Sanz, 'Childhood mortality', pp.235-67; M. Natale & A. Bernassola, *La mortalità per causa nelle regioni italiane: tavole per contemporanei 1965-66 e per generazioni 1790-1964* (Istituto di Demografia, Università di Roma, 1973).

[42] R. Woods, 'On the historical relationship between infant and adult mortality', *Population Studies*, 47, 2 (1993), p.206.

[43] D. Ramiro Farinas & A. Sanz Gimeno, 'Structural changes in childhood mortality in Spain, 1860-1990', *International Journal of Population Geography*, 6, 1 (2000), p.78.

[44] Woods, 'Urban-rural mortality differentials', p.43.

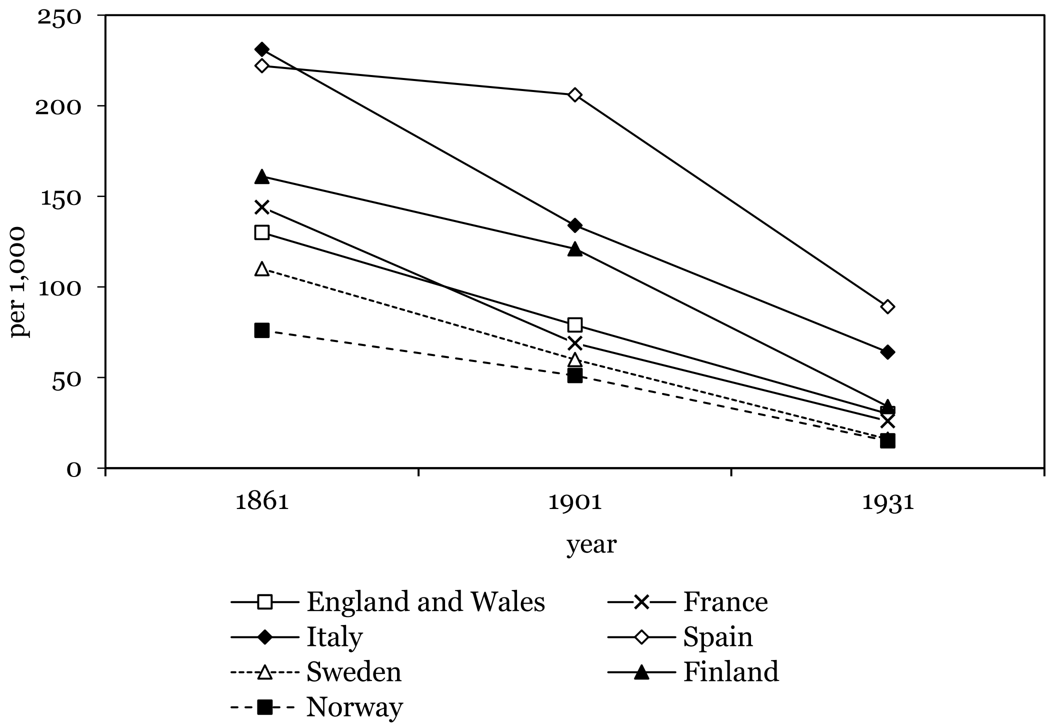
[45] L. Pozzi & D. Ramiro Farinas, 'Infant and child mortality in the past', *Annales de démographie historique*, 129, 1 (2015), p.58.

[46] M. Guillot *et al.*, 'Child mortality estimation: A global overview of infant and child mortality age patterns in light of empirical data', *PLoS Med*, 9, 8 (2012), p.12; H. Jaadla & A. Reid, 'The geography of early childhood mortality in England and Wales, 1881 and 1911', *Demographic Research*, 37, 58 (2017), p.1863.

outbreaks of diseases such as measles and smallpox along with respiratory and seasonal digestive diseases. The prevalence of those diseases during infancy was less prominent as infants were usually protected through breastfeeding.[47]

These significant geographical variations between Northern and Southern Europe are clearly visible in Figure 1.2. In 1860, Italy and Spain exhibited the highest levels of early childhood mortality in Europe, whereas levels at the same age in the northern European countries were much lower. At the turn of the twentieth century, early childhood mortality continued to decline everywhere in Europe, with the most distinct declines in Italy, which reached levels much closer to those in northern European countries. Spain still exhibited high levels. By 1931, however, these latter levels had declined sharply, whilst other northern European countries experienced further declines reaching even lower levels.

Figure 1. 2 Early childhood mortality ($_4q_1$) in selected European countries, 1861-1931



Source: Ramiro & Sanz, 'Structural changes', p.65.

The higher survival rates for young children as a result of increased attention to hygiene and diet and control of infectious diseases were found to have a delayed effect on fertility, which in some cases initiated declines in infant mortality.[48] Various

[47] Ramiro & Sanz, 'Childhood mortality', p.254.
[48] Ramiro & Sanz, 'Childhood mortality', p.261; V. Hionidou, *The demography of a Greek island, Mykonos, 1859-1959: A family reconstitution study* (University of Liverpool: Unpublished PhD thesis,

studies have found that increasing childhood survival influenced fertility change over time with parents controlling their fertility.[49]

The next section discusses the main patterns of infant mortality in Europe and the principal reasons which were responsible for its decline.

1.3.2 *Infant mortality patterns*

Infant mortality decline has been described as "one of the most extraordinary victories that humanity has known", contributing significantly to the decline in mortality.[50] Even though infant mortality started its most significant fall in most of the western-northern European countries in the 1880s and 1890s, there were noteworthy differences in the rates and variations in the timing of the decline. The IMR was particularly high in Germany and noticeably lower in Sweden, whilst in France, Italy, Spain and England and Wales it ranged between these two.[51] A main reason for these geographical variations especially between the northern and the southern countries are climatic differences, as much warmer temperatures in Southern Europe increased diarrhoeal incidence among infants.[52] Infant mortality was also greatest in urban rather than in rural populations mainly due to poor urban sanitation.[53]

The main changes in infant mortality in different parts of Europe from the mid-nineteenth century to the mid-twentieth century can be seen in Figure 1.3. Sweden

1993), pp.232-34; D. Reher, 'Back to the basics: mortality and fertility interactions during the demographic transition', *Continuity and Change*, 14, 1 (1999), p.14

[49] D. Reher & A. Sanz-Gimeno, 'Rethinking historical reproductive change: Insights from longitudinal data for a Spanish town', *Population and Development Review*, 33, 4, (2007), p.721; F. van Poppel *et al.*, 'Mortality decline and reproductive change during the Dutch demographic transition: Revisiting a traditional debate with new data', *Demographic Research*, 27, 11 (2012), p.324; D. Reher & G. Sandström, 'Dimensions of rational decision-making during the demographic transition; Aranjuez (Spain) Revisited', *Historical Life Course Studies*, 2 (2015), p.31

[50] G. Masuy Stroobant, 'Infant health and infant mortality in Europe: lessons from the past and challenges for the future', in C.A. Corsini & P. Viazzo (eds), *The decline of infant and child mortality. The European experience: 1750-1990* (The Hague: Martinis Nijhoff, 1997), p.26.

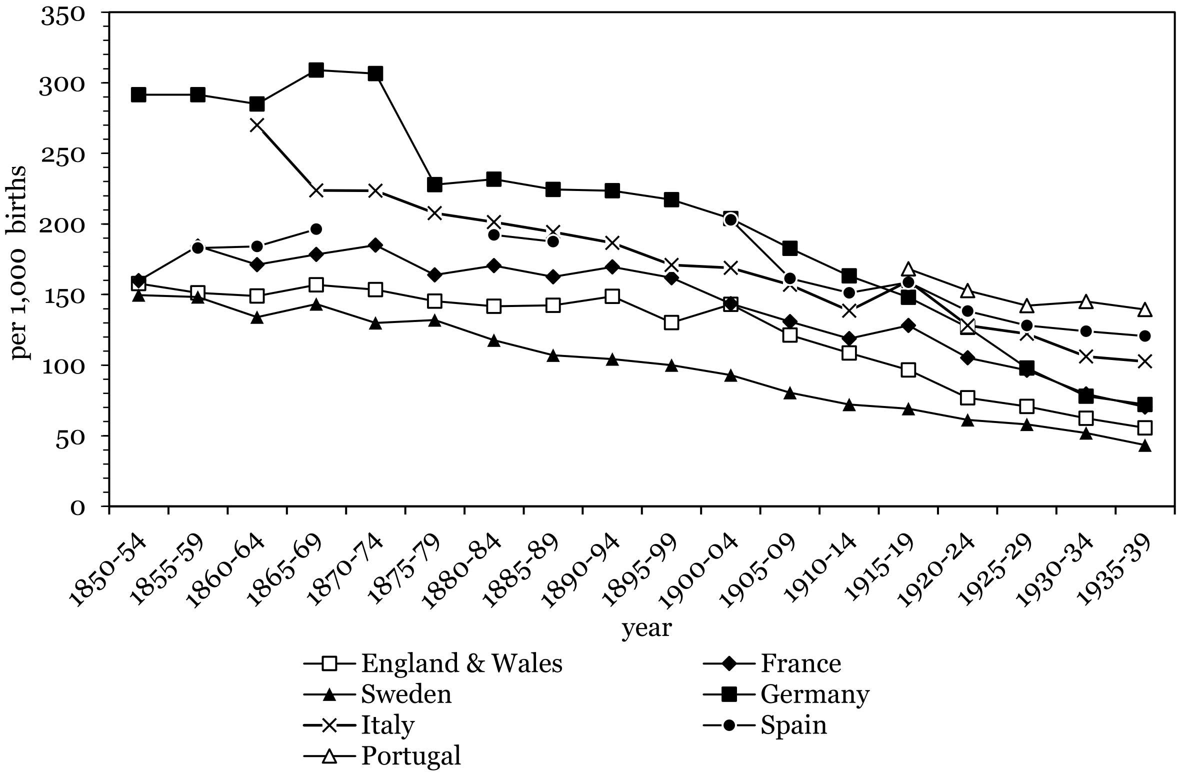
[51] R.I. Woods, P.A. Watterson & J.H. Woodward, 'The causes of rapid infant mortality decline in England and Wales, 1861-1921', Part I, *Population Studies*, 42 (1988), p.348.

[52] J. Knodel, 'Seasonal variations in infant mortality: an approach with applications', *Annales de démographie historique,* 120 (1984), p.80; M. Oris, R. Derosas & M. Breschi, 'Infant and child Mortality', in T. Bengtsson, C. Campbell, J. Lee *et al.* (eds), *Life under pressure: Mortality and living standards in Europe and Asia, 1700-1900* (Cambridge: Massachusetts Institute of Technology Press, 2004), pp.391-92; L. Del Panta & L. Pozzi, 'Age and cause mortality structure in the Italian regions at the beginning of the health transition: a research project', *Statistica*, 1 (2011), pp.28-30.

[53] N. Williams & G. Mooney, 'Infant mortality in an 'Age of Great Cities': London and the English provincial cities compared, c.1840-1910', *Continuity and Change*, 9, 2 (1994), p.185; R. I. Woods, P.A. Watterson & J.H. Woodward, 'The causes of rapid infant mortality decline in England and Wales, 1861-1921', Part II, *Population Studies*, 43 (1989), p.114.

exhibited the lowest IMR in Europe from the mid-nineteenth century –150 per thousand, whilst at the turn of the twentieth century it was the first European country to reach rates below 100 per thousand.[54] Both England and Wales and France experienced similar patterns, with IMR in both countries starting to decline rapidly at the turn of the century.[55] In the mid-nineteenth century, IMR in Germany was perhaps the highest rate in Europe, while by the 1930s it had reached levels much closer to the northern western European countries.[56] Finally, all three southern European countries – Italy, Spain and Portugal – experienced high IMR in the first decades of the twentieth century. Even though all three exhibited a diminishing trend, they were well above 100 per thousand as late as 1940.[57]

Figure 1. 3 Quinquennial IMR in selected European countries per thousand births, 1850-1939



Sources: Ramiro & Sanz, 'Structural changes', p.65; Mitchell, *European historical statistics*.

54 A. Brändström, 'Infant mortality in Sweden, 1750-1950: past and present research into its decline', in C.A. Corsini & P.P. Viazzo (eds), *The decline of infant mortality in Europe, 1800-1950, Four national case studies* (UNICEF, 1993), p.19.

55 Williams & Mooney, 'Infant mortality', p.185; Vallin, 'Mortality in Europe', p.59; C. Rollet & P. Bourdelais, 'Infant mortality in France, 1750-1950: evaluation and perspectives', in C.A. Corsini & P.P. Viazzo (eds), *The decline of infant mortality in Europe, 1800-1950. Four national case studies* (Florence: UNICEF, 1993), p.60.

56 J. Vögele, 'Urban infant mortality in imperial Germany', *Social History of Medicine*, 7, 3 (1994), pp.401-02.

57 Pozzi, 'The determinants of infant', pp.77-78; B.R. Mitchell, *European historical statistics, 1750-1975* (New York: Macmillian Press, 1981), pp.138-40; A. Monnier, 'L'Italie, l'Espagne et le Portugal: Situation démographique', *Population,* 35, 4/5 (1980), p.947, Table 13.

Mosley and Chen identified five categories of variables that influence the risk of mortality and morbidity of children: maternal factors (e.g. age, parity, birth intervals), environmental contamination (e.g. air, food, water), nutrient deficiency for both child and mother (e.g. calories), injuries (accidental or intentional) and personal illness control (e.g. personal preventive measures, quality of care during pregnancy and childbirth).[58] The lack of historical data has been the major reason for the inability to examine most of these factors in the past; and, therefore this framework has rarely been employed in historical studies.[59] Most historical studies attribute the decline in infant mortality to the rise of living standards (particularly improvements in nutrition) and public health movement, as discussed in section 1.2, or propose a joint effect of the aforementioned determinants during the onset of the mortality transition.[60] Yet, there is a significant number of studies that have expressed diverse views on the determinants of infant mortality decline in the nineteenth and early-twentieth century.

A main factor which was identified as accounting for the decline in infant mortality in England and Wales was long-term improvements in women's education which led to improvements in their status and also changed the attitude of mothers in that they cared not only about their babies but also about themselves.[61] Mothers were also encouraged to breastfeed, which in many cases has been found to be an important factor for the stabilization of infant mortality at low levels at the beginning of the twentieth century.[62] During the late nineteenth and the first decades of the twentieth centuries, an infant's survival partly depended on whether they were breast-fed or not. Several studies have shown that breast-fed infants had much greater survival chances than those who were exclusively artificially fed.[63] Conditions at childbirth also improved as the number of better-trained and more efficient midwives increased. Nevertheless, it has been suggested that the impact of professional midwives was

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[58] W.H Mosley & L.C. Chen, 'An analytical framework for the study of child survival in developing countries', *Population and Development Review*, 10 (1984) suppl., pp.32-34.
[59] J. Wolleswinkel-van den Bosch *et al.*, 'Determinants of infant and early childhood mortality levels and their decline in the Netherlands in the late nineteenth century', *International Journal of Epidemiology*, 29, 6 (2000), p.1031.
[60] C.A. Corsini & P. Viazzo (eds), *The decline of infant and child mortality. The European experience: 1750-1990* (The Hague: Martinis Nijhoff, 1997).
[61] Woods *et al.*, 'The causes of infant mortality, Part II', p.130.
[62] G. Thorvaldsen, 'Was there a European breastfeeding pattern?', *The History of the Family*, 13, 3 (2008), p.289.
[63] J. Knodel & H. Kitner, 'The impact of breast feeding patterns on the biometric analysis of infant mortality', Demography, 14, 4 (1977), pp.393, 396.

limited as their quality did not improve immediately. The main benefit was probably the lowering of maternal rather than infant deaths. Finally, improved nutritional standards among mothers resulted in a lower incidence of premature births and increased the natural resistance of the new-born.[64]

The sanitary reform movement was also responsible for the sharp fall in infant mortality, especially in deaths attributed to diarrhoeal diseases. The reductions were mainly a result of general improvements in the urban environment by the provision of pure water, paved streets, refuse collection and a proper sewage system. Improvements in hygiene facilities in houses, the expansion of public health initiatives, mainly at the local level, and the regulation of the urban milk supply have also been found to have been crucial factors for the increasing number of surviving infants.[65]

Even though social class was found to have had significant impact on infant mortality in England and Wales, it did not influence the pace or the timing of the decline.[66] Findings from Alghero, Italy, showed lower infant mortality rates among higher social classes, while higher infant mortality was calculated among farmers in wealthy parts of Finland.[67] Evidence from the US showed that inequality in infant mortality by social class was significantly lower than that in England and Wales. In addition to this, Preston and Haines suggested that 'lack of knowledge' was more important factor than 'lack of resources' for increasing infant mortality in the late nineteenth century.[68] Overall, it is believed that initially infant mortality decline was concentrated among

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[64] J. Woodward, 'Medicine and the city the nineteenth century', in R. Woods & J. Woodward (eds), *Urban disease and mortality* (London: Batsford Academic and Educational, 1984), p.76; M. Morel, 'The care of children: the influence of medical innovation and medical institutions on infant mortality 1750-1914', in R. Schofield, D. Reher & A. Bideau (eds), *The decline of mortality in Europe* (Oxford: Clarendon Press, 1991), p.204.

[65] M.E. Pooley & C.G. Pooley, 'Health, society and environment in Victorian Manchester, in R. Woods & J. Woodward (eds), *Urban disease and mortality* (London: Batsford Academic and Educational, 1984), p.160; J. Bournett, 'Housing and the decline of mortality', in R. Schofield, D. Reher & A. Bideau (eds), *The decline of mortality in Europe* (Oxford: Clarendon Press, 1991), p.172; Szreter, 'The Importance of social', pp.28-30; Woods *et al.*, 'The causes of rapid infant mortality, Part II', p.130.

[66] Woods *et al*, 'The causes of rapid infant mortality, Part I', p.365; 'Part II', p.127; M.R. Haines, 'Socio-economic differentials in infant and child mortality during mortality decline: England and Wales, 1890-1911', *Population Studies*, 49, 2 (1995), p.315.

[67] M. Breschi *et al.*, 'Socioeconomic conditions, health and mortality from birth to adulthood, Alghero 1865-1925', *Explorations in Economic History*, 48, 3 (2011), p.370; S. Edvinsson, O. Gardarsdottir & G. Thorvaldsen, 'Infant mortality in the Nordic countries, 1780-1930', *Continuity and Change*, 22, 3 (2008), p.472.

[68] Preston & Haines, *Fatal years,* p.209.

higher social classes, while it accelerated towards the end of the nineteenth century, leading to decline among all social classes.[69]

The final factor which has been found to have played an important role in the infant mortality decline was the decline in fertility. It is commonly accepted that in England and Wales, fertility started to fall in the 1870s, whilst infant mortality was still high and continued to remain high until the 1890s.[70] Woods *et al.* argued that the reduction in both marital and illegitimate fertility helped to stabilize the decline in infant mortality from the 1870s onwards by influencing maternal health as well as by increasing the intervals between successive births.[71]

This brief introduction has attempted to outline the main aspects of mortality patterns, mainly in the European context, which have been found and discussed in the literature. The next section shows the importance of studying the mortality patterns in Greece, which has very rarely been mentioned in that literature. The main reasons for conducting this research will be set out, together with the main research questions which this thesis aims to answer. Lastly, the structure of the thesis will be outlined.

1.4 Why Greece?

Mortality patterns in Mediterranean Europe exhibited different trends from those in most north-western European countries. Evidence from other Mediterranean European populations has shown that mortality declined later than in the rest of Europe, as a result of the very high IMR or ECMR, particularly in Spain, until the beginning of the twentieth century.[72] When most studies examine Mediterranean European patterns, they refer primarily to Italy and Spain and less often to Portugal. Historical demographic patterns in Spain and Italy have progressively gained interest among historical demographers, demographers, sociologists and historians in the past few decades. Greece, however, has always been absent in the literature as very little evidence is available regarding the mortality patterns there prior to the 1960s. Apart

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[69] S. Edvinsson *et al.*, 'High-risk families: The unequal distribution of infant mortality in nineteenth-century Sweden', *Population Studies*, 59, 3 (2005), p.322; H. Jaadla & M. Klesment, 'Infant mortality in the Lutheran population of Tartu at the end of the nineteenth century', *Ajalooline Ajakiri*, 2, 3 (2014), p.150.
[70] F. van de Walle, 'Infant mortality and the European demographic transition', in A.J. Coale & S. Watkin (eds), *The decline of fertility in Europe: the revised proceedings of a conference on the Princeton European fertility project'* (Princeton: Princeton University Press, 1986), pp.228-29; M. Doepke, 'Child mortality and fertility decline: Does the Barro-Becker model fits the facts?', *Journal of Population Economics*, 18, 2 (2005), p.351.
[71] Woods *et al.*, 'The causes of rapid infant mortality, Part II', pp.122-26, 130.
[72] Caselli, 'Long-term trends', p.1.

from a few studies which have attempted to estimate national mortality levels in Greece and two family reconstitution studies which refer to non-urban populations, there remains a significant lack of studies focusing solely on urban mortality patterns.[73]

In the first decades of the twentieth century, Greece was probably the most rapidly urbanized country in the Balkans.[74] Leontidou estimated that the urban population in Greece rose by 12 per cent from 1920 to 1940 mainly as a result of the refugee influx from Asia Minor in the 1920s.[75] Even though the urban population in Greece accounted for less than 15 per cent of the total population for most of the nineteenth century, a few medium-sized urban centres – by European standards – arose. The capital Athens was the largest city since the early years of the creation of the Greek kingdom, but there were also other significant urban centres, including Hermoupolis, Patras and Volos. Thus, a study of urban mortality in modern Greece is of special importance because it will not only contribute to expanding our understanding of the mechanisms of mortality decline in Greece and in Mediterranean Europe but will also provide new insights into the patterns of European urban mortality.

The discontinuity in the collection and publication of demographic data in Greece in addition to the very frequent changes of the state boundaries during the nineteenth and twentieth centuries, are probably the main reasons for the very small number of demographic studies addressing mortality.[76] Although censuses were conducted quite frequently from 1861 onwards, there were wide gaps in their publication or in the elaboration of the results.[77] The non-availability of continuous national published vital registration statistics is considered to be the most significant problem in the study of

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[73] Some studies have explored mortality in other urban Greek populations rather superficially without the use of demographic methods. All studies have been employed in this thesis enabling comparisons to be made with the findings of the current study.

[74] M.R. Jackson, 'Comparing the Balkan demographic experience, 1860 to 1870', *The Journal of European Economic History*, 14 (1985), p.224.

[75] L. Leontidou, *The Mediterranean city in transition: social change and urban environment* (Cambridge: Cambridge University Press, 1990), p.56.

[76] B. Kotzamanis & E. Androulaki, 'Oi demographikes ekselikseis ste neotere Ellada' (The demography of modern Greece), in B. Kotzamanis (ed.), *E demographike proklese, gegonota kai diakyveumata* (*Demographic challenge, facts and risks*) (Volos: University of Thessaly, 2009), pp.87-88, 104; Hionidou, *The demography of a Greek island*, p.18.

[77] More specifically, although censuses were held in 1889 and 1896, only very limited information is available, apart from the national population figures, leaving therefore a gap of almost three decades between the 1879 and 1907 censuses. Similarly, between 1928 and 1951, a gap of 23 years occurred, as in 1940 only very few figures were published: Hionidou, *The demography of a Greek island*, p.19-21.

the main demographic events in the country.[78] But even if uninterrupted series were available, these data would not allow the accurate study of the mortality patterns in Greece. These data were employed by Valaoras to examine national mortality trends, but because of the high under-registration of vital events, the results do not reflect the real levels of mortality at the time.[79] Valaoras also attempted to reconstruct the demographic history of modern Greece in 1960 by claiming to have filled in every demographic gap from 1860 to 1959.[80] His study has been the most widely used and cited study even until today. That study, however, was based on indirect techniques and an extensive number of assumptions rather than on actual data.[81] The study by Siampos concerning the demographic history of modern Greece is considered to have provided the most accurate national demographic estimates so far calculated.[82] Nonetheless, any study that uses published data to outline demographic change in Greece prior to the 1950s has to rely on multiple assumptions due to the limited availability of reliable sources at national level. Therefore, the study of mortality in Greece should be – at least initially – concentrated on smaller geographic units, preferably urban as most of the existing evidence refers to rural or semi-urban populations.

1.5 Why Hermoupolis?

Since it is impossible to study the national mortality patterns in Greece as a whole, it was decided, for a variety of reasons, to explore the mortality trends in Hermoupolis on the island of Syros. To study the mortality in an urban area, it is necessary first to establish the 'urban-ness' of Hermoupolis. Historically, a population of 5,000 inhabitants per city has been regarded as a minimum for an area to be classed as urban by the Greek National Statistical Service.[83] Even though many localities switched from urban to rural areas and vice versa during the study period, Hermoupolis had been

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[78] National published vital registration statistics are available for the periods 1861 to 1888, 1921 to 1938 and from 1955 onwards.

[79] V.G. Valaoras, *Stoiheia viometrias kai statistikes: demographike melete tou plethysmou tes Ellados* (*Biometrics and Statistics: a demographic study of Greece*) (Athens, 1943).

[80] V.G. Valaoras, 'A reconstruction of the demographic history of modern Greece', *Milbank Memorial Fund Quarterly*, 38 (1960), pp.115-39.

[81] V. Hionidou, 'Istorike kritike anadrome tes gennetikotitas sten Ellada. E periptose tes Mykonou, 1859-1959' (A critical historical review of fertility in Greece: the case of Mykonos, 1859-1959), *Greek Review of Social Research*, 92-93 (1997), pp.40-44.

[82] G.S. Siampos, *Demografike ekseliksis tes neoteras Ellados, 1821-1895* (*Demographic evolution of modern Greece, 1821-1985*) (Athens, 1973).

[83] *Apographe tou plethysmou tes Ellados kata ten 19/12/1920* (*Census of the Greek population of 19/12/1920*) (Athens: Ministry of National Finances, 1928), p.λβ.

always classified as urban, having a relatively steady population of around 20,000 inhabitants.

Hermoupolis was one of the first urban centres and a large city in modern Greece for most of the nineteenth century. It was also a part of the Greek kingdom since its creation in 1828, unlike other areas of the country which were annexed in 1881, 1913 or 1922 or even later. Hermoupolis also combined the typical characteristics of an insular port-city and an industrial urban area at the time. It contained an administrative and economic centre, a large workforce, industries, trade, shipping companies, international networks, and had developed essential urban institutions such as markets and hospitals.[84] The population of the city was increasing up to 1889, when it reached 22,104 inhabitants. By 1896, it had declined significantly to 18,760 and at the turn of the century it had been relegated to the status of a provincial and rather insignificant backwater city. In addition, the population of the city was affected by the arrival of Greek refugees from Asia Minor in the early 1920s and in 1928 it had increased to 21,416 inhabitants, but by 1940 it had declined again to the pre-1920s level. The size of the city, therefore, permits the application of the standard demographic methods used in historical demography to study the mortality in an urban environment.

Hermoupolis experienced very high mortality levels in the late nineteenth century with a Crude Death Rate (CDR) of 32 per thousand in 1896.[85] Kolodny argued that the extremely high mortality rates in Hermoupolis at the time resulted from the unhealthy work conditions and very low living standards among the working- class residents.[86] This rate was well above the national average estimated by Valaoras. By the late 1920s, CDR in Hermoupolis had reduced to 21 per thousand, much closer to the national estimates provided by Valaoras and Siampos.[87] CDR is a very basic measure when trying to understand the course of mortality in a population. Given that CDR does not take into account that risk of death increases with age, it does not reflect the true

[84] A. Delis, 'A Mediterranean insular port-city in transition: economic transformations, spatial antagonism and the metamorphosis of landscape in nineteenth-century Hermoupolis on the island of Syros', *Urban History*, 42, 2 (2015), pp.228-29.

[85] V. Hionidou, 'Demographia' (Demography), in K. Kostas & S. Petmezas (eds), *E Ellenike oikonomia tou 19ou aiona (1830-1914)* (*The Greek economy in the 19th century (1830-1914)*) (Athens: Alexandreia, 2006), p.90.

[86] E. Kolodny, 'Hermoupolis-Syros, Gennesis kai ekselikses mias ellenikes nesiotikes poleos' (Hermoupolis-Syros, the birth and evolution of a Greek island city), *Epeteris Etaireias Kykladikon Meleton*, 8 (1969), pp.274-75.

[87] Hionidou, 'Demographia', p.90.

changes in age-specific mortality.[88] Therefore, the calculation of age-specific death rates for the study of the mortality regime in a population is considered necessary in order to reach more accurate conclusions. Hermoupolis is particularly privileged since the available sources allow the calculation of such rates.

Even so, the most important reason for the selection of the city of Hermoupolis was the availability of uninterrupted series of individual-level civil registration sources which are continuously available on the island from 1859. Such a rich collection of continuous civil registration data is very rare not only in Greece but also in other Mediterranean and European populations.[89] An additional significant factor was the availability of census enumerators' books of 1861, 1870 and 1879. Beyond the individual level data, there is a wealth of qualitative sources (including the local press and medical reports) which enables the exploration of public health in a Greek urban population outside Athens. Finally, the availability of cause-of-death information from 1916 to 1940 allow the investigation of the epidemiological profile of the city.

This study begins in 1859, the year when civil registration was introduced, and it extends up to 1940, the year when Greece entered the Second World War. The mortality pattern in Hermoupolis during the period 1938-1944 was studied extensively by Violetta Hionidou in her monograph *Famine and Death in Occupied Greece, 1941-1944*, which explored the effects of the famine on several populations.[90]

In the next section, the main research questions which will be addressed in the thesis will be set out.

1.6 Research questions

The principal concern of this study is to investigate mortality change in the city of Hermoupolis over a span of 82 years, something which has never been undertaken before in such detail for a Greek city. The main research questions are:

1. What were the levels of overall mortality in Hermoupolis? How did mortality change in Hermoupolis over the course of the study period? What were the reasons for the mortality decline? Which age-groups benefited first by the decline?

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[88] A. Hinde, *England's population: a history since the Domesday Survey* (London: Hodder Arnold, 2003), pp.193-94.
[89] The most typical example of a Greek population which possesses such a good quality of data and has been studied extensively by Hionidou is the neighbouring island of Mykonos.
[90] V. Hionidou, *Famine and death in occupied Greece, 1941-1944* (Cambridge: Cambridge University Press, 2006).

2. What were the levels of infant and early childhood mortality in Hermoupolis? When did they start to decline? What were the main factors responsible for initiating the decline in infant mortality? How did childhood mortality affect the mortality decline and the growth in e_0? Did Hermoupolis experience similar trends to those in Italy or Spain? What was the relationship between fertility decline and the decline in infant and early childhood mortality?
3. What, if anything, did the state and the local authorities do to improve public health and what effect did these actions have? When did the city obtain a modern water supply and a sewage system? To what extent did these affect mortality in Hermoupolis?
4. How does Hermoupolis fit with the experience of Greece and Europe? Was there an urban penalty present and, if there was, when was it removed and how?
5. What was the epidemiological profile of the city and how did it change over time? What diseases were mostly responsible for the deaths in the population of Hermoupolis? Did these diseases affect both sexes and all ages equally?

In order to answer these questions, the standard demographic methods used in historical demography were employed along with the technique of nominal record linkage. In addition, a series of life-tables was constructed for the very first time for a Greek urban settlement. Finally, mortality by cause of death was analysed using the successive schemes of the International Classification of Diseases (ICD-3 and ICD-4) for the years 1916-1940, when cause-of-death information is available.

The following section gives details of the structure of the thesis in the light of the research agenda outlined above.

1.7 The structure of the thesis

This thesis consists of ten chapters. Following this introduction, the second chapter provides essential background to the city of Hermoupolis and an extensive account of the data sources used in the study. The final part of the chapter describes the construction of databases and the steps followed during the record linkage technique. After a brief literature review on the impact of sanitary reforms and individual sanitary innovations in various populations across Europe and the US, the third chapter examines public health in Greece and Hermoupolis. Using evidence from oral interviews, public health reports and press reports, this chapter explores the improvements in public health in Hermoupolis during the study period. Chapter Four presents the mortality analysis results by age-group and sex, and comparisons with other populations in Greece and in Europe are made. The fifth chapter examines infant mortality by focusing on the timing of and reasons for its decline while also addressing the issue of stillbirths. Chapter Six focuses on the cause-specific analysis of mortality in Hermoupolis during the period 1916-1940. Chapter seven focuses on diarrhoeal mortality during infancy and early childhood. Apart from levels of diarrhoeal mortality, the seasonality of those deaths, breastfeeding and feeding practices in general are also examined. Chapter Eight explores mortality attributed to tuberculosis, and Chapter Nine investigates the levels of the 1918-19 influenza pandemic. The final chapter offers an account regarding the reasons for the mortality decline in the city during the first four decades of the twentieth century. It also summarises the main findings and offers answers to the research questions posed in this chapter.

Chapter 2. Hermoupolis, sources and record linkage

2.1 Introduction

This chapter presents the history and socio-economic background of the city of Hermoupolis. It will give details of the available demographic sources in modern Greece, with a particular emphasis on the sources which were used extensively in this study. Finally, a summary of the steps followed during the data inputting and the nominal record linkage practice are presented.

2.2 The history of the city

Hermoupolis is the capital city of the island of Syros and of the Cycladic group of islands (Plate 2.1). The city was created during the Greek revolution against the Ottoman Empire (1821-1827). The revolution resulted in great loss of life and migration. Most of this movement consisted of refugees fleeing from areas where the revolution was suppressed or from the main war zones to a safer location. Waves of Greek refugees, primarily from Asia Minor and later from the islands of Chios, Psarra and other parts of the Ottoman Empire, sought refuge on the island of Syros, where the population at the time was principally Roman Catholic. The Catholics had moved onto Syros but also onto other Cycladic islands in the thirteenth century. Since then they have been living on the upper part of the western hill, which is called *Ano Syros* (Plate 2.2).[1]

Many of the Greek Orthodox refugees who arrived in Hermoupolis in the 1820s were merchants and mariners. They immediately realised the potential of creating a commercial centre and port on Syros. Because of its predominantly Catholic population, Syros was protected by France.[2] Another reason for this protection was the fact that Syros was situated at the crossroads of commerce in the Aegean Sea between the major ports of the eastern Mediterranean, such as Alexandria, Smyrna

[1] T. Ampelas, *Istoria tes nesou Syrou apo ton arhaiotaton hronon mehri kath'emas* (*The history of the island Syros from the ancient times to the present day*) (Hermoupolis, 1874), p.87; A. Drakakis, *Istoria tou oikismou tes Ermoupoleos Syras, 1821-1825* (*History of the settlement of Hermoupolis, Syros, 1821-1825*), vol. A (Athens, 1979), p.3.

[2] V. Kardasis, 'Ermoupole: Astikes leitourgies kai symperifores' (Hermoupolis: Urban services and performances), *Praktika tou diethnous symposiou istorias- Neollenikes poles, Othomanikes kleronomies kai Elleniko kratos* (*Proceedings of the International Symposium of History, Neo-Hellenic cities, Ottoman Heritages and Greek State*) (Athens: Etaireia Meletes Neou Ellenismou, 1985), p.586.

and Constantinople. The settlement grew at an alarming rate. From having just 150 people in 1821, it mushroomed to over 13,800 inhabitants by 1828. Hermoupolis initially was built in the coastal area around Syros harbour, while later on the city was expanded on the eastern hill (*Anastase*) and along the coastal area (Plate 2.3)

In the years that followed, its population increased to 20,000, making it the second largest city in the newly-established Greek kingdom and certainly the wealthiest city in the state.[3] Thus, Hermoupolis was transformed from a temporarary settlement into one of the most important financial, social and cultural urban centres of nineteenth-century Greece.

[3] Kolodny, 'Hermoupolis-Syros', pp.253-54; V. Kardasis, *Syros: stavrodromi tes Anatolikes Mesogeiou, 1832-1857* (*Syros: crossroads of the Eastern Mediterranean, 1832-1857*) (Athens: MIET, 1987), p.29; V. Hionidou, 'Nineteenth-century Greek households: The case of Hermoupolis, 1861-1879', *Continuity and Change*, 14, 3 (1999), pp.404-05; C. Loukos, 'Families and family structure in a Neo-Hellenic city: Hermoupolis in the mid-19th century', *The History of the Family*, 9 (2004), pp.317-18.

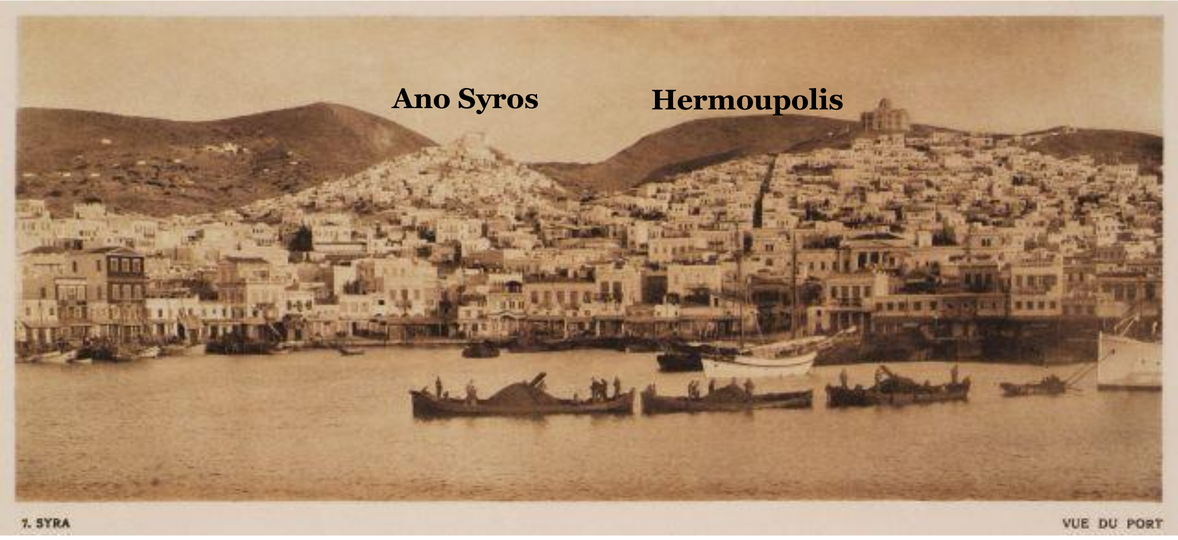
Plate 2. 1 Map of Greece

***Source*:** Data retrieved via www.geodata.gov.gr (access in May 2018).

Plate 2. 2 Hermoupolis in 1843

Source: Photo taken by Joseph Philibert Girault de Prangey. Photo retrieved via https://gallica.bnf.fr/ark:/12148/btv1b6903475w/f1.item (access in June 2018).

Plate 2. 3 The city of Hermoupolis in 1919



***Source*:** D. Baud-bovy & F. Boissonas, *Des Cyclades en Crète au gré du vent* (Geneva: Boissonnas & Co, 1919). Photo retrieved via http://eng.travelogues.gr/item.php?view=45412 (access in June 2018).

Table 2. 1 Population of Hermoupolis, Syros and Cyclades, 1821-1961

Year	*Hermoupolis*	*Syros*	*Cyclades*
1821	150	10,233	104,391
1828	13,805	18,986	98,319
1834	12,392	13,856	82,111
1848	19,410	22,025	124,204
1856	16,830	30,195	141,949
1861	18,511	28,084	118,530
1870	20,996	30,643	123,299
1879	21,540	31,412	132,020
1889	22,104	36,098	131,508
1896	18,760	32,177	134,747
1907	18,132	31,939	130,378
1920	18,663	28,889	122,347
1928	21,416	32,196	129,02
1940	18,925	30,512	129,015
1951	16,971	33,815	125,959

***Sources*:** Kolodny, 'Hermoupolis-Syros', p.255; G. Giagkakes, *Demografika Kykladon, 1821-1971* (*The demographics of the Cyclades, 1821-1971*) (Athens: Vivliopoleio ton vivliofilon, 1978), pp.18-19; Kardasis, *Syros: stavrodromi*, p.29; K. Komis, *Istorike demographia tou Neoellenikou horou, 19os aionas* (*Historical demography of the Neohellenic area, 19th century*) (Ioannina: Panepistemio Ioanninon, 2002), p.95.

After the arrival of the refugees, Hermoupolis developed into a prosperous town; its wealth was derived from manufacturing as well as from the commercial activities of the port and the shipyards.[4] According to an English visitor of the late nineteenth century:

> The flourishing commercial centre on the island of Syra is due to the spontaneous outburst of mercantile activity incident on the recovery of freedom. Thus, in many ways Hermoupolis, on Syra, is one of the most interesting towns of the Levant. Whatever was left of vitality in Greece after long years of depression found itself drawn to rocky, ungainly Syra.[5]

Hermoupolis was without a doubt the most significant Greek port in the mid-nineteenth century.[6] Moreover, it developed all the services of a typical nineteenth-century port-city, such as marine insurance companies, a trade in second-hand vessels, a maritime loan market, a depot for ship supplies and similar initiatives.[7] As a port, its principal function was distributive since it was the largest centre of transit trade in the Eastern Mediterranean. It was also an effective commercial and maritime crossroads between the Mediterranean and the Black Sea.[8] Hermoupolis was also a ship-building and repair zone for the construction and repair of sailing ships.[9]

The city's importance had already started to decline in the 1870s, although it maintained its prominence until the opening of the Corinth Canal in 1893. A major reason for its decline was the expansion of steamboat services and the opening up of other ports on the coast of Asia Minor which attracted much of the commerce with the east which Hermoupolis had virtually monopolized during the first half of the

[4] I. Travlos & A. Kokkou, *Ermoupole. E demiourgia mias neas poles ste Syro stis arhes tou 19ou aiona* (*Hermoupolis, the creation of a new town on Syros at the beginning of the 19th century*) (Athens: Emporike Trapeza, 1980), pp.37-39.

[5] J. T. Bent, *The Cyclades, or life among the insular* (London, 1885), p.304.

[6] The development of Hermoupolis as a major port-city or industrial centre in the nineteenth century has been explored extensively by Delis in his PhD thesis and in various recent publications: A. Delis, *Ermoupole- Syros: To naupegiko kentro tes istioforou nautilias, 1830-80* (*Hermoupolis-Syros: the shipbuilding centre of the sailing merchant marine, 1830-80*) (Ionian University: Unpublished PhD thesis, 2010); 'Modern Greece's first industry? The shipbuilding centre of sailing merchant marine of Syros, 1830-70', *European Review of Economic History*, 19 (2015), pp.255-74; *Mediterranean wooden shipbuilding: economy, technology and institutions in Syros in the nineteenth century* (Leiden & Boston: Brill, 2016).

[7] Delis, 'Modern Greece's first industry', p.258.

[8] Delis, 'A Mediterranean insular port-city', p.229; V. Hastaoglou-Martinidis, 'The cartography of harbour construction in eastern Mediterranean cities: technical and urban modernization in the late nineteenth century', in B. Kolluoglou & M. Toksoz (eds), *Cities of the Mediterranean. From the Ottomans to the present day* (London & New York: I.B. Tauris, 2010), p.80.

[9] Delis, 'A Mediterranean insular port-city', pp.230-31.

nineteenth century.[10] Other important reasons included the development of the railway network and the rise of Athens and its port of Piraeus, which led to reduced commercial activity through the port at Hermoupolis. After enjoying a long period of economic development, Hermoupolis entered a long phase of decline. In this period, the city's attraction for Greeks to migrate there for work decreased dramatically. At the same time, the only people who were still moving to Hermoupolis were people from the other islands of the Cyclades group. Although Hermoupolis attracted significant number of migrants, out-migration was also important. The main category of emigrants was members of fairly wealthy families who were moving to other port cities in order to develop the financial activities of their families.[11] A local newspaper reported that unemployment, especially among the working-class people, was very high in the final years of the nineteenth century as a result of the unstable financial and political situation of the whole country, mainly due to the public insolvency of 1893 and the Greco-Turkish War of 1897.[12] Other reasons contributing to the city's economic instability were the Balkan wars (1912-13) and the First World War (1917-19).[13] In addition, the annexation of Epirus, Macedonia, Crete and other parts of Greece led to the formation of new trade centres in locations that damaged Hermoupolis's development.[14] Thus, the advantageous position which the city had enjoyed was lost after the events listed above, but particularly after the Asia Minor

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[10] Travlos & Kokkou, *Ermoupole*, p.40; E. Kolodny, *Population des îles de la Grèce* (Aix-en-Provence: Edisud, 1974), p.327.

[11] Hionidou, 'Nineteenth-century urban Greek', p.405; C. Loukos, 'Merikes episemanseis gia tous katoikous tes Ermoupoles to 19o aiona: geografike proeleuse, kinetikoteta, egkatastase sto horo, epaggelmata, koinonikes sheseis' (A few points on the inhabitants of Hermoupolis in the 19th century: geographical origin, mobility, settlement, occupations and social relationships), in C. Agriantone & D. Dimitropoulos (eds), *Syros kai Ermoupolis: Symvoles sten istoria tou nesiou: 15os- 20os ai.* (*Syros and Hermoupolis: Contributions to the history of the island: 15th-20th c.*) (Athens: EIE, 2008), p.106; L. Papastefanaki, 'To "patriko endiaferon" ton viomehanon kai e diaheirise tes ergasias sten klostoufantourgia Karella' (Ermoupole, proto miso tou 20ou aiona) (The "paternal interest" of industrialists and the management of labour in Karellas's textile mill (Hermoupolis, first half of the twentieth century)), in C. Agriantone & D. Dimitropoulos (eds), *Syros kai Ermoupolis: Symvoles sten istoria tou nesiou: 15os- 20os ai.* (*Syros and Hermoupolis: Contributions to the history of the island: 15th-20th c.*) (Athens: EIE, 2008), p.158.

[12] *Helios,* 13/07/1899, KE, 702, p.2; 7/11/1899, KE, 715, p.3.

[13] Even though Greece entered officially the First World War as late as in 1917, the country experienced one of the most serious internal political crises in 1915. The country was divided in two over whether it should enter the war. For an overview of Greece's involvement in the First World War along with the political upheaval in the country during the 1910s, see L. Hassiotis, 'Greece', *International Encyclopaedia of the First World War*: https://encyclopedia.1914-1918-online.net/article/greece (access in April 2018).

[14] Travlos & Kokkou, *Ermoupole*, p.40.

crisis in 1922, which interrupted the trading activity with the main ports of the Eastern Mediterranean sea, mainly Smyrna, Constantinople and Odessa.

In the first half of the twentieth century, Hermoupolis had been transformed into a provincial and rather insignificant city, albeit with extensive administrative responsibilities as the capital of the Cyclades islands. In the interwar period, Hermoupolis experienced an extended financial and social crisis.[15] The population of the city stabilized at almost 18,000 inhabitants until 1920. In 1922-23 more than 7,000 refugees arrived on the island, not all of whom stayed, increasing the population of the city to 21,156.[16] This huge number of refugees for a city of around 18,000 inhabitants created a major population change. It seems also that the refugees revitalised the city's economy and industry, but only temporarily.[17] Then in 1940 Hermoupolis's population had decreased again to 18,925 inhabitants (Table 2.1).[18]

The interwar depression was evident in every aspect of Hermoupolis's life: the port's activity reduced dramatically and almost every industrial sector declined, apart from the textile mills, the production of which was increasing constantly until the early 1930s.[19] As a result, the economy of the city weakened, unemployment levels rose rapidly, soup- kitchens were run in the city by the local authorities, and more than a thousand people relied on municipal or charitable donations.[20]

2.3 Ano Syros

The town of Ano Syros is situated on the hill beside Hermoupolis (Plate 2.2). While Hermoupolis was inhabited almost exclusively by Greek Orthodox population, Ano Syros and the entire hinterland of the island were inhabited predominantly by

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[15] Papastefanaki, 'To "patriko endiaferon"', p.155.
[16] T. Hietala, 'Prosfygia sten Ermoupole: Ksefyllizontas to metroo prosfygon Syrou' (Refugees in Hermoupolis: browsing the Syros refugees' registers), *The City in Modern Times*: http://cities.ims.forth.gr/docs/RefugeeArrivals.Hermoupolis.pdf (access in April 2018).
[17] M. Mauroeide, 'Eisagomene kai eghoria technologia ste viomehania tes Ermoupoles ten periodo tou Mesopolemou' (Imported and domestic technology in the industry of Hermoupolis during the interwar period), in C. Agriantone & D. Dimitropoulos (eds), *Syros kai Ermoupolis: Symvoles sten istoria tou nesiou: 15os- 20os ai.* (*Syros and Hermoupolis: Contributions to the history of the island: 15th-20th c.*) (Athens: EIE, 2008), p.177.
[18] Kolodny, 'Hermoupolis-Syros', p.193.
[19] Papastefanaki, 'To "patriko endiaferon"', pp.159-60; *Tharros,* 19/02/1932, 477, Z, p.1.
[20] *Tharros,* 17/01/1925, 43, B, p.1; 22/4/1925, 70, B, p.1; 26/01/1929, 313, E, p.1; the local authorities supported financially those who were in need from the lower social classes: 08/02/1929, 315, E, p.1; 19/02/1932, 477, Z, p.2; 16/03/1932, 481, Z, p.1; 23/06/1933,549, H, p.1: soup- kitchens were created again in the city; S. Lecoeur, *Mussolini's Greek island: Fascism and the Italian Occupation of Syros in World War II* (London: Tauris Academic Studies, 2009), p.18.

Catholics.[21] When the Greek refugees arrived on the island in the 1820s, the Catholics of Ano Syros demanded the expulsion of the newcomers. In order to protect themselves from the 'corrosive' influence of their new Orthodox neighbours, the Catholics of Ano Syros kept themselves apart from the new inhabitants of Hermoupolis. [22] The occupational profile of the population of Ano Syros was mostly 'urban', while farmers resided almost exclusively in the countryside.[23] Any movement that occurred out of Ano Syros was towards the Syros countryside rather than to Hermoupolis.

These two communities existed side by side. Even though they exchanged products, as the agricultural hinterland of the island supplied Hermoupolis, they did not build close professional connections, neither did they establish personal ties. So, for example, intermarriage was extremely rare before 1940 and only in recent decades this has changed.[24] Despite the proximity between the two settlements, they had separate administrations, while communication between the two communities was limited. The co-existence of the two communities on the same island was not particularly easy, as frequent conflicts were taking place regarding the borders of each settlement or their involvement in the Greek political scene.[25]

Some few inhabitants of Ano Syros, however, had resided in Hermoupolis already since the 1860s. The number of Catholics residing in Hermoupolis was increasing gradually during the late nineteenth century and the first decades of the twentieth century. While many lived in Ano Syros but worked in Hermoupolis. Many Catholic women, especially the young ones, also worked in the textile factories in Hermoupolis in the early twentieth century. Thus, it seems that work brought the two populations together.[26] Yet, the dispute between the two religions lasted until very recently. Finally, Hermoupolis and Ano Syros merged into one municipality in 2011, while

[21] Hionidou, *Famine and death*, p.20.
[22] C. Loukos, 'Katholikoi kai orthodoksoi ste Syro, 1821-1974: Mia dyskole sygkatoikese' (Catholics and Orthodox in Syros, 1821-1974: A difficult cohabitation), *Epistemoniko symposio Meionotites sten Ellada* (*Scientific symposium Minorities in Greece*) (Athens: Etaireia Spoudon Neoellenikou Politismou kai Genikes Paideias, 2002), pp.288-89.
[23] Hionidou, *Famine and death*, p.20.

[24] Loukos, 'Katholikoi kai orthodoksoi sth Syro', p.290.
[25] Ibid: The Catholics were in favour of the Catholic King Otto, while the Greek Orthodox, as most Greeks, supported the coup against him in 1862. Furthermore, during the Crimean War the Catholics supported the French, while the Greek Orthodox the Russian Empire.
[26] Ibid., p.292.

before then, they kept separate registration records, each set of records housed in the corresponding locality.[27]

2.4 Hermoupolis data sources

The data sources which were used in the current study fall into three categories: census sources, civil registration and secondary qualitative sources.[28]

In order to reconstruct the mortality patterns in Hermoupolis, a long-term, uninterrupted run of vital statistics is required. The ideal source would be the availability of annual data, which would enable the detection of short-term fluctuations and also long-term trends.[29] Such a source does exist. The main sources which were used extensively in this current study were death certificates, which have constituted part of the civil registration sources available on the island continuously since 1859. Hermoupolis's civil registration, in terms of availability and continuity, can be regarded as a suitable data set for the study of mortality within an historical Greek population.

2.4.1 *Census sources*

The first available dataset is the census.[30] The first national population census was taken in 1861 in Greece, even though a few local enumerations had been conducted since the creation of the Greek state. It was a *de facto* enumeration of the population, listing all those people currently residing in the area where the enumeration was conducted. As a result, soldiers, sailors, monks and nuns were not included in the general population as they were enumerated separately.[31] Further enumerations were

[27] Regarding death registration, when inhabitants of Ano Syros died, their deahts were registered in Ano Syros, even when they lived in Hermoupolis, as they were buried in the Catholic cemetery, which is in Ano Syros. The same applies for the Hermoupolis's Orthodox population, who were registered in Hermoupolis and were buried in the Orthodox cemetery. Therefore, the proximity between the two settlements seems not to have affected the demographic events in Hermoupolis.

[28] C. Loukos & P. Poleme, *Odegos demotikou arheiou Ermoupoles, 1821-1949* (*A guide to the Municipal Archives of Hermoupolis, 1821-1949*) (Athens: EMNE, 1987).

[29] G. Mooney, *The geography of mortality decline in Victorian London* (University of Liverpool: Unpublished PhD thesis, 1994), p.50.

[30] For a detailed overview of the evolution of the census sources and the civil registration in a national context, see Hionidou, *The demography of a Greek island*, pp.19-21; *Statistike tes kiniseos tou plethysmou* (*Statistics of the natural movement of the population*) (Athens: National Statistical Service of Greece, 1956).

[31] Hionidou, *The demography of a Greek island*, p.19; *Statistika apotelesmata tes genikes apographes plethysmou kata tin 27.10.1907* (*Statistical results of the general population census of 27.10.1907*) (Athens: Ministry of Interior Affairs, 1909), vol.1, p.θ; *Statistike tes Ellados, plethysmos tou etous 1861* (*Statistics of Greece, the population of 1861*) (Athens: National Press, 1862), p.ια.

conducted in 1870, 1879, 1889, 1896, 1907, 1920, 1928, 1940 and 1951, but full returns were never published for the censuses of 1889, 1896 and 1940 for different reasons in each case. All Greek census publications included information on the population of Hermoupolis and its age structure. These published age-structures were used in this thesis for the construction of the life-tables (section 4.3.1).

Even though the census returns can be found online on the website of the Hellenic Statistical Authority, or *in situ* in various places in Greece, the only manuscript census books of the first three censuses which have survived in Greece are those in the General State Archives of Syros (GSAS hereafter).[32] The sources for the three nominal municipal censuses available for Hermoupolis were collected by individuals who had been appointed by the municipal authorities as a response to the government's command for the enumeration of the population of the country for the years 1861, 1870 and 1879.[33] Two out of three manuscript books of the 1861 nominal census have survived, covering 60 per cent of the population. The inhabitants of Hermoupolis were listed in the manuscript books in alphabetical order of the first name of the head of the family and not according to geographic location. Concerning the 1871 municipal census, two out of four manuscript census books (the third and the fourth) are available, while the first out of two manuscripts census books is missing for the 1879 municipal census.[34]

2.4.2 *Civil registration*

The second major source used is civil registration data. The Greek government was anxious to collect information on the population, as evidenced by the the early enumerations and the creation of a civil registration system.[35] From 1860 onwards, vital statistics on births, marriages and deaths for the entire country began to be

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[32] The entries of the nominal municipal censuses are currently available online at http://cities.ims.forth.gr/ and https://apps.ncl.ac.uk/GreekFamilyHistory/Page/Home.
[33] GSAS, Demotiko Archeio (Municipal Archive, hereafter DA), *Vivlia Apographes* (Census Manuscript Books). These unique sources have been employed in various studies: Hionidou, 'Nineteenth-century Greek households', pp.404-05; 'Domestic service on the three Greek islands in the later 19th and early 20th centuries', *The History of the Family* 10 (2005), pp.473-89; Loukos, 'Families and family structure', pp.317-18.
[34] Hionidou, 'Nineteenth-century Greek households', p.406; Loukos, 'Families and family structure ', pp.318-20; 'Oi demotikes apographes' (The municipal censuses), *The City in Modern Times* http://cities.ims.forth.gr/docs/Census.Hermoupolis.1861.1870.1879.pdf (access in April 2018)
[35] Hionidou, *The demography of a Greek island*, p.21.

published annually.[36] Mayors were responsible for registering the vital events, but due to the very low literacy of the registrars, a new approach was suggested.[37] This involved the reporting of vital events to the registrars both by family or relatives, and independently by priests. The involvement of the clergy was considered necessary due to the fact that priests were informed of a birth soon after its occurrence in order to give the first blessing, they were the only persons authorised to conduct marriages, and they also offered the last blessing prior to a burial.[38] Following this procedure, vital statistics were compiled and published for the whole country on an annual basis for the years 1860-1885, with the exception of 1862 and 1863 due to political turmoil.[39] From 1885 onwards, the collection system of the annual totals collapsed even though registration continued, at least in some areas, including Hermoupolis. This was probably the result of the erosion of all public administration, principally because of an economic recession and the ensuing political instability, ending in an unsuccessful disastrous war in 1897 and the bankruptcy of the state. There are therefore no official publications of vital statistics for the period 1886-1920, with the important exception of the 1907 population census which was published.[40]

After the 1920 census, the collection of the data from the towns and the cities started again.[41] The Central Statistical Office within the Ministry of National Economy supplied the registrars with printed tables which had to be filled in and submitted quarterly. The results were published in the two volumes of *Statistike tis kineseos tou plethysmou* (*Statistics of the natural movement of the population*), including information about births, marriages and deaths, and *Statestike ton aition thanatou* (*Statistics of causes of deaths*). These books were published annually in the period

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[36] V. G. Valaoras, 'National primary socio-economic data structures. V: Greece', *International Social Science Journal*, 32, 2 (1980), p.344.
[37] Hionidou, *The demography of a Greek island*, pp.21-22; *Statistike tes kineseos tou plethysmou* (1956), p.XIII.
[38] V. Hionidou, 'Infant mortality in Greece, 1859-1959: problems and research perspectives', in C.A. Corsine & P.P. Viazzo (eds), *The decline of infant and child mortality: the European experience: 1750-1990* (The Hague: Martinis Nijhoff, 1997), p.156; *Statistike tes kineseos tou plethysmou* (*Statistics of the natural movement of the population*) (Athens: National Statistical Service of Greece, 1869), p.3.
[39] Hionidou, 'Istorike kritike anadrome', p.36; Valaoras, 'National primary socio-economic', p.344; *Statistike tes kineseos tou plethysmou* (1956), pp.XIII-XIV.
[40] Valaoras, 'National primary socio-economic', pp.344-45.
[41] *Statistike tes kineseos tou plethysmou* (*Statistics of the natural movement of the population*) (Athens: National Statistical Service of Greece, 1921), p.ε.

1921-1938 with gradually improving coverage, referring to the whole country and its regions (Vital Statistics hereafter).[42]

The implementation of the 1920 law in 1924 concerning the 'Civil Registration Books' coincided with the reorganization of the statistical division resulting in the creation of the General Statistical Service of Greece within the Ministry of National Economy.[43] Under this law, the pattern of data collection changed. For every vital event (birth, marriage and death), along with the certificate, which was completed by the registrar, an individual nominal statistical form was filled in and sent within a month to the Central Statistical Office. The adoption of this system by municipalities and communities across the country occurred gradually until 1928, by which time it seems that all towns and communities in Greece were contributing data. A combination of the two systems was in use until 1933.[44] After the involvement of Greece in the Second World War in 1940, the collection of data collapsed once again. The war, and more importantly the threefold occupation of Greece, resulted in a paralysis of the state and massive human and material loses. Even after the war, a period of internal upheaval occurred: the civil war did not end until 1949.[45] During that period, many registration archives were destroyed and the number of employees at the General Statistical Service of Greece fell. As a result, the analysis of the existing data was limited. The collection of data was resumed in 1955, employing the pre-war system.[46]

Hermoupolis and all the Cyclades islands have been part of the Greek State from the beginning. Hermoupolis's civil registration data, therefore, is continuously available from 1859. The city is particularly privileged because of its excellent data sources, which have never been used extensively by historians or demographers interested in the city's history.[47] It is one of the very few cities where such sources have survived. Other settlements with such data include Mykonos, Paros, Poros, Volos, Patras, Athens and the Ionian islands; however the quality of the data in many of those areas is variable, they are either incomplete or not continuously available, and high levels of

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42 Ibid.

43 N. 2430, *Peri ton leksiarchikon prakseon* (Law *concerning the civil registration books*), 14/7/1920.

44 Hionidou, *The demography of a Greek island*, pp.24-25; *Statistike tes kineseos tou plethysmou* (1956), p.xv; *Statistike tes kineseos tou plethysmou* (*Statistics of the natural movement of the population*) (Athens: National Statistical Service of Greece, 1925), pp.*ζ-θ*.

45 Valaoras, 'National primary socio-economic', pp.345-56.

46 Hionidou, *The demography of a Greek island*, p.25; *Statistike tes kineseos tou plethysmou* (1956), p.xvi.

47 Hionidou has used the death registers to examine the mortality patterns during the Greek severe famine in three island populations, including that of Hermoupolis: Hionidou, *Famine and death*.

under-registration have been found in some areas, including Athens or Patras.[48] The only exception is Mykonos, which has continuous data of high quality.

The available civil registration data in Hermoupolis consist of birth, marriage and death certificates.[49] From 1859, there are no missing years for any of the vital events. In addition, the *proheira vivlia* (rough registers) of birth, marriage and death certificates of the municipality of Hermoupolis are available for some years.[50]

Each death certificate includes information about the person declaring the death (the informant) (full name, age, place of origin, occupation) as well as about the deceased person (full name, age, marital status, place of origin, occupation, relationship to the informant, mother's full name, cause of death, date of death and date of reporting). The very good quality of the death certificates can be seen in Table 2.2, which shows the percentages of missing cases for every field of information provided. The names of the deceased and of the informants are available, but for reasons of anonymity and the protection of personal data they were not transcribed into the database which was created for the purposes of this current study and is discussed thoroughly in section 2.4.1. All death registers record the exact age and sex of the deceased person but cause of death registration has been recorded only since 1916, along with the name of the doctor who confirmed the death and specified the cause of death.

Death registration was more complete than birth or marriage registration. Under-registration of deaths was always lower than that of births due to legislation which

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[48] Hionidou, *The demography of a Greek island*; V.S. Gavalas, *Demographic reconstruction of a Greek island community: Naousa and Kostos on Paros, 1894-1998* (University of London, LSE: Unpublished PhD thesis, 2001); E. Tolis, *Demographikes opseis tou Porou, 19th aionas* (*Demographic aspects of Poros, 19th century*) (University of Ioannina: Unpublished PhD thesis, 2012); D. Moustane, *Oi demographikes ekselikseis s'ena viomechaniko kentro: Volos, 1881-1922* (*Demographic evolutions of an industrial centre: Volos 1881-1922*) (University of Thessaly: Unpublished PhD thesis, 2014); P. Eliopoulos, *Oikonomikes kai koinonikes domes mias periphereiakes metropoles: Patra sto 10 miso tou 20 aiona* (*Economic and social structures of a peripheral metropolis: Patras in the second part of the 20th century*) (National and Kapodistrian University of Athens: Unpublished PhD thesis, 2011); M. Dimitropoulou, *Athènes au XIXe siècle: de la bourgade à la capitale* (Université Lumiere Lyon 2: Unpublished PhD thesis, 2008); E. Kosmatou, *La population de lles Ioniennes: XXVIIeme- XIXeme siècle*, (University de Paris 1 Pantheon Sorbonne: Unpublished PhD thesis, 2000).

[49] GSAS, DA, Leksiarheio, *Leksiarhika Vivlia Apovioseon* (*Civil Death Registration manuscript books*); GSAS, DA, Leksiarheio, *Leksiarhika Vivlia Genneseon* (*Civil Birth Registration manuscript books*).

[50] GSAS, DA, Leksiarheio, *Proheira Vivlia Apovioseon* (*Rough Death Registration manuscript books*): the rough death registers listed all deaths which occurred in Hermoupolis. These are available for the years 1848-1853, 1876-1879, 1892-1898, 1902-1904, and 1912-1913: T. Hietala, 'Proheira vivlia apovioseon demou Ermoupoles' (Rough Registers of death certificates of the Municipality of Hermoupolis), *The City in Modern Times*, http://cities.ims.forth.gr/docs/Death.Hermoupolis.pdf (access in April 2018).

dictated that every death must be reported within 24 hours of the event. If there was not a death record, the funeral could not be carried out.[51] In Figure 2.1, it is obvious that in most years, more than 90 per cent of the deaths were registered within four days of the event. In most cases, registration took place on the same day or the day following the death. When death registration is compared with that of births (Figure 2.2), it seems that a very different pattern occurred over the years. Only after the turn of the twentieth century were most births registered within four days. This delay in birth registration was due to different pieces of legislation. This is discussed more extensively in section 2.4.2, where the nominal-record linking practice is described.

In sum, Hermoupolis's civil registration data provides a very suitable data set for the study of mortality in a Greek urban settlement not only because of its continuity but also its exceptionally good quality.

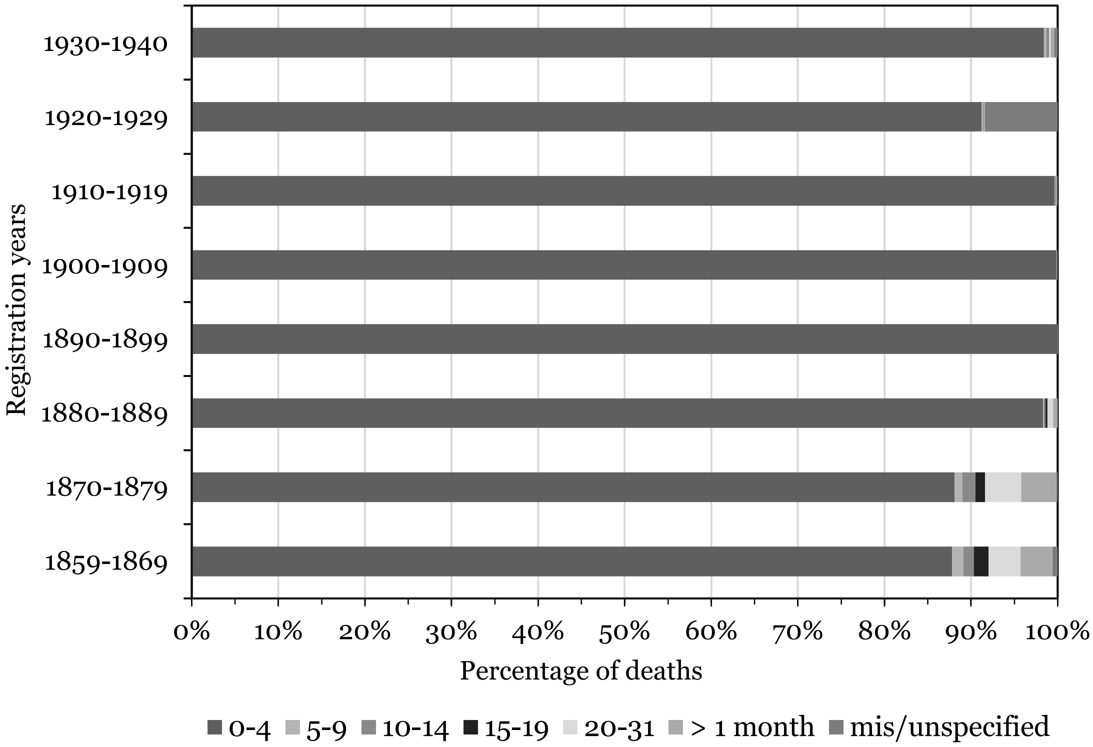
Table 2. 2 Information included in the death records and percentages of missing cases, Hermoupolis, 1859-1940

Information	***Percentage of missing cases (%)***
Informant's age	5.0
Informant's profession	1.0
Informant's origin	17.2
Kinship between informant and deceased	60.0
Age of deceased	0.0
Sex of deceased	0.2
Profession of deceased	60.0 for women older than 15 years 10.0 for men older than 15 years
Place of residence	41.1
Birthplace	7.9
Marital status	26.0 for women older than 15 years 30.0 for men older than 15 years
Father's name	56.4
Father's age	78.4
Mother's name	61.5
Mother's age	99.7
Cause of death	75.3 (0.2 from 1916 onwards)
Parish	71.4
Date of registration	0.0
Date of death	1.0

Source: Based on the analysis of 45,247 death records; calculated by the author using Hermoupolis Mortality Database (HMD hereafter).

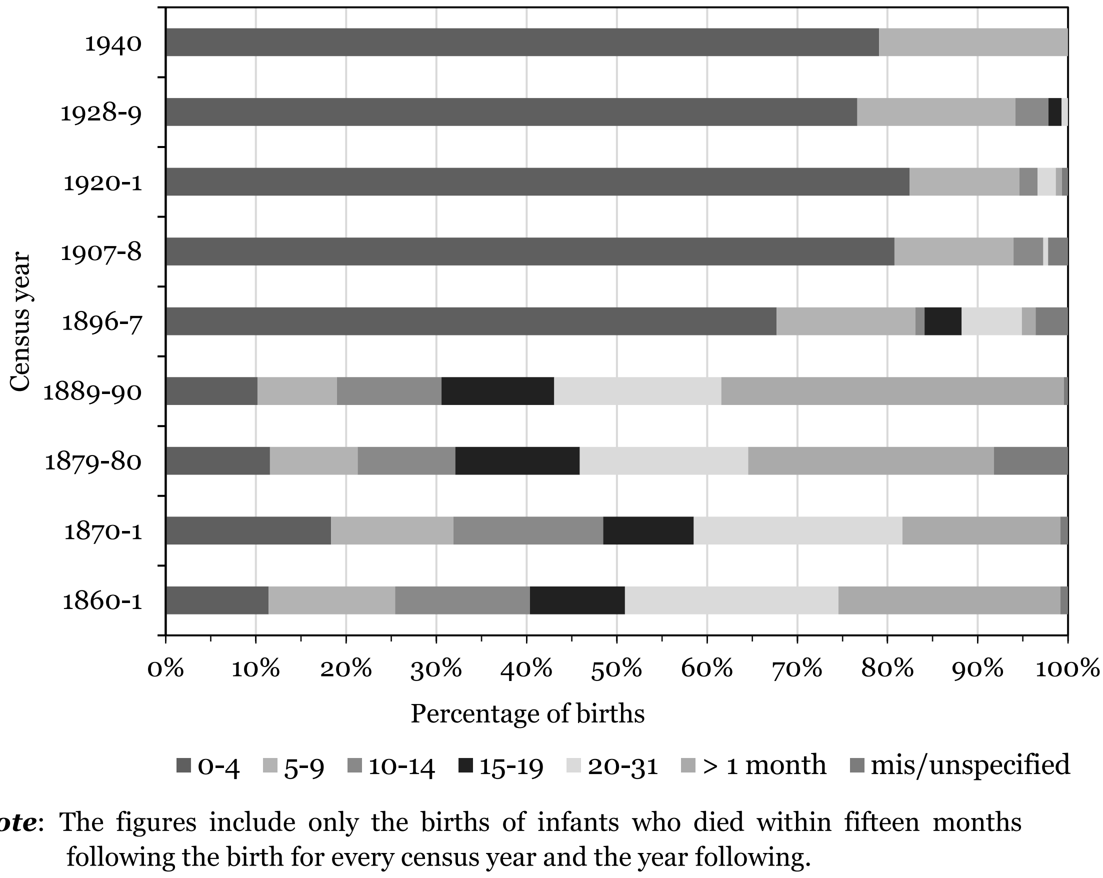
[51] G. Gavalas, 'Island mortality in the past: some evidence from Greece', *Journal of Biosocial Science*, 40, 2 (2008), pp.205-06.

Figure 2. 1 Delay of death registration in days, Hermoupolis, 1859-1940



Source: Calculated by the author using HMD.

Figure 2. 2 Delay of birth registration in days, Hermoupolis, 1859-1940



Note: The figures include only the births of infants who died within fifteen months following the birth for every census year and the year following.

Source: Calculated by the author using HMD.

2.4.3 *Secondary sources*

Beyond the individual level data, there is a wealth of sources referring to the public health efforts of the municipal and prefectural authorities. These qualitative sources include directives issued by the Ministry of Public Health established in Athens and local initiatives instigated by either the municipal authorities or by the local association of physicians. These initiatives included efforts to organise and enforce vaccination, the purification of drinking water and city sanitation improvements. Furthermore, the Minutes of the Municipal Council have been used extensively in this study mainly to investigate the initiatives or the reactions of the local authorities in dealing with public health issues.[52] This study has also employed for the very first time the archive of the Prefecture of Cyclades on *Health and Welfare* (*Ygeia kai Pronoia*), which includes various reports on public health regarding all the Cyclades islands but with special focus on Hermoupolis starting from 1920.[53] Moreover, oral interviews were also employed in this study when examining the evolution of public health and breastfeeding practices on the island mainly during the 1920s and 1930s.[54]

Finally, the local press during the study period has been used to explore public health problems and to obtain qualitative information about the population. Those publications include *Hermoupolis* (1864-1876), *Helios* (1875-1905), *Panope* (1874-1886), *Patris* (1879-1894), *Tharros* (1924-1940), *Paliggenesia* (1905-1906) and *To Vema Ermoupoleos* (1911-1916).[55]

2.5 Nominal record linkage practice

The unique availability of the civil death registers in Hermoupolis help us to explore mortality patterns in the city during the period under study. In order to extract the information necessary to produce the desired demographic measures from the

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[52] GSAS, DA, Demotiko Symvoulio (Municipal Council), *Praktika synedriaseon Demotikou Symvouliou* (*Minutes of the Municipal Council*).

[53] I am extremely grateful to Mrs Psilopoulou, the director of the GSAS, for allowing me access to this archive and also to the employees there for helping me to get access to it. A brief description of the sources is offered by Prof. C. Loukos, who was also the PI for the electronic classification of the archive: http://www.latsis-foundation.org/content/actions/action_315/inline/eng/actionInline_315_5550bc71deb1b.pdf (access in April 2018).

[54] The interviews were conducted in 2000 by Dr Hionidou: Hionidou, *Famine and death*. I am extremely grateful to Dr Hionidou for allowing me to use extracts from this very valuable source. The extracts were translated by the current author.

[55] These are available in the local library and the GSAS. I am grateful to Mrs Vafia for allowing me access to the last two newspapers and to Mrs Hietela for providing me with material which she had collected for her own personal research.

available sources, this study constructed most of the standard mortality analysis used by historical demographers: crude rates, life-tables and cause-specific mortality.[56] To facilitate subsequent analysis, the available sources had to be transcribed. Therefore, for the purposes of this study, two different databases were constructed: a main database called 'DEATHS' into which all civil registration death records from 1859 to 1940 were transcribed; and a second database called 'BIRTHS', in which the deaths of infants and young children (aged 0-15 months) were linked with their respective birth certificate. This linkage was undertaken for every census year and year immediately following the census. This section primarily offers a description of the methodology which was employed for the construction of those databases and of the problems which affected its application to our data.

2.5.1 Construction of databases and data inputting

The simple database called 'DEATHS' was created using Microsoft Access and all death records were transcribed directly into it. Separate fields were created for every piece of information which was available in each death record. The first field of the database was named 'D_ID' and included a unique identification number that was assigned to every record (Table 2.3). The final field, named COMMENTS, includes information such as whether a child was illegitimate, a foundling, a twin or stillborn or any other information which was mentioned in the death record, or whether the death had occurred elsewhere. It also contains personal comments concerning various ambiguous words or misunderstandings which were identified during the transcription. The rest of the designed fields can be seen in Table 2.3.

All deaths which were registered in Hermoupolis between 1859 and 1940 were inputted into 'DEATHS', amounting to 45,247 death records.

[56] M.A. McGehee, 'Mortality', in J.S. Siegel & D.A. Swanson, (eds) *The Methods and materials of demography* (Elsevier Academic Press, 2004), pp.265-91.

Table 2. 3 Designed fields included in the constructed databases 'DEATHS' and 'BIRTHS'

DEATHS	***BIRTHS***
D_ID	D_ID
Informant's age	B_ID
Informant's profession	Age at death
Informant's origin	Sex of deceased
Kinship between informant and deceased	Birthplace
Age of deceased	Father's name
Sex of deceased	Father's age
Profession of deceased	Father's profession
Place of residence	Father's birthplace
Birthplace	Mother's name
Marital status	Mother's age at birth
Father's name	Mother's age at death
Father's age	Parish of birth
Mother's name	Death Registration Day
Mother's age	Death Registration Month
Cause of death	Death Registration Year
Parish	Birth Registration Day
Registration day	Birth Registration Month
Registration month	Birth Registration Year
Registration year	Birth Day
Death day	Birth Month
Death month	Birth Year
Death year	D_Comments
Comments	B_Comments

Source: HMD.

There were several problems which had to be overcome during this exercise. The birth and death registers were written in Greek, but Latin characters were used in the transcription. The names of the deceased were not copied into the database. This was done for reasons of confidentiality since some of the registered individuals may still be alive. Even though the certificates are available on printed forms, entries in the register are hand-written, making the transcription time-consuming.

The transcription of the source material took place in the GSAS (for the years 1859-1924) and in the Hermoupolis City Hall (for the years 1925-1940) and was undertaken by the author. The data transcription was held in 2014-15 and lasted approximately 10 months, while data cleaning, which took place in Newcastle, lasted 2 more months.

2.5.2 Record linkage

The technique of nominal record linkage was employed for the construction of the second database. Briefly, this technique involved the identification of particular individuals in two or more datasets with the principal objective of bringing together as much information as possible concerning those individuals. In order to make a link across the two databases, the two records needed to have several common identifier data points.[57]

The record-linkage undertaken here derives from linking the death records of young children who died at the age of 0-15 months around each census year with their respective birth record. The record-linkage involved two stages: first, linking the death records with the birth records; and second, linking the death records with the *Foundling Lists of the Local Hospital* in order to obtain the necessary information for those foundlings whose birth record was either missing or whose birth record was not linkable.[58]

The first step involved the construction of a new database called 'BIRTHS', in which all the deaths of those infants and young children were merged from the 'DEATHS' database. In practice that meant that 2,790 records were inputted as part of the sampling procedure for every census year and the year immediately following the census (1861, 1862, 1870, 1871, 1879, 1880, 1889, 1890, 1896, 1897, 1907, 1908, 1920, 1921, 1928, 1929 and 1940).[59] The fields which were derived from 'DEATHS' were the identification number, age, sex and birthplace of the deceased, the names and ages of both parents and the registration date of the death.

The second step involved the creation of a new field named 'B_ID', following the same procedure as for 'D_ID', and a unique identification number was allocated for every record. Other information which was transcribed into 'BIRTHS' from birth records were father's birthplace and profession, mother's age, parish of birth, registration date and date of the event (Table 2.3). The final field was named 'B_Comments' and included other information such as whether the infant was a twin, a foundling or stillborn and also personal comments about the different items of information which were identified between the two records, such as variations in names over time. Also, for the foundlings, additional information from the hospital foundling list was

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[57] N. Williams, *Infant and child mortality in urban areas of nineteenth-century England and Wales: A record-linkage study* (University of Liverpool: Unpublished PhD thesis, 1989), pp.58-59; C. Galley, *The demography of early modern towns. York in the sixteenth and seventeenth centuries* (Liverpool: Liverpool University Press, 1998), p.95.
[58] Four different hospital foundling manuscript books are available in the Hermoupolis local archives: 1861-1873, 1861-1894, 1894-1910 and 1911-1920: GSAS, DA, Nosokomeio, *Vivlia Ektheton* (*Foundling Manuscript Books*).
[59] Records in 1941 were not linked since the study period stops in 1940.

transcribed, when available, such as the date and/or the place where the baby was found.

The third step involved the record-linkage itself. The criteria for making the links (between the death and birth records) are shown in Figure 2.3. In order to establish a link, specific information had to be the same in both sources. These were sex, birthplace and parents' full names and are shown by the bold arrows in Figure 2.3. The infant's forename could not be treated as a strong linking criterion because it was often not available on birth certificates, most probably because infants frequently died unbaptised. Although in most cases the links could be easily identified, there was a significant number of cases in which some information was not common between the two records. In most cases, there were variations in parents' names but especially of the mother's, as the naming system in Greece is more complicated than in many European countries. Women usually switched from their parental to their husband's surname upon marriage. In many cases, however, the surname reported could be her father's or her husband's forename or even middle name. There were also significant variations in the women's forenames. For example, a mother who on the birth certificate is named as 'ANNA', can be referred to as 'ANEZA' or 'ANETA' on the death certificate.[60] In these cases, additional criteria were necessary, if available, to establish links. These variables are shown by the broken lines in Figure 2.3. Finally, the linking process was done in situ in the GSAS and in the Hermoupolis City Hall during the main field trip in Hermoupolis, following the main data inputting in 'DEATHS'.

Of 1,132 infant deaths recorded in the Hermoupolis civil registration in the census years from 1861 to 1940, 867 were successfully linked to a corresponding birth record: an average linkage rate of 77 per cent (however, it ranged from 61.8 to 96.3 per cent, Table 2.4).[61] For almost a quarter of the infant deaths which occurred in the census years, it was not possible to link them to their corresponding birth certificate. Table 2.4 clearly shows that the percentage of unlinked deaths started to decrease from 1896

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[60] Hionidou, *The demography of a Greek island*, pp.26, 102; Gavalas, *Demographic reconstruction*, p.121.

[61] Comparatively speaking, nineteenth-century linkage rate was not significantly different from that in Williams's study on Sheffield, England for 1870 (78 per cent of deaths under 5 years) and for 1871 (80 per cent of deaths under 5 years); yet, a recent study in Tartu, Estonia succeeded a linkage rate of 88 per cent for the period 1897 to 1900. The very close rate to that in the latter study from 1896 onwards is an additional evidence of good quality data that Hermoupolis possesses: Williams, *Infant and child mortality*, p.66; H. Jaadla & A. Puur, 'The impact of water supply and sanitation on infant mortality: individual level evidence from Tartu, Estonia, 1897-1900', *Population Studies*, 70, 2 (2016), p.169.

onwards. A significant proportion of these unlinked deaths were those of foundlings, whose linking was virtually impossible as very little information was available from either source. For some years, the registration of the death of foundlings was reported at the end of each month or year retrospectively in an appendix to the manuscript books.

The main reason for the remaining unlinked deaths is likely to be birth under-registration. This problem has been identified in other studies as well. Under-registration of births was high in Greece.[62] According to Greek legislation and the Greek Civil Law which was enacted in 1856 and was in force until the early 1920s, a birth had to be reported within five days of the delivery. After the amendment of the 1920 Civil Registration Act, which was enacted in 1924, a birth had to be reported within ten days instead of five following the event. The main 'loss' by under-registration may have been the births of those infants who died within a few hours of birth or even a few days after birth, given than the parents may have seen no reason to register it. The decreasing number of the unlinked deaths over time is evidence that the civil registration system in Hermoupolis gradually improved (Table 2.4).

Figure 2.2 shows that birth registration improved in Hermoupolis especially from 1896 onwards, when almost 70 per cent of births were reported within four days of the event. The 1920 Act did not seem to affect the registration practices of deaths in Hermoupolis in 1928, although in 1940 all births were reported within nine days, which shows the complete implementation of the legislation.

Finally, age misreporting of infants also created some difficulties. In the case of infants, rounding up to the age of one was quite common. This issue was overcome through the linking exercise, as for all those linked deaths the age at death was re-calculated. It was therefore possible to have the real age at death for the linked infants.[63]

2.6 Hermoupolis sources: a critical evaluation

Hermoupolis data is of unique quality not only for the Greek standards but also for the European standards. Registration in Hermoupolis did not start in 1859, the year of the creation of the civil registration system in Greece, but commenced in the 1820s.

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[62] Valaoras, 'A reconstruction', p.135; G.S. Siampos & V.G. Valaoras, 'Long term fertility trends in Greece', *International Population Conference*, 1 (London: IUSSP, 1969), p.602.
[63] For further discussion, see section 5.3.1.

Hermoupolis had a long-established tradition of keeping a wide range of sources: municipal rolls ('demotologio') since the 1820s, male registers since 1845, while, rough registers of births, deaths and marriages at least since 1848 (but only sporadically available). Even though Hermoupolis is one of the few Greek populations where civil registers are continuously available since 1859, the data suffers from under-registration during the 1860s and 1870s. In addition to this, Hermoupolis's population was not stable during the second half of the nineteenth century, as it was characterized by high levels of in- and out-migration. Therefore, it is impossible to track all people who lived in the city for part of their lives. This is a standard issue faced by most researchers working on urban demography in nineteenth-century Europe. Both issues had been minimized by the 1890s onwards, as Hermoupolis had a more stable population (except for the 1920s, when 7,000 Asia Minor refugees arrived on the island). Moreover, under-registration is less important from 1896 onwards. However, death registration was found to be more complete than that of births and marriages throughout the study period.[64]

Two additional limitations of Hermoupolis data were the lack of reporting of causes of death prior to 1916 and of stillbirths prior to 1912. Thus, the study of the epidemiological profile of the city is restricted to the period 1916-1940. Furthermore, apart from the Scandinavian countries, where stillbirths have been registered from an early time, the non-registration of stillbirths is a very common problem in many European countries even until the early-twentieth century, including France and England and Wales. The lack of such information was taken into consideration in the discussion of infant mortality in Chapter 5.

In order to examine the quality of Hermoupolis sources, to detect the extent of under-registration or mis-registration and to correct the figures, linked infant mortality rates were calculated for every census year (section 5.3.1), following nominal record linkage. Apart from linking death with birth records, the linking exercise was employed also to link death data with the rough registers, when available. Therefore, it was made possible not only to confirm that the given information in the death records were correct but also to obtain information about causes of death prior to 1916.[65] Moreover,

[64] Under-registration of all vital events in other urban centres in Greece, including Athens or Patras, was found to be much more extensive, as will be discussed in Chapter 4.

[65] As will be discussed in section 6.2.1, causes of death available in the rough registers have not been used in this study due to their sporadic availability, but they will be employed in the future to fully explore the disease panorama of the city in the nineteenth century.

the link of deaths of foundlings to the foundling lists made possible to obtain the missing information, when possible. To an important extent, the failure to link almost a quarter of death records in the 1860s and 1870s is attributed to the very high number of foundlings in the city.

As mentioned in the introductory chapter of this thesis, the in some respects questionable quality of the published civil registration data in Greece prior to the 1920s makes the study of any demographic event at a national level rather forbidding. Thus, it is suggested that any demographic study should be focused on smaller geographical units, since it is easier to resolve any problems regarding under-registration or mis-registration of vital events.

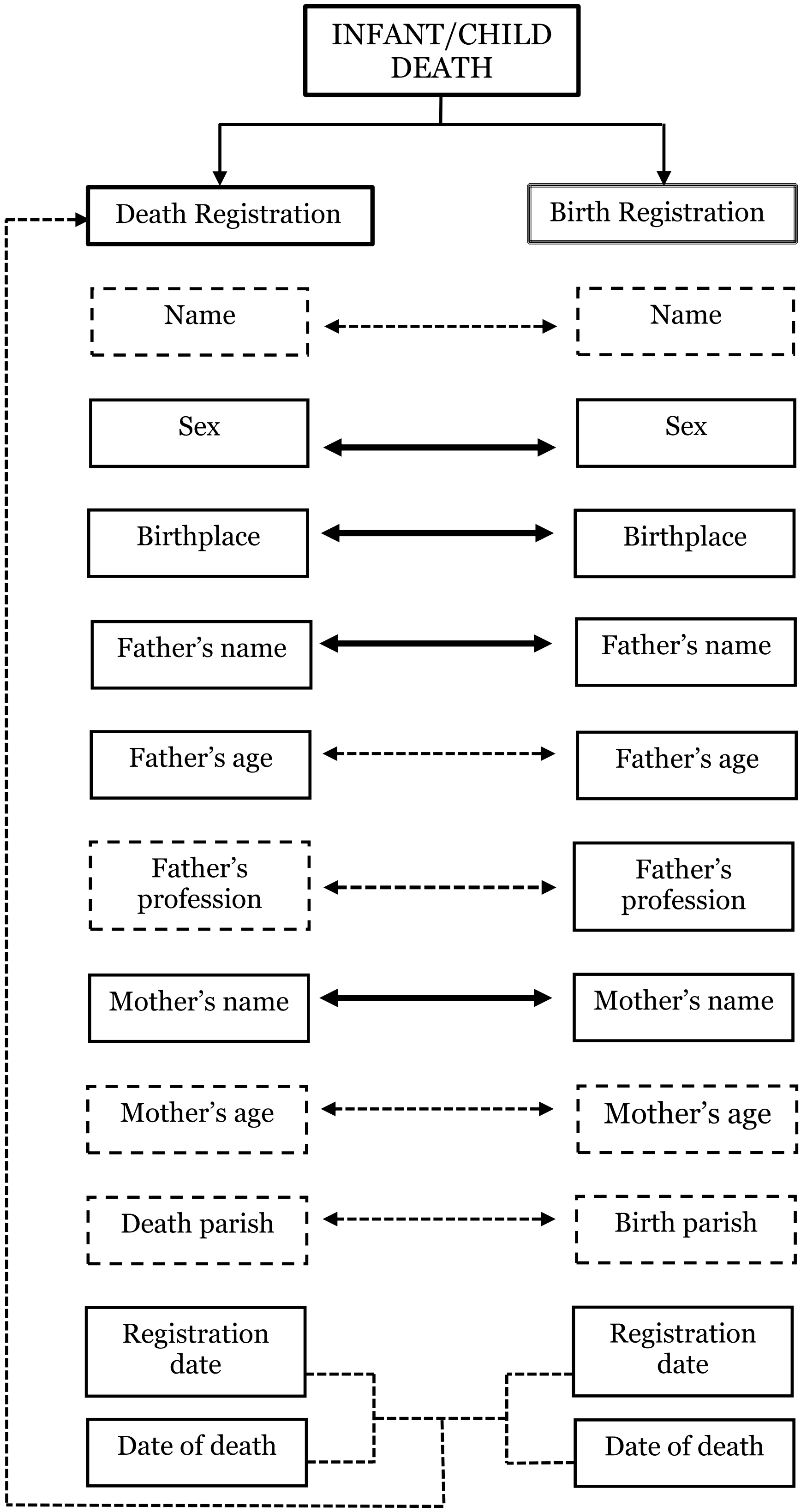
Overall, despite the limitations of Hermoupolis data, by employing various techniques to correct such data and therefore to estimate more reliable rates, it is possible to study the mortality trends in Hermoupolis during the study period.

2.7 Conclusion

This chapter has shown the importance of Hermoupolis as an urban centre but also as a port-city in Modern Greek history. The unique data sources which Hermoupolis possesses and which this study has utilised (civil registration continuously available from 1859 and a wealth of qualitative sources) made possible the study of the mortality patterns in the city throughout the study period. The way in which these sources were manipulated and analysed has also been explained in this chapter.

The next chapter outlines public health in Greece, while it provides evidence for the sanitary reforms which took place in Hermoupolis during the study period

Figure 2. 3 Basic components of record linkage



Note: Bold arrows refer to main linkage criteria; broken arrows refer to less important variables used in the record-linkage. Broken boxes indicate information not given in every case.
Source: Adapted from Williams, *Infant and child mortality*, Figure 3.3.

Table 2. 4 Number of unlinked deaths with reported age at death in days for every census year, Hermoupolis, 1859-1940

No. of days	*1861*	*1870*	*1879*	*1889*	*1896*	*1907*	*1920*	*1928*	*1940*
0 days	9	0	1	1	0	4	1	2	1
1-5 days	2	3	1	5	5	4	6	3	0
6-10 days	2	5	3	7	3	3	0	1	1
11-28 days	6	5	1	5	2	0	1	2	0
29-365 days	31	23	23	38	19	9	9	15	2
Total number	50	36	29	56	29	21	17	23	4
Total number of infant deaths	131	162	138	148	147	143	90	120	53
% of unlinked deaths	38.2	22.2	21.1	37.8	19.7	14.7	18.9	19.2	7.6
Linkage rate	61.8	77.8	78.9	62.2	80.3	85.3	81.1	80.2	92.3

Source: Calculated by the author using HMD.

Chapter 3. Sanitary Reforms in Hermoupolis

3.1 Introduction

Many studies have argued that sanitary reforms were responsible for significant declines in mortality in various north-western European countries during the second half of the nineteenth and the beginning of the twentieth centuries. In Greece, public health has attracted the interest of many researchers over the past years, however what is not yet clear is the impact of sanitary improvements on mortality or morbidity levels on any Greek population. Studies have linked the decline in mortality in the late 1920s with improvements in public health and medical care, but no further evidence is available. Even though public health policies in Greece have been studied at a significant level, most of the evidence refers to legislation without discussing its effect, if any, on the Greek population. In this chapter, I shall therefore offer what is arguably one of the very few studies of sanitary reforms in a Greek urban settlement outside Athens. Apart from discussing the evolution of sewage disposal and the water supply in Hermoupolis, this chapter analyses the public health initiatives which were implemented in the city by the local authorities and finally evaluates the existing medical care services together with the charitable activities behind them.

3.2 Sanitary reforms

One of the main reasons responsible for the high levels of mortality in the major European urban centres was the lack of public hygiene. The dissemination of epidemic diseases was facilitated by the lack of both effective sewage disposal and clean water supplies. Whether an increased public health infrastructure was the most important factor responsible for the decline in mortality has been a constant question among public health historians and historical demographers. One of the first historians who emphasized the significant effect of public health improvements on the decline in mortality in late-nineteenth century Britain was Szreter, who suggested that:

> The decline in mortality, which began to be noticeable in the national aggregate statistics in the 1870s, was due more to eventual successes of the politically and ideologically negotiated movements for public health than to any other positively identifiable factor. The resulting implementation of preventive measures of municipal sanitation and regulation of the urban environment and food market actually arrived on the ground in the many new cities throughout

> the country during the last third of the nineteenth century and the first decade of the twentieth [century].[1]

A significant number of studies have also argued that improved sanitation had an important impact on mortality evolution. Most of these studies have examined the results of water supply and sewerage systems mainly in North-western Europe and the US. Sanitation movements, especially the filtration of a public water supply, have been found to counterbalance high urban mortality by reducing deaths due to typhoid fever in various American cities from 1850 to 1915.[2] Meckel suggested that the introduction of a water supply system in Boston in the period 1840-1880 resulted in falls in mortality due to waterborne diseases.[3] More recently, Cain and Rotella suggested that increased expenditure on water, sewers and refuse collection led to a 30 per cent decline in mortality in American average-sized cities during the first thirty years of the twentieth century.[4] The introduction of water filtration and chlorination, resulting in the wide availability of clean water, together with the expansion of the sewer infrastructure in Chicago between 1850 and 1925, led to significant declines in mortality attributed to waterborne diseases but primarily typhoid fever.[5] Cutler and Miller argued that the availability of clean water reduced mortality in major American cities in the early twentieth century.[6] In addition, between 1900 and 1940, investments in the purification of water in the US contributed to significant declines in mortality especially due to typhoid fever and other waterborne diseases.[7]

In Europe too the importance of sanitary reforms in reducing mortality has been established in various studies. Preston and van de Walle demonstrated that a decline in mortality followed the improvements in water and the sewerage infrastructure in nineteenth-century France.[8] It has also been found that gains in life expectancy

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[1] Szreter, 'The importance of social', p.26.
[2] E. Meeker, 'The improving health of the United States, 1850-1915', *Explorations in Economic History*, 9 (1972), pp.371, 373.
[3] A.R. Meckel, 'Immigration, mortality and population growth in Boston, 1840-1889', *Journal of Interdisciplinary History*, 15, 3 (1985), p.404.
[4] L. Cain & E. Rotella, 'Death and spending: urban mortality and municipal expenditure on sanitation', *Annales de démographie historique*, 101, 1 (2001), p.147.
[5] J.P. Ferrie & W. Troesken, 'Water and Chicago's mortality transition, 1850-1925', *Explorations in Economic History*, 45 (2008), p.16; 'Death and the city: Chicago's mortality transition, 1850-1925', *National Bureau of Economic Research*, Working Paper 11427 (2005), p.38.
[6] Cutler & Miller, 'The role of public health improvements', p.3.
[7] B. Beach *et al.*, 'Typhoid fever, water quality and human capital formation', *Journal of Economic History*, 76, 1 (2016), p.72.
[8] Preston & van de Walle, 'Urban french mortality', pp.290-91.

resulted from improvements in sanitation in various neighbourhoods in Paris.[9] Bell and Millward suggested a causative relationship between the peak of sanitary investment and the beginning of the decline in infant mortality in late-nineteenth-century England and Wales.[10] Germany seems to have experienced the biggest declines in mortality as a result of improvements in water supply and waste disposal at the turn of the twentieth century.[11] Moreover, water supply was found to have contributed to the decline of infant diarrhoeal mortality in Sweden during the late-nineteenth and early-twentieth centuries.[12] Finally, Jaadla and Puur argued that infant mortality in Tartu, Estonia declined in households that drew water from artesian wells rather than those that acquired water from the local river, which was found to be disadvantageous for infants' survival.[13]

Other studies have been more hesitant regarding the impact of sanitary improvements on declines in mortality. Condran and Crimmins found a positive relationship between public health measures and mortality decline but these measures were not responsible for the decline in tuberculosis and diphtheria mortality in US cities during the last decade of the nineteenth century.[14] By extending his research in Philadelphia, Condran also showed that although an improved water supply had an immediate effect on the reduction of deaths from typhoid fever, deaths from water-borne diseases including infant and childhood diarrhoeal diseases dropped only slightly.[15]

The next section will review the public health reforms that took place in Greece from the creation of the state in 1832 until the Second World War. The effect of these reforms has rarely been explored, even when it has been assumed that the decline in

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[9] Kesztenbaum & Rosenthal, 'Sewers' diffusion', p.182.

[10] Bell & Millward, 'Public health expenditures', p.246.

[11] Gallardo Albarrán, 'Sanitary infrastructures', pp.27-28; J.C. Brown, 'Public health reform and the decline in urban mortality: the case of Germany, 1876-1912', in G. Kearns *et al.* (eds), *Improving the public health: Essays in medical history* (Liverpool: Liverpool University Press, 1991), pp.89-103. Vögele, *Urban mortality change*, p.188.

[12] G. Macassa *et al.*, 'The impact of water supply and sanitation on area differentials in the decline of diarrhoeal disease mortality among infants in Stockholm 1878-1925', *Scandinavian Journal of Public Health*, 34, 5 (2006), p.532.

[13] Jaadla & Puur, 'The impact of water supply', p.174.

[14] G.A. Condran & E. Crimmins-Gardner, 'Public health measures and mortality in U.S. cities in the late nineteenth century', *Human Ecology*, 6, 1 (1978), p.53.

[15] G.A. Condran, 'Declining mortality in the United States in the late nineteenth century and early twentieth centuries', *Annales de démographie historique*, 1 (1987), p.128.

mortality may have resulted from improvements in public health and medical care in the late 1920s and early 1930s.[16]

3.3 Public health in Greece

Most studies have argued that no special improvements in public health took place in the country in the second half of the nineteenth century, with water supplies and sewage systems remaining inadequate and in a poor condition even by the mid-twentieth century.[17] The political and socio-economic situation of the country, the preceding Ottoman occupation, the non-development of industry, and the lack of any investment on public health issues by many of the Greek governments, the local authorities and the people are all factors which have been cited as having contributed to the delayed evolution of public health provision in Greece.[18] In a study focusing on public health, Kopanaris pointed out that no changes in public health had taken place in the countryside in contrast to the cities, where at least a central water supply was available from the 1920s.[19] So the local authorities had to take the initiative in order to deal with the serious problems of the bigger urban centres of the country.[20]

Initially, the state intended to deal with the regular epidemics by adopting a preventive legislative framework, which was never implemented due to the lack of medical personnel.[21] The establishment of both the Sanitary Department within the Ministry of the Interior and of the Sanitary Police were among the first initiatives of the Greek State in 1833.[22] As the main public health authority, the Sanitary Police sought to

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[16] E. Bournova, *Oi katoikoi ton Athenon, 1900-1960* (*The inhabitants of Athens, 1900-1960*) (Athens: Department of Economics/ National and Kapodistrian University of Athens, 2016), pp.76-78.
[17] G. Nikolaidis & S. Sakellaropoulos, 'Social policy in Greece in the interwar period: events, conflicts, and the conceptual transformation', *SAGE open* (2012), p.5.
[18] I. Polychronides, *Demosia ygeia, koinonike pronoia kai ygeionomike politike sten Kretike Politeia (1898-1913)* (*Public health, welfare and health policy in the Cretan State (1898-1913)*) (Athens: Papazisi, 2010), p.33.
[19] F. Kopanaris, *E demosia ygeia en Elladi* (*Public health in Greece*) (Athens, 1933), p.345.
[20] P. Kooij & L. Sapounaki-Dracaki, 'Health care in Greece and the Netherlands in the nineteenth century. A tale of two cities', *Gesnerus*, 60 (2003), p.191.
[21] A. Liakos, *Ergasia kai politike sten Ellada tou mesopolemou: to Diethnes Grafeio Ergasias kai e anadyse ton koinonikon thesmon* (*Labour and politics in interwar Greece: The International Labour Office and the emergence of social institutions*) (Athens: EKT, 1993), p.316.
[22] Kooij & Sapounaki-Dracaki, 'Health care', p.188; I. Mastrogiannes, *E istoria tes koinonikes pronoias tes Neoteras Ellados* (*History of social welfare in Modern Greece*) (Athens, 1960), cited by T. Dardaveses, 'E organose tes kentrikes dioikeses gia ten ygeionomike politike sten periodo tou mesopolemou' (The organization of the central administration for the hygiene policy during the interwar period), in I. Kyriopoulos (ed.), *Demosia ygeia kai koinonike politike: o Eleftherios Venizelos kai e epohe tou* (*Public health and social policy: Eleftherios Venizelos and his time*) (Athens: Papazissi, 2008), p.100; S. Hatzianastasiou, A. Pavli & H. Maltezou, 'Legal aspects of public health: How law frames communicable disease control in Greece', *Journal of Public Health Policy*, 32, 4 (2011), p.450.

protect and 'shield' the people from the spread of infectious diseases mainly through the propagation and enforcement of hygiene rules and laws. This was followed by establishing hygiene zones, including quarantine areas and lazarettos, within the country and in the border areas, including ports.[23] The establishment of lazarettos and quarantine areas was believed to be the most effective measure for preventing the spread of infectious diseases, and for this reason the state spent three quarters of the public health budget on the improvement of such services around the country. Lazarettos were established in isolated locations outside ports or on small nearby islands and quarantine areas were established along the border with the Ottoman Empire.[24]

In addition, in 1834 after the establishment of municipalities in Greece, the local authorities together with prefectural doctors were given expanded responsibilities regarding health-care and public health.[25] The Medical Council (*Iatrosynedrion*), the main medical consultative and advisory body of the state, had the exclusive power of granting an individual a licence to practise medicine in Greece.[26] In this way, the Medical Council was able to restrict empiricists who were practising without a licence.

In 1835, vaccination was made compulsory for infants within the first year of life under a decree which was probably the first state action concerning the improvement of the public health.[27] During the following years, only legislative acts regarding the spread of infectious diseases were issued, setting out the principal measures that should be implemented by the Sanitary Police or the local authorities during outbreaks.[28]

The period from the mid-nineteenth until the early twentieth centuries was marked by the gradual liberation and annexation of areas (the Ionian islands in 1864 and Thessaly in 1881), slow urbanisation and industrialisation. Other significant events

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[23] M. Korasidou, *Otan e arrostia apeilei. Epiterese kai eleghos tes ygeias tou plethysmou sten Ellada tou 19ou aiona* (*When disease threatens. Surveillance and control of the health of the population in 19th century Greece*) (Athens: Typothito, 2002), pp.35-37.

[24] Ibid., pp.40-41.

[25] 'Nomos Peri systaseos ton demon' (Law concerning the establishment of municipalities), FEK, 10/01/1834, pp.8, 17.

[26] 'V.D. peri systaseos Iatrosynedriou' (Royal Decree concerning the foundation of the Medical Council), *FEK*, 13/05/1834; D. Ithakisios & A. Vozikis, 'Quarantine and lazarettos in 19th century Greece: an economic perspective', *SPOUDAI Journal of Economics and Business*, 64, 1 (2014), p.44; V. Hionidou, 'Popular medicine and empirics in Greece, 1900-1950: An oral history approach', *Medical History*, 60, 4 (2016), p.503.

[27] 'V.D. peri eisagoges tou emvoliasmou damalidos' (Royal decree concerning the introduction of smallpox vaccination), *FEK,* 11/05/1835.

[28] 'V.D. peri empodismou tes metadoses ton molysmatikon astheneion' (Royal decree concerning the prevention of infectious diseases), FEK, 31/12/1836.

were the public insolvency of 1893, the defeat in the Greco-Turkish war in 1897, the imposition of the International Financial Control, and the military coup (the Goudi coup) in 1909.[29] At that time, Greece tried to repay its debt by taking out more loans and as a result the fiscal deficit increased enormousely. Greece focused on the accomplishment of its geographical expansion following the *Megale Idea* (the Great Idea) formed in the late nineteenth century, by setting aside the needs of the population, including that for public health. Health legislation became inactive as only a few laws were passed, and many others became redundant.[30] Only a limited part of the national budget was spent on health-related issues and many hospitals suspended operation.[31] Charitable activities attempted to fill the gap in public health provision by establishing medical associations, including the Medical Society of Athens, the Panhellenic Anti-Tuberculosis Association and the Anti-Malaria Association, as well as hospitals including the *Evaggelismos* hospital in Athens in 1884, anti-tuberculosis hospitals and dispensaries including the *Soteria* hospital in Athens in 1904.[32]

In 1912, when Greece was embroiled in the Balkan Wars and their disastrous consequences, including the noteworthy dislocation of populations, the need for a more efficient state involvement in public health arose. After the Balkan Wars (1912-1913), Greece doubled its size and population by annexing Macedonia, Epirus and Crete.[33] Conscription and the increased hygiene needs of the period 1912-1922 led to the high morbidity of the population and also mobilised the Greek state to take action for a systematic improvement of public hygiene and health-care.[34] Based on these

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[29] A. Fragkiades, *Ellenike oikonomia, 19os -20os aionas* (*Greek Economy in the 19th-20th century*) (Athens: Nefele, 2007), p.126; G. Margarites, 'Polemoi' (Wars), in C. Hatziiosif (ed.), *Istoria tes Elladas tou 20ou aiona* (*The history of Greece in the 20th century*), vol. A (Athens: Vivliorama, 1999), p.153.

[30] N. Makrides, *Ai yperesies ygieines sten Ellada* (*The sanitary services in Greece*) (Athens, 1934), p.16, cited by Liakos, *Ergasia kai politike*, p.316.

[31] Liakos, *Ergasia kai politike,* p.316.

[32] V. Theodorou & D. Karakatsani, *'Ygieines paraggelmata': Iatrike epivlepse kai koinonike pronoia gia to paidi tis protes dekaeties tou 20ou aiona* (*'Hygiene Imperatives': medical control and child welfare at the beginning of the 20th century*) (Athens: Dionikos, 2010), p.135; L. Vladimeros & H. Fragkides, 'To Panellenio iatrikon synedrion tou 1901' (The first Greek medical congress in 1901), *Archives of Hellenic Medicine,* 19, (2002), pp.700-09; D. Soteriades, 'E demosia ygeia en Elladi kai e eklaikeuse tes ygieines' (Public health in Greece and the popularisation of the hygiene), *Athens Hygiene Association* (Athens, 1917), p.10.

[33] According to the 1913 census taken in the annexed provinces, Greece's population increased by 2,103,038 people, bringing the total population to 4,734,990. Furthermore, 58,583 km^2 were added to its territory of 63,211 km^2 producing a total of 121,794 km^2: *Arithmeses ton katoikon ton neon eparhion tes Ellados tou etous 1913* (*Enumeration of the inhabitants of the new provinces of Greece in 1913*) (Athens: Ministry of National Finances, 1915); D. Pentzopoulos, *The Balkan exchange of minorities and its impact on Greece* (London: Hurst & Company, 2002), p.27.

[34] Polychronides, *Demosia ygeia,* p.43; Liakos, *Ergasia kai politike*, p.319.

needs, in 1914 a bill was passed concerning the supervision of public health, which provided for the reorganization of public health. At the head of this public health system remained the Medical Council with expanded responsibilities.[35]

The involvement of Greece in the First World War in 1915 exacerbated the already turbulent situation in the country. In order to confront the increasing hygiene issues of the country, Eleftherios Venizelos, the Greek liberal prime-minister, established for the first time a separate Ministry of Health in 1917, which undertook the provision of health-care for the refugees.[36] By passing such a bill, the state recognized the need for the existence of a separate service which would resolve the serious sanitation problems of the country.[37]

After the failure of the Greek military campaign in Asia Minor (1920-1922) and the Treaty of Lausanne (23 July 1923), almost 1,300,000 Christian inhabitants of Greek origin living in Eastern Thrace and Asia Minor came to Greece, most fleeing from Turkey under desperate conditions. They were destitute, famished and without accommodation. The settlement of these refugees caused economic, social and public health upheavals as the population of the country increased by a quarter. As a consequence the risk of the spread of tuberculosis, malaria and other infectious diseases increased and the public health infrastructure was woefully lacking.[38] During the following years, hundreds of refugee settlements, mainly in rural areas, were built by the Refugee Settlement Commission, supported largely by the League of Nations; however the problems of housing the refugees in the cities were not solved until several years later.[39] The refugees were located in provincial settlements which lacked rudimentary facilities and did not meet the basic rules of public hygiene, resulting in the rapid transmission of infectious diseases, including tuberculosis and typhus.[40] Many philanthropic organisations such as the American Near East Relief and the American Red Cross did assist both the state and the refugees, but little was done for

[35] Law 346/1914, 'Peri epivlepseos tes demosias ygeias' (Concerning the supervision of public health), *FEK*, 27/12/1914.
[36] 'V.D. Peri systaseos ypourgeiou perithalpseos' (Royal Decree concerning the establishment of the Ministry of healthcare), FEK, 14/06/1917.
[37] N. Kapanides, *E kleiste perithalpse sto elleniko kratos, 1909-1940* (*Healthcare system in Greece, 1909-1940*) (Aristotle University of Thessaloniki: Unpublished PhD thesis, 1988), p.81.
[38] V. Theodorou & D. Karakatsani, 'Health policy in interwar Greece: the intervention by the League of Nations health organization', *Dynamis*, 28 (2008), pp.55-56.
[39] Ibid., p.57; Pentzopoulos, *The Balkan exchange*, pp.82, 105.
[40] Liakos, *Ergasia kai politike*, p.324.

the improvement of public hygiene in some of those settlements.[41] Poor housing conditions, inadequate water supplies and sewerage systems, filthy streets, very poor sanitary facilities, insufficient health-care and the lack of adequately trained doctors and nurses were factors responsible for the spread of many infectious diseases.[42]

At the beginning of 1928, a serious epidemic of dengue fever, which afflicted Venizelos himself, forced the state to adopt new hygiene measures, and further help was requested from the League of Nations. In a report by the League of Nations, it was stated that "as far as hygiene is concerned, Greece is a dangerous country" and also that "such a lack of health services and social welfare was not encountered even in countries of the lowest cultural standard".[43] Venizelos's policies therefore focused on the establishment of a more advanced public health and welfare system, the education and training of health staff, the eradication of malaria and tuberculosis and the protection of children. According to the League of Nations, these measures would only succeed if public hygiene services were established in collaboration with the local authorities, such as water supplies, sewerage systems, lighting, town planning and the construction of healthy houses and schools.[44] This attempt to rebuild the public health system was co-ordinated with the help of the Rockefeller Foundation, although it was unsuccessful because of poor cooperation between Greek and American experts, bureaucratic hurdles, and political favouritism, nepotism and corruption in the public sector.[45] The coordinated attempt of Venizelos and his liberal government to rebuilt the public health and welfare system failed because of his electoral defeat in 1932 by the conservative party, which in turn attempted to abolish many of these actions.[46] The political instability of this period (1932-1936) led to the establishment of the 'Regime of the Fourth of August 1936', an authoritarian regime under the leadership of General Ioannis Metaxas.[47] Metaxas attempted to implement policies, including improving public health services and welfare, by which he hoped to gain popularity. He supported the view that the state should participate in the resolution of the country's main social problems and for this reason he passed acts on the improvement

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[41] H. Morgenthau, *I was sent to Athens* (New York, 1929), p.246.

[42] Kopanaris, *E demosia ygeia*, pp.54-60; E. Kontogiorgi, *Population exchange in Greek Macedonia: The rural settlement of refugees 1922-1930* (Oxford: Oxford University Press), pp.266-77.

[43] Theodorou & Karakatsani, 'Health policy', p.63; Liakos, *Ergasia kai politike*, p.328.

[44] Theodorou & Karakatsani, 'Health policy', pp.63-64; Liakos, *Ergasia kai politike*, pp.328-29.

[45] D. Giannuli, '"Repeated Disappointment": the Rockefeller Foundation and the reform of the Greek public health system, 1929-1940, *Bulletin of the History of Medicine*, 72, 1 (1998), pp.49-50.

[46] Theodorou & Karakatsani, 'Health policy', p.74; Kapanides, *E kleiste perithalpse,* p.100.

[47] R. Clogg, *A concise history of Greece* (Cambridge: Cambridge University Press, 2013), p.115.

of and financial support for the public health-care system. A very important characteristic of the period was the establishment of the national Social Insurance Institute (*IKA*), even though the relevant law had been passed under Venizelos in 1932. However, the start of the Second World War did not allow the implementation of Metaxas's policies and according to Kapanides it is not possible to evaluate the effectiveness of the programme outlined above.[48]

3.4 Public health in Hermoupolis

Because the Greek state seems to have failed to implement a coordinated public health policy, the local authorities had to take charge of all public matters concerning the maintenance of the health-care system and the monitoring of public health. This section will explore the way in which public health was shaped at the local level in Hermoupolis from 1830 until 1940. Using mainly contemporary primary sources, including public health reports, transcripts of the meetings of the municipal authorities, local newspapers and oral interviews, it will seek to address one of the main questions of this thesis: what, if anything, did the local authorities do to improve public health.[49]

3.4.1 *Public hygiene*

Public hygiene was found to be poor in Hermoupolis despite the initiatives of the local authorities since the 1850s regarding the paving of the streets and main squares of the city, the construction of a water supply network and sewage system and the cleanliness of the public spaces.[50]

After its creation, the city had limited space and was cramped around the port, where tanneries, boatyards, factories, bakeries and cemeteries abutted shops, warehouses and houses (Plates 3.1 and 3.2).[51] The distance between the sea front and the hills is

[48] Kapanides, *E kleiste perithalpse*, pp.102-05.
[49] For reasons of anonymity, all interviews which were conducted by Dr Hionidou are denoted by a number. Most interviews refer to Hermoupolis but also to the neighbouring town of Ano Syros, but due to the proximity of the two places, similar conditions are expected to have been prevalent in both populations. In addition, many inhabitants of Ano Syros worked in Hermoupolis.
[50] *Minutes of the Municipal Council*, XD, 23 December 1857; IST, 9 November 1859; Hionidou, *Famine and death*, p.21.
[51] A. Fenerli, 'O kallopismos tes poles-Ermoupole, 19os ai.' (The beautification of the city of Hermoupolis in the 19th century), *E pole stous neoterous hronous: Mesogeiakes kai Valkanikes opseis, 19os -20os ai.* (*The city in modern times: Mediterranean and Balkan aspects, 19th-20th c.*) (Athens: EMNE, 2000), p.173.

very short, leaving only a little space for the city to expand.[52] According to the English Consul in 1872, the streets of Hermoupolis were asymmetrical with no paving.[53] Reports on the poor sanitation have been found in the local press throughout the period under study.[54] At every opportunity, the local press inveighed against the local authorities concerning their indifference to the fact that no hygiene measures were being implemented.[55] Since the 1860s, there were reports in the local press claiming that the streets of Hermoupolis, the second largest city of Greece, looked more like those of the Jewish quarters of Ottoman cities (that is, poor), and that the public hygiene of the city was similar to that of the unhealthiest quarters of London or Paris.[56] The vast majority of those reports were focused on the unhealthy sewage disposal systems and the deficient cleanliness of the streets and districts. Extensive criticisms were levelled at the local authorities, but mainly the police, who were responsible for the maintenance of the city's public hygiene.[57] Similar reports regarding the unhealthy public hygiene of the city were also found even in the first decades of the twentieth century.[58] The poor financial situation was found to be the main reason for the lack of public hygiene in Hermoupolis by a contemporary physician, who also argued that similar or even worse public hygiene levels were to be found in the neighbouring town of Ano Syros.[59]

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[52] For a tour of the city of Hermoupolis, see C. Agriantoni & A. Fenerli, *Ermoupole-Syros. An historical tour* (Athens: Olkos, 1999).

[53] *F.O. Report by Consul Ruby on the Trade and Commerce of the Cyclades during the year 1871*, 14/13/1872, p.123, cited by Delis, *Ermoupolis*, p.26.

[54] *Panope*, 06/06/1874, D, 174, p.2; 24/12/1877, Z, 400, p.3; 23/08/1878, H, 463, p.3; 14/10/1880, I, 677, pp.2-3; 05/01/1882, IA, 795, p.1; *Helios,* 07/07/1896; *Patris,* 29/05/1876, 528; 08/08/1881, 792; *To Vema*, 20/07/1913, Γ, 132, p.2; 21/09/1913, Γ, 141, pp.1-2; *Tharros*,13/05/1927, Γ, 222, p.1; 11/10/1931, Z, 454, p.1.

[55] It is important, however, to bear in mind that the local press was often used as a tool for political persuasion and propaganda against or in favour of the local authorities, so caution should be exercised when employing press reports as evidence.

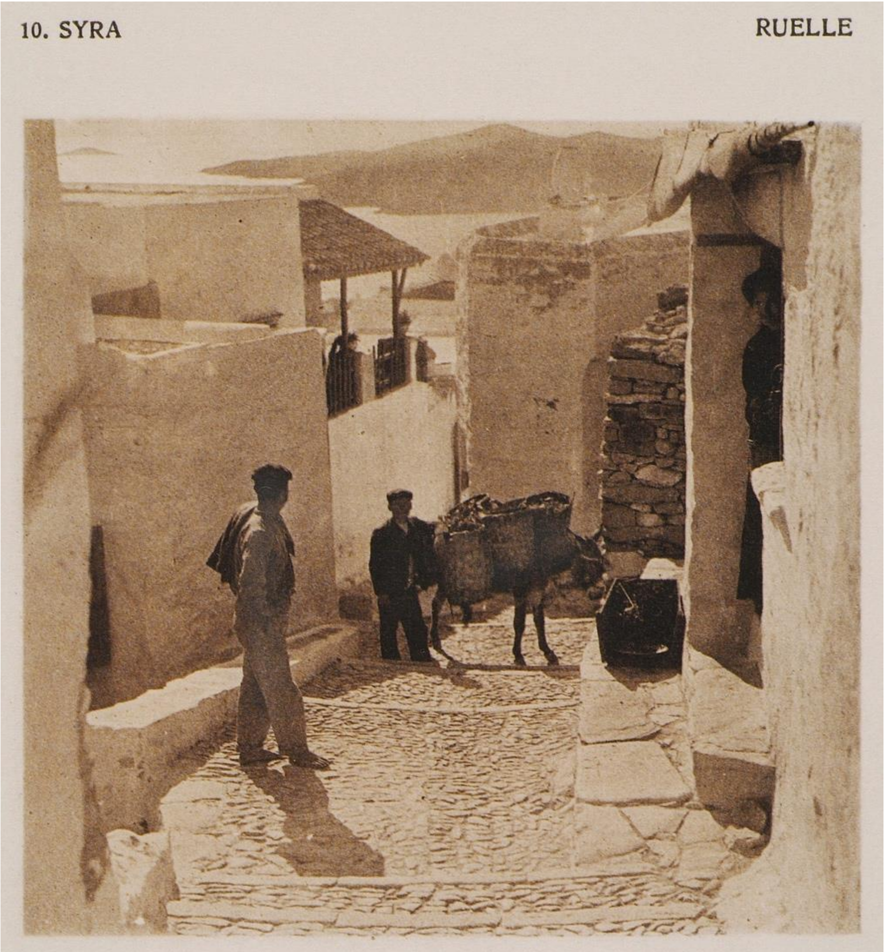
[56] *Ermoupolis,* 06/02/1865, A, 25, p.2; 04/10/1869, ST, 261: Many reports by local physicians discussed improvements which should take place in Hermoupolis, including cleaning of the streets and the sewers and better quality of water.

[57] *Helios,* 04/10/1892, 406, p.2; 07/07/1896, KA, 570, p.2; 24/10/1900, 571; 24/09/1903, ΚΘ, 883, p.3; *Patris,* 29/05/1876, 528; 08/08/1881, 792; 10/03/1884, IH, 917; *To Vema*, 20/07/1913, Γ, 132, p.2; 16/11/1913, Γ, 149, pp.1-2; 15/01/1915, Δ, 211, pp.1-2 (including correspondence with the local authorities); *Tharros*, 13/05/1927, Γ, 222, p.1; 01/06/1928, Δ, 280, p.1; 19/08/1931, Z, 451, p.1.

[58] *Paligeneseia*, 15/10/1910, 34, A, p.1; 22/02/1914, 216, E, p.1; *Tharros*, 17/02/1926, 155, B, pp.1-2.

[59] A. Tsakalotos, *Peri tes demosias ygeias kai idia tes fymatioseos en Syro* (*Concerning the public health and especially the tuberculosis in Syros*) (Athens, 1914), p.28.

Plate 3. 1 Small Street at Syros island, 1919



***Source*:** D. Baud-bovy & F. Boissonas, *Des Cyclades en Crète au gré du vent* (Geneva: Boissonnas & Co, 1919). Photo retrieved via http://eng.travelogues.gr/item.php?view=45415 (access in June 2018).

Plate 3. 2 Small Street at Hermoupolis, 1919

***Source*:** D. Baud-bovy & F. Boissonas, *Des Cyclades en Crète au gré du vent* (Geneva: Boissonnas & Co, 1919). Photo retrieved via http://eng.travelogues.gr/item.php?view=45420 (access in June 2018).

Outbreaks of various epidemics occurred almost annually in Hermoupolis during most of the nineteenth century. Contemporary physicians attributed the frequent prevalence of such infectious diseases to the insufficient sewage system, the inadequate water supply in the city and use of the communal water tanks for obtaining drinking water, deficient public hygiene, high population density, the over-consumption of alcohol and fruits and poor drainage.[60]

[60] A. Fragkides, *Istoria tes nesou Syrou* (*History of the island of Syros*) (*Syllogos ton en Athenais & Peiraiei Syrianon, 1975*), p.175: The most important epidemics were *smallpox*: 1834, 1848, 1857, 1869, 1872, 1882, 1888; *diphtheria*: 1852, 1856, 1859, 1871, 1873-75, 1877-81, 1983-85 (the diphtheria epidemics in Hermoupolis were explored by I. Foustanos whose report was presented at the Hermoupolis Medical Association meetings in 1894); *scarlet fever*: 1860, 1873, 1889; *cholera*: 1845, 1854 (the levels of 1854 cholera outbreak were explored in C. Loukos, 'Epidemia kai koinonia. E cholera sten Ermoupole tes Syrou, 1854 (Epidemic and society. The cholera in Hermoupolis of Syros, 1854), *Mnimon*, 14 (1992), pp.49-69); *dengue fever*: 1883, 1889; and *measles* 1890-91, 1894-95.

Furthermore, most houses in the city were found to be damp and dark because the city was built on a hill and therefore they had only one level. There were houses with more than one level, but they were built with unhealthy materials.[61] Members of the working class, according to Tsakalotos, lived in those damp, dark dwellings, usually in basements without courtyards, whereas the upper and middle classes lived in healthier houses.[62] Even in 1931, reports still stated that the houses of the working classes in Hermoupolis were damp, dark and badly ventilated and that people were living in the unhealthiest conditions.[63]

Many references were also found in the local press concerning the measures that should be taken for the improvement of the public hygiene in the city. These measures included the construction of a disinfection area, the decontamination of abandoned buildings, streets, sewers and unfenced fields, and the cleaning of the existing public shops (butchers, fishmongers and greengrocers shops).[64] Indeed, some of those actions were accomplished or other alternative measures were implemented by the local authorities, but principally only after an epidemic had occurred on the island. One newspaper article reported that even when the local authorities did do something, it was rendered ineffective because the people did not follow the recommended hygiene rules.[65]

Because Hermoupolis was a major port city, the local authorities attempted to deal with the potential external threat, following the national policy of establishing a lazaretto.[66] So every time an outbreak occurred either in a Greek, Mediterranean or Black Sea port all the necessary protective measures were taken against the disease.[67] Quarantines were imposed on ships arriving from countries which had been infected by plague or cholera. Hermoupolis had the largest quarantine area in the country after

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[61] Fragkides, *Istoria tes nesou* Syrou, pp.51-52; A. Fragkides *Nesos Syros ypo topographiken, klimatologiken kai iatriken epopsin* (*The island of Syros through topographic, climatological and medical perspective*) (Hermoupolis, 1894), p.62.
[62] Tsakalotos, *Peri tes demosias ygeias*, p.20.
[63] GSAS, Ygeia kai Pronoia Archive (herafter YPA), YP917, *Etesia ekthese ygieinomikes katastaseos Kykladon,* (*Annual report on public hygiene in Cyclades*) (1931).
[64] *Patris*, 12/09/1892, 1371, KZ, p.1.
[65] GSAS, YPA, YP13808/1932, *Keryks ton Kykladon*, 5/9/1932, 136.
[66] For the construction and the operation of the Hermoupolis's lazaretto, see A. Kokkou, 'To loimokatharterio tes Syrou- Istoria kai peripeteies tou mnemeiou' (Syros's lazaretto: the history and adventures of the site), unpublished paper *Ta Seminaria tes Ermoupoles* (*Hermoupolis's Seminars*) (Hermoupolis, 2012); Travlos & Kokkou, *Ermoupole*, pp.110-15.
[67] *Ermoupolis*, 26/12/1864, 19, A; 26/6/1865, 45, A; 18/9/1871, 353, Θ; *Patris*¸11/09/1893, 1428, pp.1-3.

1840 and "one of the best in the Levant [the eastern Mediterranean Sea]".[68] In the nineteenth century, therefore, the quarantine area was a mandatory stopover for all travellers arriving in or passing through the port of Hermoupolis. The existence of a quarantine area on the neighbouring island of Delos has also been mentionned in the local press.[69] Delos was part of the Syros quarantine area, where ships and passengers arriving from countries which were thought to have been infected by plague stayed for about eleven days.[70] Furthermore, for those who arrived in Hermoupolis from Delos, an additional five-day quarantine was imposed.[71] According to a newspaper article, the government sent 48 tents for the settlement of passengers who were kept in isolation on Delos, and in 1883 an expansion of the quarantine area seems to have taken place after the arrival of 1,000 passengers on the island.[72] Even though the Hermoupolis lazaretto did not cease to serve as a quarantine area, it was also used for other purposes until it was gradually abandoned over the following years.[73] In the 1890s, it was partly used as a prison and in 1908 the lunatic asylum was established there by the Hermoupolis Philanthropic Committee.[74] Although it seems that quarantine measures were not in force by the late nineteenth century, Hermoupolis had the first municipal disinfection service in Greece, established in 1903 and funded by the municipal authorities.[75] A royal decree in 1912 allowed ships to be disinfected in the Hermoupolis port by the municipal disinfection service.[76]

Hermoupolis' municipal authority attempted to improve the public hygiene of the city, but not systematically and mostly only when an epidemic occurred on the island.[77] In order to deal with the high incidence of infectious diseases (mainly smallpox and

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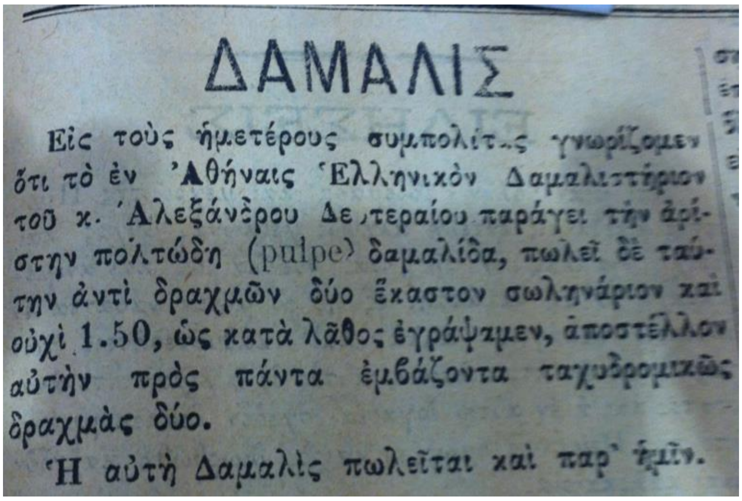
[68] E.M. Slatter, 'Illustrations from the Wellcome Institute Library', *Medical History*, 28 (1984), pp.73-80; J. Murray, *Hand-book for travellers in the Ionian sands, Greece,* Turkey (London, 1840), p.375; *Hand-book for travellers in Greece* (London, 1854), p.14, cited by Slatter, 'Illustrations', p.80: "The Lazaretto has lately become one of the best in the Levant" (1840) and " It will be useful for [travellers] to remember that the best Lazarettos in the Levant are those of Syra, Piraeus, Corfu or Malta" (1854).
[69] *Ermoupolis*, 5/2/1866, 75, B.
[70] *Ermoupolis*, 26/6/1865, 45, A; 3/7/1865, 46, A; 5/2/1866, 75, B; References on Delos were found in a study focusing on a similar quarantine area in Salamis: A. Virvilis, 'To loimokatharterio tou Agiou Georgiou Salaminos' (The lazaretto of St George on Salamis island), *Philotelia*, 590 (1998).
[71] *Ermoupolis*, 3/7/1865, 46, A.
[72] *Ermoupolis*, 26/6/1865, 45, A; *Panope*, 26/7/1883, 950, ΙΓ, p.3.
[73] References in newspapers point to its abandonment and the need for maintenance: *Patris*, 4/9/1871, ΣΤ, 285; Travlos & Kokkou, *Ermoupole*, pp.109-111.
[74] *Elios*, 20/5/1894, ΙΘ, 479; 10/8/1898, ΚΓ, 656; Travlos & Kokkou, *Ermoupole*, p.111.
[75] *To Vema*, 19/2/1915, 216, Δ, pp.1-2.
[76] *To Vema*, 4/2/1912, 54, A, p.3.
[77] GSAS, YPA, YP112, *Praktika ygeionomikou symvouliou* (*Meetings of the hygienic committee*), 14/01/1929; GSAS, YPA, YP1311, *Etesia ekthese ygieinomikes katastaseos Kykladon,* (*Annual report on public hygiene in Cyclades*) (1929).

diphtheria), especially among young children, mass immunization was implemented by the local authorities. Evidence from the local press suggests that regular smallpox and anti-diphtheria vaccinations were given from the 1880s, even though vaccination was made compulsory as early as 1835.[78] For instance, in 1888, when a smallpox outbreak occurred in Hermoupolis, the local press reported that 7,716 free vaccinations took place in the city within a very short period of time.[79] Mass vaccinations were also imposed by the state in 1891. For this reason, the municipal doctors were supplied with additional smallpox serum (*damalis*) from Athens (Plate 3.3). In an extensive article in a local newpaper regarding vaccination, it was pointed out that one of the main reasons for the frequent prevalence of smallpox in the country was the negligence of the parents to vaccinate their children. It was also emphasized that revaccination was equally important.[80] The municipal council, moreover, provided extra funding for the supply of smallpox and anti-diptheria vaccines, when needed. [81]

Plate 3. 3 Advertisement of smallpox vaccination in the local newspaper *Helios*



ΔΑΜΑΛΙΣ

Εἰς τοὺς ἡμετέρους συμπολίτας γνωρίζομεν ὅτι τὸ ἐν Ἀθήναις Ἑλληνικὸν Δαμαλιστήριον τοῦ κ. Ἀλεξάνδρου Δευτεραίου παράγει τὴν ἀρίστην πολτώδη (pulpe) δαμαλίδα, πωλεῖ δὲ ταύτην ἀντὶ δραχμῶν δύο ἕκαστον σωληνάριον καὶ οὐχὶ 1.50, ὡς κατὰ λᾶθος ἐγράψαμεν, ἀποστέλλομεν αὐτὴν πρὸς πάντα ἐμβάζοντα ταχυδρομικῶς δραχμὰς δύο.

Ἡ αὐτὴ Δαμαλὶς πωλεῖται καὶ παρ᾽ ἡμῖν.

Note: The advertisement reads: Smallpox Serum (*Damalis*). We announce to our fellow citizens, that the *Greek* smallpox vaccine provider based in Athens under Aleksandros Deyteraios produces excellent pulpy (pulpe) *damalida* (smallpox serum) and it is available via postal service for 2 drachmas per 2 tubes. The vaccine is also sold by us.

Source: *Helios*, 8/12/1896, KA, 589, p.2.

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[78] *Patris*, 17/04/1882, 828; 27/4/1882, 829; 4/4/1892, 1347; 6/03/1893, 1396; *Helios*, 06/03/1888, B, 83, p.2; 20/12/1896, KA, 590, p.2; 11/02/1898, KB, 624, p.2. 27/11/1898, 675.

[79] *Helios*, 8/12/1896, KA, 589, p.2.

[80] *Helios*, 27/01/1891, IST, 329, p.2

[81] Even though references on supplying additional smallpox serum in Hermoupolis for vaccinations were found in the Minutes of the Municipal Council throughout the study period, I cite only some of them: *Minutes of the Municipal Council*, 973, PKΘ, 20 April 1887; 1296, MZ, 29 November 1896; 146, 52, 31 October 1906; 690, 57, 23 May 1932.

Even in the 1930s, the annual reports on public hygiene in Cyclades revealed that the only regular action implemented by the local authorities to improve the public health of the city was vaccinations.[82] In 1931 3,500 inhabitants of island of Syros were vaccinated, including all pupils, as vaccination was mandatory in every school in the country.[83] In 1937, local authorites advised parents to vaccinate the newborns, while later on this was imposed by a law.[84] For this reason, additional quantities of smallpox serum were sent to the city.[85] This is probably one of the most important measures that was implemented in Hermoupolis and it would be expected to have had a great impact on the mortality levels of young children.[86]

Increased action was also taken to deal with the severe outbreak of dengue fever which occurred on the island in the period 1928-1931.[87] Actions such as mosquito control, mainly imposed by the state authorities, were intended primarily to deal with the epidemic and not to improve the public hygiene of the city as a whole.[88] Systematic mosquito control was only implemented in 1940.[89]

The level of public hygiene therefore remained consistently low throughout the study period because of the lack of financial resources, the lack of state support, and the absence of a clean water supply and sewerage systems. In the next sections, I shall

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[82] GSAS, YPA, YP917, *Etesia ekthese* (1931); GSAS, YPA, YP1308/1932, *Etesia ekthese ygieinomikes katastaseos Kykladon,* (*Annual report on public hygiene in Cyclades*) (1932); GSAS, YPA, YP1310/1930-1937, *Etesia ekthese ygieinomikes katastaseos Kykladon,* (*Annual report on public hygiene in Cyclades*) (1936); GSAS, YPA, YP113, *Etesia ekthese ygieinomikes katastaseos Kykladon,* (*Annual report on public hygiene in Cyclades*) (1940).

[83] GSAS, YPA, YP917, *Etesia ekthese* (1931).

[84] GSAS, DA, Demosia Ygeia (Public Health, herafter DY), 2A, Damalismos, *Epistole tou demarchou gia to damalismo ton vrefon* (*Letter of the mayor for the vaccination of the infants*), 11/11/1937; 'Peri ekteleseos tou Anagkastikou Nomou 171/1936 "peri damalismou" (Concerning the implementation of the compulsory law 171/1936 "concerning smallpox vaccination"', *FEK*, 208, 29/05/1937, p.1346.

[85] GSAS, DA, DY, 2A, Damalismos, *Epistole tou diefthinte tou Ygeionomikou Kentrou Kykladon pros to demarcho Ermoupoleos* (*Letter from the director of the Cyclades Health Service to the Mayor of Hermoupolis*), 2/11/1937.

[86] Riley, *Rising life expectancy*, p.96.

[87] GSAS, YPA, YP922/1931, *Ekthesis peri tes emfanisthesas epidemias tou Dagkeiou Pyretou* (*Report on the dengue fever epidemic*).

[88] The severity of the 1928-31 Hermoupolis outbreak was confirmed in the Athenian newspapers and the state reports, although this is not evident in the cause-specific mortality analysis, as will be shown in Chapter 6. The mayor of Hermoupolis claimed that 6,000 people were infected by the dengue fever but reports from the prefectural doctor stated that not more 1,500 people were infected up to September 1929: GSAS, YPA, YP 112, *Praktika ygeionomikou symvouliou* (*Meetings of the hygienic committee*), 8/9/1929. For a better understanding of the evolution of the dengue fever epidemic, see C. Louis, 'Daily newspaper view of dengue fever epidemic, Athens, Greece, 1927-1931', *Emerging Infectious Diseases*¸ 18, 1 (2012), pp.78-82.

[89] GSAS, YPA, YP113, *Etesia ekthese* (1940).

explore the impact, if any, of improvements to the water supply, the sewerage system, medical services and all other activities, initiated mainly by philanthropists, on the health of the population of Hermoupolis.

3.4.2 *Water-supply and sewage disposal in Hermoupolis*

Water supply was a fundamental issue for the local authorities, which had attempted to deal with the lack of water in the city since the 1870s. Newspaper articles reported that the available water was not enough to cover the needs of the population of the city, mainly due to regular droughts over the summer months.[90] Fragkides, however, suggested that Syros had excellent water resources and chemical examinations proved that water from the natural springs on the island was safe for consumption in the late nineteenth century.[91] The water was transferred to the city on donkeys and sold by water sellers in various areas (Plate 3.1). Contemporary physicians were still discussing the quality of the island's natural springs in the early twentieth century. Arfanes, for instance, in a published letter to the Prefect of the Cyclades islands in 1913, pointed out that the water in the district of Piskopio was contaminated and in combination with the inadequate sewage system could increase the incidence of typhoid fever in the city.[92] Moreover, the prefectural doctor reported the contamination of the water in Piskopio in 1928, a very crucial time as the severe outbreak of dengue fever occurred in Hermoupolis then.[93]

There were also private water cisterns in houses, mainly in the lower social class residential areas, although it was not possible to test its quality.[94] Until the 1930s, water was said to be a 'luxury commodity', and most of the inhabitants of Hermoupolis obtained water from their cisterns:

> *Q*. Before, let's say before the [1940s Italian and German] occupation and during the occupation, where did you get your water from?
>
> *A*. From nowhere. Water was a luxury commodity.
>
> *Q*. And where did you find, let's say drinkable water? Did you go to springs?
>
> *A*. Some donkeys went, some donkeys here and there, I have photographs. They had pitchers [vessels]. They each had four barrels and they went

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[90] *Ermoupolis*, 21/2/1870, 279, ΣΤ; 28/8/1871, 350, Z.

[91] Fragkides, *Istoria tes nesou*, p.112.

[92] *To Vema,* 16/11/1913, 149, Γ, pp.1-2. Newspaper articles reporting the bad quality of the water in Hermoupolis were rather usual: *Tharros,* 11/11/1925, 129, B, 1, p.1; 9/11/1934, 626, I, p.1.

[93] GSAS, YPA, YP1301/1924-1928, *Peri ton emfanisthenton krousmaton tyfou kai peri ton lefthenton ygeionomikon metron* (*Concerning the appearing cases of typhus and the implemented hygiene measures*).

[94] Fragkides, *Nesos Syros*, p.28.

> around and sold water to the houses. Do you understand? Others went with their own containers or, mainly all houses had water cisterns. As they still have. Now under my house, despite … despite the price of the water, I paid two hundred thousand [drachmas] last year to clean the water cistern in order for it to be clean because we collect water and pour it in so that we have it during the summer, when we have high consumption. My grandchildren come here and we get together ten people and we fill the water cistern underneath [the house] and I have a pump which pumps the water upstairs. Do you understand? So, when the desalination of the water appeared [in 1972], people started to install bathrooms in their houses because most houses did not have baths. The bathrooms were put in after the acquisition of the desalinated water. The desalination was a great issue in Syros.[95]

In Hermoupolis, a contract for a central water supply was signed with a Swiss Water Supply Company in 1923.[96] The company installed a water supply system using mainly water from the natural springs at Pege and Nikolitsa in Ano Syros. It was estimated that the water supply provided 150 m^2 of water daily, although the quantity fell during the summer months. In order to secure an adequate quantity of water, the company hired three private water drains, the water from which was mixed with natural spring water and stored in a water storage tank situated between the two cities, Hermoupolis and Ano Syros. The water was then transferred through pipes in three different directions and distributed through a ramified network of pipes to the rest of the city. However, the underground water supply system was not available in the whole city and many households still had to acquire water from artesian wells.[97]

Evidence from the minutes of the municipal council suggests that the expansion of the underground water supply was delayed significantly due to disagreements between the municipal council and the water company regarding the poor quality of the water

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[95] No.10 (Male, born in 1912, lived in Hermoupolis and was educated at the merchant marine school of Syros).

[96] The two engineers who undertook the construction of the water supply system were A. Faouster and H. Riffel. An underground water supply system was constructed in Athens only in the early-1930s, although attempts had begun in the 1880s. The Athens water supply system has been studied extensively by G. Maurogonatou, *E ydrodotese tes Athenas. Apo ta diktya sto diktyo: 1880-1930. Technologia, koinonia, politike* (*Water supply in Athens. From the networks to the network: 1880-1930. Technology, society, politics*) (National and Kapodistrian University of Athens & National Technical School of Athens: Unpublished PhD thesis, 2009).

[97] GSAS, YPA, YP1311, *Etesia ekthese* (1929).

and the company's monopoly over the supply.[98] The agreement dictated that the water company should construct public toilets in exchange for the water monopoly in the city. Because the water was found to be contaminated, the local authorities asked the water company to purify it by installing a chlorination system, but this was rejected by the company because of its high cost, claiming that it would be an unprofitable activity because of the small size of the city.[99] Evidence from Hermoupolis sources show that water chorination had not been introduced in the city until 1940.[100] By the 1930s, the water supply system had expanded to various other parts of the city, including the Vrontado area in 1932, the refugee settlements in 1934 and the Katalymata area in 1936.[101]

In addition, a contemporary report on the water supply and sewer system of the city in 1933 by a medical officer based in Athens described the water sources of the city, the quality of each source separately and the lack of hygiene standards.[102] According to that report, inhabitants in Hermoupolis acquired water from three different sources: an underground water supply through the newly built aqueduct network; rainwater stored in the private cisterns which most of the houses had had since the creation of the city; and water stored in cisterns and sold around the city, which was of dubious quality. The report mentioned that the fact that three different types of water were available in the city showed that none of them was adequate on its own to cover the needs of the city. Examination of the underground water supply showed that neither the aqueduct nor the private water drains were built according to contemporary hygiene regulations. The water from the aqueduct was transferred around the city through pipes which ran very close to the sewerage system and for this

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98 *Minutes of the Municipal Council*, 563, 301, 7 October 1924; 583, 321, 10 July 1925; 622, 31, 21 December 1926; 653, 20, 4 June 1930.

99 *Minutes of the Municipal Council*, 730, 11, 17 August 1934; 739, 15, 23 November 1934; 752, 23, 13 April 1935; GSAS, YPA, YP1310/1930-1937, *Etesia ekthese* (1936).

100 Water chlorination was discussed widely in the Minutes of the Municipal Council and the Annual report on public health in the Cyclades, which suggests that this measure was never introduced due to the rivalry between the City Council and the Water Supply Company: *Minutes of the Municipal Council*, 743, 19, 14 January 1935; GSAS, YPA, YP1310/1930-1937, *Etesia ekthese* (1936); GSAS, DA, DY, 5b, *Epistole tou diefthinte Ygeionomikou Kentrou Kykladon pros to demarcho tes Ermoupoles shetika me te chloriose tou ydatos* (*Letter from the director of the Cyclades Health Service to the Mayor of Hermoupolis concerning water chlorination*), 21/11/1939.

101 *Minutes of the Municipal Council*, 693, 60, 14 July 1932; 730, 11, 17 August 1934; 781, 46, 14 August 1936.

102 GSAS, YPA, YP113, G. Alivizatos, *Ekthesis epi tes ydreuseos kai apoheteuseos tes poleos* (*Report on the water supply and sewerage system of the city*) (Syros, 1933); GSAS, YPA, YP113, G. Pagkalos *Mikroviologike eksetasis ydatos Syrou* (*Microbiological examination of the water of Syros*) (Athens, 1933).

reason there was a significant risk of contamination in the case of a possible burst pipe. The water was therefore likely to be contaminated by human or animal excrement and evidence was provided in an attached microbiological examination showing that coliform bacteria were detected. Therefore, the report concluded that the water from the underground water supply system was unhealthy and insufficient (only five litres per person each day). The rainwater, on the other hand, which was collected in the private water cisterns was the main source of potable water in Hermoupolis. It was found to be of much better quality than the underground water, although most of the examined water cisterns had never been cleaned and therefore contaminated the water. According to the report, the use of this water was dangerous for the public health of the city.[103] Oral evidence suggests the wide use of cistern water:

> *Q*. Where did you get water from?
> *A*. We usually had water cisterns in our houses in Hermoupolis. So, from the cisterns. And in containers from some springs in Agios Athanasios up in Apano [Ano] Syros.
> *Q*. Did you drink the water from the cistern?
> *A*. Certainly.
> *Q*. You were drinking it?
> *A*. Certainly. I still drink it.
> *Q*. So you still have a water cistern?
> *A*. Yes, of course. I live in my paternal house, where I was born.[104]

The third source of water was very difficult to test as it was unknown whether it was derived from natural springs or unhealthy wells.[105] The use of bought water is also found in the oral histories in comments made by a middle-class informant:

> *Q*. And water?
> *A*. We had water... I will tell you that we did not have water, we bought [it] from the barrels, from the tanks because Syros did not have a water supply; now Syros has a water supply again [but] that [water] from the water supply is not drinkable so we buy bottled water.[106]

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[103] GSAS, YPA, YP113, Alivizatos, *Ekthesis epi tes ydreuseos*; GSAS, YPA, YP113, Pagkalos *Mikroviologike eksetasis*.
[104] No.13 (Male born in 1926, lived in Hermoupolis, lower-middle class/working class).
[105] GSAS, YPA, YP113, Alivizatos, *Ekthesis epi tes ydreuseos*; GSAS, YPA, YP113, Pagkalos *Mikroviologike eksetasis*.
[106] No.4 (upper-middle class)

Moreover, most of the inhabitants of Ano Syros acquired water from springs until public water taps were installed in the main streets of the town:

> *H.* No, of the houses, only few had [water] in the houses. In the houses back then, I tell you that a maximum of three or four people had [water], eh?
> *W.* Everybody, all the people went [to the spring]. It was called Platy.
> …
> *W.* … Now all the houses have [water].
> *Q.* They went to the taps?
> *H.* To the taps, we went with a container and took [water from them].
> *W.* Then they put taps in various [locations].
> *Q.* Everywhere?
> *W.* Everywhere, and we went and took it [water].
> *H.* Communal, communal [taps].
> *W.* Now, everybody has it in their houses.[107]

Finally, the report suggested that several improvements should be made regarding the quality of the water in Hermoupolis. The suggestions included the improvement of water production and a reduction in its price in order for more inhabitants to have access to it, regular inspections of the water tanks and the pipes, hygienic control of the commercial water supply, improvements to the aqueduct by the water supply company, and the use of water from other natural springs which were located much closer to the town, such as the one in the Talanta area.[108]

Even though Hermoupolis had one of the oldest sewage systems in modern Greece (its construction started in 1848), it was never sufficient for the whole population of the city. According to a contemporary physician in 1895, the existing sewers were totally ineffective, responsible for the transmission of infectious diseases and their complete absence would actually be more beneficial for the city.[109] In 1914, Tsakalotos argued that the sewage system had not changed since its construction and that it was only available for the households from the area of Vrontado to the area around the port, where the sewage flowed into the sea. The sewers were never cleaned and whenever it

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[107] No.2 (Husband born in 1924. They were married in 1954, very poor, lived in Ano Syros and worked in Hermoupolis).
[108] GSAS, YPA, YP113, Alivizatos, *Ekthesis epi tes ydreuseos*; GSAS, YPA, YP113, Pagkalos *Mikroviologike eksetasis*.
[109] Syros Medical Association., *Praktika Iatrikes Etaireias Syrou* (*Proceeding of the Syros Medical Association*) (Hermoupolis: Patris, 1895), p.46.

rained, they overflowed.[110] In the nineteenth century, the lack of sewers in most of the city was addressed by digging of local or individual cesspits.[111]

The informants suggested that no water closets were installed in most houses, at least not before the mid-1930s:

> *Q*. Will you tell me in your parental home, what kind of toilet did you have?
> *A*. In my parental home in my very early years as a child, I remember that we didn't have any toilet.
> *Q*. So what did you do?
> *A*. We defecated in what we called night pots or commonly chamber pots, pardon me for the phrase but ...
> *Q*. That's what we call them.
> *A*. Indeed, yes. And we emptied them outside into the sewer. There was a hole [in the street] and we emptied them into it. This is what I remember from my childhood, my very early years. Later, we moved to a new house and we had a toilet but without a flush and so on because they did not exist. We poured the water in ourselves.[112]

A middle-class informant recalled that outdoor water closets in yards existed by the early 1930s, but before then, they had used pots which were emptied into holes in the street:

> *Q*. What kind of toilet did you have, ordinary? Or ...?
> *A*. The toilet back then was in the yard, although the yard was near, but it was [further away]; back then there were no sewers, just a cesspit outside the house, in the street, and the yard was inside and to do this [defecate] and we went there.
> *Q*. and it went ...?
> *A*. It had nothing inside, no wash-basin, nothing.[113]

It seems that only the upper-middle classes had private water-closets in the mid-1930s:

> *Q*. When did you move into the new house?
> *A*. To the new [house] we came in 1936 ...

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[110] Tsakalotos, *Peri tes demosias ygeias*, p.21; Fragkides, *Istoria tes nesou* Syrou, p.52.
[111] Fragkides, *Istoria tes nesou* Syrou, p.52.
[112] No.13.
[113] No.5 (Male, born in 1924, lived in Hermoupolis, married in 1942; he and his father were civil servants, middle-class).

Q. Nice; in the new house, how many rooms did you have?

A. It had fourteen rooms.

Q. Oh big! … And how did you sleep; did every child have their own room?

A. Yes, all of them … yes, they had… their own room.

Q. Yes. I shall ask you about the toilet.

A. Yes.

Q. What kind of toilet did you have? The usual kind?

A. An ordinary toilet.[114]

In addition, evidence from Ano Syros suggests that a similar sewage disposal system to that of Hermoupolis was not installed until much later:

Q. Will you tell me, what kind of toilets did you have in that period?

H. Toilets? Toilets were … we didn't have one …

…

W. Inside the houses we didn't have toilets. They were outside, just holes.

H. Very rarely.

W. Very rarely. And we had, excuse me, the potty.

H. Do you know what that is?

W. … and every morning, we poured them out; we went outside like this and we emptied them into the holes. There were no …

Q. So you didn't clean them, right?

W. Now there are toilets and everything.

Q. You did not clean up, you did nothing? There was just a hole and that was it?

H. We poured it out, poured it into this.

W. Inside there.

H. And then we poured some water in.

W. Every house had its hole outside.

H. But there were [holes] in the streets, in the streets, there was something next to the street.

W. Yes, the central [sewage system].

H. Into the central [sewage system], it had some holes and when it was raining, [water] entered inside.…

W. The water and this [excrement].

H. … the water and [the hole] overflowed, it didn't hold.

W. There were no [toilets], there were no [toilets] back then.

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114 No.4 (Male, upper-middle class).

H. There were no such things.[115]

Kopanaris stated in 1933 that the existing sewage system was adequate, although it was improved and extended in order to be available everywhere in the city.[116] The sewage system in Hermoupolis consisted of many central sewers which started from the highest points of the city, came down through the main streets and after connecting with other branches they flowed directly into the sea.[117] However, the 1933 report pointed out that Hermoupolis's sewage system, a combined sewer system (*pantorroiko systema*), worked only partially when there was no rain. It also suggested that the existing sewage system could not be improved without spending a significant amount of money, which was just not available at the time.[118] Thus, it seems that no significant improvements in sewage disposal took place in Hermoupolis after its creation in the mid-nineteenth century and instead there were just the open public holes in the streets which were found to be foci for germs and infections.

After examining the availability and the effectiveness of the water supply and sewage disposal in Hermoupolis during the period under study, the final section of this chapter explores medical care and the related charitable activities in the city.

3.4.3 *Medical services and private/charitable activity*

Medical services in Hermoupolis were advanced in comparison with other parts of the country. Hermoupolis had the first ever hospital in the country in 1825-1827. Intitially, the wealthy inhabitants of Hermoupolis supported it financially, and later a tax on imported products was imposed by the municipal authorities for its maintenance. At first it was a small provisional construction until 1838, when it expanded to become a municipal hospital; its final stage of construction took place in the 1850s and 1860s.[119] Its running costs were met entirely by the municipality of Hermoupolis until 1885, when Stamatios Proios, one of the biggest bankers in the city, donated 600,000 drachmas in stocks of the National Bank of Greece to cover the maintenance expenses.[120] The municipal hospital appointed a Board (*Adelfato tou Nosokomeiou*),

[115] No.2.

[116] Kopanaris, *E demosia ygeia*, p.378.

[117] GSAS, YPA, YP917, *Etesia ekthese* (1931).

[118] GSAS, YPA, YP113, Alivizatos, *Ekthesis epi tes ydreuseos* (1929).

[119] Travlos & Kokkou, *Ermoupole*, pp.102-03.

[120] Proios's will can be found in C. Loukos, *Pethainontas ste Syro ton 19o aiona* (*Dying in Hermoupolis in the 19th century*) (Iraklio: Crete University Press, 2000), pp.176-77.

which was responsible for the administration of the hospital until 1954.[121] The hospital functioned under the municipal authority until 1938, when Ioannis Vardakas, one of the board members, donated four million drachmas for the construction of a new hospital, a new dispensary and a lunatic asylum. The name of the hospital was changed from Municipal Hospital *Elpis* (Hope) to the Vardakeio and Proio Hospital of Syros, dedicated to its two main benefactors. Even though its construction started in 1939, the new hospital did not operate until 1958, due mainly to the outbreak of the Second World War and the serious financial problems which followed.[122] By the 1930s, the hospital consisted only of three wards, with a total of 45 beds.[123]

In addition to the hospital, Hermoupolis had a very strong community of physicians since the mid-nineteenth century. Physicians had a continuous prominent presence in the city and also in the local press by publishing monthly or annual reports regarding the deaths which had occurred in the city and by suggesting measures for the improvement of public hygiene.[124] A Medical Association was formally established in Hermoupolis in 1894. According to the Article of Incorporation, the main aim of the Syros Medical Association was the scientific collaboration of members of the medical community through reports and discussions on every medical issue concerning the island and communication with other physicians or associations in Greece or abroad. Meetings of the members were held twice a month and additionally whenever a serious problem arose. The main topics discussed in those meetings were the development of specific epidemics, which occurred in the city, exceptional medical cases, significant medical innovations, and interventions by the Association concerning the lack of public hygiene in Hermoupolis which involved sending letters either to the mayor or to the Prefect of the Cyclades Islands. The main funds of the Association derived from membership fees and donations.[125] From the early twentieth century onwards,

[121] Throughout the period under study, municipal-related issues were among the main priorities of the Hermoupolis local authorities as it is evident in the Minutes of the Municipal Council, such as an increase in the funding: 514, ΙΣΤ, 27 August 1870; about the philanthropists who supported the institution: 790, Ξ, 26 March 1881; the hiring and firing of doctors and midwives: 786, ΝΣΤ, 26 February 1881; 6, 86, 13 December 1900; 46, 126, 19 October 1901; the financial issues of the hospital and its incapacity to provide free medical treatment and medication for poor inhabitants: 534, 201, 8 June 1920; the municipal council had to approve the hospital regulations: 788, 52, 28 July 1936.

[122] N. Leivadaras, *To proto nosokomeio tes epanastatemenes kai eleftheres Elladas sten Ermoupole Syrou 1825* (*The first hospital of revolutionary and independent Greece in Hermoupolis of Syros 1825*), (Aristotle University of Thessaloniki: Unpublished PhD thesis, 2012), pp.31-34.

[123] GSAS, YPA, YP1310/1930-1937, *Etesia ekthese* (1936).

[124] *Panope*, 05/03/1883, 911, IB, p.2; 23/07/1883; 949, ΙΓ, pp.1-2.

[125] *Praktika Iatrikes Etaireias Syrou*.

Hermoupolis, following the tendency of larger municipalities that could afford more physicians, had 25 physicians, and the ratio of physicians to inhabitants in 1902 was 1:881.[126] This is a rather high ratio, especially when compared to rural societies where medical provision was low as most physicians prefered to work in urban centres.[127]

By the early twentieth century, the city also had a municipal disinfection service (*apolymanterio*) from 1904, a municipal health centre, a private French catholic hospital from 1886 (with 24 beds), a hospital for infectious diseases (with 40 beds; it functioned only when an epidemic occurred), and another one specializing in the treatment of smallpox (*eulogokomeio*), a sanatorium and a dispensary both from 1921 onwards. Hermoupolis also had an exceptional number of philanthropic foundations including two orphanages, a foundling hospital (1920-1929), a poorhouse (*ptohokomeio*) and a lunatic asylum since 1908 (*asylo frenovlavon*).[128]

The delay or the inability of the state to enact legislation to establish a welfare system caused the bourgeois inhabitants of the city, often in association with the local authorities, to take action for those in need. Based on this practice, an organisation for the Welfare of Children (*Perithalpse tou Paidos*) was established in Hermoupolis in 1914 with the intention of helping mothers with the care of their children while they were working. Under this initiative, a group of women, using financial aid from the state, the city council or philanthropists, contributed to the daily provision of childcare for those infants and young children whose mothers worked mainly in the city's industries.[129] Another important philanthropic association was the Foundling Hospital (*Asylo ektheton vrefon)*, which was established in 1920 and in 1929 merged with the Hermoupolis Patriotic Foundation for the Protection of Children (*Patriotiko idryma prostasias tou paidiou*).[130] The principal aim of the latter body was the

[126] M. Magkakis, 'O arithmos en Elladi iatron' (The number of physicians in Greece), *Iatrike Proodos*, Z, 19 (1902): It reports that the ratio in Greece was 1:992, on Syros (the whole island) 1:1149, in Athens 1:260, in Piraeus 1:562 and in Patras 1:576; GSAS, YPA, *Etesia ekthese* (1931; 1932; 1936; 1940): 15 or 18 (from 1932 onwards) physicians, 8 dentists, 6 pharmacists and 6 midwives.
[127] Hionidou, 'Popular medicine', p.504.
[128] Not all institutions operated continuously or simultaneously throughout the study period. E. Arfanes, 'E fymatiosis en Syro kai o kat' aytes agon' (Tuberculosis in Syros and its anti-tuberculosis fight), *Syllogos Ygieines Syrou* (*Hygiene Association of Syros*), 1 (1918), pp.4-5; GSAS, YPA, YP112, *Etesia ekthese ygieinomikes katastaseos Kykladon,* (*Annual report on public hygiene in Cyclades*) (1934).
[129] C. Loukos, 'Ethelontikes syssomatoseis gia neous kai apo neous ste Syro kata to proto miso tou eikostou aiona' (Voluntary organisations for young people and run by young people on Syros during the first half of the twentieth century), in E. Avdela, C. Eksertzoglou & C. Lyrintzes (eds), *Morphes demosias koinonikotetas sten astike Ellada tou eikostou aiona* (*Forms of public sociality in twentieth century urban Greece*) (Rethymno: Crete University Press, 2015), pp.67, 72.
[130] Ibid., p.73.

childcare, medical care and protection of lower social class children. Finally, a Near East Relief Orphanage was founded in 1923, which hosted orphans from Armenia and Asia Minor.[131]

3.5 Conclusions

This chapter has presented an overview of public health provision in Greece from the creation of the country until the beginning of the Second World War. In addition, the sanitary reforms which took place in Hermoupolis during the study period have been discussed.

Successive Greek governments rarely undertook initiatives to improve public health in the country. The arrival of refugees from Asia Minor forced the Greek state to address the crisis in public health provision. Until then, local authorities were responsible for the sanitary reforms and health-care of their population. The current study is one of the very few studies in Greece which explores public hygiene at a local rather than at a national level. Public health in Hermoupolis was found to be poor throughout the study period. The implementation of mass vaccinations, especially of the young population of the city, following the 1835 legislation act, was one of the most notable actions taken by the local authorities. In addition, whenever an epidemic occurred in the city, increased measures were taken to deal with those infectious diseases. Evidence from the oral histories and the rich qualitative sources has shown that a water supply system was introduced in the mid-1920s, although sewage disposal changed very little throughout the period under study. Furthermore, health-care was found to be advanced in comparison with other settlements in the country and active philanthropy contributed to the improvement of health-care provision mainly among young children and infants.

The following chapter explores the mortality patterns in Hermoupolis from 1859 to1940 and will examine whether the actions discussed above had any effect on the evolution of mortality in the city.

[131] http://neareastmuseum.com/2015/10/09/syra-the-island-orphanage/ (access in July 2018).

Chapter 4. Mortality patterns in a Greek urban settlement

4.1 Introduction

The aim of this chapter is to explore the pattern of mortality in Hermoupolis for the years 1859-1940. I shall investigate the timing of the decline of mortality and the trends over time along with age-specific mortality levels and expectancy of life at every age-group. This is important for two reasons. First, little is known about the changes in mortality in nineteenth- and early twentieth-century Greece. Second, a demographic approach, as this chapter will show, is vital if we are properly to understand the mechanisms of mortality decline at local and national level.

4.2 Crude death rates

Two parts constitute this section. The first part, based on the existing literature, looks at mortality in a selection of places throughout Greece as a proxy for mortality in the whole country. In the second part, crude death rates (CDR) for Hermoupolis from 1859 to 1940 are presented to examine the mortality patterns in the city during that period.

4.2.1 *Mortality rates in Greece*

In 1960, Valaoras attempted to reconstruct Greek demographic history by using census population data from 1860 to 1965, a period when Greece experienced sharp population changes due to annexation of areas, migration, wars and the influx of refugees. He employed a series of survival ratios in order to link all the successive censuses of Greece and estimated the age-composition of the population for each sex independently.[1] Hionidou has drawn the attention to the fact that these are estimates based on extensive assumptions rather than on actual data and that indirect techniques were employed in the calculations.[2] His work has been the cornerstone for all subsequent historical studies and Hionidou questioned the unchallenged use of Valaoras' figures. Along with Valaoras's estimations, Siampos attempted to reconstruct the demographic history of Greece and made predictions about the

[1] Valaoras, 'A reconstruction', pp.119-20.

[2] According to Hionidou, Valaoras made extensive assumptions, including that the population was stationary, that the preponderance of males in all censuses prior to 1920 was a result of the under-registration of women and not of migration. For an extensive analysis of the limitations of Valaoras's estimations, see Hionidou, *The demography of a Greek island*, p.51; *Istorike kritike anadrome*, pp.40-44.

development of the Greek population.[3] By employing the technique of retrospective projection, Siampos attempted to estimate the levels of age and sex misreporting in all censuses from 1861 until 1961.[4] These two researchers have published the only continuous existing national estimations of demographic trends for the nineteenth and twentieth centuries, including mortality (Figure 4.1 and Table 4.1)

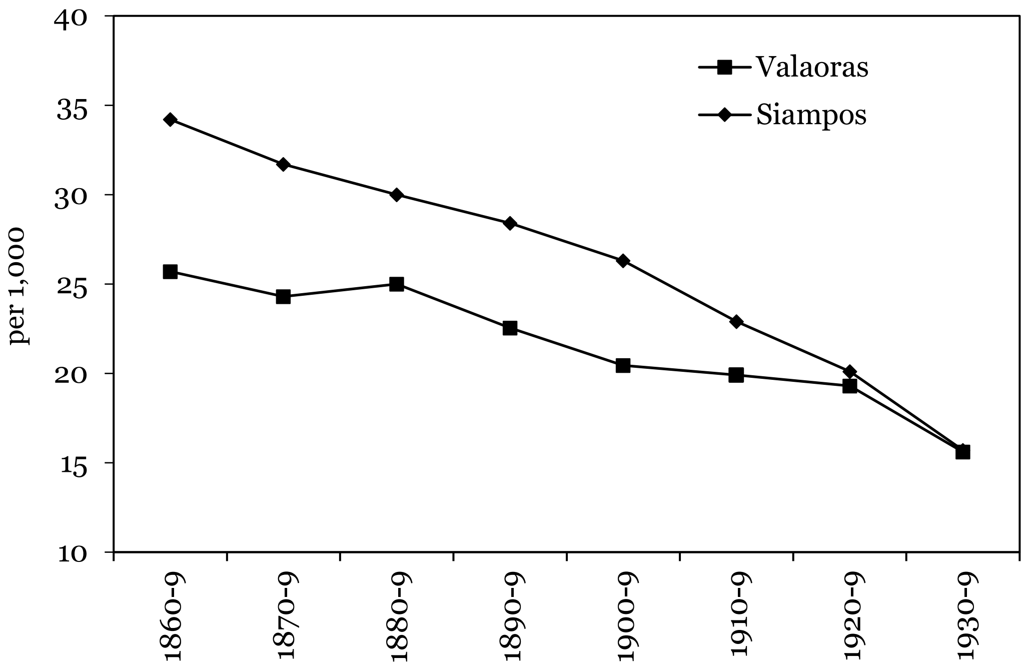
The CDR in Greece was rather high throughout the second half of the nineteenth century, reaching 25.7 and 34 per thousand according to Valaoras and Siampos respectively. At the beginning of the twentieth century, both rates started to show a clear declining trend, reaching 20.5 and 26.3 per thousand respectively. Even though Valaoras did not estimate any rates for the period 1910-1919, he suggested that mortality in the country probably increased. More specifically, he argued that:

> [T]he data suggest a huge mortality among the civilian population, as the result of a widespread food shortage caused by an international blockade as well as of the influenza epidemic which swept the country in 1918-1919. Unfortunately, not even a rough estimate of the volume of these losses is possible, because quantitative data on any of the diverse factors involved are lacking.[5]

Both rates exhibited a diminishing trend over the next two decades. However, Valaoras had estimated higher levels in CDR (21.2 per thousand) during the first five years of the 1920 most likely as a result of the refugee influx, while later on it continued its earlier decline again. Even though both rates clearly presented wide disparities for most of the study period, they agreed that the national CDR was about 15.6 per thousand in the 1930s. This agreement was mainly due to the improvement in the quality of the published mortality data, whereas prior to 1930 each author had to make assumptions to fill missing data.

[3] Siampos, *Demographike ekseliksis*, p.1.
[4] Ibid., pp.50-56; Moustane, *Oi demographikes ekselikseis*, pp.39-41.
[5] Valaoras, 'A reconstruction', p.127; Gavalas, *Demographic reconstruction*, p.78.

Figure 4. 1 CDRs in Greece according to Valaoras and Siampos, 1860-1939



Note: The rate in 1910-9 in Valaoras's estimates was estimated by the current author using the average rate of the previous and the next decade. It is shown here for visual purposes.
Sources**:** Valaoras, 'A reconstruction', p.132; Siampos, *Demographike ekseliksis*, p.20.

Table 4. 1 CDRs in Greece, 1860-1939, according to Valaoras and Siampos

Years	*Valaoras*	*Siampos*
1860-69	25.7	34.2
1870-79	24.3	31.7
1880-89	25.0	30.0
1890-99	22.6	28.4
1900-09	20.5	26.3
1910-19	-	22.9
1920-29	19.3	20.1
1930-39	15.6	15.7

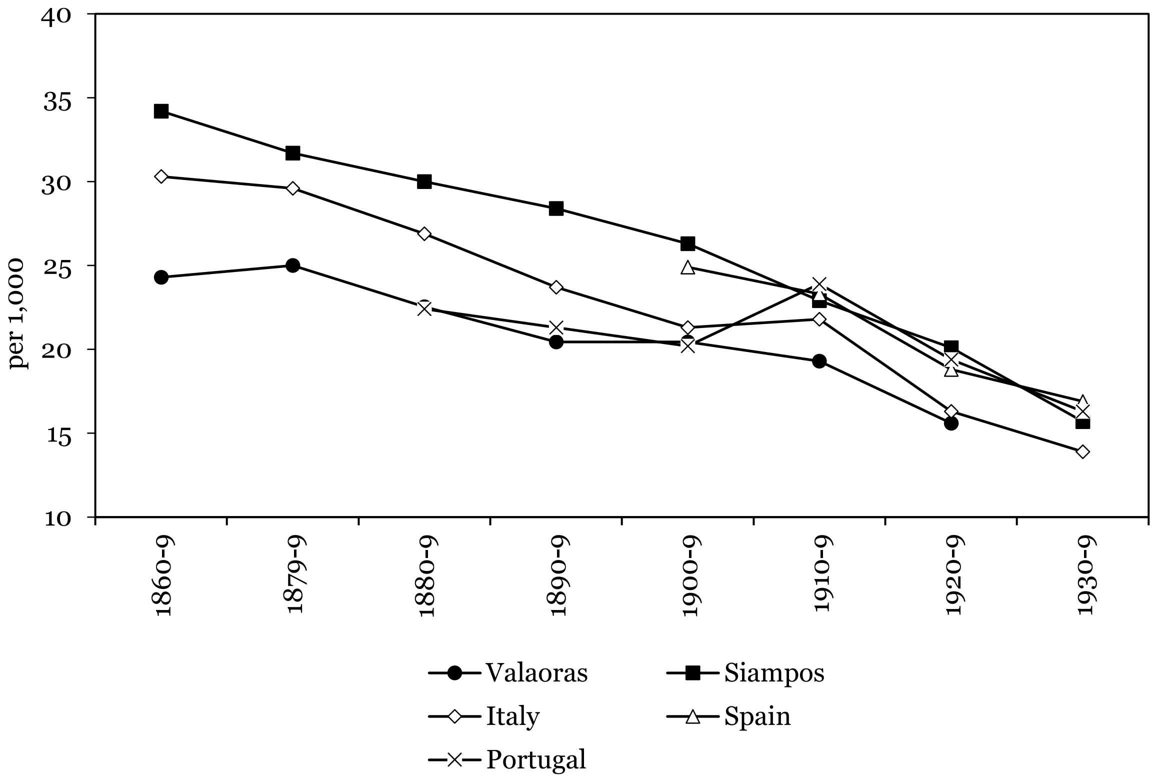
Note**:** Valaoras's rate in 1920-9 was estimated by the current author using the median rate of 1920-1924: 21.2 and 1925-9: 17.4.
Sources: Valaoras, 'A reconstruction', p.132; Siampos, *Demographike ekseliksis*, p.20.

Figure 4.2 compares Valaoras's and Siampos's rates with those in Italy, Spain and Portugal for the late nineteenth and early twentieth centuries.[6] Those countries were chosen for comparison as it is expected that similar trends would have taken place in all four countries at the same time due to geographical location, proximity and similar

[6]A. Monnier, 'L'Italie, l'Spain et le Portugal: situation démographique', *Population,* 35, 5/5 (Jul-Oct 1980), p.929; Dimitropoulou, *Athènes au XIX^{e} siècle*, pp.103-04.

climatic conditions. Valaoras's rates seem to be the lowest, whilst Siampos's rates were the highest among all rates for most of the time. More specifically, the Italian rate was consistently lower than the rate estimated by Siampos, whereas the Spanish and the Portuguese rates were the most similar to those of Greece. All the rates showed a clear declining trend already from the beginning of the twentieth century. By the late 1930s, the discrepancies among the rates had decreased significantly. It is therefore expected that similar reasons would have contributed to the mortality decline in all four countries. Evidence from Spain has shown that the key reason for the decline in overall mortality was the decline in childhood mortality and a similar explanation has been put forward for Italy.[7] Age-specific mortality rates will show whether the decline in childhood mortality was equally significant for Greece and specifically for Hermoupolis.

Figure 4. 2 CDRs in Greece, Italy, Spain and Portugal, 1860-1939



Sources: Valaoras, 'A reconstruction', p.132; Siampos, Demographike ekseliksis, p.20; Monnier, 'L'Italie, l'Spain et le Portugal', pp.103-04.

Apart from the national estimates, there are also a significant number of studies which have examined mortality patterns at the local level. Nevertheless, most of them have

7 Pozzi, 'The determinants of infant', p.77; Ramiro & Sanz, 'Childhood mortality', p.242.

examined mortality using rather simple measures such as CDR and at times the data is of questionable quality.

Dimitropoulou estimated the CDR for Athens in the second half of the nineteenth century using civil registration sources.[8] Birth and marriage under-registration, according to Dimitropoulou, was widespread in Athens.[9] Mortality was high, but not higher than the national rate estimated by Siampos for that time. More specifically, according to Dimitropoulou's estimates, CDR in Athens ranged from 17.6 to 29.6 in the period 1861-1907, with the lowest rates in the 1880s resulting from missing parts of the manuscript logbooks.[10] Similar levels to those of Dimitropoulou were estimated by Garden and Bournova, who used the vital statistics of the annual movement of the population for the years 1864-1883 in order to examine the demographic trends of the entire district of Attica, which includes Athens. They argued that the rapid expansion of the population of Athens, which doubled from 42,000 to 84,000 in the period 1860-1885, was a result of in-migration which balanced out the high mortality levels of the capital, 27.2 per thousand in the early 1880s. According to their estimates, those high levels were not found in the surrounding areas such as Piraeus (25 per thousand) or rural areas around Athens (15.4 per thousand), most likely because of rural-urban disparities. Finally, they argued that rural mortality in Attica might have already started to decline by the late nineteenth century.[11]

A more recent study by Bournova has also explored mortality levels in Athens in the first half of the twentieth century. She argued that even though a declining trend in mortality levels was observed over the period 1860-1960, a distinct decline in mortality started in the 1930s. Infant mortality was mainly responsible for the fluctuations in mortality in Athens, although under-registration of infant deaths is likely to have been responsible for the decline in 1923. Bournova also suggested that the mortality decline in Athens from 23.7 in 1928 to 19.77 in 1934 and ultimately to 15 per thousand in 1940 was a result of the improvement of public health due to the

[8] Dimitropoulou, *Athènes au XIX^e siècle*, p.104.
[9] M. Dimitropoulou, "'Enopion emou tou Leksiarchou tes poleos Athenon'. Demographikes symperifores sten Athena tou 19ou aiona' ('In front of me, the Registrar of Athens'. Demographic behaviour in Athens during the second half of the nineteenth century), in *International conference of economic and social history: New perspectives in theory and empirical research* (Athens: Publications of the Faculty of Philosophy, University of Crete/Alexandria, 2008), p.34.
[10] Dimitropoulou, *Athènes au XIX^e siècle*, p.104.
[11] M. Garden & E. Bournova, 'O plethysmos tes Athenas kai tes gyro periohes kata to 2o miso tou 19ou aiona' (Population of Athens and the region around during the second half of the 19th century), *Istorika*, 43 (2005), pp.389-94.

foundation of philanthropic institutions and hospitals, which stopped the mortality increase following the influx of refugees from Asia Minor.[12] However, as discussed in Chapter 3, the effect of such improvements has not been studied yet and therefore no concrete links can be made yet.

Overall, the main weakness of all the studies which have dealt with issues relating to the mortality levels in Athens is that none of them has attempted to correct the figures by taking into consideration the extensive under-registration of births and deaths in the calculation of mortality levels in the capital. The calculation of the real mortality levels of Athens would therefore be a productive area for further study in the future.

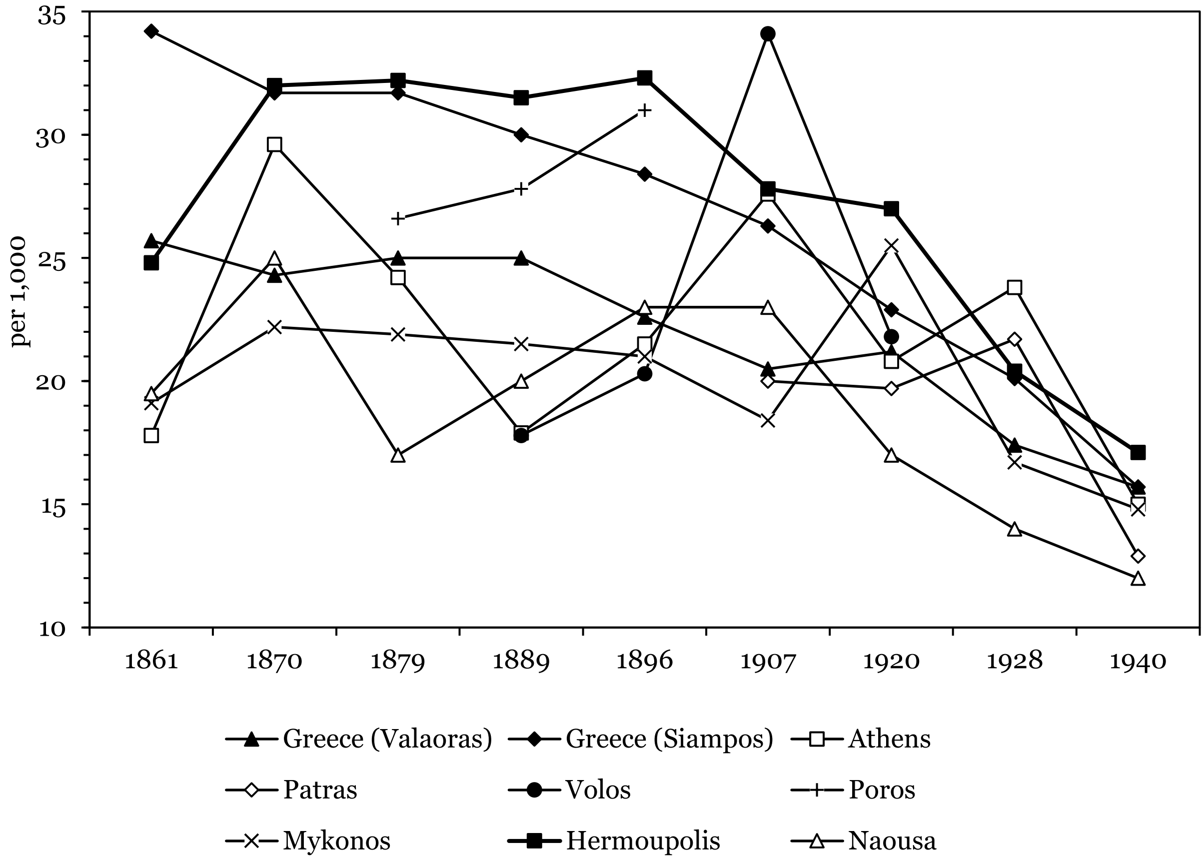
In a study focusing on the social and economic structures of Patras (the fourth largest city in Greece and a major port), Eliopoulos explored mortality trends from 1900 to 1940.[13] Eliopoulos calculated the CDR in Patras in every census year by using civil registration data although, as will be explained in Chapter 5, under-registration – especially of births –was rather high in the city during the study period. According to his estimates, CDR was lower than the rate in Athens and the national rates derived by Siampos (Figure 4.3). Eliopoulos suggested that the slight increase in CDR in 1920 resulted from the arrival of the refugees, whereas in 1928 it was due to an epidemic of dengue fever and its complications. Finally, he argued that CDR declined in the 1930s as a result of the control of infectious diseases along with improvements in standards of living.[14]

Furthermore, Moustane investigated the mortality patterns in the city of Volos (one of the largest urban centres in the country and a port) from 1889-1922 in a study focusing on the demographic profile of the city.[15] Although death registration seems to be continuous and complete, births and marriages were not reported until 1911. According to her estimates, CDR in Volos in the late nineteenth century was much lower than any other estimated rate at the time. CDR then increased dramatically to the highest rate in the country in the first decade of the twentieth century, reaching 34.1 per thousand (Figure 4.3). Moustane argued that the extremely high rate in 1907 is likely to have been a result of incomplete death registration around the census year and also of the arrival of refugees in the city.[16] In addition, mortality levels in Ioannina

[12] Bournova, *Oi katoikoi ton Athenon*, pp.76-8.
[13] Population in Patras increased from 51,932 in 1907 to 79,570 in 1920.
[14] Eliopoulos, *Oikonomikes kai koinonikes domes*, pp.103-13.
[15] Population of Volos city (Municipality of Pagason) increased from 11,029 in 1889 to 30,046 in 1920.
[16] Moustane, *Oi demographikes ekselikseis*, pp.206-07.

have only been calculated annually using civil registration data from 1913 (16,804 inhabitants) to 1923 (around 21,000), although for some years either there are no available records or the existing ones are very fragmentary. CDR is therefore available only for the years 1918-1923 and seems to be lower than the national levels (16.6-19.9 per thousand) except for 1918 (41.8) and 1923 (31.3) due to the influenza pandemic and the refugee influx respectively.[17]

Figure 4. 3 CDRs in several places in Greece, 1861-1940



Sources: *Greece*: Valaoras, 'A reconstruction', p.132; Siampos, *Demographike ekseliksis*, p.20; *Athens*: Dimitropoulou*, Athènes au XIX^e^ siècle,* p.104; Bournova, *Oi katoikoi ton Athenon*, p.77; *Patras*: Eliopoulos, *Oikonomikes kai koinonikes domes ,* p.103; *Volos*: Moustane, *Oi demographikes ekselikseis*, pp.206-7; *Poros*: Tolis, *Demographikes opseis*, pp.156, 164-67; *Mykonos*: Hionidou, *The demography of a Greek island*, p.50; *Paros*: Gavalas, *Demographic reconstruction*, pp.223-24; HMD.

Mortality rates have also been calculated for a few island communities. The first study focused on demographic aspects of the island of Poros (with of population of less than 5,000 inhabitants), using civil registration sources for the period 1879-1900. CDR in Poros was amongst the highest in Greece, as Figure 4.3 shows.[18] Even though Tolis

[17] M. Pappa, *Nosoi kai thnesimoteta: to paradeigma ton Ioanninon* (*Diseases and mortality: the case of Ioannina*) (University of Ioannina, MSc dissertation, 2009), pp.14-25.
[18] Tolis, *Demographikes opseis*, pp.156, 164-67.

calculated annual mortality rates, those presented in the figure have been derived using the two-year average number of deaths for the rate in 1879 and the three-year average number of deaths for the other two rates in 1889 and 1896.

The next two studies are of special importance because they are the only existing studies which employed the method of family reconstitution to reconstruct the demographic changes in the populations of two small Greek islands. Hionidou explored the case of Mykonos, a neighbouring Cycladic island with a population not exceeding 5,000 inhabitants throughout the period under consideration (1859-1959). Hionidou's work is significant since the population of Mykonos combined a small urban and a rural settlement on the island. Following Hionidou's study, Gavalas reconstructed the population of the rural communities of Naoussa and Kostos on Paros, another Cycladic island, from 1894 to 1998; however, for the period 1914-1931 data refer only to Naousa. The mean population of the communities together was 1,900 inhabitants for most of the study period.[19]

For reasons relating to limitations of the family reconstitution method, both Hionidou and Gavalas calculated infant and childhood mortality rates and CDRs throughout the study period, although age-specific deaths were calculated only for limited number of years.[20] In both studies, CDR was mainly compared with the national estimates prepared by Valaoras in order to situate those communities within the national context. According to Hionidou's calculations, CDR in Mykonos was significantly lower than the values given by Valaoras for Greece during the second half of the nineteenth century. In the first half of the twentieth century, the difference diminished and they presented similar values, apart from 1920 when the CDR of Mykonos significantly exceeded that estimated by Valaoras.[21] In Paros, Gavalas used seven-year moving averages instead of annual CDRs. Gavalas also argued that "the absence of extreme fluctuations and the fact that the CDRs in the beginning of the observed period oscillate at 25 per thousand, indicate that we have to do with populations already undergoing the first stage of demographic transition".[22] CDR in Naousa, a community on the island of Paros, showed similar values to those given by Valaoras, but this trend is not particularly clear because of the gap in Valaoras's estimations for

[19] Gavalas, *Demographic reconstruction*, p.41.
[20] Ibid., p.224; Hionidou, *The demography of a Greek island,* p.121.
[21] Hionidou, *The demography of a Greek island,* p.121.
[22] Gavalas, *Demographic reconstruction*, p.78.

the period 1909-1920. Finally, CDR had started to decline continuously from the 1920s (Figure 4.3).[23]

4.2.2 *Mortality levels in Hermoupolis, 1859-1940*

CDRs in Hermoupolis were calculated using civil registration sources around the census years. They were calculated by simply dividing the three-year average number of deaths around the census year by the mid-year population of that year. The results are presented in Table 4.2 and Figure 4.4.

It seems that CDR followed an increasing trend during the second half of the nineteenth century, reaching a peak of 32.3 per thousand in 1896, whereas from the beginning of the twentieth century CDR started to decline gradually, as it fell almost by five points in 1907. The gradual improvement of civil registration along with the decline of Hermoupolis's population towards the end of the nineteenth century might have contributed to some of the fluctuations of the CDR. In 1920, CDR seems to have stabilised at levels around 27 per thousand. If 1919 is excluded from the calculation and instead the two-year average number of deaths is used for the calculation of the rate in 1920, the declining trend appears to be continuous. This decision was made due to the significant increases in mortality in 1918 and 1919 due to the influenza pandemic which affected Hermoupolis too. In 1928, CDR fell by seven points, the steepest ever decline to take place in Hermoupolis. Finally, by 1940, the death rate improved strongly, reaching 17 per thousand.

Table 4. 2 CDR for every census year, Hermoupolis, 1859-1940 (per 1,000 population)

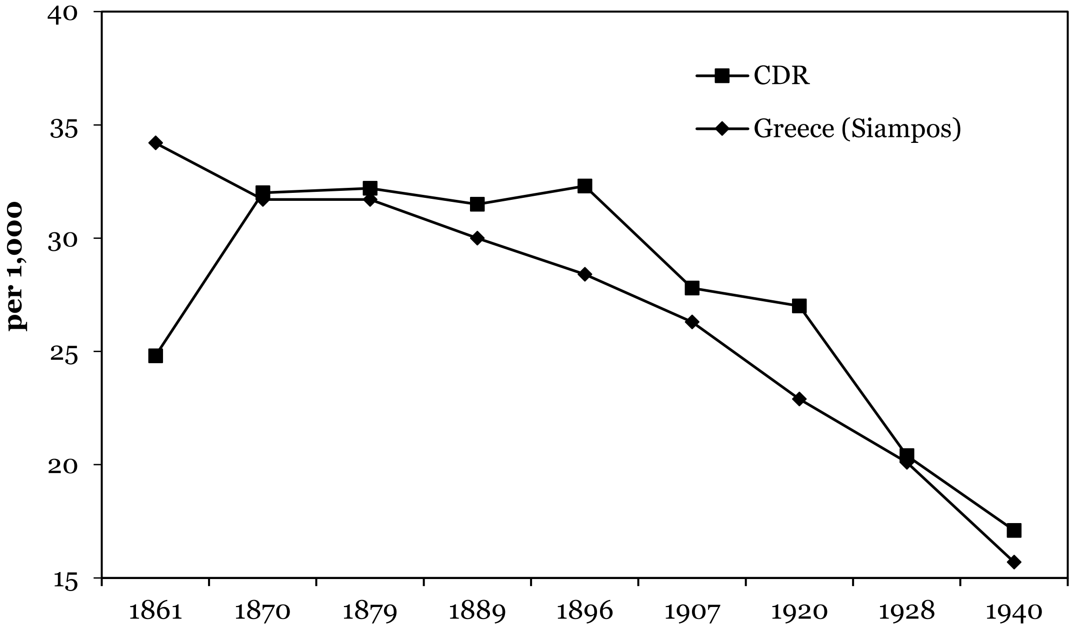
Year	*CDR*
1861	24.8
1870	32.0
1879	32.2
1889	31.5
1896	32.3
1907	27.8
1920	27.0
1928	20.4
1940	17.1

Note: The rate was calculated using the three-year average number of deaths around the census year, apart from the CDR in 1940, for which the two-year average number of deaths was used.

Source: Calculated by the author using HMD.

[23] Ibid.

Figure 4. 4 CDR Hermoupolis (excluding 1919)



Sources: Siampos, *Demographike ekseliksis*, p.20; HMD.

Figures 4.3 and 4.4 clearly show that Hermoupolis experienced very high mortality levels in the nineteenth century and the first decades of the twentieth century. CDR in Hermoupolis seems to have been consistently higher than any other rate that has been calculated in Greece. The only exceptions were the rates in Volos in 1907 and Athens in 1928, although the rate in Volos was a product of incomplete registration and that in Athens the result of the influx of refugees from Asia Minor, which affected the population of the capital extensively. Furthermore, if the mortality pattern in Hermoupolis is compared with that of Athens, it is observable that at the turn of the twentieth century, CDR declined in Hermoupolis whereas the Athenian rate seems to have increased significantly. This was the time when the development and urbanisation of Athens was taking place, whereas in Hermoupolis it was the period of the major financial and commercial decline which occurred on the island; the reasons for this were explored in detail in section 2.2. Internal migrants, mostly males, made a large part of the Athenian population at the time whilst in Hermoupolis in-migration was rather low.[24] Mortality analysis by age and sex will explore whether male death rates exceeded those of females and also which age-groups were affected the most by the high levels of mortality in the city; however, such calculations are not yet available for Athens.

[24] Bournova, *Oi katoikoi ton Athenon*, pp.65-6.

When Hermoupolis's CDR is compared with the national rates published by Siampos and Valaoras, it seems that, from the 1870s onwards, the rate in Hermoupolis was consistently higher than both rates throughout the study period. In 1928, Hermoupolis's CDR declined to levels much closer to those estimated by Siampos, and by 1940 the disparities had diminished, reaching very similar levels.

These high CDR levels in Hermoupolis can be compared with some of the unhealthiest industrial cities in Europe. Similar mortality patterns also occurred in nineteenth-century English and German cities and towns, where the rates declined to much lower levels by the beginning of the twentieth century. Important examples are those of Munich in Germany, and Liverpool and Manchester in England, whose CDR levels were even higher than those of Hermoupolis in the mid-nineteenth century, but by the first decade of the twentieth century their mortality rates had declined to under 20 per thousand, unlike Hermoupolis, where the levels stayed high until the 1920s.[25]

The much higher rates which were found in all urban centres in Greece compared with the rates in Mykonos, Naousa and Poros which represent mostly rural or semi-urban populations, provide strong evidence that the 'urban penalty' was operating especially harshly in the second half of the nineteenth century. The urban-rural differences were a result not only of the high levels of mortality in the urban centres but also of the high under-registration in most rural areas. However, it should be noted that in Mykonos, civil registration was found to be of a very high standard, as it was a semi-urban population.[26] Another reason responsible for the observed urban-rural differences may have been the existence of hospitals in the urban centres, which paradoxically increased the number of deaths in the cities; the rural population needed to travel to health institutions in the cities in order to have access to health care. Evidence from London and several urban centres in Spain, such as Toledo and Salamanca, demonstrates that a significant percentage of deaths registered in those cities were actually the deaths of rural residents.[27] This phenomenon is expected to have affected mostly Athens from the early twentieth century onwards due to the very rapid urbanisation, but for Hermoupolis it is not known yet whether this factor did affect the high mortality levels in the city. Information on the residence of the deceased in the Hermoupolis death registers shows that only a very limited percentage of them

[25] Vögele, *Urban mortality change*, p.37.
[26] Hionidou, *The demography of a Greek island*, p.123.
[27] Ramiro, 'Mortality in hospitals', p.405; Mooney *et al.*, 'Patient pathways', p.247.

were not residents of Hermoupolis, although such information is missing in 41 per cent of all the deaths registered. Evidence from death registration is not possible to show whether residents from the rest of the Cyclades would have travelled to Hermoupolis in order to receive medical care. Oral histories suggest that the Catholic population of the island would go first to the Galliko [French] hospital situated in Ano Syros, and then to the Hermoupolis's hospital.[28] But in any case, when they died, their deaths were registered in Ano Syros as they were buried in the Catholic cemetery. In the twentieth century, most patients would go to health institutions in Athens, which were believed to be better than the provincial ones.[29] Further research in the hospital records, which are almost continuously available since the creation of the hospital, will shed more light on whether patients from other parts of the island or from other islands used the hospital and, if so, to what extent they influenced the mortality levels of the city.

Increasingly unhealthy urban conditions due to growth of the cities along with low public health prevented mortality rates from declining.[30] This is more likely to have been the reason for the high mortality levels in the major urban centres in Greece during the period under study. As discussed in the previous chapter on public health, very limited improvements in public health took place in the country, at least before the mid-1930s. This is the time when the urban penalty seems to have gradually disappeared as the urban- rural mortality gap closed, but also the quality of the published mortality data improved.

The question which therefore arises is why the decline in mortality started at the beginning of the twentieth century and why did it also further decline in the 1930s, not only in Hermoupolis but also in the whole country. It seems that improvements in public hygiene and health (including the introduction of water supply system in the mid-1920s) did not initiate this downward trend but might have contributed to its stabilisation in the 1930s. Cause-specific mortality analysis will explain whether those improvements affected the urban disease panorama at the local level of Hermoupolis. A discussion of the main findings and those reasons that may have contributed to the decline in mortality in Hermoupolis during the study period will take place in Chapter 10, which will take into account all the different aspects of the mortality analysis. More

[28] No.22 (Female, lived in Vari, Syros, married in 1945; she and her husbands were farmers).
[29] V. Hionidou, '"It was a bridge from life to death": Hospitals during the Food Crisis, Greece 1941-1944', *Social History of Medicine*, 22, 2 (2009), p.365.
[30] Ramiro & Oris, *New approaches to death*, pp.5-6.

specific rates, as will be explained in the next section, will help to explore more effectively the mortality patterns which occurred in Hermoupolis over the period under study, which specific age-groups were more at risk and which age-groups benefited from the calculated mortality decline. Since CDR does not take into consideration the age distribution of the population, age-specific rates will be calculated by constructing life tables.

4.3 Life tables

In order to examine the overall mortality levels and the e_0 over the period under study it is fortunate that the available data permit the construction of life tables. Mortality decline can be explored more accurately as an age-specific phenomenon because the mortality rates of different age-groups declined at different times. The main reason for this is that age is related to the probability of dying (the likelihood that a person of age x will die before reaching the age $x + n$) because it is connected to the biological process of ageing and signifies the aggregation of harmful effects from prolonged exposure to risks in the past. However, age is not an independent cause of an individual's state of health, but instead serves as indirect evidence for other variables which cannot be observed directly.[31] Moreover, adult mortality is partly determined by the risk factors experienced in the first years of life, as high early mortality can either influence all members of a cohort or selectively eliminate only the weakest members.[32]

Finally, life expectancy is the most reliable measure of the mortality conditions between populations over time. It enables us to make reliable comparisons between different times and places because it takes into consideration the age-structure differences, which are ignored when alternative measures of mortality such as the CDR are used.[33]

4.3.1 *Construction of life tables*

For the purposes of this current study, abridged life tables were constructed around the census years. Ages were grouped at 0, 1-4, 5-9, 10-14 and so on until the final 75-plus age-group is reached. Two sets of data were used to calculate conventional life tables: first, the mid-year age-structure of the population (by the age-groups defined

[31] G. Caselli & R. Capocaccia, 'Age, period, cohort and early mortality: an analysis of adult mortality in Italy', *Population Studies*, 43, 1 (1989), p.142.
[32] Ibid.
[33] Szreter & Mooney, 'Urbanization, mortality', pp.86-87.

above) in a census year; second, the three-year average number of deaths in each of these age-groups around the census year.

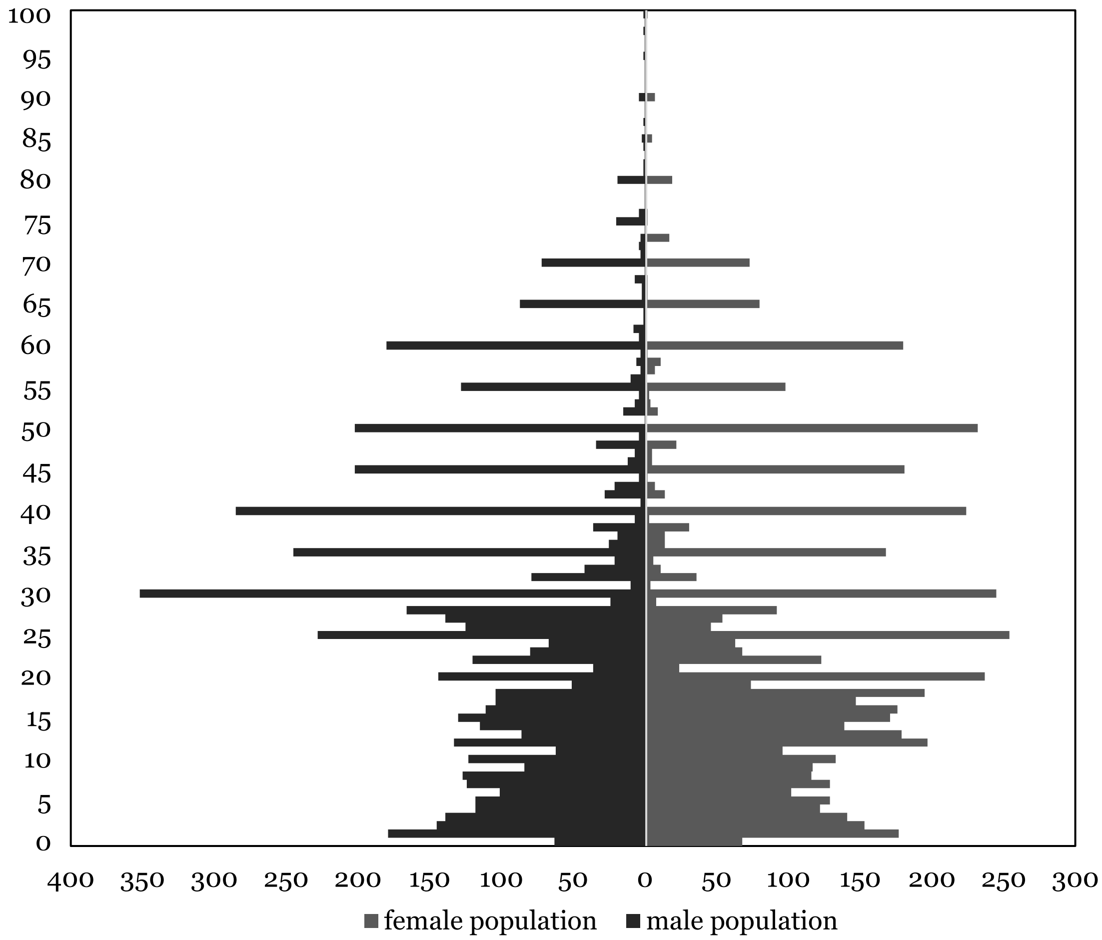
The available data during the period under study includes the 1861, 1870 and 1879 enumerated age-structure from the nominal census records which are available; the 1861 and 1870 published age/sex structure; the 1879 published age-structure for males and the 1907, 1920 and 1928 published age/sex structures.[34] The main problems to overcome in order to use these data are the unconventional age groupings used in the published data and the lack of coverage of the whole population for some of the years. In 1861, the published age-structure was grouped by 0 to 18, 18-25, 25-30, 30-40, 40-50 and so on. Therefore, the nominal municipal censuses, as described in section 2.3.1, were used instead of the published age structure. For 1870 and 1879, the published data were grouped at less than one, 1 to 5, 5 to 10, 10 to 15 and so on. These, according to the current terminology, would be expressed as less than one, 1 to 5, 6 to 10, 11-15 and so on. This becomes apparent from the available published data for 1879, in which the male population is given by single years of age up to the age of 30, whilst in 1907, the age-structure is given by single years of age up to the age of 34. So, in order to adjust the age-groups according to the current demographic conventions, graduation of the age-structures was employed.[35] In 1920 and 1928 there were no similar issues since ages were grouped conventionally. Finally, it should be noted that it was not possible to calculate life tables for each census year due to the problems affecting the sources. For 1889, only figures of the population for each administrative unit were published. In 1896, all the census returns were destroyed in a fire, so in 1897 only some rudimentary enumeration reports were published.[36] The 1940 census material was never analysed because the country was occupied in 1941.[37]

Another important problem which arises during the analysis of the published vital registration data is age misreporting. Age misreporting can create some difficulties. The pattern of age misreporting for 1861 is shown in Figure 4.5. It suggests that strong preference was shown to ages ending in ‘0’ and ‘5’, although it seems that there was an

[34] Dr Hionidou provided the age-structure of Hermoupolis for the years 1861, 1870 and 1879, since the nominal census records have been inputted into a database, see section 2.3.1.
[35] This method was first employed by Hionidou for the construction of life tables on Mykonos: Hionidou, The *demography of a Greek island*, pp.144, 146.
[36] *1907 Census*, vol.1, pp.*ιβ-ιγ*.
[37] Valaoras, ‘National primary socio-economic’, p.345.

equal distribution of all ages below 30 for both sexes. The use of five-year age-groups is expected to minimise this problem.

Figure 4. 5 Age/sex pyramid by single year of age, Hermoupolis, 1861



***Source*:** 1861 nominal municipal census. Based on 11,082 out of 18,044 inhabitants.

The most frequent example of age misreporting which researchers encounter in all early Greek censuses is the under-reporting of the 18 to 24 ages among males because these were the ages at which they were eligible for military service.[38] Hionidou was able to detect the extent of age misreporting in Mykonos by comparing the published data with those derived from enumerators' books, but only for the first three censuses.[39] Such comparisons are not possible for Hermoupolis because the enumerated age-structure is only partly available. Finally, no extensive death under-registration of infants (infants aged less than twelve months reported as being one year older) is evident in the Hermoupolis data at least around the census year, as the

[38] Siampos, *Demographike ekseliksis*, p.55; A. Mansolas, *Politeiographikai plerophoriai peri Ellados* (*Statistical information concerning Greece*) (Athens: National Press, 1867), p.15.
[39] Hionidou, *The demography of a Greek island*, pp.144-45: Hionidou constructed life tables in 1861, 1870 and 1870 only for males.

linking practice has shown. But even if there were under-registered infant deaths in Hermoupolis, it was not sex-specific since similar rates for both sexes under one year are observed in Figure 4.5. Under-registration of infant deaths was observed by both Gavalas and Hionidou as a limitation in their calculation of the nineteenth-century life tables.[40]

In order to calculate the life table for 1861, the enumerated age-structure was used, even though this was only available for two thirds of the population, that is, 11,082 out of a total of 18,044. For this reason, it is assumed that the available age-structure of the nominal census population is representative of the whole population. This is considered a valid assumption because the inhabitants were registered in alphabetical order (according to the household head's surname). The 'full size' of each group was estimated by using the ratio of each age-group divided by the population given in the two surviving manuscripts (11,082) and then multiplied by the whole population (18,044).

Because the age grouping used in the published data is not the conventional one for the years 1870, 1879 and 1907, the age-structures underwent graduation by employing the quadratic re-orientation of age-group method.[41] This graduation gave us the population by single years which were regrouped to the conventional age-groups. For the 1870 and 1879 male age-structure, the initial grouping was used to obtain the population by single year of age. Another deficiency in the data is that in 1879 the published age-structure is only available for males. However, an attempt was made to construct the age-structure for females using the enumerated age-structure, which is available for part of the population. As the life table for females in 1879 is based on multiple assumptions, care needs to be taken in its interpretation. One of the two manuscripts of the census has survived, recording the entries 6856-13052. Inhabitants in 1879, as in 1860, were listed in the manuscript in alphabetical order. Only a part of the entries from the enumeration is available, 3,130 males and 3,045 females, whilst in the published sources the number of males is 10,716 and that of females 10,824. In order to calculate the size of each age-group, the ratio of each female age-group as calculated by using the nominal census was multiplied with the total number of women. Comparisons of the male age-structure between the two sources showed very

[40] Ibid; Gavalas, *Demographic reconstruction*, p.82.

[41] N. Carrier & J. Hobcraft, *Demographic estimation for developing societies* (London: Population Investigation Committee, 1971), pp.16-17, 55-57 and Table D, p.204.

similar results, and therefore it was assumed that the estimated age structure of the 1879 female population is representative of the actual female population.

The second dataset used in the construction of the life tables was the registered deaths classified by reported age at death. The three-year average number of deaths in each of these age-groups around the census year was used in order to eliminate erratic fluctuations. Hermoupolis civil registration data, and especially the death records seem to be reasonably accurate with no special evidence of under-registration. Finally, it should be noted that for the calculation of every life table the linked IMR, as it will be analysed in section 5.3.1, was used as q_0.

The complete life tables for each census year can be seen in the Appendix and the results of those calculations are explored in the next two sections.

4.3.2 *Patterns of age-specific mortality*

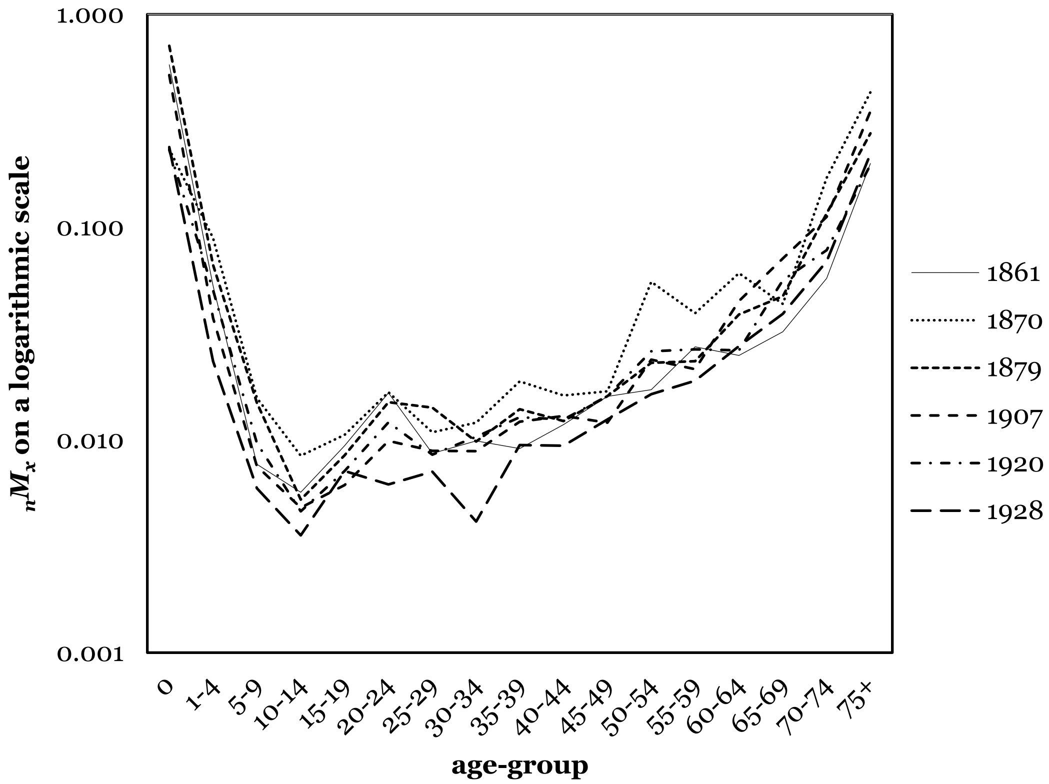
Through the use of life tables, age-specific death rates (ASDRs hereafter) were calculated using a technique which is often called 'survival analysis', which involves calculating mortality from the number of deaths in a specific age-group related to the population at risk of the same age-group.[42] However, the general observations concerning the age-specific mortality trends which follow can only be fully appreciated in the light of the cause-specific analysis presented in Chapter 6. ASDRs provide a platform upon which it can be observed how age-specific profiles interact to understand the life chances of the Hermoupolis population.

In Figures 4.6-4.8, age-specific death rates *nMx* for both sexes, then males and females separately, are plotted. The generally expected U-shaped curve of the death rates is clearly seen. Concerns may be raised about the reliability of the figures in the 1870s, when relatively low infant mortality is coupled with relatively high childhood mortality. The noteworthy raised male mortality in the age-group 20-24 in the nineteenth-century censuses is almost certainly to a great extent the result of age-misreporting. Even though the real age was reported in death registers, males avoided to report ages between 18 and 24, because these were the ages at which they were eligible for military service. Other studies have also identified significant survival disadvantages for men during young adulthood. Occupational risk, especially for industrial workers, and biological differences between men and women in their immunological responses due to the high prevalence of infectious diseases over the

[42] C. Newell, *Methods and models in demography* (New York: Guilford Publications, 1988), p.67.

past centuries have been suggested as likely reasons for the high levels of male mortality.[43]

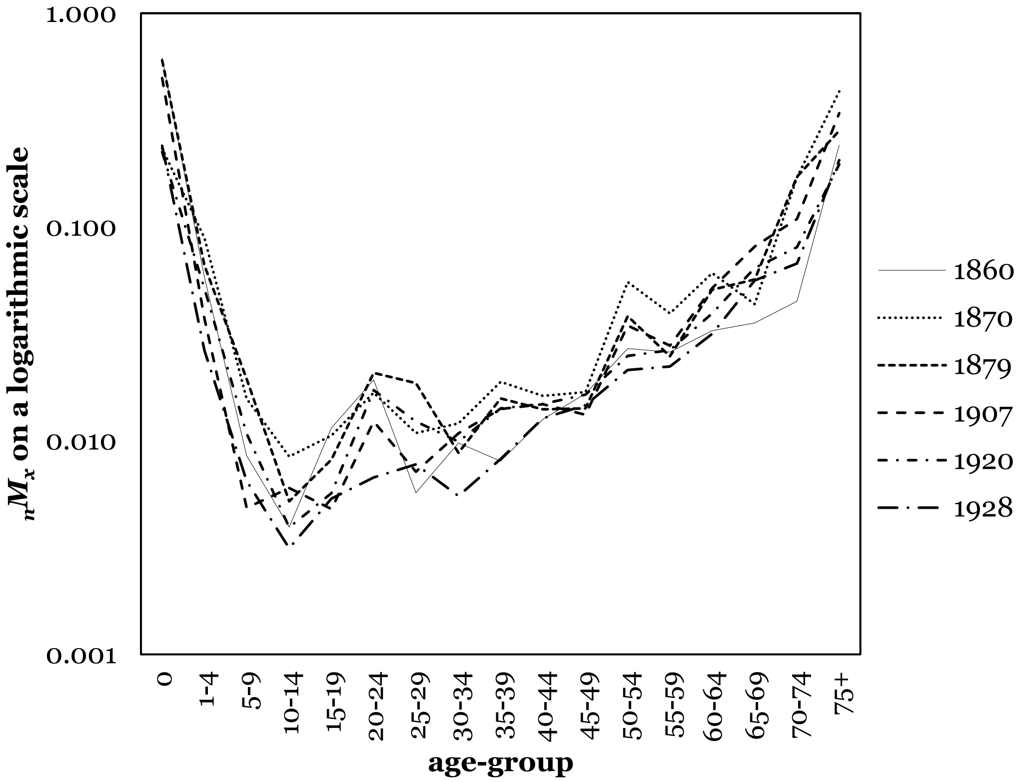
Figure 4.6 Age-specific death rates (nMx) for both sexes, Hermoupolis



***Source*:** Calculated by the author using HMD.

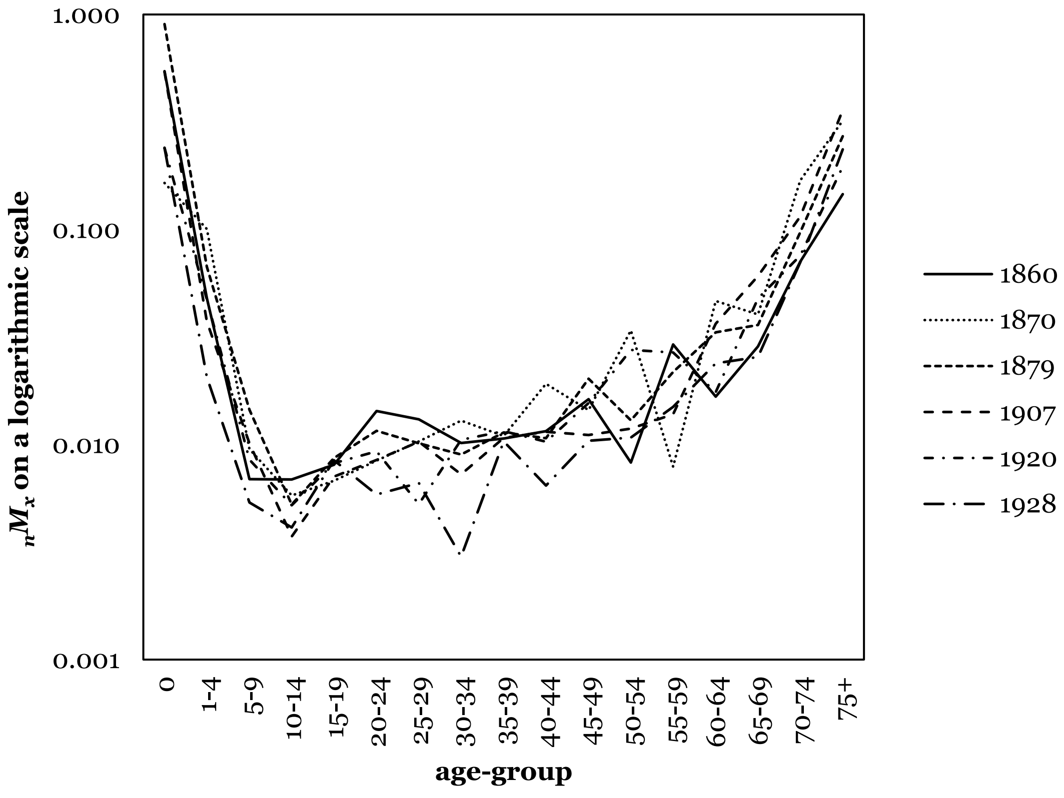
[43] M.M. Weden & R.A. Brown, 'Historical and life course timing of the male mortality disadvantage in Europe: Epidemiologic transitions, evolution and behavior', *Social Biology*, 53, 1/2 (2006), p.76; T. Gage, 'Population variation in cause of death: level, gender, and period effects', *Demography*, 31, 2 (1994), p.273; O. Wisser & J.W. Vaupel, 'The sex differential in mortality: a historical comparison of the adult-age pattern of the ratio and the difference', MPIDR Working Paper (Rostock: MPIDR, 2014), p.2.

Figure 4.7 Age-specific death rates (nMx) for males, Hermoupolis



Source: Calculated by the author using HMD.

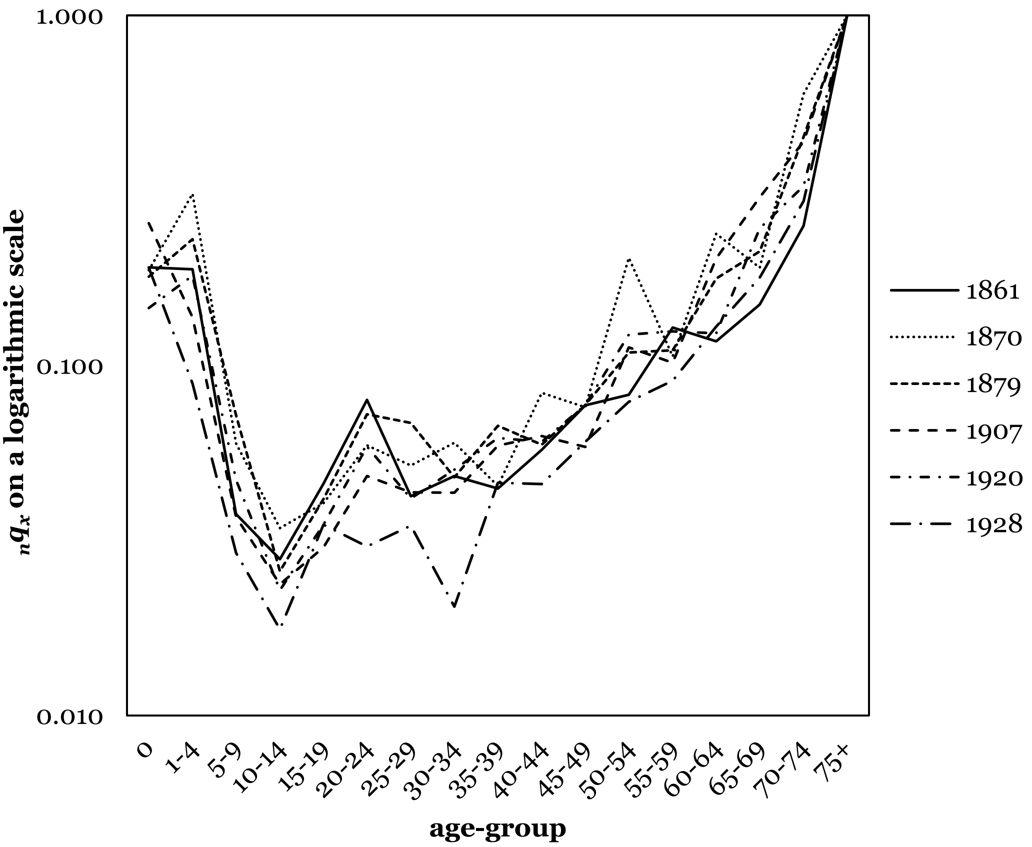
Figure 4.8 Age-specific death rates (nMx) for females, Hermoupolis



Source: Calculated by the author using HMD.

Figure 4.9 illustrates the trends in age-specific mortality for all ages and Figures 4.10, 4.15 and 4.16 show the patterns in specific age-groups. The curve of the probability of dying ($_nq_x$) in Figure 4.9 takes on the shape of a 'tick' when plotted on the graph, although a number of remarkable patterns are evident.[44] Of all age-groups, $_5q_{10}$ exhibits the lowest levels of probability of dying, but after that age, there is a slight rise in the curve for ages 15-24, and then a constant increase until $_\infty q_{75}$ is observed.

Figure 4. 9 Probability of dying for both sexes, Hermoupolis



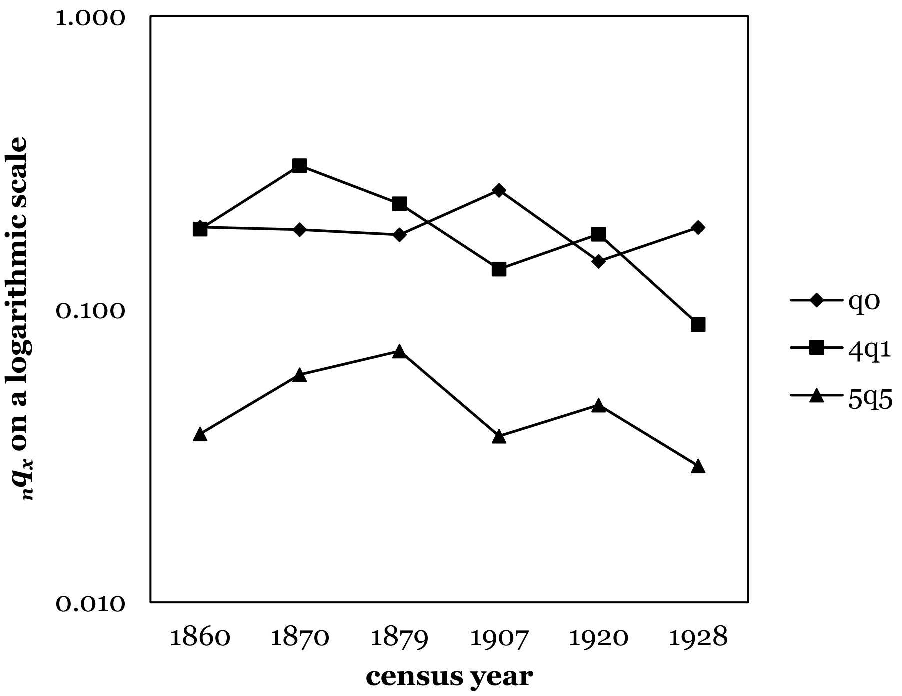
***Source*:** Calculated by the author using HMD.

As is evident in Figure 4.10, which depicts the evolution of mortality of the under 1, 1 to 4, and 5 to 9 age-groups, mortality among children aged from 1 to 4 was far more prevalent than for the infants in 1870, confirming the ASDRs' results. A similar trend of increasing childhood mortality is observed in neighbouring Mykonos during the same period.[45] Following the Mediterranean model, this trend of a higher rate of early childhood mortality than infant mortality was also observed in Spain and Italy at that time.[46] The reason for the great increase of $_4q_1$ from 1861 to 1870 is likely to have been outbreaks of typical childhood diseases such as scarlet fever, whooping cough, measles

[44] R. Woods, *Population analysis in geography* (New York: Longman, 1979), p.54.
[45] Hionidou, *The demography of a Greek island*, pp.139-140.
[46] Pozzi, 'The determinants of infant', pp.77-86; Ramiro & Sanz, 'Childhood mortality', pp.235-67.

and diphtheria. Evidence from contemporary medical records has shown that a series of outbreaks of smallpox, scarlet fever and diphtheria occurred on the island in the 1860s and 1870s and were responsible for the deaths of many children, but cause-specific information is not available for this period.[47] It is therefore not possible to detect the real reasons for this trend and only assumptions can be made at this stage.

Figure 4. 10 Probability of dying for age-groups 0-9, sexes combined, Hermoupolis



Source: Calculated by the author using HMD.

For a closer examination of the early childhood mortality rate (ECMR hereafter), its levels were estimated for the census years when ASDRs could not be calculated, by employing a method proposed by Ramiro and Sanz. This procedure (shown above) was followed due to their calculation of ECMR in specific years where it was not possible to rely on the available data for births and deaths by exact age. It should be noted that this procedure does not take into account the exact population in those ages nor the actual deaths, because it does not control the effects of migration in that age-group. Therefore, this is an indirect method for capturing the trend, even though we

[47] I. Foustanos, 'Syzetesis peri diptheritidos. Statistike thnesimotetos en Ermoupolei ton eton 1848-1894' (Discussion on diphtheria. Statistics of mortality in Hermoupolis for the years 1848-1894), *Praktika Iatrikes Etaireias Syrou* (*Proceeding of the Medical Association of Syros*) (Syros: Patris, 1895).

cannot calculate the actual rates.[48] So, because of the lack of the population in ages 1-4, the formula below was used for the years 1889, 1896 and 1940:

$$_4q_1 = \frac{d_{1-4}}{B\,(1-q_0)}$$

where:

d_{1-4} = deaths occurring between the first and the fifth birthdays;
B = live births; and
q_0 = IMR.

ECMR in Hermoupolis exhibits a very interesting trend: that of a significant decline which started approximately 30 years before that of infants, which seems to have started in the 1920s or even earlier (its levels will be explored in the next chapter). This trend has been also confirmed by other European studies, which also demonstrate that childhood mortality started to fall much earlier than that of infants.[49] Figure 4.11 illustrates this declining trend, and the estimated rates which are shown in squares on the graph followed the same trend. The decline among young children could well have been to a significant extent a result of the mass immunisation practices which started in the 1880s. As discussed in Chapter 3, regular smallpox and anti-diphtheria vaccinations took place in the city and therefore it is very likely to have increased the survival rates of those in young childhood. Another explanation for the decline in ECMR that could be suggested is changes in the virulence of some childhood diseases, as suggested by Woods for England and Wales in the second half of the nineteenth century.[50] Finally, the improvement in coverage of registration might have also affected the decline in ECMR, as it is expected that age-reporting was more accurate by the late-nineteenth century.

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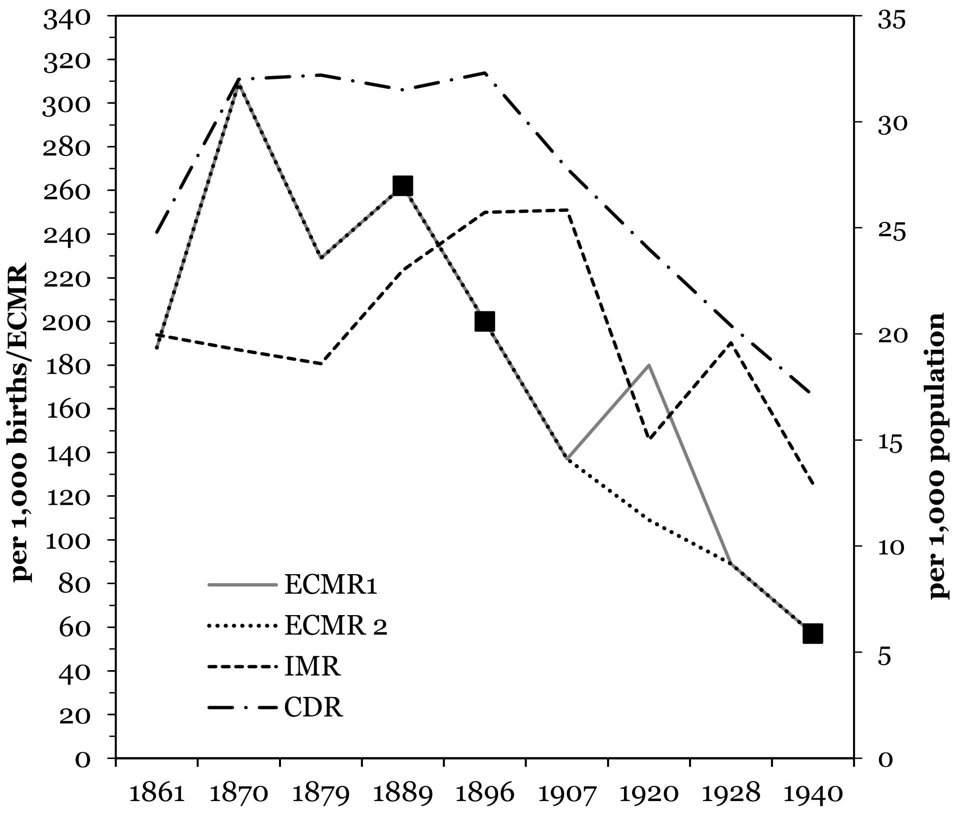
[48] Ramiro & Sanz, 'Structural changes', pp.63-64; A. Sanz Gimeno & D. Ramiro Farinas, 'Estructuras internal de la mortalidad de la infancia (0-4 anos) en la Espana de siglo XX', *Politica y Sociedad*, 26 (1997), pp.125-42.
[49] Woods *et al.*, 'The causes of rapid infant mortality, Part I', p.350, Fig.3; Williams & Mooney, 'Infant mortality', p.185; Vögele, *Urban mortality change*, p.56; Woods, *The demography of Victorian*, p.247; Ramiro & Sanz, 'Structural changes', p.62.
[50] Woods, 'On the historical relationship', p.215.

Figure 4. 11 CDR, IMR, ECMR and ECMR excluding 1919, Hermoupolis, 1859-1940

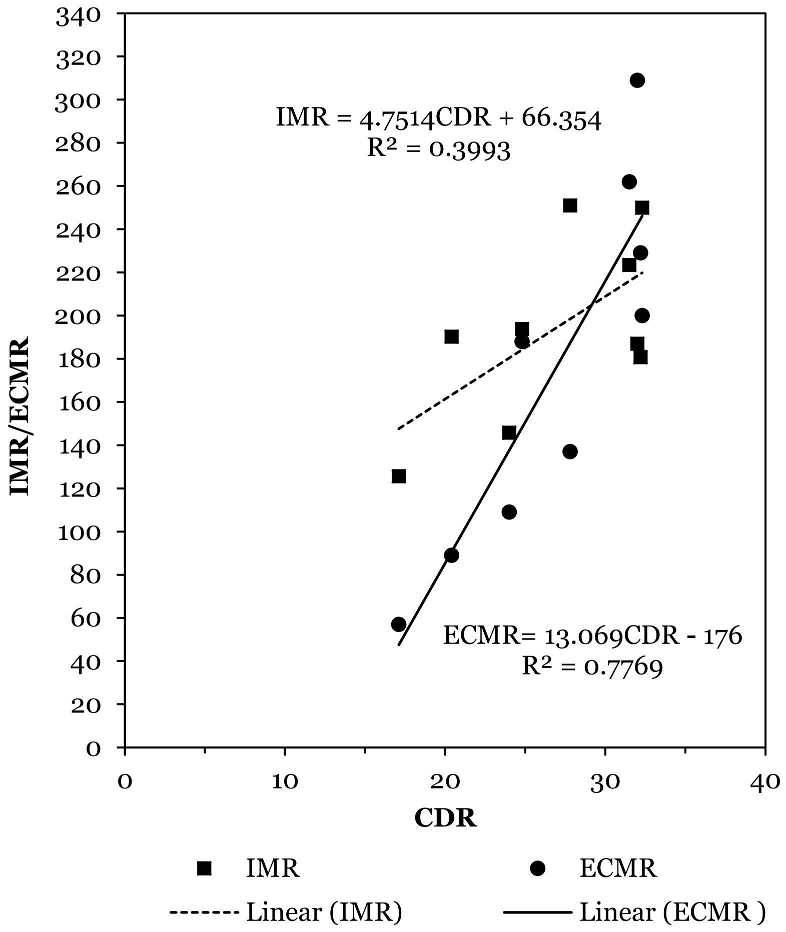


Note: ECMR in 1889, 1896 and 1940 has been estimated, see text.
Source: Calculated by the author using HMD.

This decline in $_4q_1$ was only interrupted in 1920, which seems to have been a consequence of the 1918-19 great influenza pandemic[51]. If the 1919 number of deaths is excluded from the calculation of the rate in 1920, and the two-year average number of deaths is used, it is observed that ECMR was declining continuously from the last quarter of the twentieth century. This trend is shown with ECMR 2 in Figure 4.11. Furthermore, when ECMR is plotted together with CDR, it seems that the former was responsible for initiating the decline of the latter in the late nineteenth century. They also followed the same pattern in the first decades of the twentieth century. Correlation analysis (Figure 4.12) showed a much stronger link between ECMR and CDR (R^2=0.7769) than between IMR and CDR (R^2=0.3993). However, it should be noted that CDR is linked with both ECMR and IMR, so the three variables are not independent. By the late 1920s, both ECMR and CDR exhibited a steady decline, yet the further decline of the latter in the 1930s seems to have been influenced by the significant decline in IMR. This issue will be further explored in Chapter 5.

[51] Evidence from HMD and cause-specific analysis showed that a measles outbreak occurred in Hermoupolis during the summer months in 1919.

Figure 4. 12 IMR and ECMR against CDR, Hermoupolis, 1859-1940

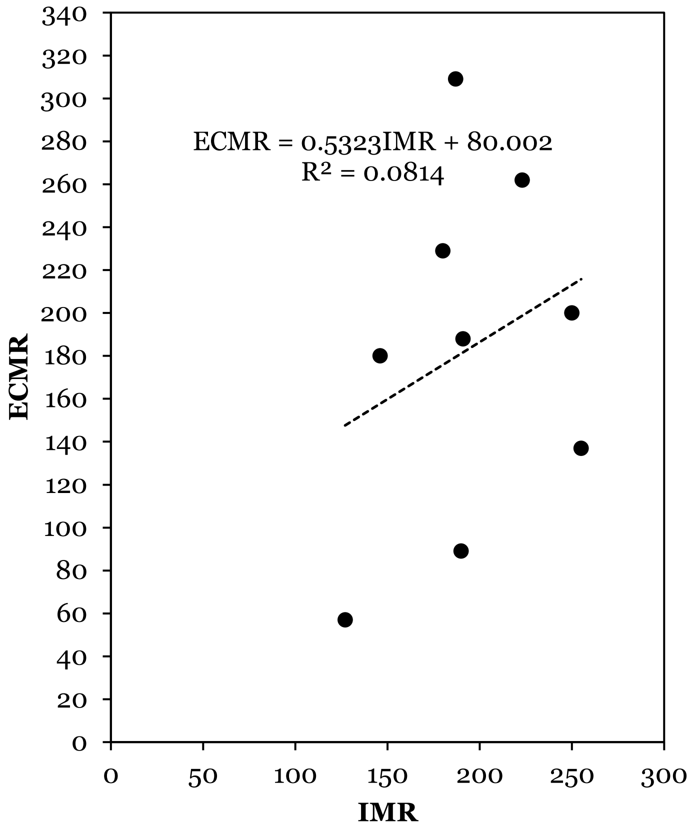


***Source*:** Calculated by the author using HMD.

A scatter-plot of IMR against ECMR provides additional evidence examining the interaction between infant and early childhood mortality, as Figure 4.13 exhibits. As expected from the very different timings of their decline, no correlation was found between the two variables (R^2=0.0814). Before examining the IMR and the reasons that may have contributed to its fluctuations, it is assumed that the effect of immunization should have been minimal to infants, as it was found in the literature that infectious diseases affect mainly children rather than infants, who are mostly protected through breastfeeding.[52]

[52] Guillot *et al.*, 'Child mortality estimation', p.12.

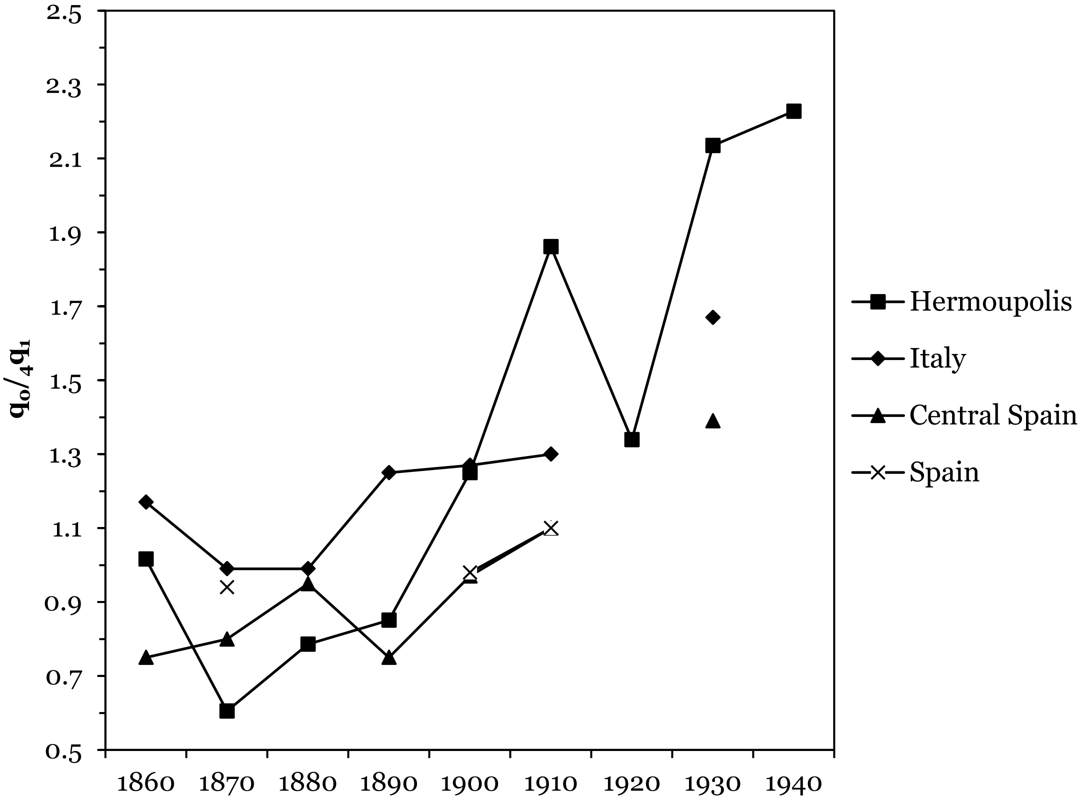
Figure 4. 13 ECMR against IMR, Hermoupolis, 1859-1940



Source: Calculated by the author using HMD.

When the ratio between infant and early childhood mortality in Hermoupolis is compared with those in Italy and Spain, it seems that ECMR in Hermoupolis was higher during the 1870s and 1880s (Figure 4.14). The decline in ECMR in Hermoupolis which started in the 1890s presents similar timing and rates with the Italian national average rate, although the decline in Hermoupolis was much steeper. At the turn of the century and while ECMR was still in rather high levels in Spain, the rate in Hermoupolis was significantly lower and it had been surpassed by the much higher IMR, which seems to be in low levels in the other two Mediterranean countries. Further comparisons of IMRs in Hermoupolis with Spain and Italy will take place in the next chapter.

Figure 4. 14 Ratio of IMR: ECMR in Hermoupolis, Italy, Central Spain and Spain, 1859-1940



Note: where: <1: $q_0 < {}_4q_1$; =1: $q_0 = {}_4q_1$; >1: $q_0 > {}_4q_1$

***Sources*:** For rates until 1910: F. Dopico, 'Regional mortality tables for Spain in the 1860s', *Historical Methods*, 20, 4 (1998), p.176; F. Dopico & D.S. Reher, *El declive de la mortalidad en España, 1860-1930* (Zaragoza: Mongráfias I, Asocoación de Demographía Histórica, 1998); Natale & Bernassola, *La mortalità per causa*, all cited by Ramiro & Sanz, 'Childhood mortality', p.245 & Figure 1. For rates in 1930: Ramiro & Sanz, Structural changes', p.65 & Table 1; HMD.

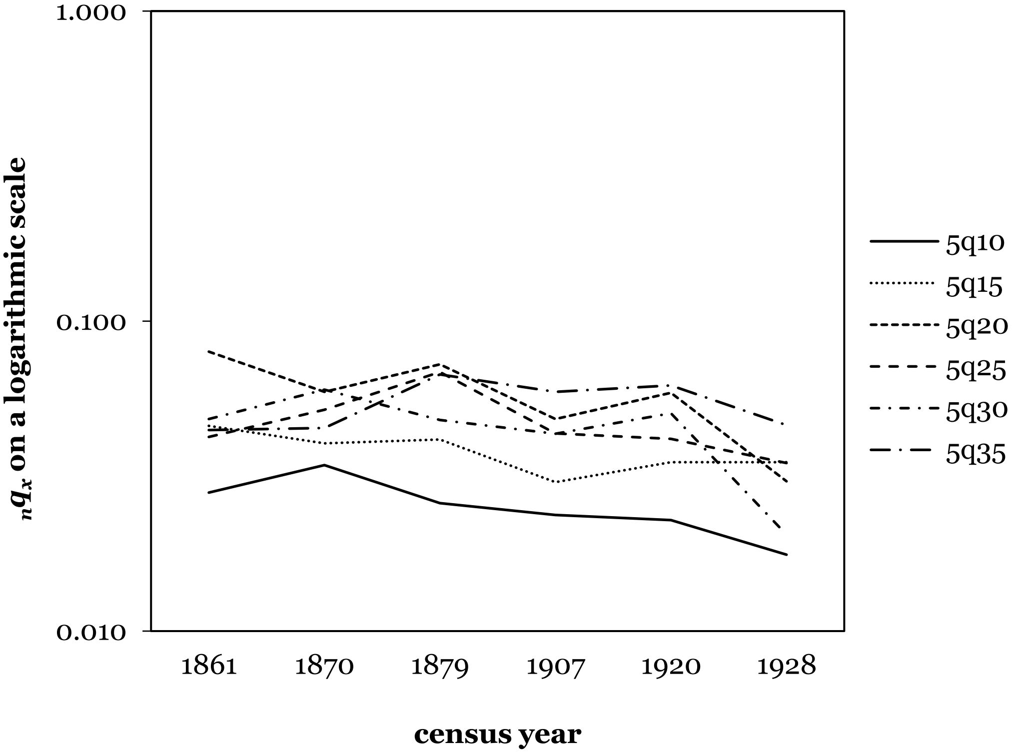
In 1870, apart from the high ECMR, it is clear that the age-groups 40-64 had a relatively greater possibility of dying in comparison with either the younger ages or the same age-groups in other census years (Figure 4.16). All age-groups show a downward trend at the beginning of the twentieth century except for ${}_5q_{60}$ and ${}_5q_{65}$, which increased significantly in 1907 and then fell again. In 1920 a rise in mortality levels for the ages 20 to 40 is observed, which may have been resulted from the 1918-19 influenza pandemic.[53]

By examining cause-specific mortality, it will be attempted to integrate the pattern of mortality levels in Hermoupolis into the 'epidemiologic transition' model suggested by Abdel Omran.[54] Finally it will be possible to draw some firm conclusions about when the shift in mortality and the underlying disease patterns occurred.

[53] More specific mortality rates over the course of the influenza pandemic are presented in Chapter 9.

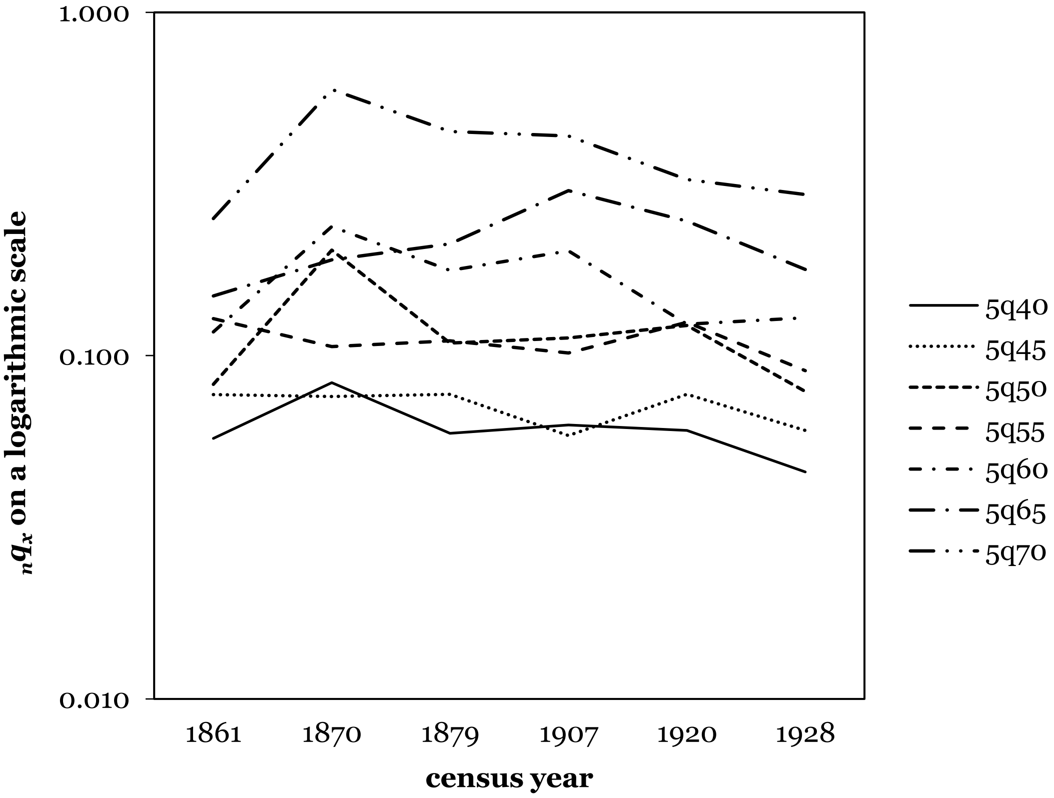
[54] Omran, 'The epidemiologic transition', pp.737-38.

Figure 4. 15 Probability of dying for age-groups 10-39, sexes combined, Hermoupolis



Source: Calculated by the author using HMD.

Figure 4. 16 Probability of dying for age-groups 40-74, sexes combined, Hermoupolis



Source: Calculated by the author using HMD.

4.3.3 *Expectancy of life*

Table 4.3 depicts the main trends of life expectancy at every age-group for both sexes separately in Hermoupolis for every census year, and Table 4.4 shows e_0 in various places in Greece, which have been calculated and presented in other studies. Life expectancy at birth in Hermoupolis is relatively low, especially when compared with those of other rural or semi-urban places and with that of Greece as whole in 1879. It should be noted that the very low e_0 in Hermoupolis in the nineteenth century resulted from the very high infant and even higher early childhood mortality rates of the city. The low levels of e_0 in Hermoupolis should not be surprising given that sanitation was rather poor there as late as the 1930s.

These very low levels of e_0 are not that exceptional. Life expectancy at birth was equally low in the second half of the nineteenth century for two industrial urban centres in England and Wales with very similar levels of CDR to that of Hermoupolis: 29 and 32 for Manchester and 25 and 28 for Liverpool in 1861-1870 and 1871-1880 respectively.[55] Life expectancy at birth had increased significantly in those two cities by the beginning of the twentieth century, yet similar levels were only achieved in Hermoupolis a few decades later.

What is surprising is that the life expectancy at birth in 1861 seems to be the next best after 1920 and 1928. During the third quarter of the nineteenth century, it seems that e_0 remained at relatively low levels, after falling by eight years in 1870, whereas it improved by about five years in 1879. In the early twentieth century, the pace of change did begin to accelerate, especially after the decline of infant and early-childhood mortality, reaching almost 46 years of age in the late 1920s. It has been suggested and confirmed for some northern European countries (England, Sweden and Germany) that there is a strong inverse connection between infant mortality and e_0.[56] Woods suggested that:

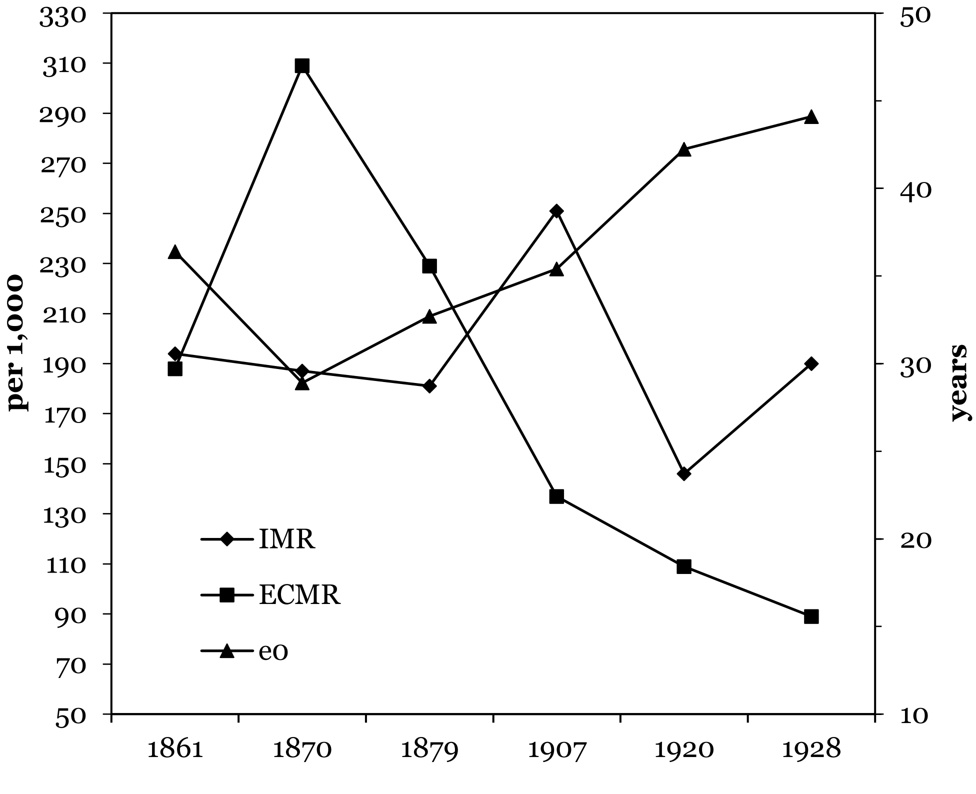
> Fluctuations in life expectancy at birth were influenced more by changes in infant and child mortality than in adult mortality.[57]

Evidence from the Hermoupolis data, however, shows that there was not always an inverse association between infant mortality and e_0. This is clearly illustrated in Figure

55 Szreter & Mooney, 'Urbanization, mortality', p.90.
56 K.R. Gabriel & I. Ronen, 'Estimates of mortality from infant mortality rates', *Population Studies*, 12, 2 (1958), pp.164-65.
57 Woods, 'On the historical relationship', p.200.

4.17, in which IMR and ECMR are presented along with e_0. In 1870, even though the IMR declined, the e_0 fell by almost eight years. In 1907, although the IMR reached its peak, e_0 increased by three years. Nonetheless, it should be emphasized that life tables were not constructed for the thirty-year period between those two census years for reasons explained previously. Only in 1920 is a strong inverse association between the two rates observed. The tremendous gains made in 1920 seem to be due to the great decrease in infant mortality, but in 1928, whilst IMR rises, the e_0 improved by two years. It seems therefore that IMR had limited influence on the evolution of e_0 apart from 1879 and 1920, when inverse association between the two rates was found. If there was no strong relationship between IMR and e_0, what was the link between e_0 and ECMR?

Figure 4. 17 IMR, ECMR and e_0 in every census year, Hermoupolis



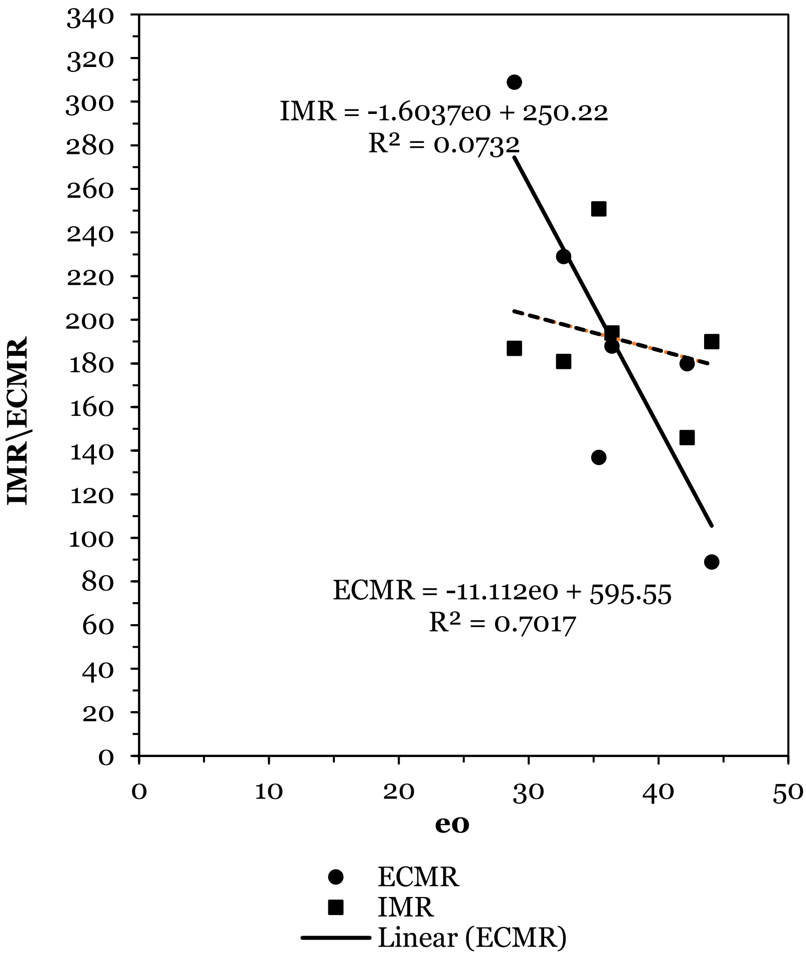
Source: Calculated by the author using HMD.

In Spain, the decline in childhood mortality was mainly responsible for the rapid growth in expectancy of life in the late-nineteenth and early-twentieth centuries.[58] The strong correlation (R^2 =0.7017) between the two rates is clearly shown in Figure 4.18, where IMR and ECMR are plotted against e_0. Early childhood mortality was also found to be a very efficient indicator of adult mortality, which measured by e_{20}, following

[58] Ramiro & Sanz, 'Childhood mortality', p.235.

Wood's steps.[59] This very strong correlation (R^2=0.814) between the two variables is shown in Figure 4.19. On the other hand, an extremely weak relationship was found between IMR and e_{20} (R^2=0.0049), as expected after the results which were derived between IMR and e_0. Due to the lack of published data and therefore the absence of life tables at the time when ECMR started to decline, no concrete conclusions can be suggested regarding the real effect of the decline in ECMR to adult mortality. However, it is assumed that the effect of the decline in ECMR would be visible in e_{20} in 1907, as a cohort effect. The lack of cause-specific information does not allow us to proceed any further.

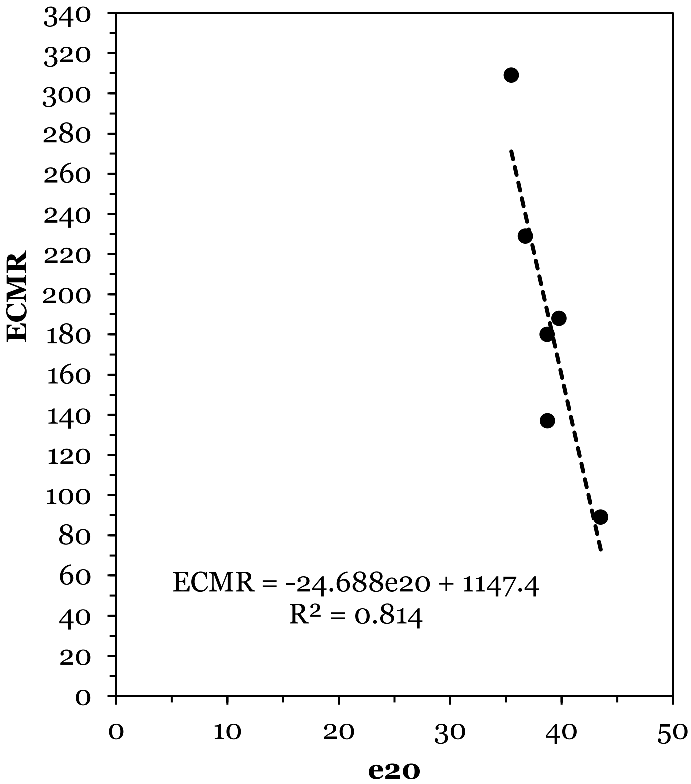
Figure 4. 18 IMR and ECMR against e_0 in every census year, Hermoupolis



Source: Calculated by the author using HMD.

[59] Woods, 'On the historical relationship', p.201.

Figure 4. 19 ECMR against e_{20} in every census year, Hermoupolis



Source: Calculated by the author using HMD.

Life expectancy for the age-groups 1-14 seems to have followed similar trends to that of e_0, although life expectancy at adult age-groups improved only very slowly, remaining relatively steady throughout the whole period under study (Table 4.3, Figures 4.21-4.23).

The construction of life tables in Greece has to date been limited to mostly rural and island societies together with a few attempts to estimate the national rates around the period under study. For this reason, comparisons with other Greek populations are limited. Even so, it is argued here that at least the 1861 and 1870 life tables of Hermoupolis should be representative of major urban centres in Greece. Life expectancy at birth in Hermoupolis was very low compared with any other calculated for Greece. More specifically, in 1861 evidence from Mykonos suggests that e_0 was much higher than that of Hermoupolis.[60] In 1870, when more results are available, e_0 in Hermoupolis was still much lower than in any other part of Greece. Expectancy of life at birth in the Ionian Islands was almost twenty years higher.[61] In 1879, as Table 4.4 depicts, two rates are available for the whole country. In order to calculate the

[60] Hionidou, *The demography of a Greek island*, p.149.
[61] Kosmatou, *La population de lles Ioniennes*, p.328.

national life tables in 1879, Gavalas used the 1870 age-specific mortality rates at age 0 (${}_1M_0$), due to the "astonishing under-registration of infants in the 1879 census".[62] Valaoras constructed life tables in 1879 as well. The lower levels of e_0 produced in Valaoras's study should be attributed to the use of an estimated IMR for the construction of the national life tables.[63] In 1879, the low e_0 in Hermoupolis compared with any other estimated rate is still apparent. A possible explanation for the difference is the relatively higher levels of infant but also early-childhood mortality found in Hermoupolis.

After a gap of almost fifty years, in 1920 the first national life tables were published. As is evident in Table 4.4, two different national rates of e_0 were produced by the National Statistical Service of Greece (NSSG) and by Valaoras.[64] The 1926-1930 life tables underwent revision, according to the NSSG, in order to correct the underestimation of infant mortality and the overestimation of the mortality at older ages, as a result of age and sex misreporting.[65] On the other hand, Valaoras did not discuss any possible corrections apart from the fact that he used the official vital statistics of the country (census returns and mortality statistics). He estimated the mid-year population by using the last two censuses of 1920 and 1928 and assumed that the population increased. Furthermore, the five-year average of deaths was used (1926-1930) in order to minimise the influence on the increased mortality by the refugee influx and also the high mortality levels in 1929 caused by an epidemic of dengue fever.[66]

By employing model life tables, Hionidou showed that even though the increasing IMRs did not allow extensive increases in life expectancy, e_0 was above 45 in the 1870s and reached 60 in the 1940s.[67] By comparing Hermoupolis's life e_0 with that of Mykonos, a noteworthy discrepancy is still evident even in the 1920s.

When e_0 is examined according to sex, it becomes apparent that gains were not the same for both sexes. Females who lived in Hermoupolis could expect to live nearly two

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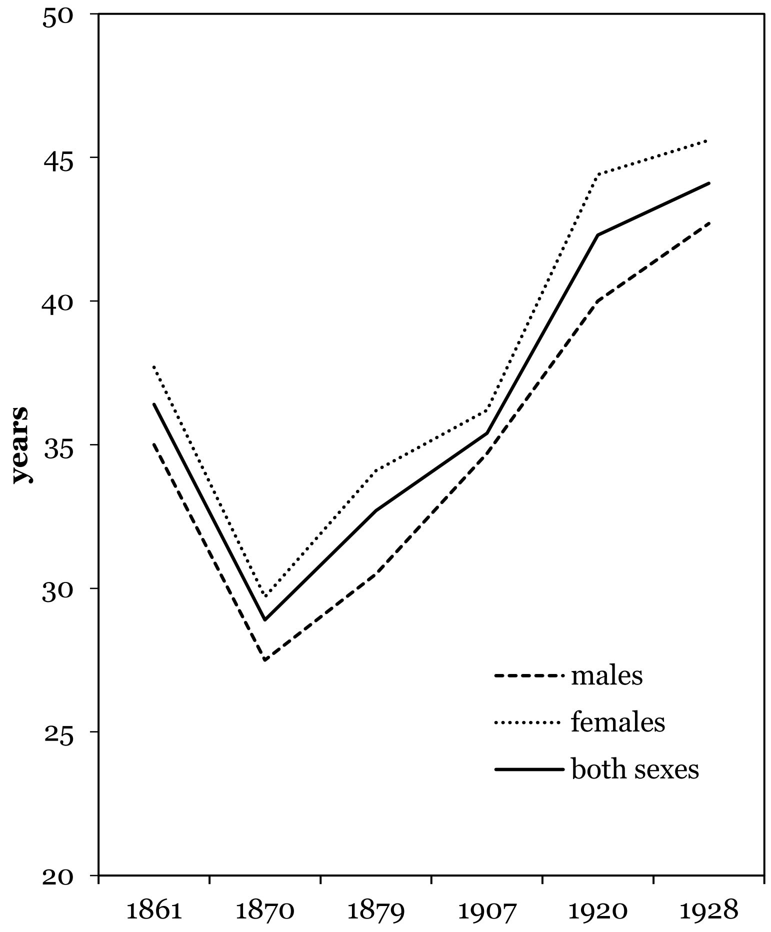
[62] Gavalas, *Demographic reconstruction*, pp.82-3.
[63] Hionidou, *The demography of a Greek island*, p.149.
[64] National Statistical Service of Greece, *Ellenikoi pinakes epiviosis* (*Greek life tables*) (1964); V.G. Valaoras, 'A comparative study of the mortality of the population of Greece', *Human Biology*, 8, 4 (1936), pp.553-64.
[65] *Ellenikoi pinakes epiviosis*, pp.22-3.
[66] Valaoras, 'A comparative study', p.554.
[67] Hionidou, *The demography of a Greek island*, pp.151-54; A.J. Coale & P. Demeny, *Regional model life tables and stable population* (New York: Academic Press, 1983), pp.12-15.

to four years longer than males throughout the study period (Figure 4.20, Table 4.4). When I compare the e_0 results for women in Hermoupolis and Mykonos, it seems that women in Hermoupolis had better survival chances compared to men whereas that was not the case in Mykonos in 1860 and 1870 (Table 4.4). However, evidence from other parts of Greece confirms the results found in Hermoupolis in relation to sex.

Figure 4. 20 Expectation of life at birth, Hermoupolis



***Source*:** Calculated by the author using HMD.

Life expectancy at birth in most European countries was relatively higher than that in either Hermoupolis or Greece as a whole, reaching almost levels of more than 40 years of age already by the 1850s (Table 4.5). Noteworthy exceptions are nineteenth-century Italy, Germany, Spain and English urban centres, which exhibited very similar rates to those of Hermoupolis mainly due to relatively high infant and childhood mortality rates.[68] Even though the Mediterranean countries such as Spain or Italy exhibited similar CDRs, their e_0 was consistently much higher than that of Hermoupolis, exceeding it by seven or eight years in 1930. It was expected that e_0 of the other

[68] Caselli, 'Long-term trends', p.2, Tables 1, 2; Szreter & Mooney, 'Urbanization, mortality', p.90.

Mediterranean countries would be rather close to the one estimated in Hermoupolis.[69] The main reasons for these discrepancies are likely to be the much higher levels of IMR in Hermoupolis, when compared with the levels in the other Mediterranean or European countries. Therefore, the analysis of IMR levels in Hermoupolis which follows in the next chapter is expected to shed more light and explain the different trends which took place in the city at the time.

[69] The lack of local studies in English prevent us from making sensible comparisons.

Table 4. 3 Calculated life expectancy at all ages, Hermoupolis

	1861		1870		1879		1907		1920		1928	
Age-group	*Males*	*Females*	*Males*	*Females*	*Males*	*Females*	*Males*	*Females*	*Males*	*Females*	*Males*	*Females*
<1	**35.05**	**37.68**	**27.46**	**29.75**	**30.50**	**34.08**	**34.66**	**36.19**	**40.08**	**44.4**	**42.66**	**45.58**
1-4	42.29	45.54	32.76	35.57	36.14	40.51	45.48	47.52	45.90	51.0	51.66	55.26
5-9	48.72	50.67	41.66	47.87	42.34	48.21	48.45	50.82	47.85	52.1	53.18	55.83
10-14	45.73	47.37	39.86	45.09	41.41	46.65	44.58	48.34	44.72	48.4	49.85	52.28
15-19	41.59	43.94	36.47	41.34	37.43	42.82	40.86	44.20	40.24	44.4	45.60	48.31
20-24	38.90	40.64	33.31	37.68	33.89	39.61	36.79	40.71	36.33	41.1	41.77	45.29
25-29	37.57	38.47	31.01	34.20	32.33	36.82	33.96	37.36	34.73	38.2	38.11	41.56
30-34	33.59	35.90	27.60	30.88	30.23	33.60	30.11	34.21	32.04	33.9	34.52	37.87
35-39	30.14	32.64	24.15	27.77	26.47	30.03	26.65	30.38	28.53	30.2	30.41	33.41
40-44	26.27	29.30	21.29	24.20	23.44	26.65	23.41	26.92	24.83	26.6	26.58	30.05
45-49	22.82	25.89	17.88	21.38	19.96	22.97	20.02	23.36	21.67	23.1	23.16	25.95
50-54	19.58	22.87	14.24	17.80	16.24	20.16	16.22	19.55	18.31	19.9	19.74	22.21
55-59	17.04	18.73	13.00	15.64	14.14	16.34	13.81	15.59	15.11	17.7	16.69	18.30
60-64	14.06	16.29	10.29	11.17	10.68	12.93	10.50	11.53	12.34	14.5	13.36	14.53
65-69	11.12	12.49	8.08	8.45	8.06	9.82	7.88	8.34	9.79	10.5	10.22	11.05
70-74	7.80	9.03	4.44	4.78	4.91	6.27	5.60	5.43	7.70	7.8	7.75	7.22
75+	4.14	6.85	2.32	3.12	3.54	3.69	2.93	2.79	4.80	5.4	4.88	4.24

***Note*:** In 1920, the two-year average number of deaths (1920 and 1921) has been used instead of the three-year average.

***Source*:** Calculated by the author using HMD.

Table 4. 4 Expectancy of life at birth in various places in Greece, 1861-1930

	GREECE		HERMOUPOLIS		MYKONOS		MYKONOS MODEL LIFE TABLES	CYCLADES ISLANDS		IONIAN ISLANDS	
	M	***F***	***M***	***F***	***M***	***F***	***BOTH SEXES***	***M***	***F***	***M***	***F***
1861	-	-	**35.0**	**37.7**	47.4	43.6	51.0	-	-	-	-
1870	39.8	41.3	**27.5**	**29.5**	45.3	42.6	53.0	43.1	44.6	47.4	47.8
1879	36.0/44.9	37.5/46.3	**30.5**	**34.1**	48.7	-	53.7	47.0	49.2	49.1	49.8
1907			**34.7**	**36.2**			55.0				
1920			**40.0**	**44.4**			53.5				
1930	45.0/49.1	47.5/50.9	**42.7**	**45.6**			51.9				

Sources: *Greece*: Valaoras, 'A comparative study', pp.560-64; 'The gain in the expectation of life in Greece during the last fifty years', *Bulletin de l'Institute International de Statistique*, 29, 2 (1937), pp.34-40; *Ellenikoi pinakes epiviosis*, pp.22-23; *Mykonos*: Hionidou, *The demography of a Greek island*, p.149; *Ionian islands*: Kosmatou, *La population de lles Ionienne*, p.328; *Greece/ Cyclades islands*: Gavalas, *Demographic reconstruction*, pp.82-83; HMD.

Table 4. 5 Expectancy of life at birth in various European countries,

Country	1850	1880	1900	1910	1930		1850	1880	1900	1910	1930
Male						***Female***					
Sweden	40.5	48.7	52.7	55.2	62.3	Sweden	44.9	50.0	55.2	57.6	64.4
Norway	45.5	48.5	50.4	55.0	62.8	Norway	45.5	48.5	50.4	55.0	65.7
England and Wales	39.9	44.3	45.0	51.1	58.3	England and Wales	41.1	47.1	49.4	55.4	62.4
France	40.3	41.0	43.4	48.5	54.3	France	41.8	47.1	47.0	52.2	59.3
Germany		36.3	42.7	47.4	58.4	Germany		39.2	46.1	50.7	61.3
Italy	30.2	33.3	42.5	44.3	51.0	Italy	31.1	34.0	43.0	45.7	54.4
Spain				40.9	48.4	Spain				42.6	51.6
Portugal					45.1	Portugal					50.0
Greece		36.0			45/49.1	Greece		37.6			47.5/50.9
Hermoupolis		30.5		34.7	42.7	Hermoupolis		34.1		36.2	45.6

Note: The rates in Greece refer to 1879 and 1928, while in Hermoupolis 1879, 1907 and 1928.
Sources: Valaoras, 'A comparative', pp.560-64; 'The gain in the expectation of life', pp.34-40; *Ellenikoi pinakes epiviosis*, pp.22-23; Caselli, 'Long-term trends', pp.2, 5; Szreter & Mooney, 'Urbanization, mortality', p.90; HMD.

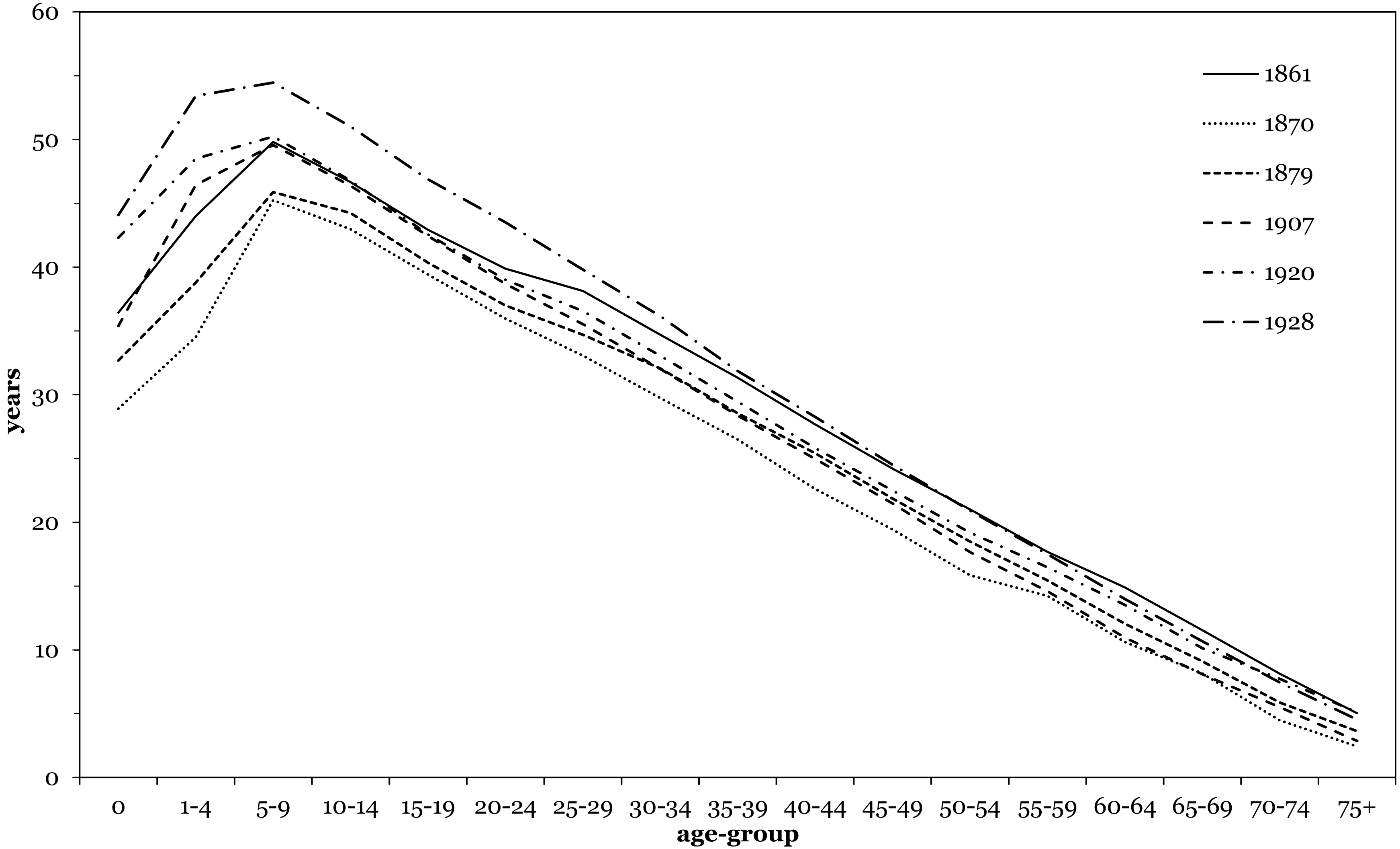
4.4 Conclusions

All studies, including the current one, agree that a possible diminishing trend in the mortality levels of the country was already in progress by the beginning of the twentieth century or even earlier. Evidence from the current thesis but also from other studies underline the urban-rural differences which occurred in Greece, confirming the 'urban penalty', although these discrepancies had become minimal by the late 1930s.

Falls in childhood mortality seem to be responsible for much of the mortality decline and the growth of e_0 in Hermoupolis during the early period under study. Early childhood mortality probably declined, at least partly, as a result of the implementation of mass vaccination among the children of the city from the 1880s onwards. Further research should be undertaken to investigate the impact of vaccination policies into the decline of early-childhood mortality in Hermoupolis but also elsewhere. The effect of infant mortality seems to be less important for most of the years, although it played a crucial role in the further decline of mortality in the 1920s and 1930s. It seems also that infant mortality contributed to the stabilisation of mortality at rather low levels, much closer to those of other Mediterranean countries at the time. The main reasons for this trend will be explored in the next chapter, where infant mortality is discussed.

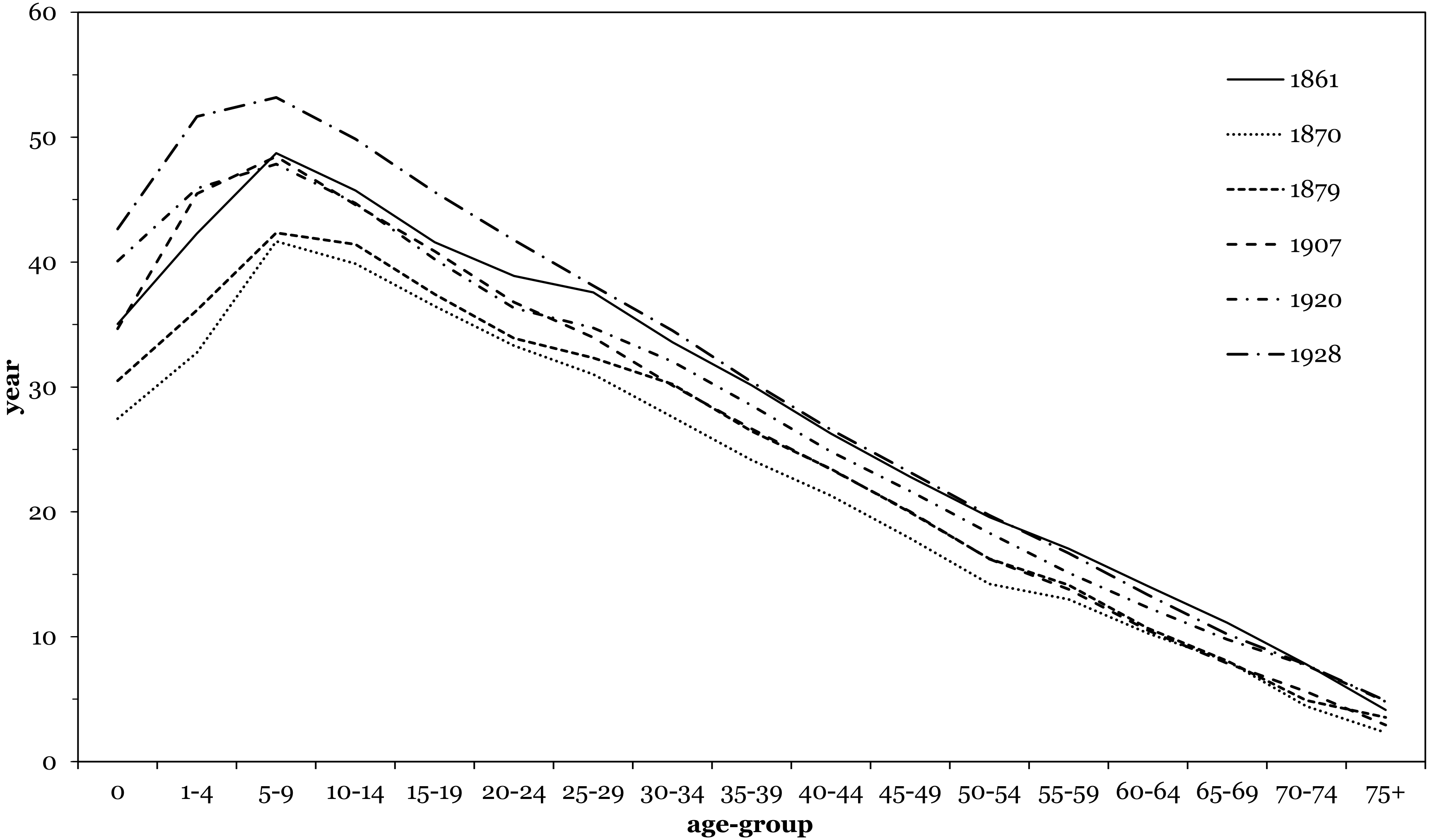
Other findings of this chapter include the very low levels of e_0 compared to that of Greece as a whole, especially in the nineteenth century, and the consistent excess of male over female mortality, which resulted in higher e_0 for women. The sources and methods which were employed in order to construct abridged life tables were also discussed. However, age-specific mortality was only briefly discussed, as further discussion about its levels and trends will follow after an examination of cause-specific mortality. Overall life tables provide a valuable summary of the mortality experience of the population which, in association with causes of death, bring new insights into the epidemiological profile of the city.

Figure 4. 21 Life expectancy for both sexes, Hermoupolis, 1861-1928



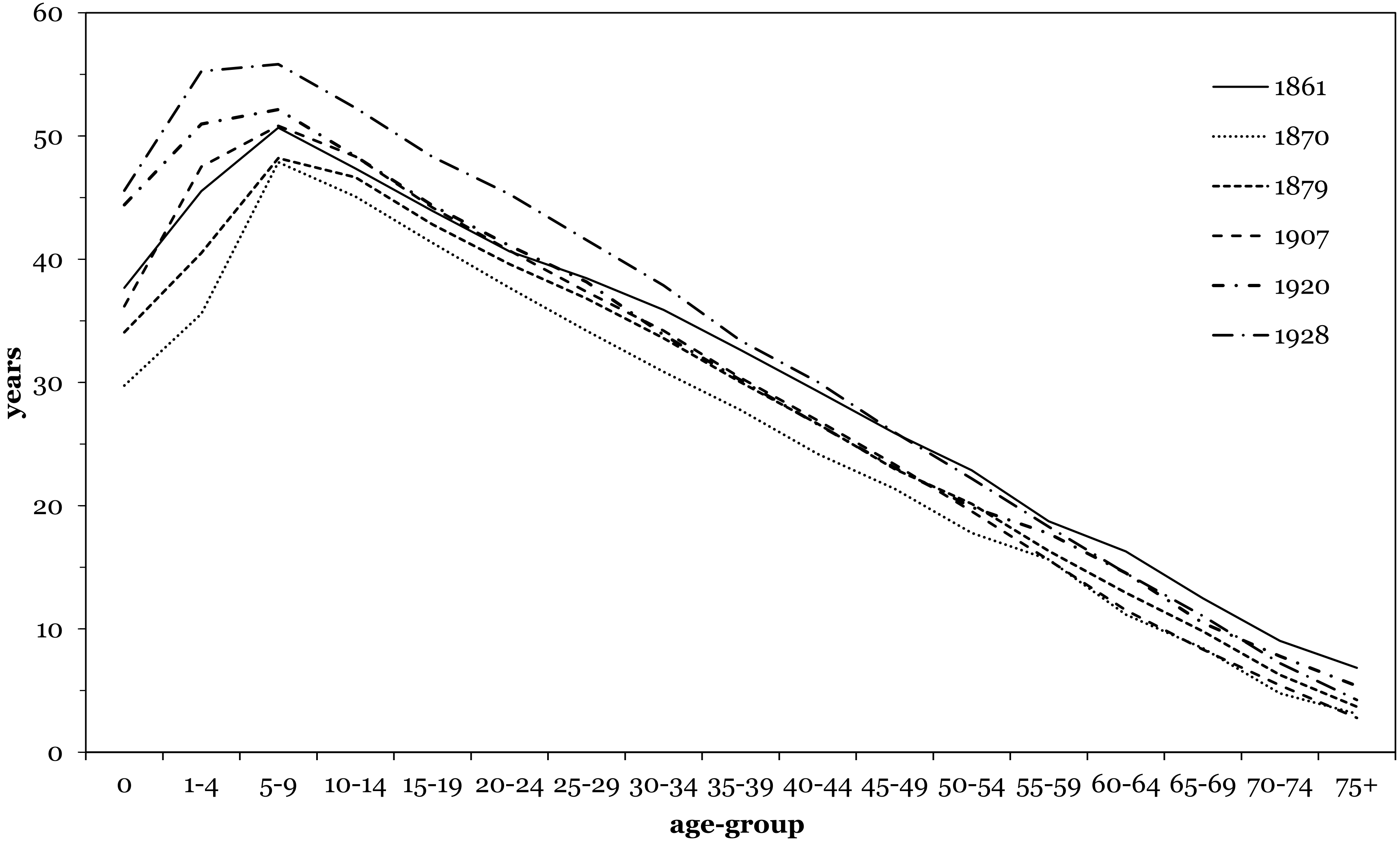
***Source*:** Calculated by the author using HMD.

Figure 4. 22 Male life expectancy, Hermoupolis, 1861-1928



***Source*:** Calculated by the author using HMD.

Figure 4. 23 Female life expectancy, Hermoupolis, 1861-1928



***Source*:** Calculated by the author using HMD.

Chapter 5. Infant Mortality (1859-1940)

5.1 Introduction

The aim of this chapter is to examine the levels of infant mortality in Hermoupolis between the mid-nineteenth and mid- twentieth centuries. Before discussing the Hermoupolis results, a literature review of the existing studies which have explored Greek infant mortality in the past is necessary to properly understand the mechanisms associated with the patterns that were observed during the study period. Hermoupolis's IMR, neonatal and post-neonatal mortality rates are presented and discussed, whilst this chapter also examines how the IMR in Hermoupolis fits into the Greek, Mediterranean and European contexts. Furthermore, this chapter explores stillbirth mortality for the period 1912-1940, when stillbirth registration is available. The final part of this chapter offers an explanation for the decline in IMR in Hermoupolis.

5.2 Infant mortality in Greece

5.2.1 *Infant mortality levels*

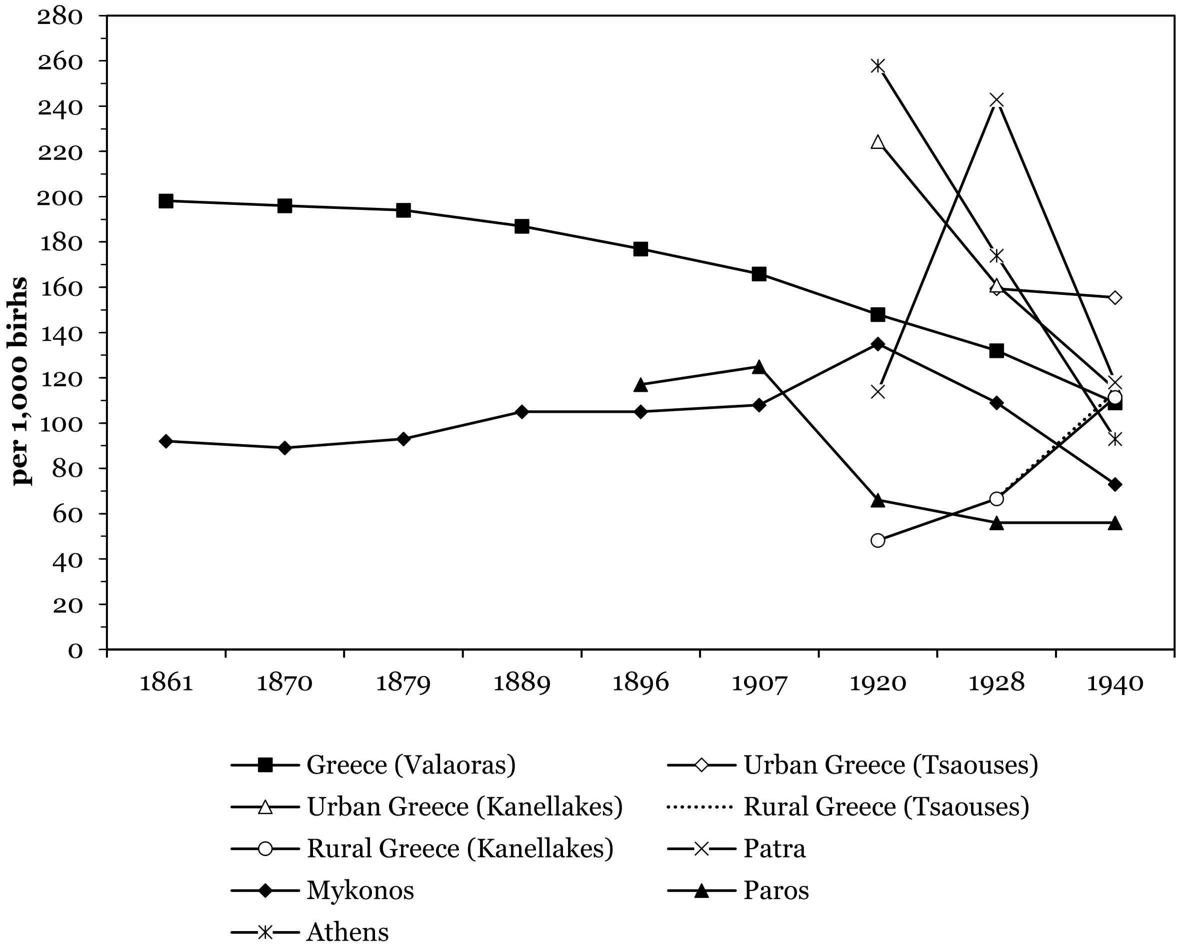
IMR is available for only a few Greek settlements, and the only continuous national estimates were constructed by Valaoras. According to his figures, Greek IMR was one of the highest in Europe after only Germany and Italy during the second half of the nineteenth century. Although IMR in most other European countries had already started to decline in the late-nineteenth and the beginning of the twentieth centuries, IMR in Greece was still at relatively high levels. The national IMR declined continuously from about 200 infant deaths per thousand births in 1860 to almost 170 in 1900 and continued to exhibit the same pattern in the early twentieth century, reaching about 110 per thousand in the late 1930s.[1]

National rates have been also estimated for the 1920s and 1930s, when vital statistics are available. Both Tsaouses and Kanellakes estimated infant mortality for urban and rural areas separately. Both sets of figures, shown in Figure 5.1, found significant urban-rural differences, as expected from the findings discussed in the previous chapter. Even though urban mortality was much higher than in rural areas, the gap between the two rates had narrowed significantly by the 1930s. According to Valaoras,

[1] Valaoras, 'A reconstruction', p.132.

extensive under-registration of vital events and age-misreporting, mainly in rural areas, were the main reasons for the urban-rural differences in Greece in the 1920s and 1930s.[2] All rates so far – both for urban and rural areas together with the national rate – agree that IMR in Greece was 115 per thousand births in 1940. Due to the gradual improvements in civil registration, IMR in 1940 is expected to be the most accurate.

Figure 5. 1 IMRs of various places in Greece, 1859-1940



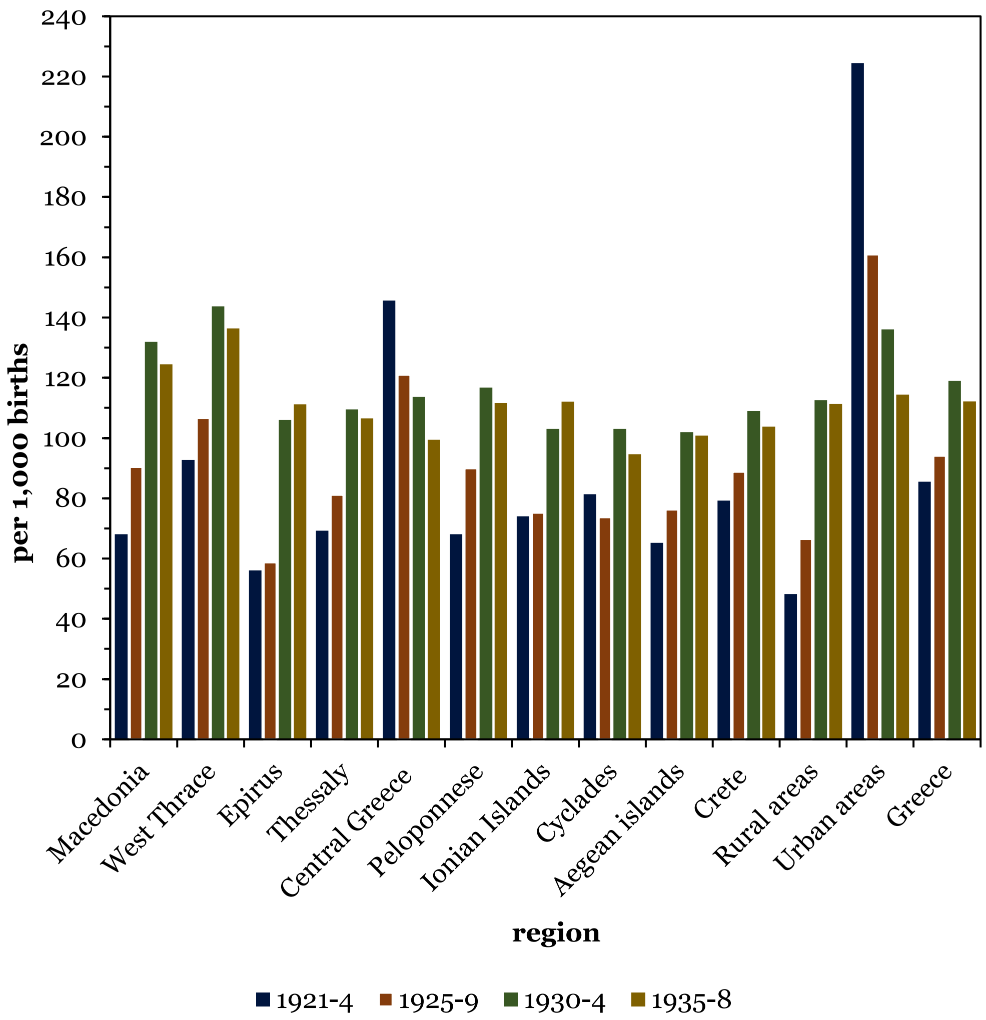
Sources: *Athens*: Kanellakes, *Symvole eis ten melete*, p.136; *Greece*: Valaoras, 'A reconstruction', p.132; Tsaouses, *Morphologia tes Neollenikes koinonias*, p.198; *Mykonos*: Hionidou, *The demography of a Greek island*, p.50; *Paros*: Gavalas, *Demographic reconstruction*, p.79; *Patras*: Eliopoulos, *Oikonomikes kai koinonikes domes*, p.103.

Kanellakes also estimated the IMR using vital statistics from every region of the country during the 1920s and 1930s. The rates are shown in Figure 5.2. The results indicate the mixed picture of the interwar levels of infant mortality around the country. The low levels of rural infant mortality, especially in the 1920s, are most

[2] V.G. Valaoras, 'Adynamies ton leksiarhikon mas katagrafon kai e vrefike thnesimoteta ton Ellenon' (Weaknesses of the civil registration and infant mortality of the Greeks), *Parnassos*, A (1988), p.429.

probably a result of the high under-registration of deaths, and especially of births, in the vital statistics. On the other hand, the levels of urban infant mortality seem to be more realistic. According to his results, the IMR increased everywhere in the country in the 1930s apart from Central Greece, which includes Athens. Elsewhere in the country, similar patterns seem to have been taking place in the 1920s and 1930s.[3]

Figure 5. 2 IMRs of the geographical regions in Greece, 1921-1938



Source: Kanellakes, *Symvole eis ten melete*, p.73.

Most of the rates which have thus far been estimated for specific Greek settlements refer to short periods of time (Figure 5.1). Apart from the case of Mykonos, which will be discussed later, there is no other continuous calculation for a Greek population that can show a long-term perspective or can be compared with the results of the current study.

[3] A. Kanellakes, *Symvole eis ten melete tes vrefikes thnesimotitos en Elladi* (*A contribution to the study of infant mortality in Greece*) (University of Athens: PhD thesis, 1955), p.73.

High levels of IMR were found in Athens by Dimitropoulou. Those rates refer to the period 1860-1880 and provoke many questions since they fluctuate at levels outside the range of stationary populations. For this reason, it was not possible to include them in Figure 5.1. Dimitropoulou argued that IMR in Athens was consistently higher than 300 per thousand during the 1860s and the 1870s, even reaching 437 in 1868.[4] IMRs estimated in Athens are far above the levels of the biggest urban centres of Western Europe at the time. Those rates, therefore, could be compared perhaps with eighteenth-century London (200 per thousand), nineteenth-century Berlin (300 per thousand) or Rouen in the late nineteenth century (more than 300 deaths per thousand).[5] Contemporary estimates by Makkas showed that IMR in the Attica region exceeded 300 per thousand in the period 1868-1878 as a result of massive birth under-registration.[6] In the twentieth century, Kanellakes showed that the high levels of IMR in Athens had started to decline continuously from the early 1920s, whilst by the late 1930s it had reached levels just above 100 (Figure 5.1).[7]

The extremely high levels which were estimated for Patras in the 1920s by Eliopoulos may also be the result of incomplete civil registration. To overcome this, Eliopoulos employed a combination of data: civil registration and vital statistics. Nonetheless, after comparing the two sources, he found great levels of under-registration in the city. Rates as high as 360 per thousand in the mid-1920s cannot be found in any urban place in Europe during the same period and they must, therefore, be interpreted with caution. The great decline in IMR in Patras – by almost 90 units – in the 1930s may be attributed to improving registration. By 1940, IMR had reached much lower levels, very close to the national rate, as can be seen in Figure 5.1.[8] So, even if the Patras IMR is accurate, its short availability and its very extensive fluctuation make it unusable for comparisons for most of the time.

Hionidou also estimated IMR in Mykonos using three different methods: reported age at death, deaths linked to a birth and family reconstitution. All three rates refer to nine-year periods rather than around the census years. Even though Figure 5.3

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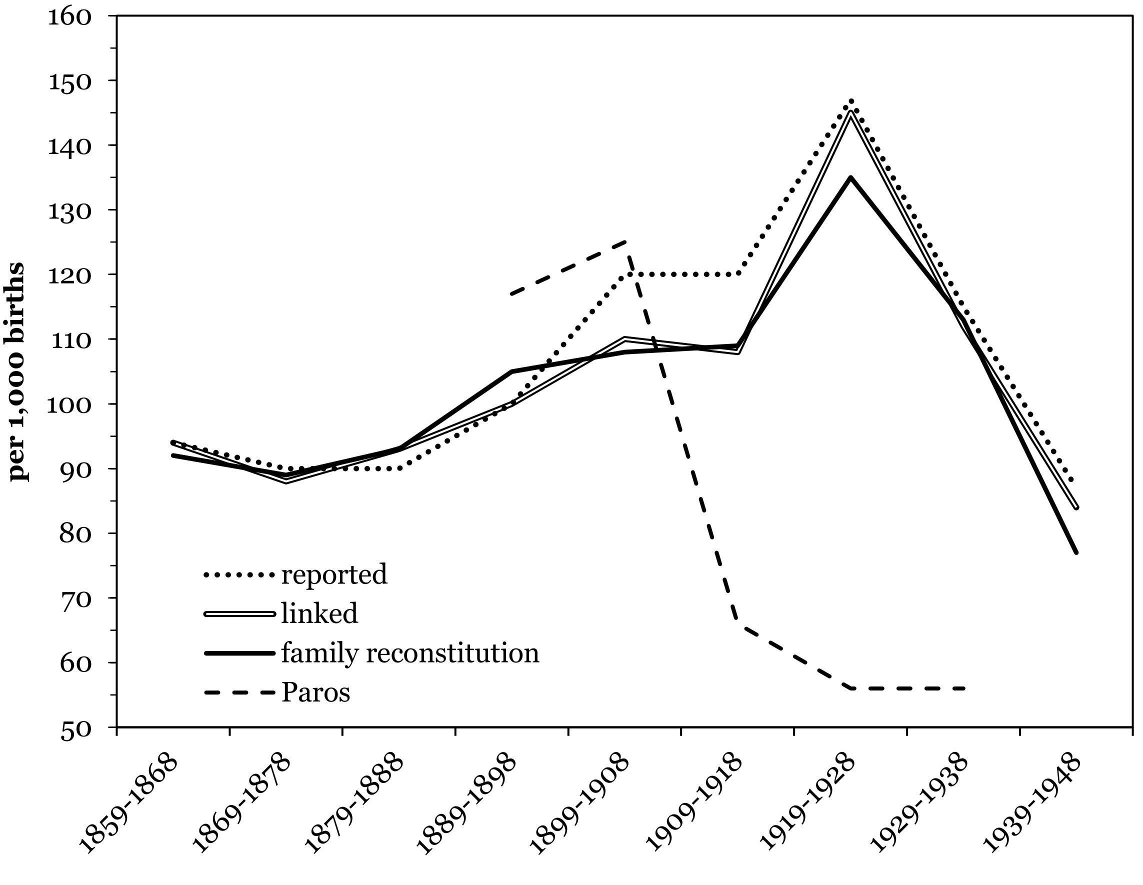
[4] Dimitropoulou, *Athènes au XIX^e siècle*, pp.103-4.
[5] J. Landers, *Death and the metropolis studies in the demographic history of London 1670-1830* (Cambridge: Cambridge University Press, 1993), p.137; Rollet & Bourdelais, 'Infant mortality', p.63; Vögele, 'Urban infant mortality', p.405.
[6] G.N. Makkas, *E thnesimotis tes paidikes elikias en Elladi: Aitiai kai mesa pros peristolin* (*Childhood mortality in Greece: causes and means for its reduction*) (Athens, 1911), cited by Kanellakes, *Symvole eis ten melete*, p.31.
[7] Kanellakes, *Symvole eis ten melete*, p.136.
[8] Eliopoulos, *Oikonomikes kai koinonikes domes*, pp.122-24, 130-32.

illustrates all three rates, this current study made use only of the family reconstitution results, which Hionidou argued are the most reliable. All three rates seem to follow similar trends. IMR in Mykonos did not exceed a level of 135 per thousand throughout the period from 1859 to 1959, which is a fairly low level. It ranged around 100 deaths per thousand throughout the nineteenth century and the first two decades of the twentieth century. In the 1920s, IMR increased, reaching its peak and then from 1928 onwards it started to fall sharply.[9] The importance of Hionidou's study lies in the fact that infant mortality on Mykonos can be seen as representative of Greece if the main urban centres were to be excluded, since the country had relatively low levels of urbanisation throughout the nineteenth and early twentieth centuries.[10]

Figure 5. 3 IMRs (reported, linked and family reconstitution results) in Mykonos and Paros, 1859-1948



***Sources*:** Hionidou, *The demography of a Greek island*, p.50; Gavalas, *Demographic reconstruction*, p.79.

Finally, the IMR in the two rural communities in Paros (in the period 1914-1931, this refers only to Naousa) was also low. It stood at 120 deaths per thousand in the late

[9] Hionidou, 'Infant mortality', p.160.

[10] Ibid., p.170; Leontidou, *The Mediterranean city*, p.56, Table 2.2: 11.01 per cent by 1879, 17.14 per cent in 1907 and 32.07 per cent by 1940.

nineteenth century. In the 1910s, the IMR declined sharply, reaching 66 per thousand, most likely as a result of death under-registration and the exclusion of Kostos. In the following years, it remained stable at extremely low levels when compared with neighbouring Mykonos (Fiugure 5.3). [11]

5.2.2 *Urban-rural infant mortality differences*

The IMRs in Mykonos and Paros, a semi-urban and a rural population respectively, exhibited much lower levels than the rates that have been estimated for Greek urban populations, including Athens and Patras. This is in line with most of the European literature, which suggests that urban infant mortality was very high in the nineteenth century, as discussed in Chapter 1. When IMR declined, urban rates reached levels much closer to those of rural areas.[12] In Greece, as suggested earlier, the main reason for the low rural infant mortality has been assumed to have been the high under-registration in those areas. A possible additional explanation for the excess urban infant mortality may have been the poor environmental and hygiene conditions of such areas in Greece (Chapter 3), as elsewhere in Europe. According to the literature, infants, roughly after the first month of life, had a very high risk of dying due to external causes, such as infectious diseases, which were associated with poor sanitation. Such causes have been found to have been responsible for the very high levels of infant mortality in England and Wales during the last part of the nineteenth century.[13]

Some contemporary studies have also discussed possible reasons for the high infant mortality levels in urban centres, mostly in Athens. The first reason is thought to have been the existence of specialised foundling hospitals or hospitals that received foundlings. Such institutions existed in both Athens and Hermoupolis, for which contemporary estimates have found very high infant mortality levels, 319 and 241 per thousand respectively.[14] Mortality rates for foundlings were rather high in Hermoupolis but still much lower than the rates estimated for Athens, where a foundling hospital (*Vrefokomeio*) existed. In Hermoupolis, unlike Athens, the public

[11] Gavalas, *Demographic reconstruction*, pp.228-29.
[12] Ramiro & Oris, *New approaches*, p.6.
[13] N. Williams & C. Galley, 'Urban-rural differentials in infant mortality in Victorian England', *Population Studies*, 49, 3 (1995), p.419.
[14] Kanellakes, *Symvole eis ten melete* as cited by Hionidou, 'Infant mortality', p.170.

hospital accepted foundlings and placed them with hired wet-nurses.[15] A significant number of those foundlings were traced in the civil registrations (both death and birth records) and some of them were linked also to the *Foundling List of the Local Hospital* for every census year. A foundling hospital was established in Hermoupolis in 1920, although by that time evidence from HMD has shown that the number of foundling deaths had declined significantly.[16] In Athens, however, there is no evidence that the foundlings were part of the civil registration or vital statistics and it is therefore not possible to estimate their impact on infant mortality. Under-registration or mis-registration of the foundlings in urban areas in the past was a very common problem which researchers need to overcome in order to be able to explore the real levels of infant mortality.[17] At the London Foundling Hospital in the eighteenth century, for instance, the deaths of foundlings were recorded outside the parish, regardless of where their births had been recorded.[18]

Recent studies have shown that 38.95 per cent of infants in the Municipal Foundling Hospital in Athens died during the period 1859 to 1884, whilst in the 1920s and 1930s, for which more information is available, those rates increased dramatically.[19] Between the years 1915 and 1919, 85 per cent of all infants in the foundling hospital died and those who survived were either adopted or were claimed by their families.[20] In Hermoupolis, it has been estimated that about 60 per cent of the foundlings died within their first year of life during the last quarter of the nineteenth century.[21]

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[15] C. Loukos, 'Ta ektheta vrefe tes Ermoupoles: Ta prota thymata tes pathologias mias koinonias?' (Foundling infants of Hermoupolis: First victims of a society's pathology?), *Volume in Honour of the Professor Vasileios VI Sfyroeras* (Athens: Lychnos, 1994).

[16] More specifically, the number of foundlings who died was declining throughout the period under study: 1860-1879: 439; 1880-1899: 333; 1900-1919: 202; 1920-1940: 53.

[17] Revuelta & Ramiro, 'Understanding infant mortality', pp.19-42; B.A. Revuelta Eugercios 'Abandoned and illegitimate, a double mortality penalty? Mortality of illegitimate infants in the foundling hospital of Madrid, La Inclusa (1890-1935)', *History of the Family*, 18, 1 (2013), pp.44-67.

[18] R. Davenport, J. Boulton & L. Schwarz, 'Infant and young adult mortality in London's West End, 1750-1824', unpublished working paper: http://research.ncl.ac.uk/pauperlives/infantandchildmortality.pdf (access in March 2018); A. Levene, *Childcare, health and mortality at the London Foundling Hospital 1741-1800:'left to the mercy of the world'* (Manchester: Manchester University Press, 2007).

[19] M. Korasidou, *Oi Athlioi ton Athenon kai oi therapeutes tous. Ftocheia kai filanthropia sten Ellenike protevousa to 19o aiona* (The *Athens miserable and their therapists. Poverty and charity in the Greek capital of the 19th century*) (Athens: Typothyto, 2004), pp.124-25; C. Papavlasopoulou, 'Demotiko Vrefokomeio Athenon' (Municipal Foundling Hospital of Athens), *Publications of Historical Demography Postgraduate Program*, 9 (2013), p.91.

[20] Papavlasopoulou, 'Demotiko Vrefokomeio', p.92.

[21] Loukos, 'Ta ektheta vrefe', p.252.

Another reason which might account for the urban-rural differences is the use of wet-nurses, a very popular practice in many western European countries. In France, for instance, wealthy urban parents sent their offspring to wet-nurses in the countryside. It has been estimated that during the nineteenth century, more than 20,000 infants of nearly 54,000 live births in Paris were sent to nurses in the countryside. Of these, possibly a third died whilst they were still in infancy. Their deaths were registered in the countryside instead of being registered in Paris. [22] In Athens, unlike Paris, wet-nurses came in from the countryside and stayed at the houses of wealthy Athenian families. As a result, according to Zinnes, all those infants who may have died they were registered in Athens. This factor may not only be responsible for the urban-rural differences but may also account for the continuous high levels of infant mortality in Athens, especially when compared with other European cities.[23]

After outlining the main studies which have explored infant mortality in Greece together with probable reasons for the urban-rural differences, the need for a continuous series of infant mortality estimates, especially in an urban population, is evident. In the next section, therefore, the results that have been derived from research on Hermoupolis will be discussed in detail. The results are expected to fill the gap in the existing literature and also to provide additional evidence on the levels and the timing of the decline of infant mortality in Greece.

5.3 Infant mortality in Hermoupolis

5.3.1 *Estimation of IMR*

In order to examine the quality of the Hermoupolis sources, to detect the extent of under-registration and to correct the figures from the effect of such under-registration, two rates of infant mortality were calculated for every census year. For the first rate – the Reported IMR – the annual number of deaths that were recorded in the local civil death registration with a reported age of less than a year was used, together with the annual number of births (Tables 5.1 and 5.2: Reported IMR).[24] For the second rate – the Linked IMR – I used those death records that could be linked to a birth record providing a calculated age at death of less than 365 days, and those death

[22] J. Cole, '"A sudden and terrible revelation", motherhood and infant mortality in France 1858-1874', *Journal of Family History*, 21 (1996), pp.422-23.

[23] A. Zinnes, *Etude sur les principals causes léthifères chez les enfants au dessous de cinq ans et plus spécialement chez ceux de 0-1 an à Athènes* (Athens, 1880), cited by Korasidou, *Otan e arrostia apeilei,* p.199.

[24] The reported rate was calculated annually for the entire period under study.

records with a reported age of less than a year that it was not possible to link to a birth record (Table 5.2: Linked IMR). The number of deaths that were used for the calculation of the linked IMR can be seen in Table 5.2, in which the number of linked and unlinked cases are presented separately.

Death records for which the age was missing and thus impossible to link to a birth record, or when the death record indicated that the deceased had been born outside Hermoupolis, were ignored and were not used in the calculation of either rate. Stillbirths were also ignored in the calculations of both rates. It is important to keep in mind that systematic registration of stillbirths took place from 1912 onwards; prior to that, it was not possible to identify the extent of stillbirth mortality. Stillbirths in Hermoupolis are discussed in section 5.5.

In the case of infants, age-rounding was common.[25] So, in order to produce an accurate age at death and to find the real number of infants who died in every census year, for the cases in which the death and birth records were successfully linked, the exact number of surviving days was calculated by linking the recorded date of birth to that of the death. It was decided also to include in the linking exercise those infant deaths with a reported age at death up to 15 months in order to capture those cases where the age had been misreported and the real age at death was less than 365 days. When the calculated number of surviving days exceeded 365, the recorded death was treated as the death of a young child and therefore excluded from the calculation of the linked IMR. When the calculated surviving days were up to 365, the death was included in the linked IMR. Furthermore, in order to detect those infant deaths for which registration was delayed, the linking exercise was performed for the year following each census year. Therefore, the linking of infant deaths and births was performed for 17 years out of the 82-year study period.[26]

[25] Hionidou, The *demography of a Greek island,* p.125.
[26] The linking practice did not take place in 1941, as data were only collected until 1940.

Table 5. 1 Reported and linked IMRs for every census year, Hermoupolis, 1859-1940 (per 1,000)

Year	*Reported IMR (annual births and deaths)*	*Linked IMR 1 (births+ dummy births ≤365days)*	*Linked IMR 2 (births+ dummy births ≤8 days)*
1861	209.2	193.8	205.0
1870	191.5	187.0	193.5
1879	163.4	180.7	186.9
1889	234.6	223.4	240.0
1896	246.4	250.0	258.0
1907	269.6	251.0	260.5
1920	148.3	145.8	148.0
1928	192.4	190.2	195.4
1940	136.4	125.6	127.0

Note: For the calculation of the rates, see text.
Source: Calculated by the author using HMD.

For reasons related to the under-registration of births, the Linked IMR was calculated twice using different number of dummy births each time. For the purposes of this study, dummy births are defined as unrecorded births of infants whose death was registered in the Hermoupolis civil records. For the first rate, Linked IMR 1, dummy births were created for all cases of registered infant deaths for which there was no recorded birth certificate. For Linked IMR 2, dummy births were created for those deaths which occurred during the first 8 days after birth. This particular number of days was used as it is the average number of days for the compulsory reporting of births between the two registration acts in 1856 and 1924 (5 and 10 days respectively). The number of the dummy births created for both rates can be seen in Table 5.2, and all three IMRs are shown in Table 5.1 and Figure 5.4. Because the majority of the unlinked cases of infant deaths occurred after the tenth day and especially between the 29^{th} and 365^{th} day (Table 2.5), in this study Linked IMR 1 was used.

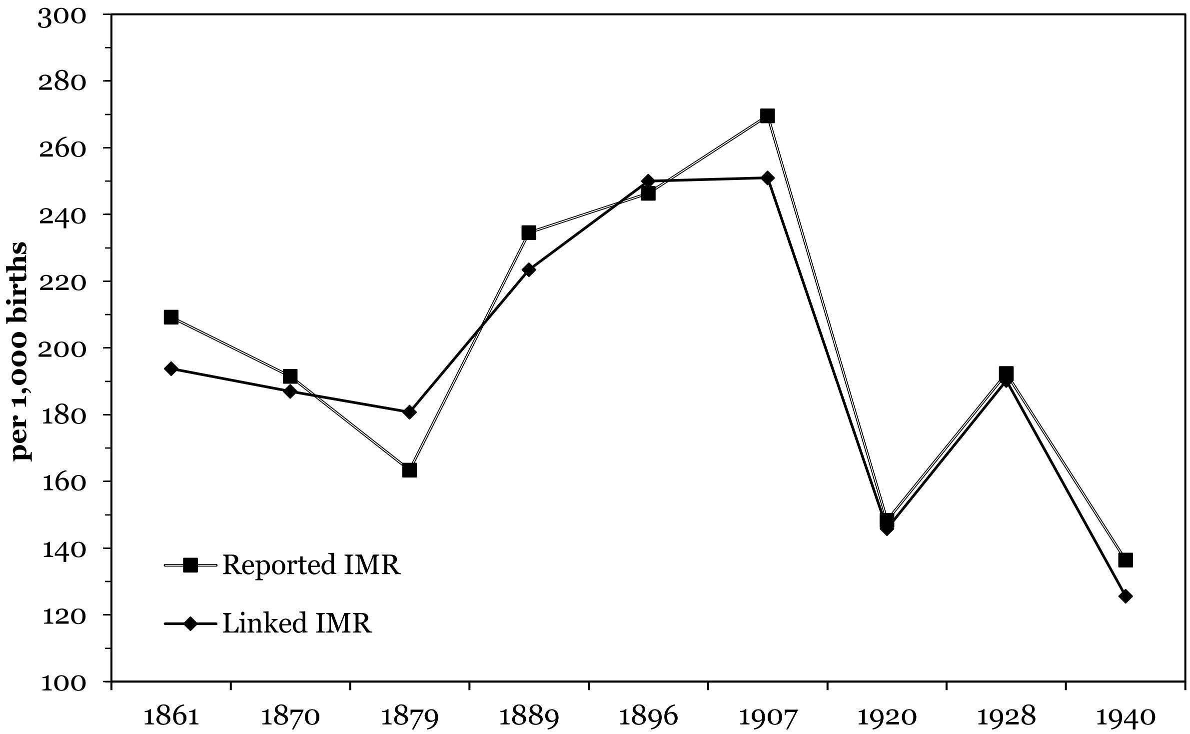
Table 5. 2 Number of deaths, births and dummy births for every census year, Hermoupolis, 1859-1940

Year	***No. of deaths linked age ≤365 d. (linked cases)***	***No. of deaths reported age ≤365 d. and not linked to a birth certificate***	***Total no. of infant deaths (linked IMR)***	***Total no. of infant deaths (reported IMR)***	***No. of births***	***Dummy births ≤365 d.***	***Total no. of births***
1861	81	50	131	131	626	50	676
1870	126	36	162	159	830	36	866
1879	108	29	138	119	728	30	758
1889	91	56	148	141	601	57	658
1896	118	29	147	138	560	29	589
1907	123	20	143	148	549	20	569
1920	73	17	90	89	600	17	617
1928	97	23	120	117	608	23	631
1940	49	4	53	57	418	4	422

Source: Calculated by the author using HMD.

When the two rates (Linked and Reported) are compared, as in Figure 5.4, they seem to follow the same pattern, although there are some disparities in 1870, 1879 and 1896. The disparities between the two rates may be attributed partially to age-misstatement. The linking exercise, as explained earlier, made it possible to overcome this problem by linking the date of birth with that of death, and thus calculating the exact number of days that those infants survived. In the twentieth century the discrepancies between the two rates had been minimised. Therefore, since both rates followed similar trends, it was decided to use the Linked IMR from now on as it seems to be smoother and more realistic compared with the rates from other parts of the country. The same decision was made for the several CBRs that were calculated after the linking exercise (Table 5.3).

Figure 5. 4 Reported and Linked IMRs for every census year, Hermoupolis, 1859-1940



Source: Calculated by the author using HMD.

Table 5. 3 Reported and Linked CBRs for every census year, Hermoupolis, 1859-1940

Year	*Reported CBR 1* (three-year average number of births)	*Reported CBR 2* (total number of births of each year)	*Linked CBR 1* (dummy births ≤365days)	*Linked CBR 2* (dummy births ≤8days)
1861	35.5	33.8	36.5	34.6
1870	39.5	39.5	41.0	39.9
1879	34.4	33.8	35.0	34.0
1889	29.3	27.2	29.7	27.7
1896	32.3	29.9	31.5	30.4
1907	33.1	30.3	31.4	30.9
1920	29.8	32.1	33.0	32.6
1928	26.2	28.4	29.5	29.8
1940	20.7	22.0	22.3	22.7

Note: For the calculation of the rates, see text.
Source: Calculated by the author using HMD.

5.3.2 *Infant mortality patterns*

IMR in Hermoupolis was high and seems to have been among the highest rates in both Greece and Europe, particularly in the late nineteenth and early twentieth centuries. Hermoupolis is a very suitable place for examining urban infant mortality in Greece as it was one of the largest urban centres and the second most populated city in the country, next only to Athens, for most of the second half of the nineteenth century. No other continuous calculations of the IMR in a Greek city are available, except sporadically (in Patras and Athens). For this reason, the comparisons which follow are restricted to the available estimates, which have either been based on assumptions (Valaoras) or have used sources that display significant problems (Patras).

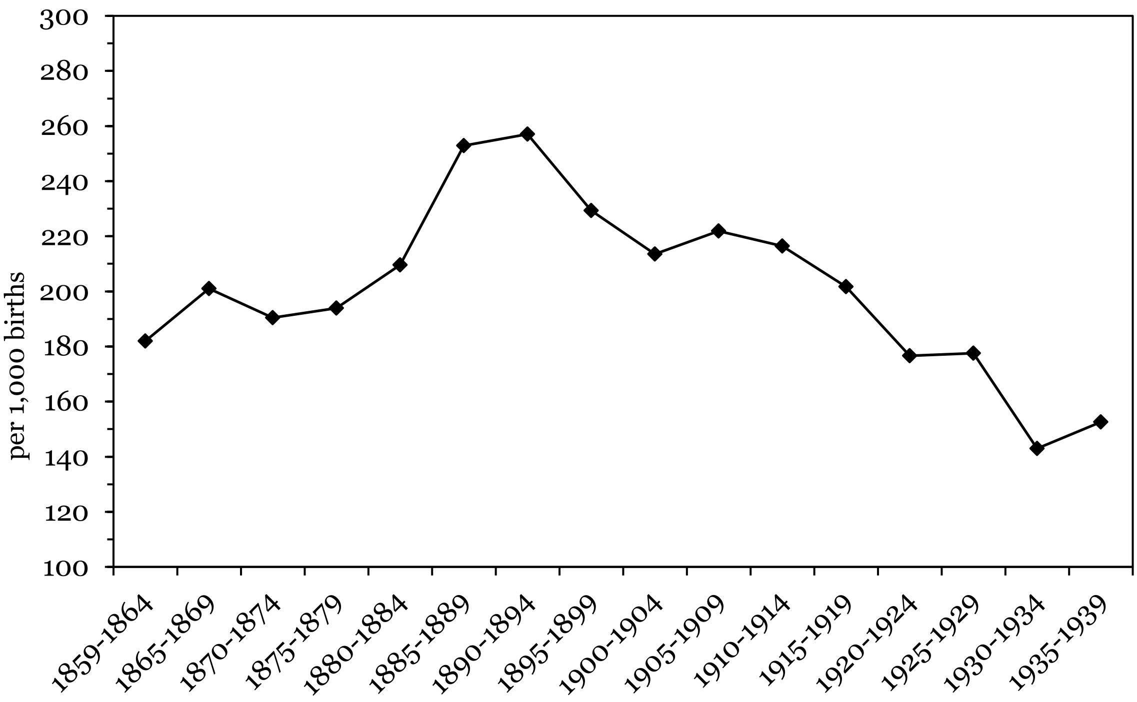
IMR in Hermoupolis in the mid-nineteenth century was 193.8 per thousand, at a similar level to the national rate estimated by Valaoras, which was 198 per thousand (Figure 5.6). In the late 1870s it declined, reaching 180 per thousand. During the following decades and until the early twentieth century, IMR increased and remained remarkably higher than the national rate, reaching 250 per thousand in 1896 and 1907. This increase in IMR in the late nineteenth century is assumed to have been the product of the decline of the economy in the city, as discussed in section 2.2; however, this will be further examined in section 5.4.2. Another reason that might have contributed to this increase is the improvement of civil registration, as showed in the linking exercise. By 1896 registration coverage was of very high standard. The decline in infant mortality in Greece has been found to have started in the 1930s, which is in close agreement with the trend in Hermoupolis.[27] Nonetheless, IMR in Hermoupolis showed clear signs of decline in the decade leading up to 1920 which decline seems to have been interrupted in 1928, probably as a result of the refugee influx on the island as everywhere else in the country. Subsequently, IMR declined from 190 per thousand in 1928 to 125.6 in 1940, thus reaching levels much closer to the national rate (Figure 5.6).

Calculating the linked IMR around the census years did not allow us to explore the short-term fluctuations of infant mortality for specific span of years due to the long gaps in the publication of censuses (for example, from 1907 to 1920). Therefore, the five-year moving average of the reported IMR, as shown in Figure 5.5, was calculated in order to examine more thoroughly infant mortality trends in Hermoupolis. The five-year moving average of Reported IMR followed a similar trajectory to that of the linked IMR, increasing from the 1870s onwards and reaching its peak in the 1890s.

[27] Valaoras, 'A reconstruction', p.132; D.G. Tsaouses, *Morphologia tes Neollenikes koinonias* (*Morphology of the Modern Greek society*) (Athens: Gutenberg, 1971), p.198; Bournova, *Oi katoikoi ton Athenon,* pp.76-77.

Even though the linked rate exhibited a clear decline in 1920, the five-year moving average of Reported IMR showed that this decline may have started before that by the turn of the century, whilst the fall was continuous throughout the first decades of the twentieth century.

Figure 5. 5 Five-year moving average of the reported IMR, Hermoupolis, 1859-1940



***Source*:** Calculated by the author using HMD.

A main reason for the high levels of infant mortality in Hermoupolis was undeniably the high number of foundlings in the city during the second half of the nineteenth century. Loukos estimated that 1,426 foundlings were abandoned in the local hospital during the period 1873-1910, with most of them dying within the first year of life.[28] HMD suggests that foundling deaths accounted for roughly 10 per cent of all annual infant deaths for most of the period prior to 1920. Yet, not all foundlings were necessarily of urban origin. As has been found elsewhere, the existence of foundling hospitals or hospitals which received foundlings in urban centres affected the mortality pattern in those areas, as infants who were born elsewhere, were abandoned in those institutions.[29] Given that Hermoupolis was the major urban area of Syros, it is possible that mothers from other parts of the island might have abandoned their infants in the Hermoupolis local hospital. However, this is highly unlikely. The

[28] Loukos, 'Ta ektheta vrefe', p.252.

[29] Ramiro, 'Mortality in hospitals', p.405; Revuelta & Ramiro, 'Understanding infant mortality', p.33

pregnant woman would have to travel on foot to Hermoupolis, give birth on her own there and then deposit the newborn baby. Alternatively, she would give birth secretly in her place of origin and then travel on foot with the baby to Hermoupolis. As the sole purpose of disposing the foundling was to retain her anonymity and conceal her association with the illegitimate child either of the above scenarios are highly unlikely. In both cases, the woman would come across acquaintances who would ask questions. Oral evidence also indicates that the Catholics of Ano Syros left unwanted babies in or near Catholic churches in Ano Syros. The Catholic priest then judged what would happen to them, allocating them to Catholic families.[30] It is more probable that women who could afford to do so, did travel from Syros to bigger urban centres such as Athens or Piraeus in order to retain anonymity and to avoid the social stigma. The hypothesis that mothers had travelled from other Cyclades islands to Hermoupolis in order to abandon their children is highly improbable, as in most cases women would not travel to Syros since anonymity could never been ensured there. Those who could afford such a trip, they would have travelled to Athens for similar reasons as their counterparts from Syros. It has been suggested that the stressful experience of those single mothers during the pregnancy, who had no partner to support them either economically or emotionally, could have harmful effects on children's mortality.[31] The higher mortality levels for those children born out of wedlock is very well established in the literature.[32]

In addition, prostitution was common in the busy port of Hermoupolis. Some of the Hermoupolis's foundlings would have been their children. The high prevalence of syphilis or other sexually transmitted diseases among these women in Hermoupolis had significant effects on pregnancy and increased the risks for the newborns.[33] Those babies, as a consequence, had very high risk of dying regardless of treatment received. The high number of female servants found in Hermoupolis might have also contributed to the high number of foundlings in the city. In many cases, these women were sexually harassed by the head or other members of their household, and any

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[30] No.9 (Husband and Wife who lived in Ano Syros and were married in 1943).

[31] Revuelta, 'Abandoned and illegitimate', p.45.

[32] A. Brändström, S. Edvinsson & J. Rogers, 'Illegitimacy, infant feeding practices and infant survival in Sweden 1750-1950. A regional analysis', *Hygiea Internationalis*, 3(2002), p.31.

[33] Revuelta, 'Abandoned and illegitimate', p.46; D. Watson-Jones *et al.*, 'Syphilis in pregnancy in Tanzania. I. Impact of maternal syphilis on outcome of pregnancy', *The Journal of Infectious Diseases*, 186 (2002), p.944; G. Gonatidis, *Afrodisia nosemata sten Ermoupole ton 19o aiona* (*Venereal diseases in Hermoupolis in the 19th century*) (University of Ioannina, MA dissertation, 2014), p.112.

unintended pregnancies often ended up in infanticide or abandonment of the newborns.[34]

For all these reasons, it is likely that many infants who were born in other parts of the island, had their death recorded in the city. This might have resulted in the increase of infant mortality levels in Hermoupolis and the mis-registration of infant deaths in Ano Syros or the rural parts of the island. To be able to reduce any possible effect of the over-estimation of infant mortality in the city, those deaths of infants, where place of birth was clearly stated to be outside Hermoupolis, were straightforward excluded from our calculations. Moreover, death records of the foundlings were linked to the foundling lists of the local hospital, when possible, as described in section 2.5.2, in order to obtain the missing information. While for all those cases, where the deaths were not able to be linked with a birth certificate, dummy births were created (see also section 5.3.1). Although it is expected that in this way the effect of miscalculation of infant mortality rates in Hermoupolis was minimized, it is important to keep in mind the likely impact of those usually resided in other parts of the island having their deaths registered in the city, as found also elsewhere.

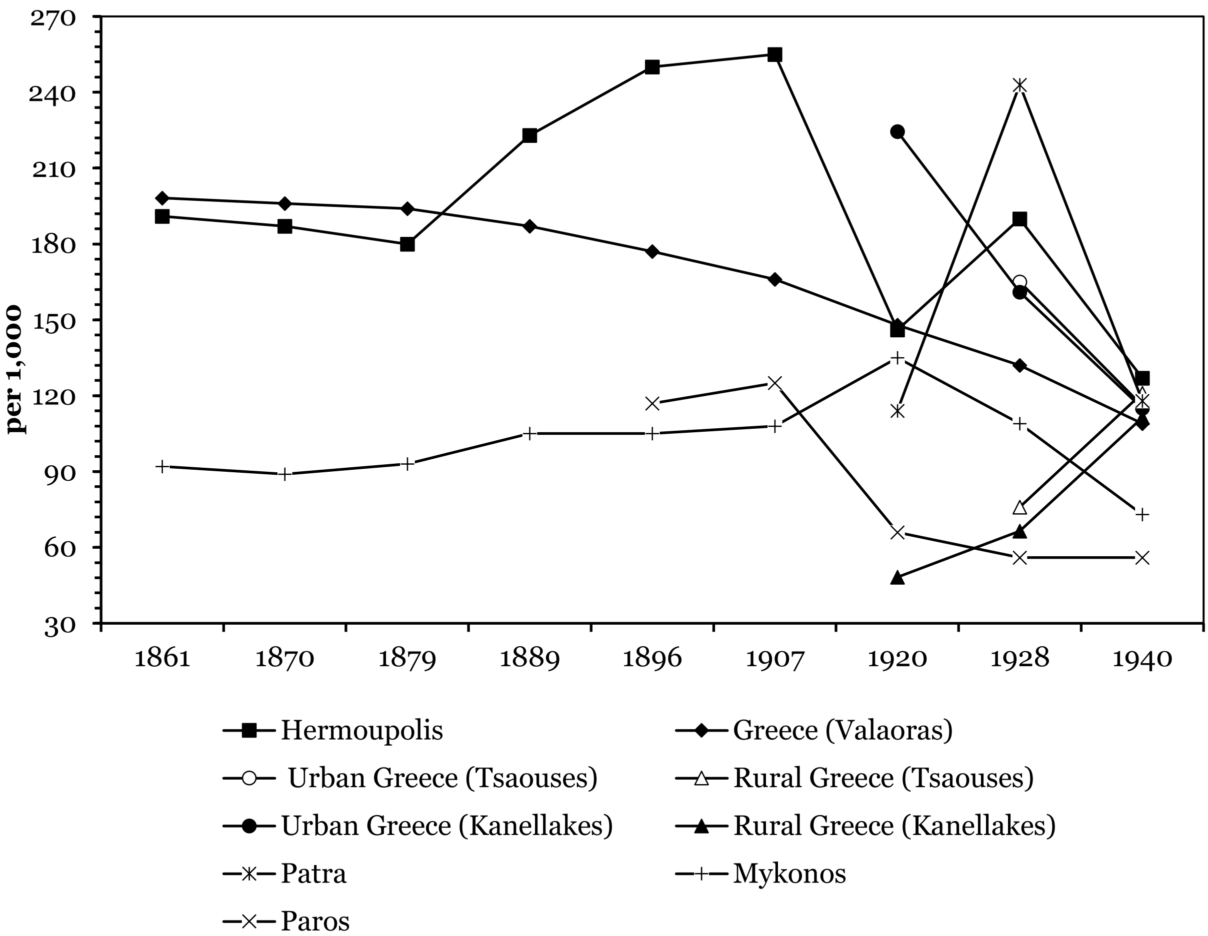
IMR in Hermoupolis provides additional evidence to contextualise the rates in Athens in the 1860s and 1870s and also in Patras in the 1920s – neither of them seems to be in line with the rates calculated in this thesis. IMRs of Hermoupolis and Patras in the 1930s are in much closer agreement than in the previous decade. When the Hermoupolis rate is compared with that estimated in Mykonos and Paros, important urban-rural differences are detected, as Hermoupolis's rate was much higher than the other two rates throughout the study period. But even if we exclude Mykonos from our comparisons, as it was a semi-urban population, the urban-rural gap between Hermoupolis and Paros is even more apparent.

In addition, the almost parallel decline of IMR, as can be seen in Figure 5.6, in Hermoupolis and Paros from 1907 to 1920 suggests that fluctuations in infant mortality may have depended on local factors. Similar declining trends have not been found in other places in the country and neither were they expected because of the continuous involvement of the country in various wars since 1912 and the resulting consequences. This declining trend is not evident in Mykonos's results, as the nine-year moving average number of deaths was used for the calculation of the IMR. The

[34] Loukos, 'Ta ektheta vrefe', p.255; Gonatidis, *Afrodisia nosemata*, p.112.

1920 rate refers to the period 1919-1928 and therefore takes into account the possible impact of the refugees, which in Hermoupolis and Patras is shown in the 1928 rate. These results seem to suggest that IMR increased in those urban centres in the years following the refugee influx. Nonetheless, there are still many unanswered questions about the effect of the refugees on infant mortality, and there is therefore much room for further research.

Figure 5. 6 IMRs in various places in Greece, including Hermoupolis, 1859-1940



Sources: *Athens*: Kanelakes, *Symvole eis ten melete*, p.136; *Greece*: Valaoras, 'A reconstruction', p.132; Tsaouses, *Morphologia tes Neollenikes koinonias*, p.198; *Mykonos*: Hionidou, *The demography of a Greek island*, p.50; *Paros*: Gavalas, *Demographic reconstruction*, p.79; *Patras*: Eliopoulos, *Oikonomikes kai koinonikes domes*, pp.103; Hermoupolis: HMD.

IMR in Hermoupolis seems to be high even when compared with the rates in most western European countries. After its decline, its rates were still among the highest in Europe in the 1920s. Hermoupolis's IMR was above that of some of the unhealthiest English cities and towns throughout the period under study. In Manchester, for instance, where CDR surpassed Hermoupolis's CDR in the second half of the nineteenth century, its IMR was lower than that of Hermoupolis. More specifically, in the late 1910s, Manchester's IMR was about 141 per thousand, and the highest rates at the time were 161 in Stoke and 152 in Preston.[35] Nineteenth-century Hermoupolis's IMR can be compared with the IMR of some regions in Germany at the time, such as Silesia, Saxony and Posen, with rates higher than 200 per thousand.[36] When Hermoupolis's IMR is compared with other Mediterranean populations such as Alghero in Sardinia, it seems that similar trends were in progress at the same time.[37] IMRs in both Alghero and Hermoupolis declined almost at the same time in the mid-1910s. However, IMR in Hermoupolis was always higher than that in Alghero, which had the lowest IMR in Italy since the late nineteenth century.[38] Another Mediterranean population with a very similar timing of decline to that of Hermoupolis is the city of Palma on the island of Mallorca. There, IMR started to decline in the 1920s, reaching 110 per thousand in 1928, which was among the lowest rates in Spain at the time. As in the case of Alghero, IMR of Palma was much lower than that of Hermoupolis.[39] The very high levels of infant mortality in Hermoupolis at the beginning of the twentieth century are comparable with those of the Mediterranean island community of Malta. More specifically, IMR in Malta was at levels well above 200 per thousand births even until the 1940s, mainly due to a very high incidence of infant diarrhoeal diseases.[40]

IMR in Hermoupolis produces new insights into the urban infant mortality of the country. These results demonstrate a high IMR in the city throughout the period under study. IMR declined significantly in 1920, which seems to have been a unique case within the country, followed by an increase in 1928. By 1940, the decline in infant mortality was clearly in progress, which is in line with the results from similar studies among Greek populations. Moreover, findings from Hermoupolis are part of the urban-rural debate in the Greek literature since they reveal the much higher incidence of infant deaths in the cities. The next section explores the neonatal and post-neonatal

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[35] R. Millward & F. Bell, 'Infant mortality in Victorian Britain: the mother as medium', *Economic History Review*, LIV, 4 (2001), p.708.
[36] Vögele, 'Urban infant mortality', p.405.
[37] M. Breschi *et al.*, 'A slow transition. Infant and child mortality decline in a Sardinian community: Alghero (1866-1935)', in D. Ramiro Farinas and M. Oris (eds), *New approaches to death in cities during the health transition* (New York: Springer, 2016), p.122.
[38] M. Breschi *et al.*, 'The Sardinian experience of the lowest Italian infant mortality at the turn of the twentieth century. True or false empirical evidence?', *Annales de démographie* historique, 123, 1 (2012), pp.63-94.
[39] J.M. Pujadas Mora, *L'evolució de la mortalitat infantile i juvenil a la ciutat de Palma (Mallorca, 1838-1960)* (Universitat de les Illes Balears: Unpublished PhD thesis, 2009), pp.277, 514.
[40] L.A. *Sawchuk et al.*, 'Situating mortality: quantifying crisis points in period of stability', *American Journal of Physical Anthropology*, 152 (2013), p.460.

mortality levels of the city. The calculation of these rates is expected to shed more light on the patterns of infant mortality in Hermoupolis and help to uncover the reasons for its noteworthy decline.

5.4 Neonatal and post-neonatal mortality

Situating the levels of neonatal and post-neonatal mortality in Hermoupolis into the Greek context, this section considers the contribution of each of these two components to the fluctuations of IMR in Hermoupolis.

The first 30 days of life have always been the riskiest. Neonatal deaths are caused mostly by genetic makeup or conditions occurring before or during the birth and the quality of care during the delivery itself. They are also related to obstetric trauma, the mother's health, the number of births she had previously had and her nutritional status during pregnancy, all of which would impact on the immaturity of the foetus.[41] However, it has been suggested that not all neonatal deaths can be treated as endogenous mortality, as they can occur for different reasons also, such as respiratory diseases as a result of climatic conditions.[42] Some deaths also triggered by endogenous causes might occur after the first month of life, although their effect is considered to be minimal.[43]

Most European countries had experienced a decline in neonatal mortality before the nineteenth century, followed by an increase in post-neonatal mortality.[44] The most probable reasons suggested in the literature for the decline in endogenous mortality are improvements in obstetric care and more advanced training of midwives, and

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[41] R.S. Kirby, 'Neonatal and post-neonatal mortality: useful constructs or outdated concepts?', *Journal of Perinatology*, 13,6 (1993), p.433; Millward & Bell, 'Infant mortality', pp.707-08; A. Reid, 'Neonatal mortality and stillbirths in early twentieth century Derbyshire, England', *Population Studies*, 55, 3 (2001), p.213.

[42] Pozzi & Ramiro, 'Infant and child mortality', p.59; Oris *et al.*, 'Infant and child mortality', p.378.

[43] Hionidou, *The demography of a Greek island,* p.217.

[44] Williams, *Infant and child mortality*, p.23; A. Bideau, J. Dupaquier & J-N. Biraben, 'La mortalité de 1800 a 1914', in J. Dupaquier (ed.), *Histoire de la population francaise: De 1789 a 1914* (Paris: Presses Universitaires de France, 1988), pp.289-90; C. Corsini, 'Structural changes in infant mortality in Tuscany from the eighteenth to the nineteenth century', in T. Bengtsson, G. Fridlizius & R. Ohlsson (eds), *Pre-industrial population change. The mortality decline and short-term population movements* (Stockholm: Almquist and Wiksell International, 1985), pp.127-149; A. Brändström, 'The impact of female labour conditions on infant mortality: a case study of the parishes of Nedertomea and Jokkmokk, 1800-96', *Journal of the Society for the Social History of Medicine,* 1 (1988), p.339.

improvements in nutrition and living conditions, which led to better nourished mothers who gave birth to healthier infants.[45]

Post-neonatal deaths (1-11 months) comprise the largest proportion of infant mortality. It has been argued that falls in post-neonatal mortality were responsible for much of the early stages of the decline of infant mortality in northern European populations.[46] The post-neonatal mortality rate is affected by external environmental changes as a consequence of the current socio-economic conditions.[47] Post-neonatal mortality is strongly related to poor hygienic conditions, infectious diseases, child-care practices, and length of breast-feeding.[48]

Neonatal and post-neonatal mortality rates in Hermoupolis have been calculated for every census year using the reported and the linked age at death, thus providing two sets of figures (Table 5.4). Any differences between the linked and reported neonatal mortality rates in Hermoupolis, as discussed in section 5.3.1, could well be attributed to birth under-registration of those infants who died within a few hours or days after their birth, and also age-misreporting. For reasons explained earlier, the linked rates have been used for the analysis of neonatal and post-neonatal mortality in Hermoupolis during the study period. Finally, due to the lack of similar rates in other urban centres of the country, Hermoupolis's rates are compared only with those in Mykonos and, for a limited number of years, with those in Paros.[49]

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[45] Woods et *al*., 'The causes of rapid infant mortality, Part I', pp.351-52; Williams, *Infant and child mortality*, pp.23-24; Millward & Bell, 'Infant mortality', p.706.
[46] Williams, *Infant and child mortality,* p.23.
[47] N. Hart, 'Beyond infant mortality: gender and stillbirth in reproductive mortality before the twentieth century', *Population Studies*¸ 52, 2 (1998), p.220.
[48] Woods *et al*., 'The causes of rapid infant mortality, Part I', pp.352-53.
[49] Kanellakes also estimated neonatal and post-neonatal rates in Athens and also in every region of the country, as he did for IMR. However, those results are not presented in this thesis because Kanellakes divided post-neonatal mortality quarterly and it was therefore impossible to make comparisons with Hermoupolis's results. Neonatal mortality rates in Athens in the early 1920s have been estimated at extremely high levels (1,348 per thousand). Thus, Hermoupolis's results will not be compared with those derived by Kanellakes in order to avoid inaccurate comparisons or conclusions.

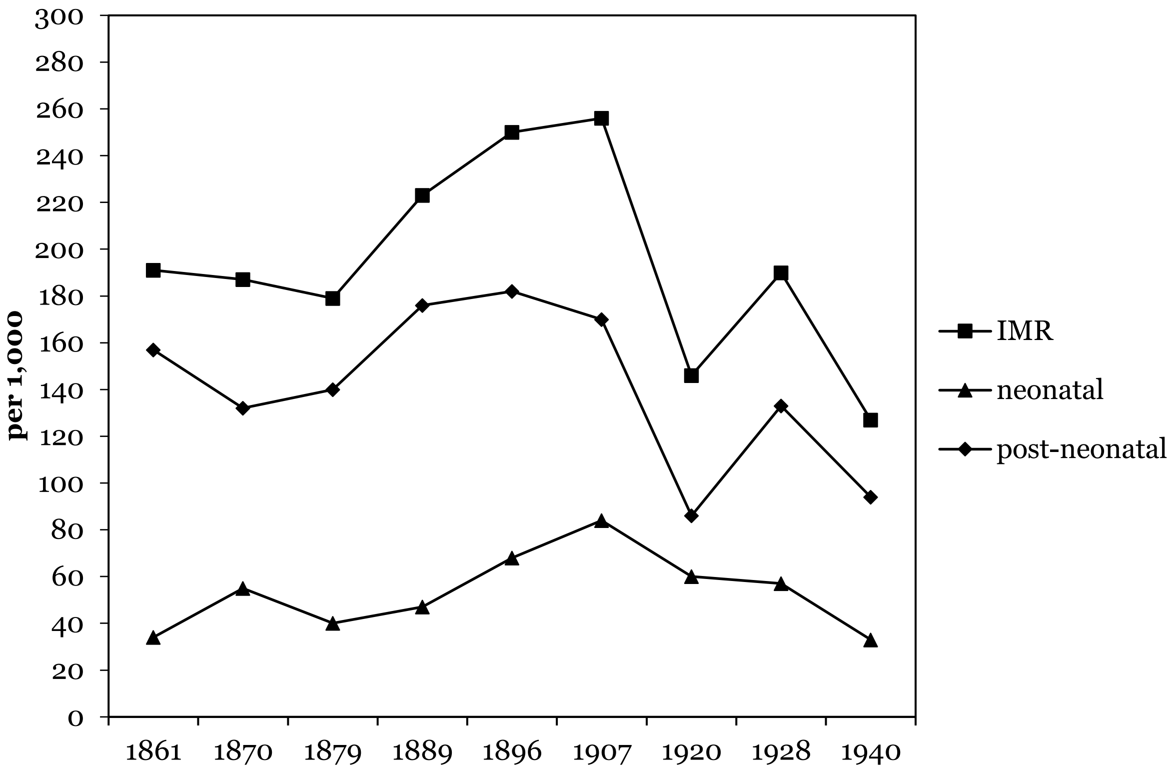
Table 5. 4 Reported and Linked IMRs, neonatal and post-neonatal mortality rates, Hermoupolis, 1859-1940

Year	*Reported IMR*	*Linked IMR*	*Reported neonatal mortality*	*Linked neonatal mortality*	*Reported post-neonatal mortality*	*Linked post-neonatal mortality*
1861	209.2	190.8	36.7	34.0	172.5	156.8
1870	191.5	187.0	57.8	55.4	133.7	131.6
1879	163.4	179.4	41.2	39.6	122.2	139.8
1889	234.6	223.4	51.6	47.1	183.0	176.3
1896	246.4	249.6	76.8	67.9	169.6	181.7
1907	269.6	254.8	76.5	84.4	193.1	170.3
1920	148.3	145.8	56.7	60.0	91.6	85.8
1928	192.4	190.2	55.9	57.1	136.5	133.1
1940	136.4	127	33.5	33.0	102.9	94.0

Note: For the calculation of the rates, see text.
***Source*:** Calculated by the author using HMD.

As expected from the findings in other European studies, fluctuations in post-neonatal mortality levels were mainly responsible for the fluctuations of IMR. As is evident in Figure 5.7, the sharp increase in IMR in the 1880s, its decline in 1920 and its significant increase in 1928 were the results of fluctuations in post-neonatal mortality. A strong correlation (R^2=0.8585) was found between IMR and the post-neonatal rate, whereas a much weaker correlation was detected with neonatal mortality (R^2=0.4392). Nonetheless, neonatal mortality had contributed to the increase in IMR towards the end of the nineteenth and the early twentieth centuries and partly to the decline in 1920.

Figure 5. 7 Linked IMR, neonatal and post-neonatal mortality rates, Hermoupolis, 1859-1940



Source**:** Calculated by the author using HMD.

5.4.1 *Neonatal mortality*

Even though neonatal mortality was low at the beginning of the study period, it doubled between 1879 and 1896 (from 40 to 84 per thousand) and remained high until 1907. This peak seems to have been an unusual trend for the levels of neonatal mortality in the city throughout the study period. One of the main reasons for the great increase in neonatal mortality in the late nineteenth century could be the gradual improvement of civil registration, as was shown in section 2.3.2. Another possible explanation, as found in the local press, was the massive increase in the prices of basic products such as bread, and it is therefore assumed that this may have affected the nutrition of mothers and ultimately that of infants.[50] It is expected that the decline of the city's economy and the increasing unemployment rates, especially among the working classes, would also have played an important role in the increase in neonatal mortality at the time.[51]

[50] *Panope*, 17/06/1877, Z, 348, p.2; 18/10/1877, Z, 387, p.4.
[51] *Panope*, 29/11/1877, Z, 393, p.3.

Neonatal mortality followed a significant decline from 84 per thousand in 1907 to 60 per thousand in 1920. A reason for this decline is more possibly the registration of stillbirths from 1912 onwards. As indicated earlier, stillbirths have been excluded from our calculations, which means that those stillbirths that occurred prior to 1912 and had been reported as neonatal deaths had been included in the calculations, as it was impossible to identify them.[52] Therefore, the decline – at least partly – is more likely to be an artefact of a change in the registration process rather than an actual decline.Finally, neonatal mortality remained stable until 1928, but by 1940 it seems that it experienced a significant decline, reaching lower levels in 1940: 33 per thousand.

Even though the decline in neonatal mortality has been connected with advances in medical care, it seems that no special improvements took place in the city even by the end of the study period. It is possible to hypothesise that changes would have taken place in childbirth practices; for example, improvements in cleanliness during childbirth and also in caring for infants, but it has not been possible to trace any evidence for this in the available primary sources. Evidence from the Swedish case has shown that better education of midwives had contributed to the fall in infant mortality from the mid-eighteenth century.[53] From the 1910s onwards, the Greek state showed great interest in obstetrical care and the training of midwives. In order for a woman to become a midwife, it was mandatory for her to receive one year's training by attending the Midwifery School of Athens and then to take an examination to qualify for a licence to practice.[54] Even so, there is no evidence with which to examine the impact of the better training of midwives on birth practices in Hermoupolis, apart from a few references in the local press showing that a few trained midwives moved to the island, and also census sources, which reveal that the number of midwives had increased in the city by 1928.[55] Such arrivals would be expected to have had a cumulative though

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[52] As will be discussed in section 5.5.4, only a few stillbirths were found in the Hermoupolis civil registration prior to 1912, while the number of infants dying within the first few hours or days after birth declined significantly after the registration of stillbirths. The use of a retrospective projection technique in the future, similar to that employed by Hart, will reveal more accurate rates for the period when stillbirth registration is not available: Hart, 'Beyond infant mortality'.

[53] A. Brändström, 'Infant mortality', p.21; S. Edvinsson, O. Gardarsdottir & G. Thorvaldsen, 'Infant mortality in the Nordic countries, 1780-1930', *Continuity and Change*, 22, 3 (2008), p.475.

[54] ΔΞΓ 4063, 'Peri eksaskiseos tou epaggelmatos' (Concerning the training of the medical profession), *FEK*, 68, 20/02/1912, A, p.1; 'Peri foiteseos eis to Maieutikon Scholeion' (Concerning the attendance at the Midwifery School), *FEK*,169, 13/09/1916, A, p.1.

[55] *Tharros,* 6/10/1933, 566, Θ, p.2; Evidence from census data shows that in 1907 in the department (*eparchea*) of Syros (which included Hermoupolis, the rest of the island of Syros and the island of

gradual effect, since the new midwives would have been trained in hygienic practices. However, oral evidence indicates that even in the 1920s and later, all women gave birth in their houses with the help of unqualified 'practitioner' midwives:

> *Q*. And when she gave birth, did she go to the hospital, the maternity hospital?
>
> *A*. No, in houses.
>
> *Q*. In houses?
>
> *A*. In their own houses.
>
> *Q*. Who went to the maternity hospitals? The rich, the most affluent?
>
> *A*. They [the rich] know that. I haven't heard of anyone ... like nowadays, they say such and such went to that hospital and ...
>
> *Q*. Yes?
>
> *A*. Back then, I beg your pardon, because you are a young woman, they wore those long trousers. My mother gave birth to three babies inside them [wearing those trousers]. Whilst she was walking, she had three [babies].
>
> *Q*. Whilst she was walking, she had them?
>
> [...]
>
> *A*. And there were there [during the birth], the female neighbours; how should we call them? Healers? How are they called? And they knew [had the knowledge] and took care of her.[56]

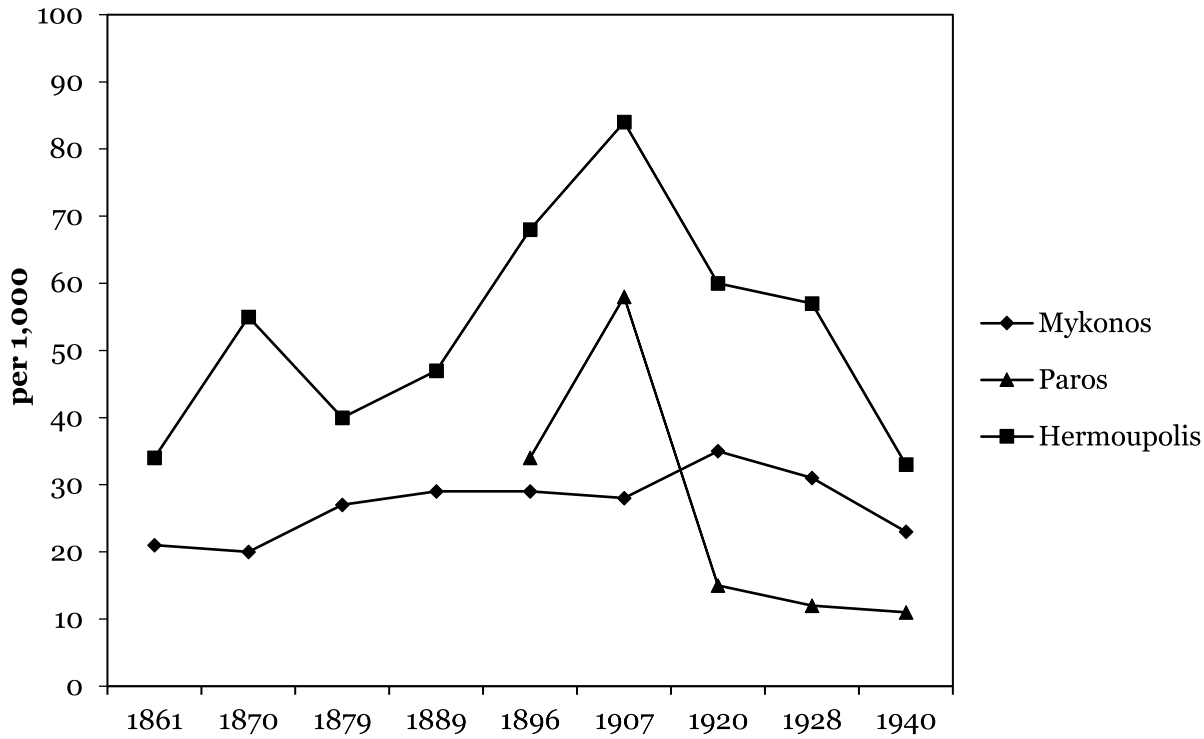
Finally, when Hermoupolis's neonatal mortality is compared with that of Mykonos and Paros, it seems that it fluctuated at much higher levels than the other two populations. (Figure 5.8, Table 5.5). In both Mykonos and Paros, neonatal mortality was found to be extremely low, but especially in Paros, which Gavalas suggested was a result of the great under-registration of deaths occurring within a few hours or days after birth, together with the exclusion of Kostos, as discussed previously.[57]

Mykonos), there were 27 midwives; in 1920, 16 midwives were found on the island of Syros, 12 of whom were based in Hermoupolis. In the 1928 census, 16 midwives were recorded in Hermoupolis.

[56] No.11 (Male informant, working class, born and resident in Hermoupolis, parents married around 1916).

[57] Gavalas, 'Island mortality', pp.210-12.

Figure 5. 8 Neonatal mortality rates in Mykonos, Paros and Hermoupolis, 1859-1940



Sources: Hionidou, The *demography of a Greek island,* p.126; Gavalas, *Demographic reconstruction*, p.230; HMD.

Table 5. 5 Neonatal and post-neonatal mortality in Mykonos, Hermoupolis and Paros, 1859-1940

	Hermoupolis			Mykonos			Paros		
Year	***Neonatal (Linked)***	***Post-neonatal (Linked)***	***IMR (Linked)***	***Neonatal***	***Post-neonatay***	***IMR***	***Neonatal***	***Post-neonatal***	***IMR***
1861	34	157	191	21	70	91			
1870	55	132	187	20	69	89			
1879	40	140	180	27	67	93			
1889	47	176	223	29	76	105			
1896	68	182	250	29	76	105	34	82	116
1907	84	170	255	28	81	108	58	67	125
1920	60	86	146	35	101	135	15	51	66
1928	57	133	190	31	78	109	12	44	56
1940	33	94	127	23	50	73	11	45	56

Note: Paros includes the communities of Naousa and Kostos but the rates in 1920 and 1928 refer only to Naousa.
Sources: Hionidou, The *demography of a Greek island*, p.126; Gavalas, *Demographic reconstruction*, p.230; HMD.

5.4.2 *Post-neonatal mortality*

Because post-neonatal mortality is affected by exogenous causes, a description of the post-neonatal levels, together with a narration of the socio-economic conditions of the city, is necessary in order to properly understand its fluctuations over time.

The decline in post-neonatal mortality in 1870 is a rather surprising pattern, as in both the previous and the following census years the rate was noticeably higher. The reason for this is not known, but it is likely to have been a consequence of the improvement of registration coverage and more accurate age-reporting (Figure 5.7 and Table 5.5).[58] It might be also somehow related to the great increase in ECMR at the same time (Figure 4.11).

The continuous increase in post-neonatal mortality in the following decades can be attributed to the city's unstable economic profile. The worsening of working conditions and the very low living standards, especially of the working class, should be among the main reasons that contributed to the increase in mortality of those infants aged between 1 and 12 months.[59] According to a newspaper article:

> The working class on Syros experiences high unemployment. Many shipyard workers along with craftsmen and their families are deprived of bread. Almost all ships remain in the port and therefore unfortunately sailors stay unemployed as well. Due to the lack of wheat, the price of bread, the main food for the people, increases more and more.[60]

In 1879, the significant devaluation of the Russian and Turkish currencies, which were used extensively in Hermoupolis, caused a massive increase in the price index of around 27 per cent.[61]

A major peak of post-neonatal mortality occurred in 1896 – the largest in the whole 82-year series – when refugees arrived from Crete after the Cretan Revolution. The refugee settlements that were created in the city by the local authorities were described

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[58] The linkage rate increased significantly from 62 per cent in 1861 to 78 in 1870 (Table 2.4).

[59] *Panope*, 17/06/1877, Z, 348, p.2; Kolodny, 'Hermoupolis-Syros', pp.274-75.

[60] *Panope*, 29/11/1877, Z, 392, p.3.

[61] M. Tountas, 'Pole kai viomehania, e periptose tes Ermoupoles' (City and industry, the case of Hermoupolis), *Praktika tou diethnous symposiou Istorias- Neollenikes poles, Othomanikes kleronomies kai Elleniko kratos* (*Proceedings of the International Symposium of History, Neo-Hellenic cities, Ottoman Heritages and Greek State*) (Athens: Etaireia Meletes Neou Ellenismou, 1985), p.630.

in the local press as dirty and unhealthy places with high population density and poor sanitary conditions. Problems with the disposal of excreta and inadequate housing contributed to worsening public hygiene in the city and the transmission of infectious diseases.[62] Unemployment, vagrancy and migration were among the main characteristics of Hermoupolis in the 1890s according to the local press, as a result of the unstable financial and political situation of the whole country, due primarily to the public insolvency of 1893 and the Greco-Turkish War of 1897.[63]

Post-neonatal mortality declined dramatically from 170 in 1907 to 86 per thousand in 1920, even though the financial situation of neither the city nor the country improved. The country imported foodstuffs due to the decline in domestic production, which was mainly a result of the effects of the very long period of almost continuous war from 1912 to 1923, followed by serious economic disruption, devaluation of the drachma (the currency at the time) and sustained high inflation.[64] This fact raises a very interesting question about the determinants that contributed to the sharp decline in post-neonatal mortality. As the general economic and political situation of the country at the time seems not to have affected the post-neonatal mortality levels of the city, the explanation should be found at the local level. The calculation of the rates around the census years may be the reason why the IMR in 1920 does not reflect the financial or social consequences of that period. According to Valaoras, the decline in infant mortality rates in the whole country in the early 1920s was due to the implementation of public hygiene measures and improved living standards.[65] Similar points were raised by Bournova for Athens in the late 1920s.[66] As shown in Chapter 3, very limited improvements in public hygiene took place in the city before the 1930s. It is therefore very unlikely to be the reason for this inexplicable decline of the post-neonatal mortality in the city in 1920. In Hermoupolis, however, according to Loukos, the establishment of philanthropic organisations from the mid-1910s onwards led to the

[62] *Helios,* 16 /01/1894, IH, 464; 26/09/1897, KB, 621, p.1; 7/12/1897, KB, 628, p.2; however, the same newspaper suggested that the Cretan refugees left the island in 1898, and during this period a resurgence in the economic activity on the island was observed: 6/12/1898, 676.

[63] *Helios,* 16/01/1894, KH, 464, p.2; 13/07/1899, KE, 702, p.2; 7/11/1899, KE, 715, p.3.

[64] Hionidou, 'Infant mortality in Greece', p.163; in the newspaper *Paligeneseia*, there are articles about the increase of price index of basic products: 10/01/1915, 258, ST, pp.1-2; 14/08/1915, 284, ST, p.1; *Tharros*, 1/10/1924, 13, A, p.2; also in 1917, a soup-kitchen for the indigent was operating in the city, the first time after the arrival of the Cretan Revolution refugees: *Paligeneseia*, 21/01/1917, 355, H, p.1; the high unemployment rates of the country are confirmed in *Tharros,* 22/04/1925, 70, B, p.1.

[65] Valaoras, *Stoiheia viometrias*, p.165.

[66] Bournova, *Oi katoikoi ton Athenon,* pp.76-77.

better care of those infants from the lower social classes (section 3.4.3).[67] In addition, in 1920 a foundling hospital was established in the city based on charitable funds, leading to significant declines in foundling mortality.[68] Therefore, it seems that infants in Hermoupolis received better care and nourishment after the establishment of those philanthropic services in the city, increasing their survival chances.

The noteworthy increase in 1928 must be associated with the refugee influx and its impact on the economy and public health. The arrival of the refugees in autumn 1922 was connected with an upturn in mortality throughout the country but also in the city, as indicated in the local press.[69] The more than 5,000 refugees who stayed on the island triggered a major population change.[70] Hermoupolis's local authorities built a provisional hospital for the refugees, a settlement and houses in the district of Kserokampos and also compensated all the refugees who stayed on the island.[71] Finally, by 1940, post-neonatal mortality seems to have declined to levels much lower of than 100 per thousand. The main reasons for this decline are explored further in section 5.7.

Finally, comparisons with Mykonos and Paros in Figure 5.9 show that post-neonatal mortality in Hermoupolis was much higher than in the other two populations for which we have comparable data. In Mykonos, post-neonatal mortality was responsible for the rather low IMR and its fluctuations.[72] Surprisingly, when the post-neonatal rate in Hermoupolis declined dramatically in 1920, Mykonos's rate rose sharply. However, the rates in Mykonos refer to the period 1919-1928, whilst those of Hermoupolis and Paros are for 1920. Therefore, the disparities among the three rates in 1920 probably reflect the difference in their calculations.

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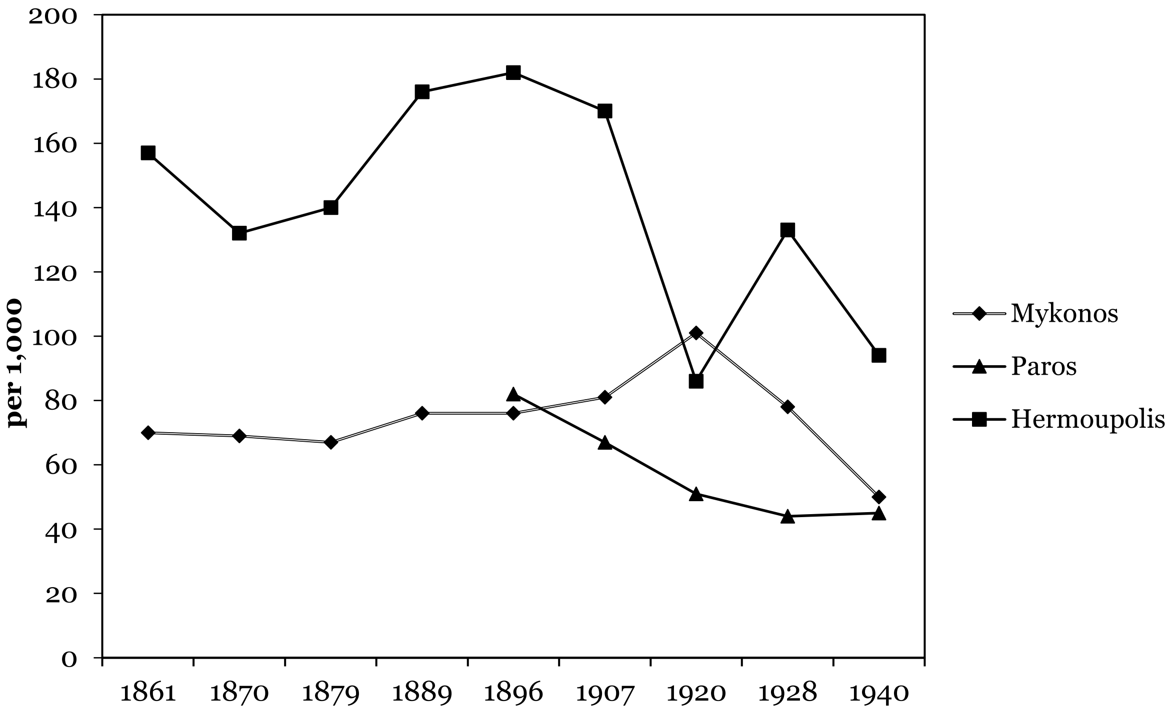
[67] Loukos, 'Ethelontikes syssomatoseis', p.72. However, further research is clearly needed to establish more secure findings on the effect of the foundling mortality to the evolution of infant mortality in Hermoupolis.
[68] Ibid., p.66.
[69] G. Valaoras, *To demographiko provlema tes Ellados kai e epidrasis ton prosfygon* (*The demographic problem of Greece and the effect of the refugee population*) (Athens, 1939), pp.21-22; *Tharros,* 6/09/1924, 6, A, p.1; 20/09/1924, 10, A, p.1
[70] Hietala, 'Prosfygia sten Ermoupole'; *Tharros,* 13/01/1926, 145, B, p.1; 11/05/1928, 278, D, p.2.
[71] Hietala, 'Prosfygia sten Ermoupole'.
[72] Hionidou, 'Infant mortality', p.160.

Figure 5. 9 Post-neonatal mortality rates in Mykonos, Paros and Hermoupolis, 1859-1940



Sources: Hionidou, The *demography of a Greek island*, p.126; Gavalas, *Demographic reconstruction*, p.230; HMD.

After having acquired a better understanding of infant mortality patterns in Hermoupolis during the period under study, the next section investigates stillbirth mortality in the city, an issue which has only rarely been explored in the Greek literature.

5.5 Stillbirths in Greece (1912-1940)

Even though stillbirths (as is conventional) have been excluded from the calculation of IMR, evidence from the infant mortality figures showed that their exclusion might have been partly responsible for the decline in infant mortality in 1920. The main objective of this section is to explore the reasons for the sudden reporting of stillbirths in 1912 and their subsequent absence in civil registrations from 1924 onwards. Annual stillbirth rates (SBR hereafter) have been calculated in Hermoupolis and compared with the national average. Hermoupolis's SBR levels are also situated within Europe. The results of this discussion fill a major gap of the study of stillbirths in the Greek literature. The discussion which follows, it should be noted, is based on the scant evidence available in legislation, civil registration and vital statistics.

5.5.1 *Definition of stillbirths*

In most studies that have explored infant mortality in the past, stillbirths are mentioned only occasionally, even though they constituted a considerable proportion of all mortality losses in the past.[73] The main reason for this gap in the study of stillbirth mortality is their absence from vital or civil registration.[74] In Scandinavian countries, stillbirth registration started in the 1870s or even earlier, and in England and Wales, as in the rest of the European countries, stillbirths started to be registered only in the early twentieth century.[75]

It is virtually impossible to explore the stillbirth levels prior to the late nineteenth or the early twentieth centuries, mainly due to the different registration practices which took place across Europe. In addition, in many cases stillbirths were registered as early neonatal deaths, and *vice versa*. This issue seems to be the most important problem when measuring the level of stillbirths. The misreporting of infant deaths as stillbirths may have happened mainly among those infants dying within the first hours or even days after birth.[76] This misclassification of live-born infants as stillbirths was even more evident during the seventeenth and eighteenth centuries.[77] The under-reporting of early neonatal deaths can lead to underestimation of IMR or early-neonatal mortality rates, which are usually used as an indicator of maternal health and environmental influences.[78] For these reasons, Woods suggested that:

> Any study of stillbirths will not be straightforward, it will have to break a new ground in several areas, use a variety of sources and make informed assumptions.[79]

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73 R. Woods, *Deaths before birth, fetal health and mortality in historical perspective* (Oxford: Oxford University Press, 2009), p.1.
74 G. Davis, 'Stillbirth registration and perceptions of infant death, 1900-60: the Scottish case in national context', *Economic History Review*, 62, 3 (2009), p.630.
75 Ibid.
76 J. Boulton & R.J. Davenport, 'Few deaths before baptism: clerical policy, private baptism and the registration of births in Georgian Westminster: a paradox resolved', *Local Population Studies*, 94 (2015), p.36.
77 R. Finlay, 'Distance to church and registration experience', *Local Population Studies*, 24 (1980), p.26.
78 R.J. Davenport, 'The relationship between stillbirth and early neonatal mortality: evidence from eighteenth century London', unpublished working paper: http://www.geog.cam.ac.uk/people/davenport/davenport9.pdf (access in March 2018); L. Pozzi & J.S. Barona, 'Vulnerable babies. Late foetal, neonatal and infant mortality in Europe (18th-20th centuries)', *Annales de démographie historique*, 123, 1 (2012), p.16.
79 Woods, *Deaths before birth*, p.3.

Various attempts have been made in the past to establish a definition of foetal deaths and live births. The ambiguity of the meaning of 'signs of life' was the main reason why some infants who, although they were born alive and survived only for a short time, were registered as stillbirths.[80] The signs of life varied over time and among countries, as different criteria, such as weight or height, were applied. The most accepted definition of the most important signs of life was proposed by the WHO, based on the ICD-10 in 1992. According to the WHO, a stillbirth is:

> … death prior to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy; the death is indicated by the fact that after such separation the fetus does not breathe or show any other evidence of life; such as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles. [81]

5.5.2 *Historical trends of stillbirth mortality in Europe*

In most European countries, a simultaneous decline in SBR in the late 1930s or early 1940s has been recorded (Table 5.6). The main reasons for this decline have been found to be improvements in the quality of obstetric care (intrapartum stillbirths), better maternal nutritional status and better epidemiological profile (antepartum stillbirths). Better skilled birth attendants and improved technology seem to have played a crucial role as well. In the Scandinavian countries, where midwives were very well educated, trained and licensed, the decline in the nineteenth century was more rapid and more effective.[82] Socio-economic circumstances and better living standards together with better environmental factors, also influenced the mother's health and consequently gave better life chances to the foetus.[83]

In England and Wales, stillbirths were registered mainly from 1927 onwards, when national and local SBRs were published annually by the General Register Office.[84] However, in the period 1918-1926, when it was attempted to record all births, SBR

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[80] C. Galley, 'The stillbirth rate in early modern England', *Local Population Studies*, 81 (2008), p.76; C. Gourbin & G. Masuy-Stroobant, 'Registration of vital data: are live births and stillbirths comparable all over Europe?', *Bulletin of the World Health*, 73, 4 (1995), p.450.
[81] WHO, *Neonatal and perinatal mortality: country, regional and global estimates* (Geneva: WHO, 2006), p.6.
[82] Brändström, 'Infant mortality', p.21; Edvinsson *et al.*, 'Infant mortality', p.475.
[83] Woods, *Deaths before birth*, pp.31-2, 195.
[84] G. Mooney, 'Still-births and the measurement of urban infant mortality rates c.1890-1930', *Local Population Studies*, 53 (1994), p.45.

varied from 30 to 33 per 1,000 total births.[85] Up until 1938, SBR remained relatively stable, ranging from 38.3 to 41.4 per 1,000 total births, even though the geographical range varied from 25 to 70 per 1,000.[86] In the following years until 1944 a rather rapid decline followed. [87]

Table 5. 6 SBR and IMR [in brackets] of selected European countries, 1920-1939

Country	***1920-29***	***1930-39***
England and Wales	-	40 [59]
France	37 [94]	35 [71]
Sweden	25 [60]	27 [48]
Denmark	24 [83]	25 [69]
Norway	22 [52]	24 [43]
Germany	34 [111]	26 [72]
Italy	40 [125]	33 [95]
Spain	26 [144]	26 [122]
Portugal	40 [148]	42 [142]
Greece	11 [140]	10 [115]

Note: Mean SBR for Greece has been calculated by the author of this study using the published annual rates from the vital statistics.
***Sources**:* UN, *Foetal, infant and early childhood mortality*, I (1954), extracted from annex tables I and III, cited by Woods, *Deaths before Birth*, p.86; Vital statistics (1921-1938); Valaoras, 'A reconstruction', p.132.

In Sweden, foetal mortality has been registered since the beginning of vital registration in the 1750s. In Denmark and Norway, the first registered foetal deaths appeared in the registrations in the early nineteenth century. In all three countries, SBR peaked in the 1850s, when it reached levels of over 40 per 1,000, but it declined significantly from the early 1900s onwards, ranging somewhat over 20 per 1,000 total births.

[85] *Registrar-General's Statistical Review of England and Wales*, New Annual Series, 7 (1927), p.130; Attempts to estimate the national SBR of previous centuries took place in the 1990s. However, here there will be no references made to methodologies and results as they are not relevant to this current issue. For further study: A. Wrigley, 'Explaining the rise in marital fertility in England in the 'long' eighteenth century', *The Economic History Review*, New Series, 51, 3 (1998), pp.435-64; Hart, 'Beyond infant mortality', pp.215-29; R. Woods, 'The measurement of historical trends in fetal mortality in England and Wales', *Population Studies*, 59, 2 (2005), pp.147-62.
[86] Galley, 'The stillbirth rate', p.76.
[87] I. Sutherland, *Stillbirths: their epidemiology and social significance* (Oxford: Oxford University Press, 1949), p.87.

However, any increases in SBR in the Scandinavian countries might be attributed to the inclusion of some live births in the number of stillbirths.[88]

The French case raises an important methodological issue: IMR takes into account what is described in the sources as stillbirths and infants who died before registration.[89] Many attempts have been made to separate the 'false' stillbirths from the 'true' stillbirths, although many issues are still arising.[90] In Italy, the registration of stillbirths started in 1862. Even though for the first years after stillbirth registration, SBR was at a low level, in the first quarter of the twentieth century it increased substantially as a result of the improvement of the data-collection process.[91]

5.5.3 Stillbirth registration in Greece

In Greek civil registration, the term 'dead-born' was used by contemporaries to refer to a foetal death (*nekrogenneto* or *egennethe nekro*).[92] This term was adopted in the vital statistics and legislation after 1856. The only definition of a stillbirth which could be traced in the Greek literature was in a demographic dictionary by V. Kotzamanis:

> Stillbirth (or dead birth, *nekrogennetikoteta*) is the fetal mortality after a period of gestation of 24 or 28 weeks. Stillbirth is different to miscarriage, as the length of gestation of the dead-born infant (or even the height or weight) is taken into consideration.[93]

Under the same entry, Kotzamanis also mentioned the official, current definition of stillbirths used by the National Statistical Service of Greece (NSSG):

> Stillbirth refers to an infant born after at least the twenty-eighth week of pregnancy which did not breathe after being extracted from its mother because it was dead.[94]

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[88] Woods, *Deaths before birth*, pp.56-62.
[89] V. Gourbon & C. Rollet, 'Stillbirths in nineteenth-century Paris: social, legal and medical implication of a statistical category', *Population*, 64, 4 (2009), p.601.
[90] Even though these studies are not discussed in this thesis, for a further study on the French case, see: J. Bertillon, 'Mort-né', *Dictionnaire Encyclopédique des Sciences Médicales,* x (Paris: Masson/Libraire de l'Académia de Médicine, 1876), pp.2-28.
[91] Woods, *Deaths before birth*, pp.56-62; L. Del Panta, 'Infant and child mortality in Italy, eighteenth to twentieth century: long-term trends and territorial differences', in A. Bideau, B. Desjardins & H. Brignoli (eds), *Infant and child mortality in the past* (Oxford: Clarendon, 1997), pp.8-9.
[92] These terms have also been found in Ioannina: Pappa, *Nosoi kai thnesimoteta*, p.20.
[93] B. Kotzamanis, *Dictionary in Demography*: http://www.demography-lab.prd.uth.gr/DDAoG/edu/Lexiko/LEXIKO_GR.pdf (access in March 2018).
[94] Ibid.

According to Greek legislation and the Greek Civil Law which was enacted in 1856 and was in force until the early 1920s:

> The registrar to whom a dead new-born child is shown whose birth had not been reported in the civil registration books [before the death], shall not report that the infant died, but only that it was shown to him dead … This certificate is recorded in the death registration books, without prejudging whether the child was born alive or dead.[95]

The only information that was included in the civil registration were parents' full names, profession(s) and address, together with the date of delivery. A birth could be reported within five days after delivery but a death was reported much sooner (usually within 24 hours) as a burial could not be carried out without a death record.[96] After the amendment of the Civil Registration Act of 1920, which was enacted in 1924, a birth had to be reported within ten days, rather than five following the event.[97] The new act required that stillbirths had to be registered in the birth instead of the death registration book but the registrar had to record that the new-born was no longer alive, without saying whether it was live-born or dead-born. This change in the registration practice explains the sudden disappearance of stillbirths from the death registers. The implementation in 1924 of the 1920 Civil Registration Act in Hermoupolis is further strong evidence of the very good quality of the sources that the city possessed and which were used for this study.

The reason for the continuous reporting of stillbirths in the Hermoupolis civil registers in 1912 is still under question. Even though the law had required the registration of stillbirths in 1856, only 14 stillbirths were found in the Hermoupolis civil registers for the years from 1859 until 1911. For the period 1912-1924, 221 stillbirths were found in the death registrations. The only evidence that was traced in the legislation is that in February 1912 a new law concerning the establishment of the municipalities was passed. According to article 206 of that law, the mayor was appointed as registrar in addition to the duties outlined in the 1856 Civil Law. It is therefore possible that the

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[95] 'Astikos Ellenikos Nomos' (Civil Greek Law), *FEK*, 75, 15/11/1856, p.404.
[96] Ibid.
[97] 'Law 2436 Peri ton leksiarchikon prakseon' (Concerning the Civil Registration), *FEK*, 156, 14/07/1920, p.1567.

introduction of this law may have been responsible for the stillbirth registration practice in Hermoupolis from 1912 onwards. [98]

5.5.4 *Stillbirth Rates in Hermoupolis*

All the published vital statistics from 1921 until 1938 include estimates of the SBR for every region and the whole country. As Table 5.7 shows, the national SBR was fairly low, ranging around 10 per 1,000 total births throughout the 1920s and the 1930s. The Greek SBR seems to have been extremely low, especially when compared with those of the main European countries (Table 5.6). Even countries with very low IMRs exhibited much higher levels of SBR compared with the Greek rate. The most probable explanation for the very low SBR seems to be the non-registration of stillbirths. Given the high under-registration of births it is expected that those rates did not include the genuine number of stillbirths in Greece.

Table 5. 7 SBRs and actual number of stillbirths, Greece, 1921-1938

Year	*Total number of stillbirths*	*SBR per 1,000 live births*
1921	1,632	–
1922	1,210	–
1923	1,284	11.27
1924	1,206	10.31
1925	1,962	12.55
1926	1,735	9.57
1927	1,816	10.29
1928	1,911	10.10
1929	1,853	10.19
1930	1,881	9.43
1931	2,286	11.47
1932	2,054	11.07
1933	1,980	10.44
1934	2,107	10.08
1935	1,794	9.32
1936	1,759	9.10
1937	1,814	9.87
1938	1,835	9.95

Source*:* Calculated by the author using Vital Statistics (1921-1938).

[98] 'Law 4057 Peri systaseos demon kai koinoteton' (Concerning the establishment of municipalities and communities), *FEK*, 58, 14/02/1912, p.372.

SBR in Hermoupolis varied from 7 to 47 per 1,000 from 1912 to 1941 (Table 5.9). Moreover, the published figures of SBR for Hermoupolis were among the highest in Greece in the period 1932-1935, ranging from 28 to 30 per 1,000 total births (Table 5.8). Although the calculated SBR for these years is very close to the estimated rate, the two rates diverge. For the years 1921-1938, when national SBR is available in the published sources, it seems that Hermoupolis's SBR was much higher than the national average, with exceptions in 1922, 1925 and 1926, when the two rates were somewhat close. Hermoupolis's rates for those three years seem to be exceptionally low as in the rest of the study period much higher rates were recorded (Figure 5.10). When Hermoupolis's SBR is compared with that of other European states, seems to be in rather similar levels (Table 5.6); yet, SBR in the biggest urban centres was in much higher levels, including Paris (around 90 per thousand), in the early twentieth century.[99]

Perinatal mortality, which includes the number of stillbirths and the number of neonatal deaths, as shown in Figure 5.10, followed a similar pattern to that of SBR for most of the study period. The most significant expection, however, seems to be in 1919 when perinatal mortality increased extremely due to the excessive increase in early-neonatal mortality which followed the 1918 influenza pandemic. Various studies have interpreted the occurrence of excess-neonatal mortality during the months after the epidemic peak as an effect of the increase in prematurity rate, most likely because of infections to mothers in the first or the second trimester of the pregnancy.[100] It seems, therefore, that those infants born during the first months of 1919 were at the greatest risk of neonatal mortality during the epidemic.[101] It was also possible that the "interruption of a woman's pregnancy due to influenza may have resulted not in a stillbirth but in a live premature or abnormal birth, perhaps after exposure earlier in pregnancy".[102] The second greatest increase of the early-neonatal mortality was in the second half of the 1930s, which in combination with the increase in SBR were responsible for the very high levels of perinatal mortality. Unfortunately, it is not possible at this stage to explain this specific observation. The available causes of death

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[99] Woods, *Deaths before birth*, pp.60-61; Gourbon & Rollet, 'Stillbirths in nineteenth-century Paris', p.604.
[100] A. Reid, 'The effects of the 1918-1919 influenza pandemic on infant and child health in Derbyshire', *Medical History*, 49 (2005), pp.34, 44.
[101] Ibid., p.41.
[102] Ibid., p.48.

do not shed any further light, as most early-neoanatal deaths during the period from 1935 to 1937 were attributed to the vague condition of infantile debility.[103]

Table 5. 8 SBR of the Cyclades islands, 1921-1938

Year	*Births*	*Stillbirths*	*SBR*	*Hermoupolis SBR*
1921	3,801	28	7.4	
1922	3,575	8	2.2	
1923	–	–	–	
1924	–	–	–	
1925	3,995	48	11.9	
1926	4,178	48	11.4	
1927	4,155	32	7.64	
1928	4,217	44	10.54	
1929	3,996	40	10.01	
1930	4,073	34	8.35	
1931	3,890	54	13.88	
1932	3,753	50	13.32	29.74
1933	3,571	47	13.16	33.80
1934	3,691	35	9.48	33.13
1935	3,350	31	9.25	28.38
1936	3,302	34	10.30	
1937	3,149	43	13.66	
1938	2,979	23	7.72	

Source: Calculated by the author using Vital Statistics (1921-1938).

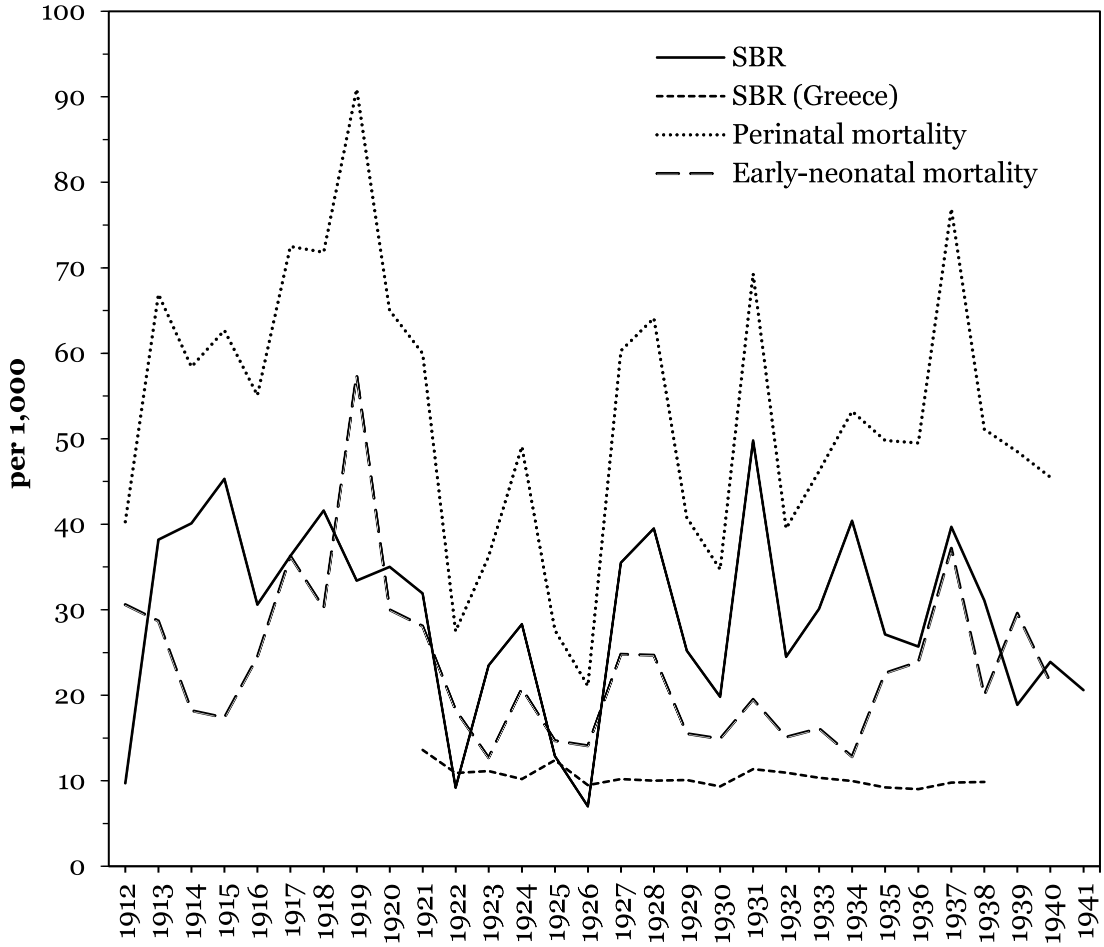
[103] As will be discussed in section 6.4, the quality of cause-of-death information in the period 1935-1938 is rather problematic, as deaths due to 'old-age'/ 'senile decay' also fluctuated in much higher levels than in the rest of the study period.

Table 5. 9 SBRs, early neonatal and perinatal rates, Hermoupolis, 1912-1941

Year	***Stillbirths***	***Live births***	***SBR***	***IMR***	***0-6 days***	***Early-neonatal mortality***	***Perinatal mortality***
1912	6	621	9.7	180.0	19	30.6	40.3
1913	20	523	38.2	239.0	15	28.7	66.9
1914	22	548	40.1	217.0	10	18.2	58.4
1915	26	574	45.3	146.0	10	17.4	62.7
1916	15	490	30.6	200.0	12	24.5	55.1
1917	21	579	36.3	217.6	21	36.3	72.5
1918	22	529	41.6	217.0	16	30.2	71.8
1919	18	539	33.4	228.0	31	57.5	90.9
1920	21	600	35.0	146.6	18	30.0	65.0
1921	17	533	31.9	198.8	15	28.1	60.0
1922	5	546	9.2	157.5	10	18.3	27.5
1923	13	553	23.5	191.7	7	12.7	36.2
1924	15	530	28.3	188.8	11	20.8	49.1
1925	7	544	12.9	180.0	8	14.7	27.6
1926	4	569	7.0	148.7	8	14.1	21.1
1927	20	564	35.5	207.4	14	24.8	60.3
1928	24	608	39.5	192.4	15	24.7	64.1
1929	13	515	25.2	159.2	8	15.5	40.8
1930	12	605	19.8	99.2	9	14.9	34.7
1931	23	462	49.8	188.3	9	19.5	69.3
1932	13	531	24.5	156.3	8	15.1	39.5
1933	15	498	30.1	128.5	8	16.1	46.2
1934	19	470	40.4	142.5	6	12.8	53.2
1935	12	442	27.1	151.6	10	22.6	49.8
1936	14	545	25.7	110.1	13	23.9	49.5
1937	16	403	39.7	168.7	15	37.2	76.9
1938	14	450	31.1	106.6	9	20.0	51.1
1939	7	371	18.9	239.9	11	29.6	48.5
1940	10	418	23.9	138.8	9	21.5	45.5
1941	8	388	20.6	–	–	0.0	–

***Source**:* Calculated by the author using HMD.

Figure 5. 10 SBR and perinatal mortality in Hermoupolis and SBR in Greece, 1912-1941



***Source**:* Calculated by the author using HMD and Vital Statistics (1921-1938).

Table 5.8 shows the SBR in the Cyclades islands from 1921 until 1938 as it was calculated and published in the vital statistics. Hionidou's study on Mykonos found only one reported stillbirth in the civil registrations for the whole period under study from 1859 to 1959.[104] The high number of stillbirths found in Hermoupolis's civil registration may indicate that most stillbirths reported in the vital statistics for the Cyclades islands were those registered in Hermoupolis. Additional evidence for this hypothesis is shown in Figure 5.11, where a parallel pattern of similar fluctuations takes place when the number of stillbirths in the Cyclades and Hermoupolis are plotted between 1921 and 1938.

Similar high levels to those of Hermoupolis were also found in other places, mostly urban, during the period 1932-1937 including Thessaloniki (33-37 per thousand), Ioannina (35-53 per thousand), Argostoli (37-66 per thousand) and Didimoticho (47

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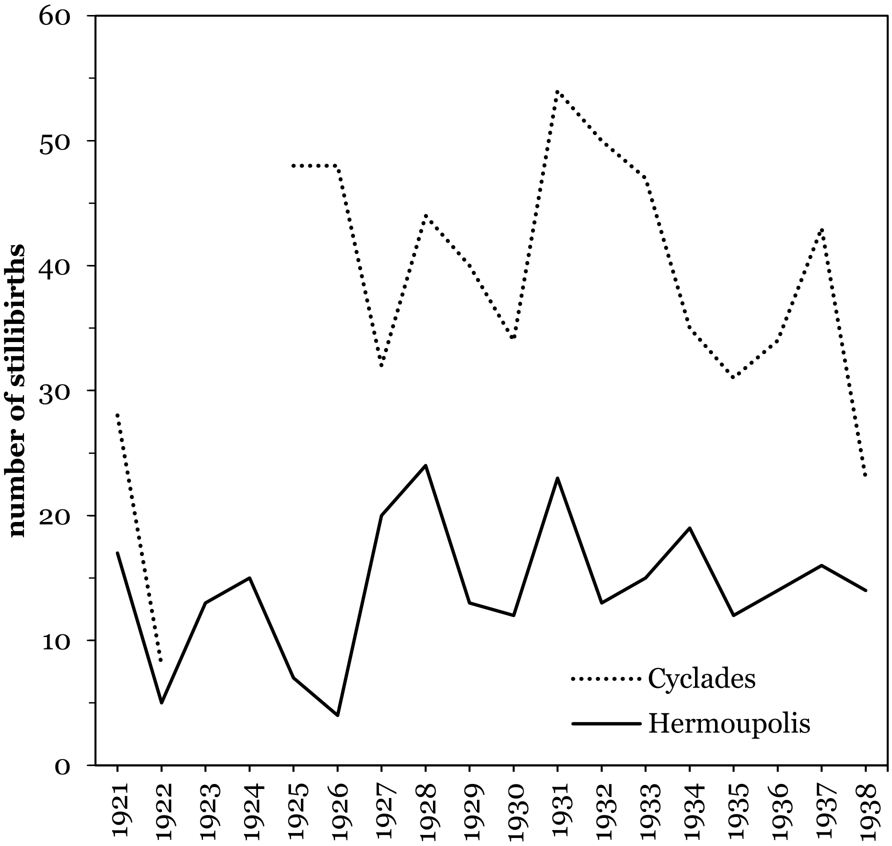
[104] Hionidou, *The demography of a Greek island*, p.124.

per thousand).[105] Discrepancies in the levels of SBR within the same country and especially between urban and rural communities may be attributable to the different registration practices that were implemented in each region.

Figure 5. 11 Number of stillbirths in the Cyclades and Hermoupolis, 1921-1938



Source: Calculated by the author using HMD and Vital Statistics (1921-1938)

Based on the assumption that early neonatal deaths have a lot in common with stillbirths, Hart estimated SBR for past populations in England and Wales (stillbirths were not reported prior to 1927) by using the ratio of stillbirths to first-week deaths, which he estimated to be 1.8 to 1.[106] The equivalent ratio in Hermoupolis was 1.3 to 1 for the years 1912 to 1924, and 1.46 to 1 for the years 1926 to 1940. Nonetheless, the improving trend of this ratio reveals improved reporting of stillbirths over time and ultimately a better registration system.

According to Hionidou, the most probable loss by under-registration is of those infants who died within a few hours of birth. If unbaptised infants had not been offered the last blessing, these births may easily have been reported as stillbirths.[107] This is most

[105] Vital statistics (1921-1938).
[106] Hart, 'Beyond infant mortality', p.224.
[107] Hionidou, *The demography of a Greek island,* pp.123-24.

likely to have been the case in Hermoupolis, where the number of infants who died within a few hours of birth was 10 in 1911 but in the following year, when stillbirths started to be registered, was 2, and in all the subsequent years it remained around the same figure. However, the registration of stillbirths in Hermoupolis from 1912 onwards seems to be fairly complete as those infants who died within a few hours after birth were recorded separately.

In Hermoupolis, stillbirths were registered mainly by the father of the stillborn child, but no further information is given in each record. There are also many records in which no information is given at all apart from sex, and then not necessarily in all cases, and the date of the event. The lack of more specific information, including weight and height of the foetus, do not allow us to draw more specific and more accurate conclusions. Neither can the main reasons contributing to the high SBR be investigated, as no cause of death was reported in any death certificate.

After outlining the main trends of SBR in the main European countries and Greece throughout the 1920s and 1930s, the representativeness of the SBR of Hermoupolis compared to the whole country needs further treatment. It has been suggested that there was a common turning point in the decline of the SBR in most European countries in the 1930s and 1940s. There is no evidence of a similar trend in Hermoupolis, as SBR fluctuated at high levels even into the late 1930s. The calculated SBR in Hermoupolis was much higher than the national SBR as estimated in the vital statistics as a possible result of the under-registration of stillbirths, whilst its levels seem to have been in line with the respective levels of the western European countries.

What also needs to be explored is the quality of the midwifery available as well as the extent of obstetric advances in the city. These two factors may help to explain the rather high SBR in Hermoupolis when such sources become available. Unfortunately, it is not possible to explore the causes of stillbirths as very limited information is available in the civil registration and only hypotheses can be attempted. The preceding analysis is the first study of stillbirths in a Greek population in the early twentieth century: additional research is needed to establish the levels of stillbirth rate in the rest of the country.

After exploring the level of stillbirths in Hermoupolis in the first decades of the twentieth century, the final part of this chapter will present a possible explanation of the reasons for the decline in infant mortality in the 1930s.

5.6 Why did infant mortality decline in Hermoupolis?

After having discussed the fluctuations in IMR in Hermoupolis during the study period and having attempted to offer an explanation for its early decline in 1920 by hypothesising that it was a result of the registration of stillbirths and the better care of infants by philanthropic organisations, this section examines the reasons for the further decline in IMR in the 1930s.

In order to explain the great decline in IMR in England and Wales at the turn of the twentieth century, Woods *et al.* identified the following main factors: infant feeding practices, women's education and a decline in fertility. They also suggested that improvements in public hygiene such as the availability of fresh water and better quality of milk supply had made a positive contribution to this decline.[108] In this section, therefore, using those factors as a guideline, I shall suggest possible reasons for the decline in infant mortality in the 1930s.

Woods *et al.* identified that a decline in both legitimate and illegitimate fertility helped to stabilise a decline in infant mortality from the 1870s onwards by influencing maternal health, as well as by increasing the intervals between successive births.[109] Under natural fertility patterns, couples do not plan the size of their families, and breastfeeding was the key factor associated with the increase of birth intervals. Breastfeeding tends to delay the return of ovulation and, therefore, a surviving infant postponed the arrival of the next child. On the other hand, an infant's death will interrupt lactation and as a result ovulation will start again and the woman will be able to conceive.[110] The introduction of controlled fertility altered existing practices. More children survived, which resulted in a decline in infant mortality and a 'pressure for fertility control' was created.[111] A decline in infant mortality may not be recognised as occurring by the parents, and they may find themselves with more children surviving than they had expected. Hence, their delay in recognising the new conditions of mortality and in adjusting their fertility meant that fertility decline lagged behing childhood mortality decline.[112]

Evidence from studies in other Mediterranean countries have shown that the decline in childhood mortality increased the number of children who survived the riskiest

[108] Woods *et al.*, 'The causes of rapid infant mortality, Part II', p.130.
[109] Ibid., pp.122-26.
[110] van de Walle, 'Infant mortality', pp.202-03.
[111] Ibid., p.205.
[112] Ibid., pp.205-06.

years (the first five years of life) and it therefore stimulated the decline in fertility, but with a time lag.[113] The decline in infant mortality that followed the decline in childhood mortality in most cases had an immediate fertility-reducing effect, the main reason being the decreased interruption of breastfeeding. Finally, declining fertility seems to have had a great effect on reducing mortality at young ages even further by lengthening child spacing, which allowed parents more time to care for their children.[114] Parents therefore cared more about the 'quality' than the 'quantity' of their children, as apart from the additional time, they had also more financial resources to spend on their offspring.[115]

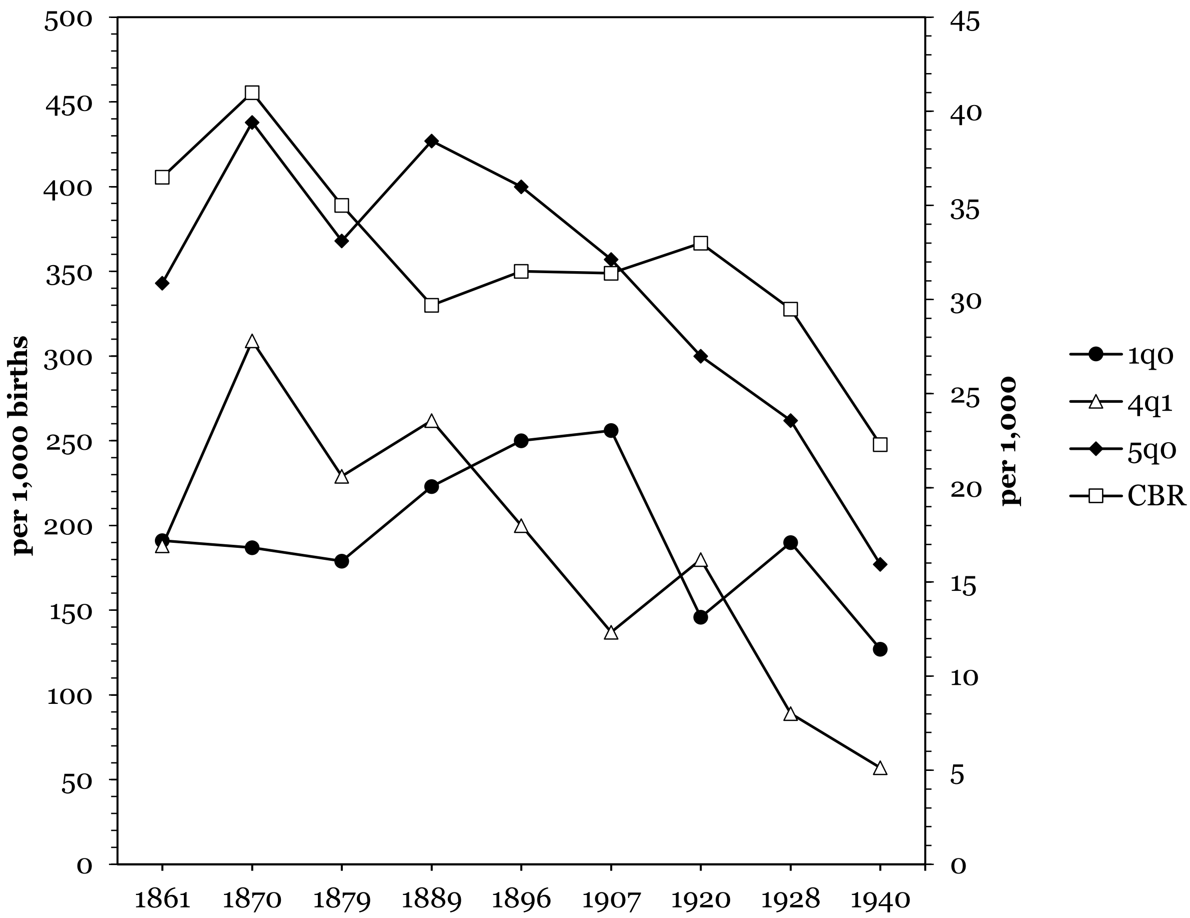
Although sophisticated fertility rates have not been calculated in this study, CBR has been calculated for every census year following the methods described and discussed in section 5.3.1. In Figure 5.12, it is evident that CBR started to decline in the 1920s. The timing of the decline in fertility in Greece has been found to be for places such as Athens in the late nineteenth century or for the rest of the country in the very early twentieth century; however, evidence from Mykonos and Paros has shown that a noteworthy decline in fertility was well in progress only by the late 1920s or early 1930s.[116] Decline in fertility in Hermoupolis, therefore, seems to have been within the time-frame found in the two latter studies.

By plotting CBR, IMR and ECMR in Figure 5.13, it seems that the decline in ECMR preceded that of CBR by a few decades. As a result, fertility started to fall substantially in the early 1920s, the same time as the significant decline in infant mortality. Even though the decline in infant mortality was interrupted for reasons that were explained earlier in this chapter, infant mortality declined again in the 1930s, which seems to

[113] G. Carlsson, 'The decline of fertility: innovation or adjustment process', *Population Studies*, 20, 2 (1966), p.161; Reher, 'Back to the basics', p.12.
[114] Reher, 'Back to the basics', pp. 13-17; Doepke, 'Child mortality', p.351.
[115] G.S. Becker, 'An economic analysis of fertility', in Universities-National Bureau (ed.), *Demographic and economic change in developed countries* (New York: Columbia University Press, 1960), pp.211-13.
[116] For an overview of the fertility patterns in Greece and an evaluation of the already estimated national fertility rates, see Hionidou, 'Istorike kritike', pp.31-62. Other studies include Siampos & Valaoras, 'Long term fertility', pp. 598-610; V. Hionidou. 'The adoption of fertility control on Mykonos 1879-1959: Stopping, spacing or both?', *Population Studies*, 52, 1 (1998), pp.67-83; V.S. Gavalas, 'Fertility transition on a Greek island', *Continuity and Change*, 17, 1 (2002), pp.133-60; 'E ptose tes gennetikotetas stis Kyklades' (Fertility decline in the Cyclades islands), *Epeteris Etairias Kykladikon Spoudon*, 21 (2014), pp.121-40.

have affected the decline in fertility even further.[117] In addition, correlation analysis showed, as expected, a stronger link between early childhood mortality and fertility (R^2=0.5229) than between infant mortality and fertility (R^2=0.0488). If the mortality in the first five years (${}_5q_0$) is used as a mortality indicator, it is clearly seen that the decline in mortality started almost 25 years before the decline in fertility, whilst a parallel inverse trend was in progress already in the late nineteenth century. However, the calculation of more specific fertility rates in Hermoupolis will shed more light on the association of fertility with infant and childhood mortality.

Figure 5. 12 IMR, ECMR and CBR, Hermoupolis, 1859-1940



***Source*:** Calculated by the author using HMD.

Long-term improvements in women's education was one of main factors linked with the decline in infant mortality. Education affected the decline of fertility as well as

[117] Similar findings have been proposed by Hionidou, when examining the relationship between the decline of infant mortality and that of fertility in Mykonos, and whether the decline in early childhood mortality had contributed to a decline in fertility: Hionidou, *The demography of a Greek island*, pp.232-34, 250-53.

improving “the status of women, their access to information, the way in which they cared for their babies and the way in which they were themselves cared for. They may even have encouraged more women to breastfeed”.[118] Concerning women’s education in Hermoupolis, sufficient evidence is not yet available to reach similar conclusions. However, education became compulsory in 1926, so any possible improvements in female education would not have affected potential mothers for at least ten years.[119] Evidence from school registers in Hermoupolis shows a significant increase in female school attendance in the 1920s. More specifically, in 1920, only ten female students were recorded, whereas in 1928 there were 167 female students in one school.[120] Nonetheless, the coexistence of these ‘educated’ mothers with the older, ‘less-educated’ mothers most likely delayed the impact on infant mortality. It is therefore expected that any possible effects of increased female literacy would become visible in the 1940s, a period when infant mortality had already started to decline.[121] Many informants also explained that many women, both single and married, worked in factories in the 1920s and 1930s, mainly in textile manufacturing, whilst only a few of them worked in the public sector, mainly due to their limited access to education.[122] Papastefanaki, who has extensively explored the patterns of industrial employment in Hermoupolis, argued that “the cheap employment of women on the island is the key point to understand the growth of the textile manufacturing on Syros”.[123] In addition, she found that 76 per cent of all workers in 1920 in Karella’s textile mill were women; 76 per cent of those women were between 15 and 29 years and a further 22 per cent between 30 and 54.[124] In another study, using census data, Papastefanaki

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[118] Woods *et al.*, ‘The causes of infant mortality, Part II’, p.130.
[119] *Tharros*, 5/5/1926, 168, B, p.4.
[120] *Mathetologion B’ Ellenikou Sholeiou, 1913-1929* (*Registers of the 2nd Greek School, 1913-1929*). I would like to thank Mrs Pope Paschalidou for providing me with these figures. Moreover, census data does not include specific information on the number of students, although it does include literacy statistics by age and sex. In 1928, the number of literate women was higher than in 1920, possibly due to the increase in the population between the two census years.
[121] Hionidou, ‘Infant mortality’, p.160.
[122] V. Hionidou, ‘Adjusting to crisis on Greek islands: a micro-historical approach’, unpublished paper presented at the *Crises, gender and adaptive family economies in Mediterranean Europe (late XVIIIth-20th centuries). Concepts, definitions and methods*, École Française d’Athènes, Athens, May 2017; ‘“Etote den etan opos tora pou mathainoun ta koritsia grammata kai pane sta grapheia kai douleuoune. Tote pegainame yperetries”: Yperetries sten Ellada, 1860-1960’ (“Then it was not as it is now with girls being educated and working in offices. Then we became servants”: Domestic servants in Greece, 1860-1960), in P. Mene *et al.* (eds), *To yperetiko prosopiko sten ellenike tehne, ten koinonia kai ten istoria. Mythoi kai pragmatikoteta* (*Servants in Greek art, society and history. Myths and reality*) (Rethymno: University of Crete Press, in press).
[123] Papastefanaki, ‘To “patriko endiaferon”’, p.161.
[124] Ibid., p.167.

estimated that women constituted the most significant component of the labour force in textile manufacturing and personal services (mainly servants) in Greece in 1907.[125]

Even though there are no studies or reports available on breastfeeding, oral evidence from Hermoupolis has shown that the minimum average duration of breastfeeding was thought to be around 8 to 12 months and was quite widespread in the first decades of the twentieth century. As it does not appear that major changes in breastfeeding patterns had taken place, it does not seem that breastfeeding was responsible for the decline in infant deaths, although it may have helped to stabilise the rates. Breastfeeding and infant feeding practices in Hermoupolis and Greece are discussed extensively in Chapter 7, where infant diarrhoeal mortality for the period 1916-1940 is explored.

The positive impact of sanitary improvements, increased access to fresh water and improvements in the quality of the milk supply on the decline of infant mortality has been discussed extensively in the existing literature.[126] In Hermoupolis, as found in Chapter 3, public hygiene had improved only very little by the early 1930s. Water closets were not introduced before at least the mid-1930s, and the city relied on public springs for potable water as most of the private water tanks proved to be contaminated. Even though the water supply, which was introduced in the mid-1920s, was not available throughout the city, it may have led to changes in personal care in the subsequent decade.[127] In addition, it is not possible to detect whether the milk supply was contaminated, although evidence from the annual reports on public health shows that regular tests were undertaken by the local authorities in order to test its quality in the 1930s.[128]

It seems, therefore, that neither public health improvements, nor increased female literacy nor changing breastfeeding practices were responsible for the decline in infant mortality in Hermoupolis. Thus, it seems that the main factor which may have been

[125] L. Papastefanaki, 'Katamerismoi ergasias kai fylo stis ellenikes poleis' (Divisions of labour and gender in Greek cities)', published paper presented at the *Gynaikes kai andres stous horous tes kathemerinotetas* (*Women and men in everyday places*) (Athens: National Technical University of Athens, 2006), p.124.

[126] They include: Szreter, 'The importance of social', pp.98-145; Woods, 'Public health and public hygiene', pp.233-47; J. Vögele & W. Woelk, 'Public health and the development of infant mortality in Germany, 1875-1930', *The History of the Family*, 7 (2002), pp.585-99.

[127] A discussion of the reasons that may have been responsible for the decline in mortality in general in Hermoupolis takes place in Chapter 10, where this argument is further developed.

[128] GSAS, YPA, YP1308/1932, *Etesia ekthese* (1932).

responsible for initiating this decline was the decline in fertility, which, in turn, was the result of the earlier decline in early childhood mortality.

5.7 Conclusions

The main objective of this chapter was to describe the main trends of infant mortality in Greece from the mid-nineteenth century to the first decades of the twentieth century. For the first time, infant mortality levels in Hermoupolis from 1859 to 1940 have been calculated and discussed extensively.

However, due to the limited number of studies exploring infant mortality levels in Greece, the comparisons that have been made are relatively restricted. None of the studies focused exclusively on the continuous examination of infant mortality of a Greek town or city. Almost all of them approached the study of the trends and the levels of infant mortality using rather simple methods and rates and at times employing data of questionable quality. The only exceptions are the studies of Mykonos and Paros, which have been utilised in this thesis as comparator semi-urban and rural populations respectively.

IMR in Hermoupolis was found to be among the highest in Greece. When the rate is compared with other Mediterranean communities including Alghero and Palma de Mallorca, it exhibits much higher levels; however, all three populations showed similar timings in the decline in infant mortality when compared with the northern and western European populations.

Previous studies suggested that the fall in IMR in Greece started in the 1930s; however, evidence from Hermoupolis showed that the decline may have already started by the mid-1910s. Nonetheless, this decline may have been partly an artefact of the change in stillbirth registration. The noteworthy decline in neonatal mortality in 1920 is an additional piece of evidence to support this hypothesis. Another reason for this early decline is more likely to be that infants from lower social classes and foundlings attracted the interest of local philanthropy from the mid-1910s onwards. Loukos suggested that the creation of the local foundling hospital in 1920 may have led to the noteworthy decline in foundling mortality, which was estimated to be a significant proportion of the overall infant mortality in the second half of the nineteenth century.

After an increase in IMR possibly because of the arrival of refugees in the city, infant mortality continued to decline further in the 1930s. Other studies have associated this decline with improvements in medical care and public health. In Hermoupolis the decline in fertility is more likely to be the principal factor responsible for the decline in infant mortality in the 1930s, as no other factor that could have affected infant mortality appears to have been in force at the same time. The introduction of the water-supply in Hermoupolis in the mid-1920s, although not expanded across the whole city, is expected to have had an indirect impact on the decline in infant mortality.

The findings of this chapter provide important evidence of the levels of infant mortality in a Greek urban settlement. Additional research is clearly needed to establish the levels and trends of infant mortality in Greece as a whole both in rural and urban areas.

The next chapter will explore the way in which cause-of-death information can be employed and analysed over the period 1916 to 1940.

Chapter 6. Cause-specific mortality in Hermoupolis, 1916-1940

6.1 Introduction

Analysis of causes of death is a very important element in the study of mortality in the past. The use of causes of death to explore the mortality levels of any population, however, can be problematic. For example, it may be unknown whether any given diagnosis was accurate or whether it was reported by a physician. Even if a physician did report a cause of death, did he examine the deceased himself, or did he instead rely on information from the deceased's friends or relatives? Perhaps most importantly, if more than one cause of death was reported, which one should be used in any analysis? In addition to discussing these questions, the sources and methodology employed for the calculation of cause-specific mortality rates are also presented. The chapter then sets out the epidemiological profile of Hermoupolis by producing cause-specific death rates and distribution by age and sex.

6.2 Causes of death in Hermoupolis and Greece

6.2.1 *Available sources*

Cause-of-death data are available in Northern and Central Europe from the early nineteenth century or even earlier. In the southern and eastern parts of the continent, data on causes of death started to appear later, around the beginning of the twentieth century, although in Spain, for instance, such information is regionally available from 1838.[1]

In Greece, the first official national cause-of-death statistics were published in 1921 and civil registration cause-of-death information was already being collected from 1916 in Hermoupolis.[2] According to Rondopoulos, aggregate monthly and annual cause-of-death statistics by five-year age-groups were published for the largest cities

[1] G. Caselli, 'National differences in the health transition in Europe', *Historical Methods*, 29, 3 (1996), p.107; J. Bernabeu-Mestre *et al.*, 'El analisis historico de la mortalidad por causas. Problemas y soluciones', *Revista de Demographia Historica*, XXI, I (2003), p.175.

[2] However, it is unknown whether the same registration practices took place simultaneously in every part of the country. NSSG, *Statistike ton aition thanatou kata to 1922* (*Statistics of causes of death in 1922*) (Athens: NSSG, 1927).

in Greece by the Medical Council during the period 1899 to 1909.[3] The publication of those statistics ceased in August 1909 due to financial reasons.[4]

In Hermoupolis, even though civil registration records have been available continuously from 1859, cause of death has been consistently reported in the civil death registers only since 1916 and the name of the physician who confirmed the death and specified the cause was included on the certificate. Prior to that, rough registers of death (see section 2.3.2), in which cause-of-death information was reported, are available but only for sporadic runs of years. These registers have been linked to the civil registration data, but they have not yet been analysed yet because of their limited availability. Although this material can generate useful results, the focus in this chapter will be only on the epidemiological profile of the town from 1916 to 1940, the period with unbroken cause-of-death material. In this twenty-five-year period, cause-of-death information was available on 10,890 death certificates.

It is not yet known why cause of death started to be recorded by civil registration in 1916. A draft law concerning the foundation of the Service of Medical Statistics, introduced by Rondopoulos, was found in the medical journal *Iatrike Proodos* in June 1916, a few months after cause-of-death reporting was implemented in Hermoupolis. It seems that this was the first occasion when the responsibility of physicians to report causes of death was actively encouraged. So, according to article 15:

> In the case of death of any person due to any cause or disease, the physician shall fill in the official certificate (*Episimon Deltion*) to the best of his knowledge and shall forthwith deliver or send it through the deceased's relatives to the registrar of the municipality or the community.[5]

Later, the Civil Registration Act, which was amended in 1920 and enacted in 1924, provided further guidance on how and by whom causes of death should be reported in civil registrations. Article 24 provided that:

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[3] P. I. Rondopoulos, 'Shedio Nomou peri systaseos kai organoses iatrikes statistikes yperesias en Elladi' (Draft Law concerning the foundation and organization of the Service of Medical Statistics in Greece), *Iatrike Proodos* (1916), p.282.

[4] According to *Statistike tes kiniseos*, (1956), p.XIV, the 'Bulletin of deaths of twelve cities' (*Deltion thanaton ton 12 poleon*) was published monthly from 1899 until 1908 and was one of the very few sources published over the period 1890-1920. This source has not been traced so it has not been used in this study. It is believed that this is one, or even the only one, of the few existing sources of cause-of-death data sources in Greece before the reporting of cause of death in civil registrations.

[5] Rondopoulos, 'Shedio Nomou', p.287.

1) No death certificate shall be registered without death certification, signed by the coroner (*nekroskopos*) or the physician.[6]

2) In the event of the lack of a coroner or physician, the registrar shall sign the death certificate after affirming the death to the best of his knowledge.[7]

3) The physician shall state on every death certification the primary cause of death and the final symptom that caused the death.[8]

It is worth noting that the 1856 law, which was in force until 1924, did not make any references to cause-of-death reporting.

Since the study of causes of death in Greece is in its very early stages, it is unclear yet whether cause-of-death information is also available in the civil registration in other localities. In Mykonos, for instance, cause of death was reported since 1896, and from 1919 onwards the name of the physician who certified the cause of death also appeared on the certificate.[9]

Death registration was considered to be more complete than birth registration, as discussed previously in section 2.3.2.[10] Figure 6.1 presents the schematic process of registration as it seems to have taken place in Hermoupolis at the time. A death was usually reported by a relative of the deceased in order to obtain the necessary burial permit. Evidence from oral material in Hermoupolis confirms this practice and the lack of any involvement of physicians:

Q. Did the physician used to come? In order to …

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[6] Whether the *nekroskopos* was a physician is not very clear in the Greek legislation. As early as 1835, a decree was issued concerning the duties of a *nekroskopos*. According to this decree, the *nekroskopos* was called upon to certify whether the death was an actual death, whether it was a natural or violent death, or whether the diseased had died from an infectious disease. It is doubted whether a *nekroskopos* at that time had any medical training, since most physicians were unlicensed empiricists. Legislation in the 1910s refers to a *nekroskopos* as a physician who was called on during disease outbreaks to certify whether a death was caused by an infectious disease. It is therefore assumed that by the beginning of the twentieth century, a *nekroskopos* was a trained physician. Finally, although the word is translated into English as 'coroner', it is not known whether the education of a *nekroskopos* matched that of a coroner. This does, however, seem to be the most relevant translation. The presence of a *nekroskopos* in Hermoupolis is confirmed in the local press in 1910. It mentioned also that the priest could not conduct a burial without the certification of the *nekroskopos*: *Paliggenesia*, 18/9/1910 B, 52, p.3.

[7] In the case of Greece, registrars are municipal employees with no medical knowledge or training.

[8] Law 2436, 'Peri ton leksiarchikon prakseon' (Concerning civil registration), *FEK*, 156, 14/06/1920, p.1568.

[9] Hionidou, The *demography of a Greek island*, p.31.

[10] Gavalas, 'Island mortality', pp.205-06; Hionidou, *The demography of a Greek island,* p.31; *Fysike Kinese,* (1922), p.ε.

A. No, nothing.

Q. And when [someone] died, did [the physician] still not visit?

A. No.

Q. Who reported them [the deceased] to the town hall? Did you report them?

A. The relatives, the relatives. The relatives would report them.[11]

Based also on oral evidence from Hermoupolis, Hionidou pointed out that a neighbour or the parish priest would take the responsibility of reporting a death when there was no relative.[12] All death certificates were supposed to be certified by a physician throughout the period when cause of death was recorded; however, as the extract from the oral interview shows, it is unclear whether physicians examined the deceased themselves or whether they relied on information from the deceased's relatives.

Evidence from the death certificates in Hermoupolis from 1916 to 1940 shows that only 1,545 were reported by a relative, almost all of them by the deceased's father (87 per cent).[13] On the remaining 9,497 certificates, the relationship between the deceased and the informant was not stated and only in 15 cases was the death reported by a priest.

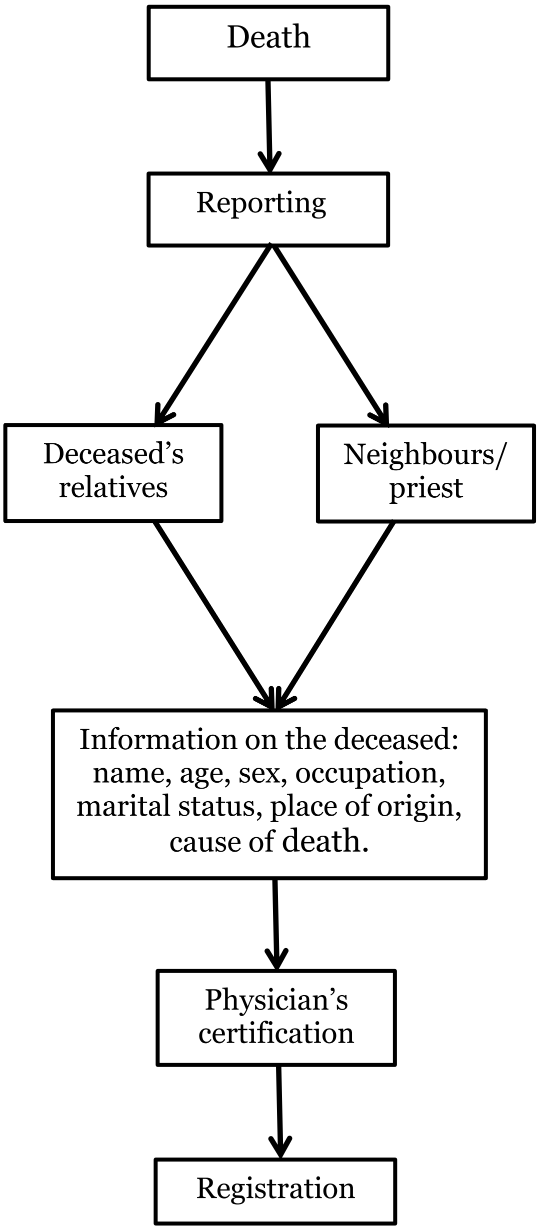
The possible limitations of the cause-of-death reporting in the Hermoupolis death records are explored in the next section.

[11] No. 15 (Female, born in 1921, married about in 1950).

[12] Hionidou, *Famine and death,* p.204.

[13] The other people listed as reporting a death included mother, children, siblings, spouse/husband grandparents, siblings-in-law and uncle/aunt.

Figure 6. 1 Schematic diagram of the processes followed in Hermoupolis's registration of causes of death



Source: HMD.; adapted from M. Livi-Bacci's presentation at the Bloomington conference, cited by Alter and Carmichael, 'Classifying the dead', p.128.

6.2.2 *Limitations of the Hermoupolis cause-of-death data*

In Europe, cause-of-death reporting started to improve in parallel with the decline in mortality in the nineteenth century, providing evidence about the causes of that decline.[14] Two of the most influential studies that have constituted cornerstones for demographic and historical studies using cause-of-death data are Omran's

[14] Caselli, 'National differences', p.107.

epidemiologic transition theory and McKeown's study on the rise of population.[15] Both of them "assumed that the official statistics of cause of death could be straightforwardly interpreted at face value".[16] However, there have been a significant number of studies in the past few decades which debated the accuracy of the historical cause-of-death data.[17] Using the existing literature, I shall discuss the possible limitations and problems of interpreting cause-of-death statistics in Hermoupolis.

The lack of clear reporting instructions in the Greek statistics up to 1937, to the best of our knowledge, makes us wonder whether a common practice in cause-of-death reporting was followed by physicians prior to that date, or whether it depended on local practices. Hermoupolis, for instance, as explained in section 3.4.3, already had an active medical association from the mid-nineteenth century. Reports from the late nineteenth century suggest that the local association was up to date on contemporary medical discoveries as its members were in continuous communication with other associations in Athens, Constantinople and Paris.[18] It is expected, therefore, that medical knowledge in Hermoupolis would have been quite advanced in comparison with other places in the country at that time. Linking the names of the certifying physicians and the causes of death reported by those physicians would probably lead to a better understanding of how consistently individual physicians were reporting causes of death at the time. Although the names of those physicians are available in the Hermoupolis death certificates, they have not been inputted into the database and, therefore, this falls out of the scope of this current study.

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[15] Omran, 'The epidemiologic transition'; McKeown, *The modern rise*.

[16] A. Reid *et al.*, '"A confession of ignorance": deaths from old age and deciphering cause-of-death statistics in Scotland, 1855-1949', *The History of the Family*, 20, 3 (2015), p.321.

[17] These issues have been addressed extensively by C.G. Alter & A.G. Carmichael, 'Studying causes of death in the past', *Historical Methods: A Journal of Quantitative and Interdisciplinary History*, 29 (1996), pp.44-8; 'Reflections on the classification of causes of death', *Continuity and Change*, 12 (1998), pp.169-73; 'Classifying the dead: towards history of the registration of causes of death, *Journal of the History of Medicine*, 54 (1999), pp.114-132; A. Hardy, 'Death is the cure of all diseases': Using the general register office cause of death statistics for 1837-1920', *Social History of Medicine*, 7 (1994), pp.472-92; F. Mesle & J. Vallin, 'Reconstructing long-term series of causes of death', *Historical Methods: A Journal of Quantitative and Interdisciplinary History*, 29 (1996), pp.72-87; N. Williams, 'The reporting and classification of causes of death in mid-nineteenth century England', *Historical Methods*, 29, 2 (1996), pp.58-71; R. Kunitz, 'Premises, premises: comments on the comparability of classifications', *Journal of the History of Medicine*, 54 (1999), pp.226-40; Bernabeu-Mestre *et al.*, 'El analisis historico', pp.167-92; A. Reid & E. Garrett, 'Doctors and the causes of neonatal death in nineteenth century Scotland', *Annales de démographie historique*, 123 (2012), pp.149-79.

[18] Some of those references can be found in the meetings of the Syros Medical Association: *Praktika Iatrikes Etaireias Syrou* (*Minutes of the Syros Medical Association*), 20 October 1894; 7 November 1894; 3 May 1895, 25 September 1900.

The quality of cause-of-death statistics was challenged in official state publications. More specifically, according to Ministry of Health guidelines that were issued as late as 1937, one-tenth of all reported causes of death cannot be used because cause-of-death registration was either incomplete, vague or incorrect.[19] The report also suggested that 'old age'/ 'old age decay' (*gerontikos marasmos*) was the most common cause of death reported on death certificates. It was reported mainly as a sole cause of death for those who died from the age of 45 onwards. By referring to an earlier study in 1933, the report suggested that the distribution of mortality attributed to influenza (*grippe*) across the whole population of the country was higher than in any other country at the time.[20] Moreover, malaria was widely used instead of typhoid fever or other diseases; pneumonia instead of tuberculosis; and decay (*marasmos*) or weakness (*adynamike katastase*) replaced deaths due to cancer or even tuberculosis in old age. These practices seem to have been a result of the incomplete training of the physicians on cause-of-death reporting or the lack of a standardised nosology. The first issue could have only been resolved in the medical schools. In order to deal with the weakness of the civil registration data, the Ministry of Health decided to publish and distribute this 1937 report, which included the fourth revision of the ICD. According to a compulsory law issued in 1937, all physicians had to report cause of death using ICD-4 as the guideline.[21] However, as will be discussed in section 6.3, evidence from the vital statistics has shown that ICD-4 was used in the Greek registration to classify causes of death as early as 1932.

A very important issue concerning the diagnosis of the cause of death was the stage at which a physician was called in and whether the person was still alive when that was done. It is possible that a physician was called in *post mortem* just to provide the medical certificate of death. When this happened, because of insufficient medical equipment and the lack of first-hand observation, a diagnosis provided by the physician would have been based on the symptoms described by the deceased's relatives. In such cases, primary and secondary causes are more likely to have been confused, and primary causes might have remained undetected. It was not possible to find any similar guidelines before 1937, so it seems that no standardised regulations were issued before that year. This report listed the guidelines that should be followed

[19] 'Egkyklios me thema 'Odegiai dia ten delosin aition thanatou' (Circular Letter entitled 'Guidelines for the cause of death reporting), *Arheia Ygieines*, B, 1, 1 (April 1937), p.170.
[20] *Praktikos Iatros* (*Empirical Medic*) (April 1933), cited in 'Egkyklios me thema', p.170.
[21] 'Egkyklios me thema', p.170.

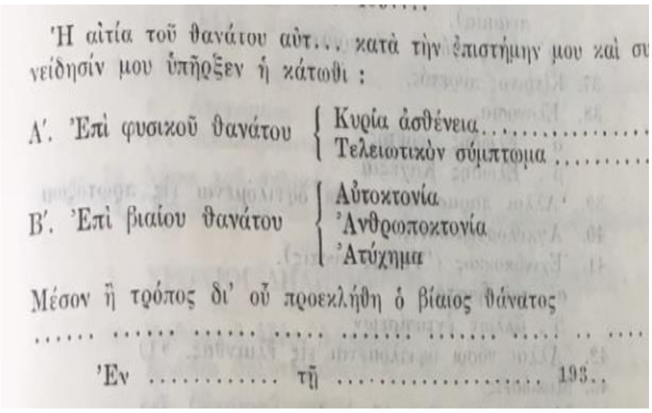
by the physician in the case of a death being due to a complication caused by another disease:

> If there are complications or the patient suffers from two diseases, the division of the main cause of death from the secondary cause or the final symptom shall take place under the following rules:
>
> A) If one of the diseases or the final symptom is considered as a more common consequence of the main disease, then the initial disease shall be reported as the main cause of death. For instance, in the case of measles and bronchopneumonia, measles should be reported as the main cause of death and bronchopneumonia as the secondary cause or the final symptom.
>
> B) If the first rule cannot be applied, then the following shall be implemented. If one of the causes of death is certainly fatal or more dangerous than the other one, then the most severe cause is reported as the main cause of death. For instance, if the deceased suffered from cancer and bronchopneumonia, then cancer is reported as the main cause of death, since mortality from cancer is the highest of two.
>
> C) If the first two rules cannot be applied, then the following shall be implemented. If one of the two diseases is infectious or it develops very fast, then this shall be the primary cause of death. For instance, typhoid fever and chronic nephritis, then typhoid fever is the main cause of death because it is an infectious disease.[22]

Plate 6.1 shows an extract from a death certificate as included in the 1937 report. It is evident that both the main disease and the final symptom responsible for the death were required for the registration of a death, whilst further information was needed for those deaths attributed to ‘violent death’. However, evidence from the Hermoupolis civil registration data shows that different registration practices were employed in the city at least until 1940, the final year of the study period. Different versions of reporting documentation were in use, some of which only required reporting the main cause of death, as Plate 6.2 shows.

[22] Ibid., pp.171-72.

Plate 6. 1 Extract from death certificate (1937 guideline report)



Ἡ αἰτία τοῦ θανάτου αὐτ... κατὰ τὴν ἐπιστήμην μου καὶ συ-
νείδησίν μου ὑπῆρξεν ἡ κάτωθι :

Α'. Ἐπὶ φυσικοῦ θανάτου { Κυρία ἀσθένεια................ Τελειωτικὸν σύμπτωμα.........

Β'. Ἐπὶ βιαίου θανάτου { Αὐτοκτονία 'Ανθρωποκτονία 'Ατύχημα

Μέσον ἢ τρόπος δι' οὗ προεκλήθη ὁ βίαιος θάνατος

....

Ἐν .... τῇ .... 193..

The cause of death of … according to my science and conscience was:

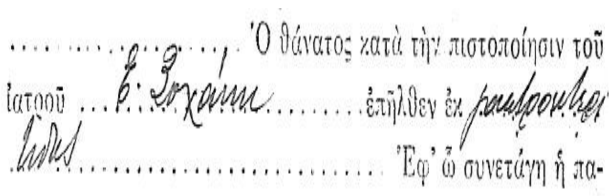
A. Natural death: Main disease…….
Final symptom….

B. Violent death: Suicide
Homicide
Accident

How or what caused the violent death:
…….

***Source*:** ‘Egkyklios me thema’, p.171.

Plate 6. 2 Cause-of-death reporting on death certificates in Hermoupolis, 1916-1940



.... Ὁ θάνατος κατὰ τὴν πιστοποίησιν τοῦ ἰατροῦ .... ἐπῆλθεν ἐκ .... Ἐφ' ᾧ συνετάγη ἡ πα-

.... The death according to the certification of the physician…. (Name)…. was due to…(Cause of death)..

***Source*:** Hermoupolis death registration.

Evidence from Hermoupolis civil registration shows that only one cause of death was reported in most cases. Nonetheless, when more than one cause was stated on a death certificate, it is not clear which was the primary and which was the secondary cause. For such cases, therefore, some adjustments were made on which cause of death to use in this study. It was decided to use the first-mentioned cause as the primary cause of death. Following Hionidou’s steps, for those cases, when the stated cause had the form ‘Cause A due to Cause B’, the latter cause was used as the primary cause.[23] For example, when ‘scarlet fever due to complications of diphtheria’ or ‘nephritis due to pulmonary tuberculosis’ were given as causes of death, the deaths were classified under ‘diphtheria’ and ‘pulmonary tuberculosis’ respectively.

Despite these limitations, cause-of-death information provides very rich data, which will contribute to the study of the epidemiological transition of the city and ultimately of the country during the interwar period.

[23] Hionidou, *Famine and death,* p.204.

6.3 Methodology

Two different revisions of the ICD were used in the Greek vital registration over the period under study. More specifically, ICD-3 was used from 1922 until 1931 and ICD-4 from 1931 onwards. Following this, a past classification system was employed for this study rather than trying to fit older terminology into a modern classification system. So, in order to classify the reported causes of death in Hermoupolis, the Intermediate nomenclature of ICD-4 was employed for the years from 1932 until 1940.[24] For the years from 1916 to 1931, a linked version of ICD-3 and the Intermediate ICD-4 was used, combining the descriptions of the causes of death from the former and the coding from the latter. All the changes between the two revisions were taken into account.[25]

In the classification process, even though the diseases remained in the same broad categories throughout the period under study, in order to achieve a standardised picture, some adjustments were made. Stillbirths were excluded from the total number of deaths. In addition, under the heading of 'Diarrhoea and Enteritis' are included all those deaths with reported age at death less than or equal to one year, even though in the vital statistics the age-group 0-2 was used. In order to separate those deaths attributed to malnutrition between infants and adults, two further categories were created and added to the existing classification coding system. Thus, the heading 'atrophy/athrepsia' was created for infants with a reported age at death of less than or equal to one year and 'malnutrition/starvation' (the Greek terms were *asitia, peina* and *kaheksia*) was used for the remaining ages.

Not all causes were classified under the classification system (101 certificates) and no cause was stated on 26 certificates.[26] If those two groups are added together, they form only 1.2 per cent of all records, which is insignificant in statistical terms and was therefore excluded from the cause-specific analysis.

[24] The current study adopted a similar classification system with the one devised by Hionidou for reasons of comparability: Hionidou, *Famine and death,* p.204.

[25] The different revisions of the ICD are discussed in I. Moriyanna, R. Loy & A. Robb-Smith, *History of the Statistical Classification of diseases and causes of deaths*, edited and updated by H. Rosenberg & D. Hoyert (CDC, National Centre for Health Statistics, 2001); I. Borowy, 'Counting death and disease: classification of death and disease in the interwar years, 1919-1939', *Continuity and Change,* 18, 3 (2003), pp.457-81.

[26] Cases which were not classified include (translated when possible): *'yperthermikos pyretos', 'mparmpeta', 'esoterike aimorragia'* (internal haemorrhage), *'vrohtheia nosos', 'porfyra', 'hronia nosos/nosema'* (chronic disease/illness).

Finally, after classifying the causes of death, the distribution of each category of causes or particular diseases per thousand deaths was calculated for every year. Also, the cause-specific mortality rates (deaths per 100,000 population) around every census year were calculated. For this reason, the population total of Hermoupolis taken from the census was used, along with the average number of deaths around the census years of 1920 (1916 to 1924), 1928 (1926 to 1932) and 1940 (1937 to 1940). Because no census was held between 1928 and 1940, the cause-specific mortality rate was calculated for 1934 (1932 to 1936) using the average population figure from the 1928 and 1940 censuses (20,160 inhabitants).[27]

6.4 Quality of cause-of-death registration

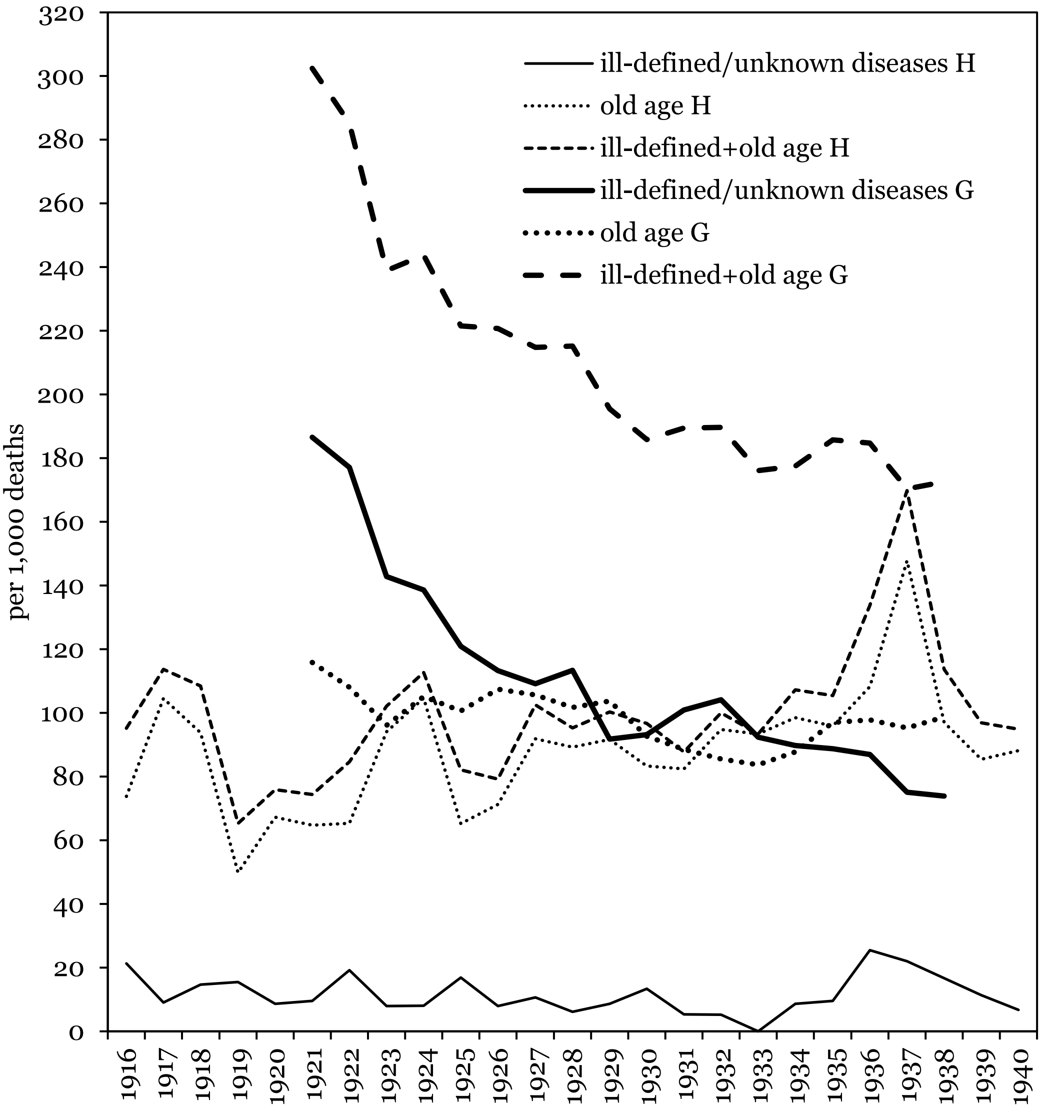
Woods and Shelton suggested that 'other causes' is a useful component to use to test the quality of cause-of-death registration. If such a component is relatively high, then the quality of the cause-of-death registration is likely to be poor.[28] In the current study, the broader group of 'ill-defined/unknown causes' was utilised in order to test the quality of the cause-of-death data. Among the deaths in the older age-groups, there was a tendency for deaths to be attributed simply to 'old age', without reporting a more specific cause.[29] This exercise will therefore include those deaths as well. The results of these calculations will enable us to evaluate the ability of contemporary physicians to diagnose specific causes of death in Hermoupolis. By using evidence from the vital statistics for the period 1921-1938, the ratio of either 'ill-defined' cases or 'old-age' cases to the total number of deaths per year was calculated.[30] Therefore, Hermoupolis's rates were compared with the national average.

The rates of deaths attributed to 'ill-defined' causes in Hermoupolis are constantly and significantly lower than the national ones (Figure 6.2 and Table 6.1). The declining national rates in every calculation suggest that the national registration system was gradually improving in relation to the reporting of causes of death. This seems to be in line with the general improvement of the vital statistics by the late 1930s.

[27] The cause-specific mortality rate was also calculated for 1934 by dividing the average number of deaths from 1932 to 1936 by the average population between 1932 and 1936 from the annual natural movement of the population (22,268 inhabitants). However, the population in the annual vital statistics does not take the migration levels into account. Since the two calculations present the same trend, it was decided to use the first rate as presented in the main text.
[28] R. Woods & N. Shelton, *An atlas of Victorian mortality* (Liverpool: Liverpool University Press, 1997), p.39.
[29] Evidence from HMD shows that 'old age' was used as cause of death mainly from age 60 onwards; even so, there were a few cases in which 'old age' was found in ages from 20 to 40.
[30] *Statistike ton aition thanatou* (1921-1938).

Hermoupolis's rates of 'ill-defined' causes of death fluctuated at much lower levels in the same period. In contrast, the 'old-age' rates for Hermoupolis and Greece fluctuated at very similar levels, except for the annual variations. Interestingly, the rates in Hermoupolis increased substantially in the years 1936 to 1938, reaching much higher levels than the national ones. The factors contributing to this noteworthy increased trend are not known. On the whole, therefore, cause-of-death reporting may have been better in Hermoupolis than in Greece overall, but not when it came to older people.

Figure 6. 2 Distribution of 'ill-defined/unknown' causes of death and deaths attributed to 'old age' per 1,000, Greece and Hermoupolis, 1916-1940



Note: The rates for Greece presented in this graph were calculated by the current author using the number of deaths in the vital statistics.
Sources: HMD; Vital Statistics (1921-1938).

Table 6. 1 Distribution of 'ill-defined/unknown' causes of death and deaths attributed to 'old age' per 1,000 deaths, Greece and Hermoupolis, 1916-1940

Year	***Ill-defined/ unknown causes Hermoupolis***	***Ill-defined/ unknown causes Greece***	***'Old age' Hermoupolis***	***'Old age' Greece***	***Ill-defined +old age Hermoupolis***	***Ill-defined +old age Greece***
1916	21.4	-	73.8	-	95.2	-
1917	9.1	-	104.5	-	113.6	-
1918	14.7	-	93.8	-	108.5	-
1919	15.5	-	49.8	-	65.3	-
1920	8.7	-	67.2	-	75.9	-
1921	9.6	186.6	64.7	115.9	74.3	302.4
1922	19.2	177.1	65.4	108.0	84.6	285.1
1923	8.0	142.9	94.1	96.1	102.1	239.0
1924	8.0	138.6	104.6	105.1	112.7	243.7
1925	16.9	120.9	65.2	100.6	82.1	221.5
1926	7.9	113.3	71.2	107.4	79.2	220.7
1927	10.7	109.1	91.9	105.6	102.6	214.8
1928	6.1	113.4	89.2	101.8	95.3	215.2
1929	8.6	91.8	91.7	103.7	100.3	195.5
1930	13.3	93.2	83.3	92.6	96.7	185.8
1931	5.3	100.9	82.4	88.6	87.8	189.5
1932	5.3	104.1	94.7	85.5	100.0	189.7
1933	0.0	92.4	93.4	83.7	93.4	176.1
1934	8.7	89.8	98.6	87.8	107.2	177.6
1935	9.6	88.7	95.8	97.0	105.4	185.7
1936	25.5	86.9	108.3	97.8	133.8	184.7
1937	22.0	75.0	147.8	95.3	169.8	170.4
1938	16.7	73.9	97.0	98.7	113.7	172.6
1939	11.4	-	85.5	-	96.9	-
1940	6.8	-	88.1	-	94.9	-

Note: National rates were calculated by the current author using the number of deaths in the vital statistics.
Source: HMD; Vital Statistics (1921-1938).

The significant number of ill-defined and unknown causes of deaths was also highlighted in the vital statistics. More specifically, it was estimated that 20 per cent of all deaths were attributed to 'ill-defined/unknown causes' in the first two years of their publication.[31] In the general comments of the first publication, the authors/compilers of the vital statistics suggested that:

> Even though the number of reported deaths is supposed to be more accurate than those of births or marriages ... we cannot say the same for the

[31] *Statistike ton aition thanatou* (1922), p.ε.

> accuracy of the reported causes of death, because in most cases not only is 'ill-defined/unknown cause' stated, but often it is omitted completely.
>
> Because of this uncertain statement of the possible cause of death, and due to the lack of any reference to the primary or secondary cause, the reported causes of death are rather difficult to classify according to the classification schemes, hence the number of ill-defined cases increases.[32]

Another reason for the high number of ill-defined/unknown causes in the vital statistics was that many people died without receiving any medical help because of the dearth of physicians, especially in the smaller and more remote areas. It is known that the concentration of physicians in urban centres was much higher than in rural areas, where the number of physicians only started to increase in the 1950s.[33] This is reflected in Table 6.2, which depicts separately the distribution of ill-defined/unknown causes in rural and urban areas of the country. As is shown, the number of ill-defined causes in urban areas is much lower than that in rural areas, whilst both present a sharp declining trend over the study period. In addition, the much lower rates in Hermoupolis compared with the urban level, as shown in the same table, are more likely to reflect the existence of a well-developed medical establishment in the city, one that appears to have been working closely with the civil registration service.

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[32] Ibid.

[33] Hionidou, 'Popular medicine', p.504; V. Valaoras, *E ygieine tou choriou* (*The hygiene of the village*) (Athens: Ypourgeion Anoikodomeseos, 1945), p.45; H. Zelides¸ *Aksiologese ton protovathmion yperesion ygeias tou agrotikou plethysmou* (*Evaluation of the primary medical care of the rural population*) (Athens: Agrotike Trapeza Ellados, 1989), pp.122, 136-37.

Table 6. 2 Distribution of 'ill-defined' causes of death per 1,000 deaths in rural and urban areas, Greece and Hermoupolis, 1921-1938

Year	*Rural areas*	*Urban areas*	*National*	*Hermoupolis*
1921	250	36	187	9.6
1922	266	44	177	19.2
1923	225	37	143	8.0
1924	196	67	139	8.0
1925	178	35	121	16.9
1926	164	34	114	7.9
1927	156	29	109	10.7
1928	163	30	113	6.0
1929	124	29	92	8.6
1930	124	29	93	13.3
1931	134	30	101	5.3
1932	140	28	104	5.3
1933	119	34	92	0.0
1934	119	33	90	8.7
1935	116	34	89	9.6
1936	111	37	87	25.5
1937	97	32	75	22.0
1938	97	31	74	16.7

Source: HMD; Vital Statistics (1921-1938).

6.5 Disease panorama in Hermoupolis (1916-1940)

6.5.1 *Cause-specific mortality analysis*

In this section, I shall outline the main findings of the research, derived from the analysis of the cause-specific data in Hermoupolis for the years when such information is available. In order to trace changes in the mortality profile of the city by causes of death, it will also be useful to look at the evolution of cause-specific mortality at different age-groups. A cause-specific mortality analysis by age and sex will therefore be presented in the next section.

Before presenting the results, it is important to outline the main trends which took place in the rest of Europe over the late nineteenth and early twentieth centuries in order to find possible associations with the patterns in Hermoupolis. Infectious diseases were by far the main cause of death, accounting for just over a third of total mortality in every part of Europe during the first decades of the twentieth century. Even in the 1930s, infectious diseases were responsible for a high number of deaths, despite their significant decrease. Among them, tuberculosis was the main killer, especially for adolescents and young adults. Higher rates have been estimated for those countries still undergoing urbanisation, which contributed to the propagation of tuberculosis. Another significant group of causes of death, accounting for a significant proportion of all deaths, were digestive diseases, which were found to be more dominant in the southern parts of Europe during this period. Cardiovascular diseases started to play an important role in mortality patterns across Europe from the 1930s, and in the following decades they took the lead among causes of death. Cancers, together with cardiovascular diseases, followed the same trends, even though Caselli has argued that because cancer was still a poorly diagnosed disease, its frequency was probably underestimated.[34] More recently, Reid *et al.* also suggested, using cause-of-death statistics from Scotland, that the increase in the risk of death from cardiovascular diseases and cancers, which was observed in Europe in the late nineteenth and early twentieth centuries, is artificial. They therefore challenged Omran's theory by arguing that the epidemiologic transition was a result of improving diagnosis rather a genuine increase of 'degenerative diseases', as is described in the third phase.[35]

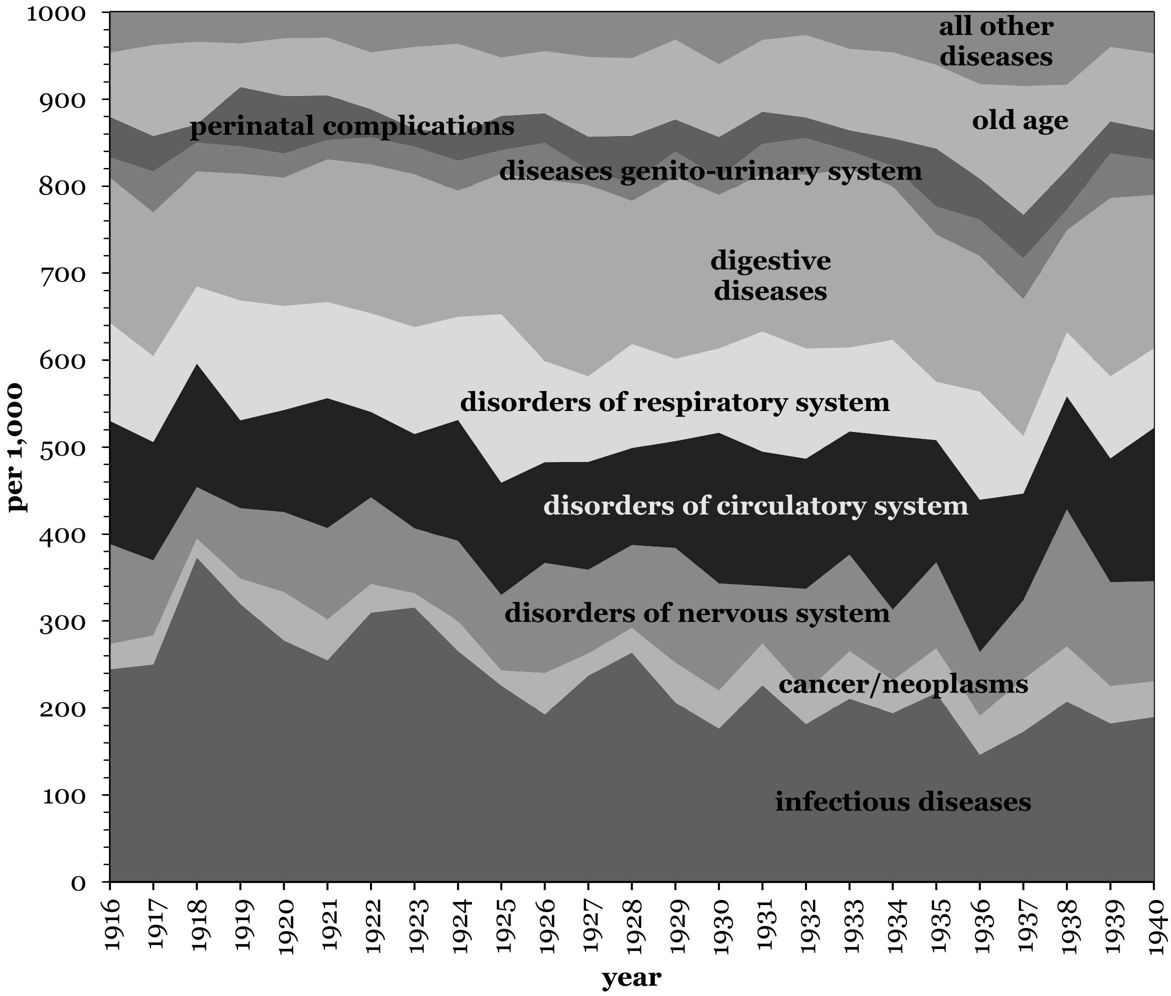
Figure 6.3 and Table 6.4 depict the annual cause-specific mortality distribution in Hermoupolis for every single year when such information is available. Following the typical European pattern, infectious diseases were the primary causes of death throughout the period under study. Digestive diseases, disorders of the circulatory system and respiratory diseases made significant contributions to mortality levels in the city. More specifically, by the beginning of the study period, infectious diseases caused between 20 and 30 per cent of all deaths, digestive diseases about 15 per cent, respiratory diseases 10 per cent and circulatory diseases about 10 per cent of all deaths. By the end of the study period, cancer and diseases of the circulatory and nervous systems seem to have increased or to have stabilised at higher levels than in the earlier years. In addition, mortality due to infectious diseases declined, accounting for less than 20 per cent of all deaths, whilst digestive diseases declined only slightly in the 1930s. The rather high levels of digestive mortality even until the late 1930s may have been a result of the lack of clean potable water in the city. On the other hand, the timing of the creation of the underground water supply system in the city seems to coincide with the onset of a diminishing trend in mortality due to infectious diseases in the mid-1920s. However, the extreme annual fluctuations of the levels of infectious diseases in

[34] Omran, 'The epidemiologic transition theory', pp.516-18; Caselli, 'Long-term trends', pp.19-20; Schofield & Reher, 'The decline of mortality', pp.6-7.
[35] Reid *et al.*, '"A confession of ignorance"', p.340.

Hermoupolis may confirm the unhealthy environment of the city, as discussed previously in Chapter 3.

In Greece, climatic conditions would be also expected to be conducive to the prevalence of diarrhoeal diseases, especially the hot summer months of June, July and August, as has been observed in other southern European and Mediterranean populations. Chapter 7 will explore more thoroughly mortality due to digestive diseases, especially among infants and very young children. It will also address questions concerning the seasonality of such deaths and examine the prevailing infant feeding practices in Greece during the study period.

Figure 6. 3 Annual cause-of-death distribution per 1,000 deaths, Hermoupolis, 1916-1940



Source: Calculated by the author using HMD.

Table 6.3 and Figure 6.4, which present cause-specific death rates per 100,000, show that tuberculosis was by far the most fatal single cause of death throughout the period under study, but especially in the years around 1920. This seems to be in accordance with the contemporary literature, which suggested that mortality due to tuberculosis was particularly high everywhere in the country, with Hermoupolis exhibiting the highest levels.[36] Tuberculosis, then, was the main killer among the infectious diseases, accounting for 500 deaths per 100,000 inhabitants in 1920. Its levels had already declined significantly by 1928, when mortality due to tuberculosis became lower than 280 per 100,000 and continued to fall until the end of the study period (Figure 6.5). Bearing these high levels in mind, it seems necessary to explore tuberculosis mortality in Hermoupolis more deeply and to attempt to understand the reasons for this trend (see Chapter 8).

Another striking finding of the cause-specific mortality analysis are the very high mortality levels due to influenza in Hermoupolis in 1918. Following the global pattern, this is not an unexpected result, as an influenza pandemic was in progress in 1918-19 in every part of the world. Little research has been undertaken on the prevalence of the pandemic in Greece, so Chapter 9 will further explore the impact of influenza on the mortality of the population of Hermoupolis.

By the end of the study period, evidence from cause-specific mortality analysis shows that the second stage of Omran's epidemiological transition 'age of receding pandemics' was still ongoing, as infectious diseases still accounted for the majority of the deaths occurring in Hermoupolis at the time. The significant decline in mortality in general, and especially that due to infectious diseases may indicate that the second stage was in its final phase. In any case, the transition was interrupted by the Second World War and the severe famine which occurred on the island in 1941-44. Therefore, no firm conclusions can be drawn for the evolution of the epidemiologic transition at this stage.

After presenting these first results of the cause-specific mortality analysis, this analysis will be extended in the next section, by looking at the specific trends by sex and age-group.

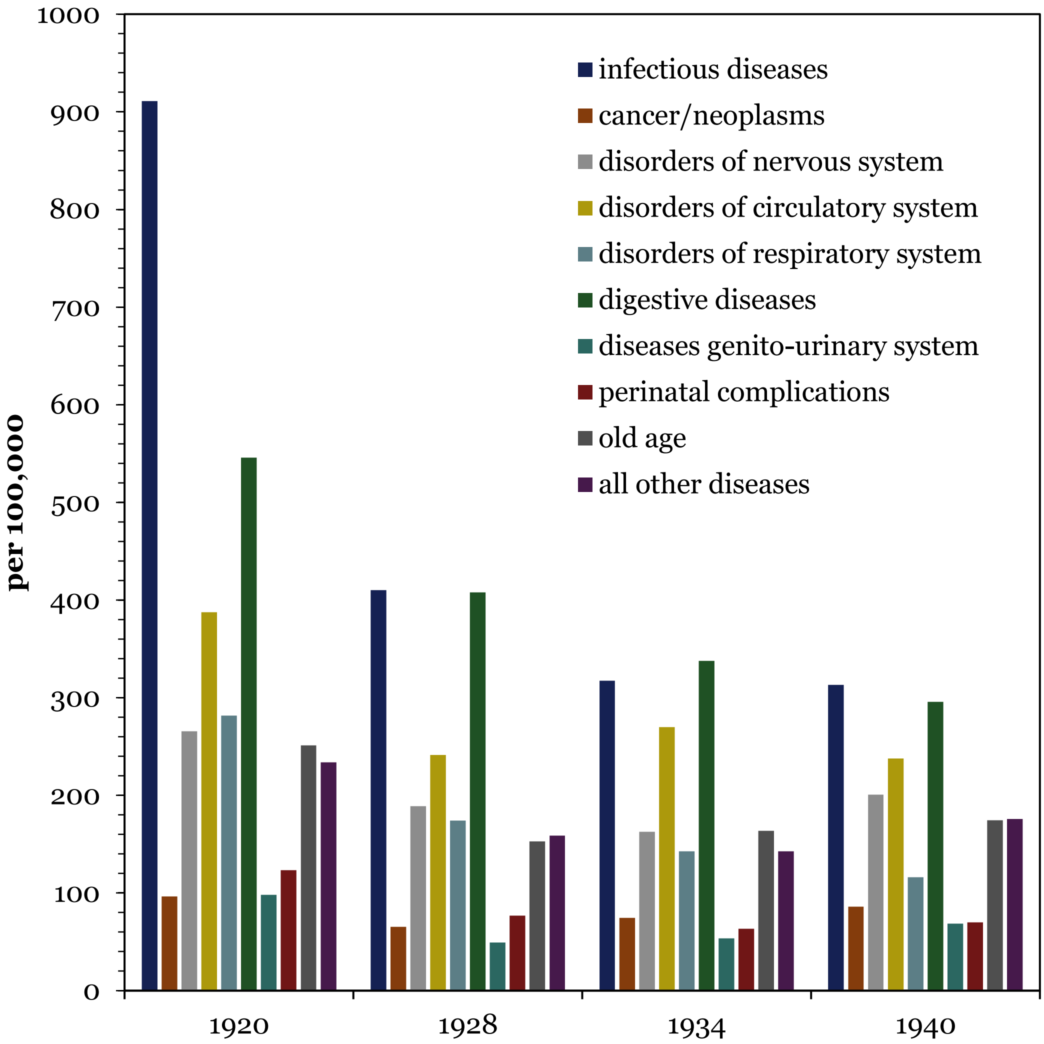
[36] Arfanes, 'E fymatiosis en Syro', pp.2-3.

Table 6. 3 Cause-specific death rates per 100,000 people, Hermoupolis, 1916-1940

Causes of death	*1920*[a]	*1928*[b]	*1934*[c]	*1940*[d]
Typhoid and typhus	50	11	13	5
Influenza	167	47	48	65
Dysentery	35	9	11	7
Tuberculosis	500	283	208	192
Other infectious diseases	159	61	38	45
Cancer/neoplasms	96	65	74	86
Diabetes, rheumatisms, etc.	14	16	16	16
Disorders of the blood	4	6	9	5
Alcoholism	2	5	1	0
Disorders of the nervous system	266	189	163	201
Disorders of the circulatory system	388	241	270	238
Disorders of the respiratory system	282	174	143	116
Diarrhoea/enteritis 0-1	185	180	130	147
Other digestive diseases	228	143	129	103
Diseases of the genito-urinary system	98	49	54	69
Delivery complications and pregnancy	13	8	8	8
Disorders of the skin and subcutaneous tissue	3	3	3	8
Disorders of the musculo-skeletal system	4	4	5	0
Congenital malformations	2	0	0	4
Peri-natal complications	123	77	63	70
Old age	251	153	164	174
Accidents or poisoning	33	26	27	41
Ill-defined and unknown	39	18	16	24
Malnutrition/starvation	47	16	14	8
Atrophy/athrepsia (0-1)	88	69	65	38

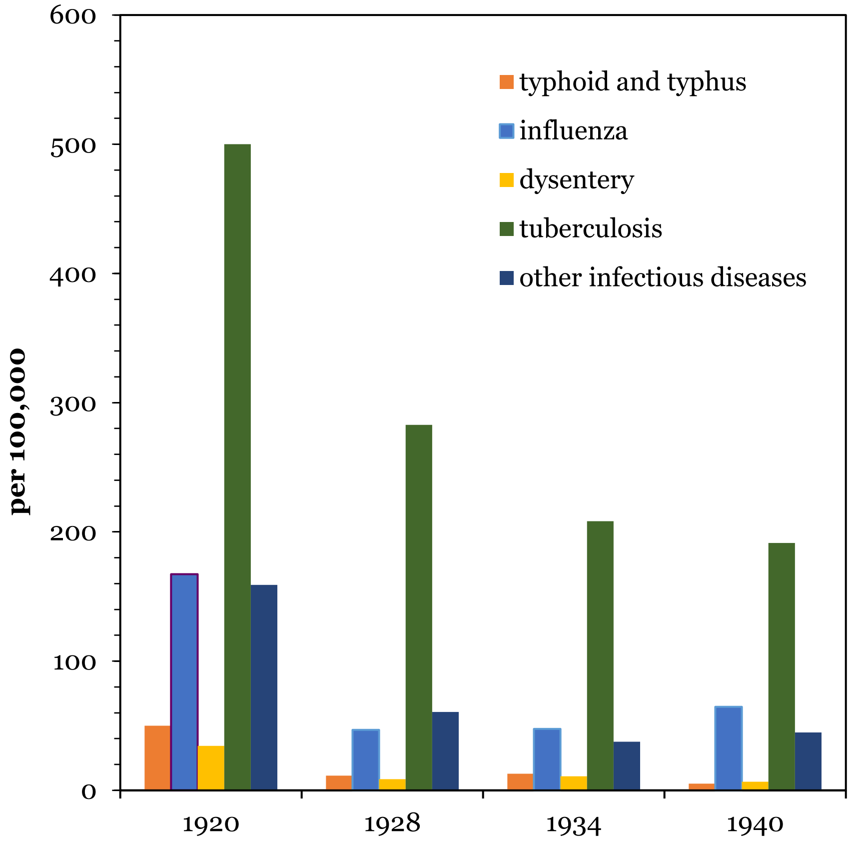
Notes: [a] average number of deaths and population from 1916 to1924.
[b] average number of deaths and population from 1925 to 1931.
[c] average number of deaths from 1932 to 1936, average population from 1928 and 1940 censuses (20,170).
[d] average number of deaths and population from 1937 to 1940.
Source**:** Calculated by the author using HMD.

Figure 6. 4 Cause-specific mortality rates per 100,000 inhabitants, Hermoupolis, 1916-1940



***Source*:** Calculated by the author using HMD.

Figure 6. 5 Infectious diseases specific mortality rates per 100,000, Hermoupolis, 1916-1940



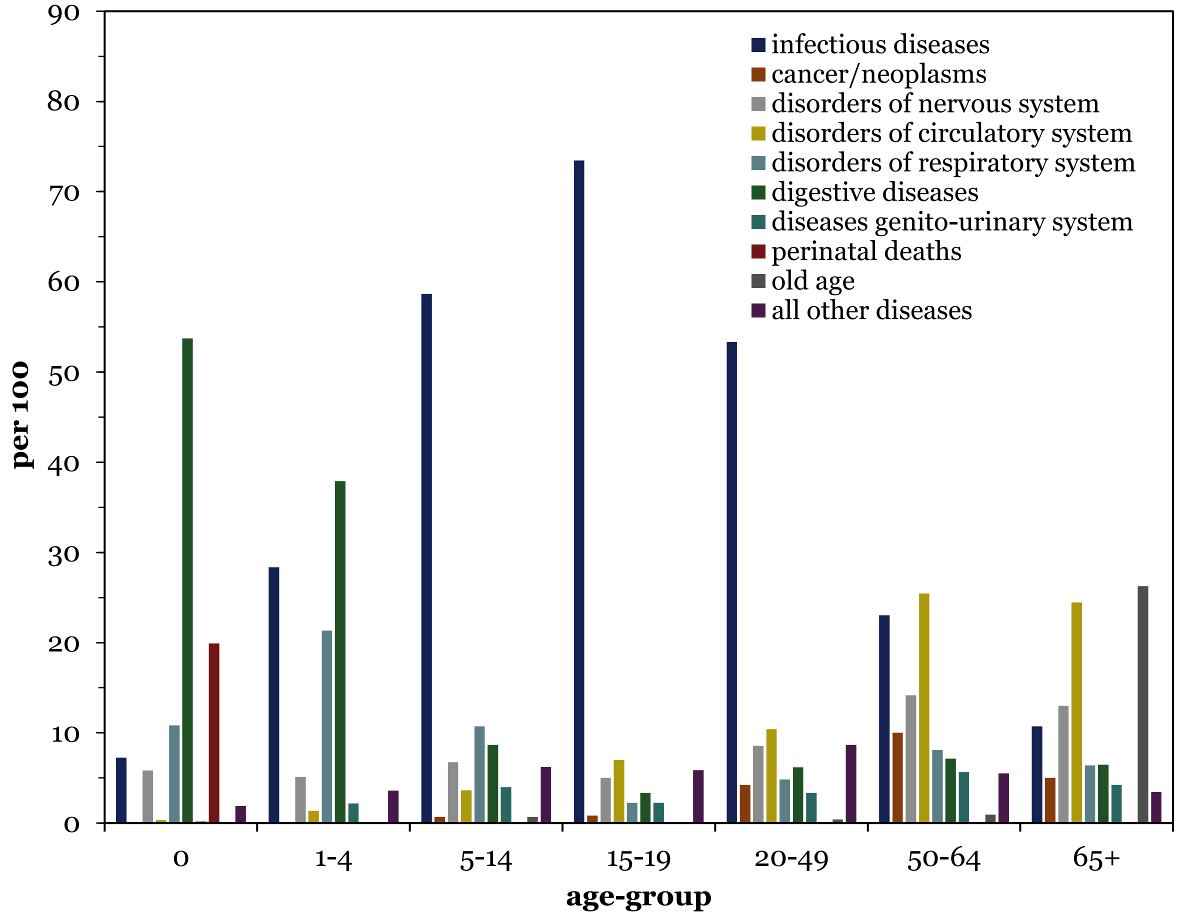
Source: Calculated by the author using HMD.

6.5.2 *Cause-specific mortality analysis by sex and age-group*

In order to achieve a better understanding of cause-specific mortality, rates by sex and age-group were calculated. Figure 6.6 shows overall mortality rates by cause and age-group for the entire period in order to capture general mortality trends. Figures 6.7 to 6.12 show mortality rates by cause, age-group and sex for the periods 1916-1929 and 1930-1940. It should be emphasised that this time division was not chosen because it marks a particular change in the pattern but to test whether different trends took place between the 1920s and the 1930s.

As Figure 6.6 shows, more than 50 per cent of infants and almost 40 per cent of young children died due to digestive diseases. The main causes of death among children, young adults and adults were the infectious diseases, reaching 55-75 per cent of all deaths in those age-groups. Almost half of the deaths in the age-group 50-64 were due to infectious and circulatory diseases, and for ages above 65, 60 per cent of all deaths were due to circulatory diseases and old age.

Figure 6. 6 Cause-specific distribution by age-group for both sexes, Hermoupolis, 1916-1940



***Source*:** Calculated by the author using HMD.

The analysis which follows will examine each age group separately comparing the two periods 1916-1929 and 1930-1940.

Findings from the study of infant mortality presented earlier in this thesis showed that the magnitude of the decline in infant mortality during the 1920s and 1930s was due to a drop in post-neonatal mortality as a result of the decline in exogenous causes of death. Mortality among infants due to digestive diseases did not decline at all throughout the study period, accounting for more than 50 per cent among all deaths in that age group in each period (Figures 6.7 and 6.8).[37] In addition, around 20 per cent of infant deaths were due to perinatal conditions. This rather broad category includes causes such as premature birth, injury at birth, congenital debility and other diseases specific to early infancy.

Mortality among young children (aged 1-4) was mainly due to digestive (38 per cent) and infectious diseases (30 per cent) during the first period. In the 1930s, digestive

[37] See Chapter 7.

mortality remained at the same levels and infectious diseases seem to have slightly declined. A significant proportion of deaths in this age-group was due to respiratory diseases (20 per cent in the first period and 25 in the second period), with higher levels among young boys. Respiratory mortality during young childhood seems also to have increased during the 1930s.

Sixty-two per cent of all deaths in the next age-group (5-14) were a result of the high prevalence of infectious diseases, with higher mortality observed among girls (Figure 6.11). The rate declined significantly in the next decade, reaching 44 per cent of all deaths. Other significant causes of death were respiratory, nervous and digestive diseases.

The young adults' age-group (15-19) experienced the highest percentage of deaths due to infectious diseases, which were responsible for 74 per cent of all deaths in this age-group in the period 1916-1929. Similar high levels were found also in the next decade (71 per cent), although higher levels were recorded for females and lower ones for males. The extremely high levels of infectious diseases within this age-group left very little space for other causes of death.

A very similar picture can be seen for adults in the age-group 20-29, reaching a little above the 70 per cent level in the first period, whereas in the 1930s the rate declined slightly (62 per cent). Although females aged 20-29 had higher mortality due to infectious diseases (74 per cent) than men (65 per cent) in the years until 1929, similar rates were recorded between the two sexes over the next decade. Circulatory diseases filled the gap created by the decline in deaths caused by infectious diseases. The very high mortality among young adults and adults, and especially for women, due to infectious diseases should not be a surprising finding as the literature has shown that those age-groups were affected the most by tuberculosis. More specific findings on mortality due to tuberculosis by age-group and sex will be presented in Chapter 8.

Deaths of adults in the 30-39 age-group were also dominated by infectious diseases, accounting for half of all deaths in this age-group (50 per cent in the first period and 44 per cent in the second period). Among women, deaths due to infectious diseases declined by almost a third in the 1930s, from 48 to 31 per cent (Figures 6.10 and 6.11). The high rates of mortality due to infectious diseases for men remained stable in both decades. Disorders of the nervous and circulatory systems were the next most important causes of death – although much lower – for both sexes in the first and the second period respectively (both around 10 per cent in both periods).

Even though mortality due to infectious diseases had declined in the age-group 40-49, it was still responsible for 42 per cent of all deaths in that age-group. Female mortality from this cause was slightly lower than that of males throughout the period under study (Figures 6.9 and 6.11), whilst male mortality increased slightly in the second period. Cancer and disorders of the nervous and circulatory systems were the next most important causes of death (15 and 12 per cent respectively).

One-third of all deaths in the age-group 50-59 were attributed to infectious diseases between the years 1916 and 1929 (29 per cent), but the rate reached a lower level (22 per cent) in the 1930s. Male mortality due to infectious diseases was slightly higher over the period. Furthermore, in the 1930s, mortality due to circulatory diseases was almost at the same level as that of infectious diseases (23 per cent).

Mortality among people in the 'older' age-group, 60 years and over, was dominated by circulatory diseases (25 per cent) or causes attributed to old age (22 per cent) in both periods. Mortality due to nervous diseases gradually increased towards the second period (15 per cent).

Overall, cause-specific mortality in Hermoupolis was dominated primarily by digestive diseases in infancy and young childhood, infectious diseases for children, adolescents, young adults and adults, whilst the final age-group experienced relatively high mortality due to circulatory diseases and unspecified old age.

6.6 Conclusions

The aim of this chapter was to examine the disease panorama of Hermoupolis from 1916 to 1940, when cause-of-death information is available in the civil registration. The findings presented and discussed in this chapter provide important evidence about the epidemiological profile of a Greek urban population during the interwar period.

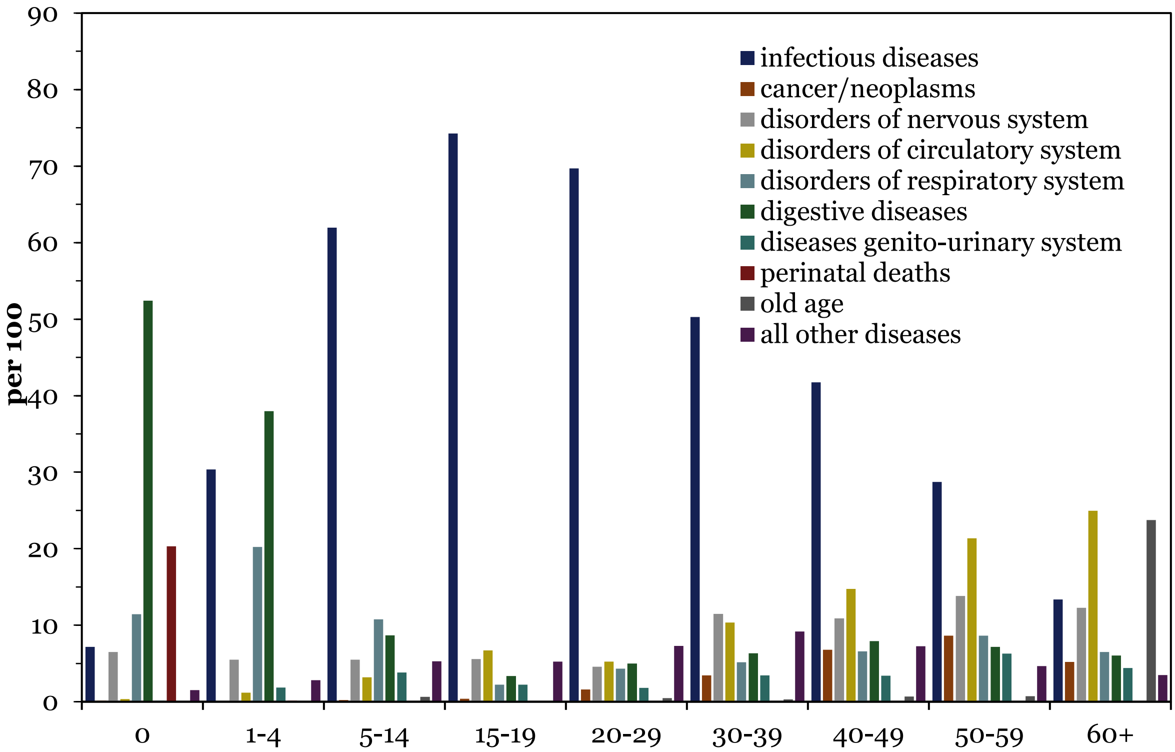
A significant part of this chapter has been devoted to discussing the methods that were employed in this study to produce cause-specific mortality results by using civil registration data. The principal findings of this analysis have been the typical pattern of high mortality attributed to infectious and digestive diseases, which is – at least partly – associated with poor public hygiene in the city throughout the study period. Attempts have also been made to link Omran's epidemiologic transition theory to a Greek population. The findings suggest that the second stage, 'the age of receding diseases', seems to have been still in progress by the end of the study period.

Analysis of the cause-specific mortality by age-group and sex has demonstrated the high prevalence of digestive diseases among the very young, infectious diseases among adults, and circulatory diseases and old age for the older population. High female mortality due to infectious diseases was identified among women in the age-groups 15-29 for the entire study period.

The following three chapters will focus on specific diseases: diarrhoeal diseases in infancy and childhood, tuberculosis mortality patterns and the 1918-19 influenza pandemic.

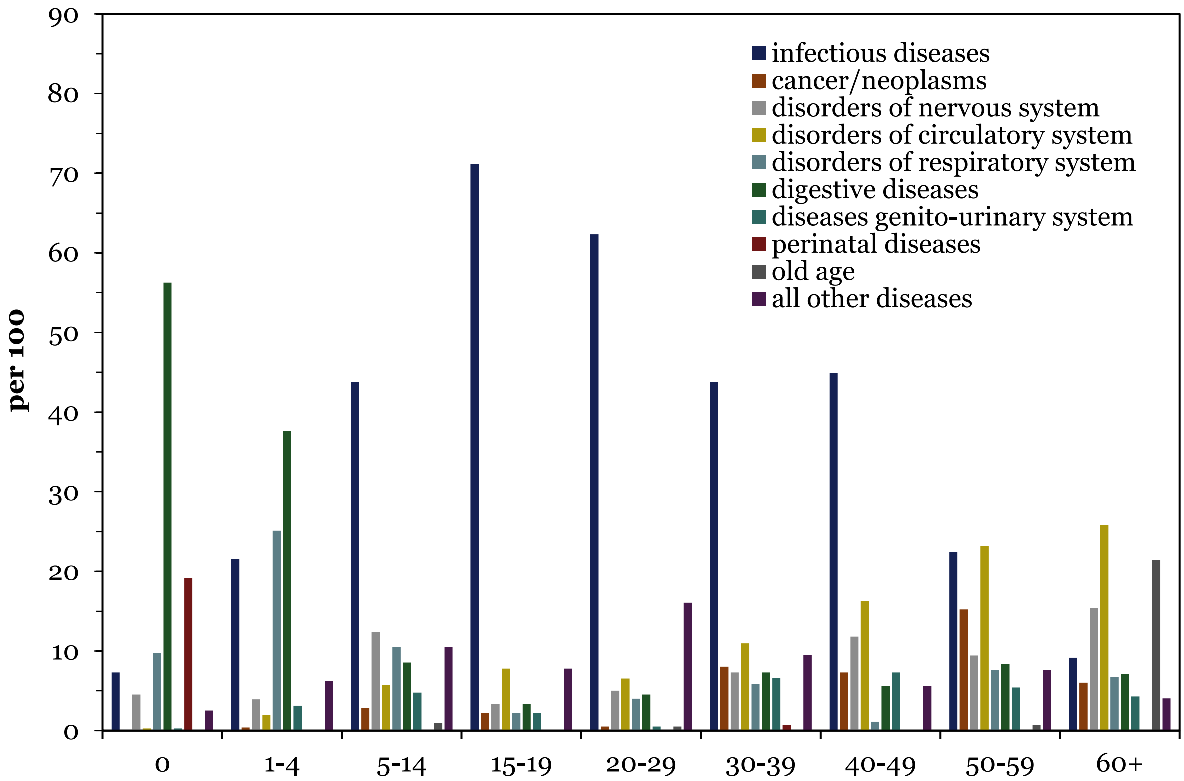
The next chapter on infant and early childhood diarrhoeal mortality will discuss the patterns during the period 1916-1940 together with a seasonality analysis. It will also seek to examine the reasons for high mortality among the very young and make associations with breastfeeding and infant feeding practices in Hermoupolis.

Figure 6. 7 Cause-specific distribution by age-group for both sexes, Hermoupolis, 1916-1929



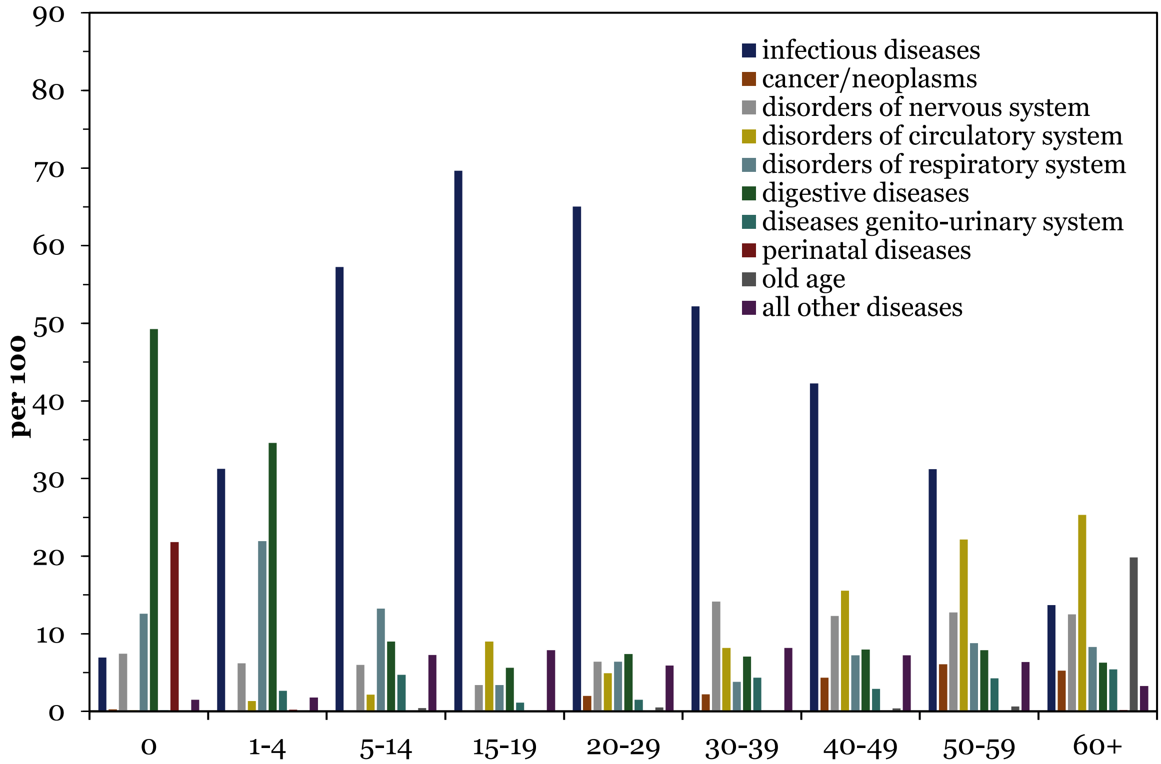
Source: Calculated by the author using HMD.

Figure 6. 8 Cause-specific distribution by age-group for both sexes, Hermoupolis, 1930-1940



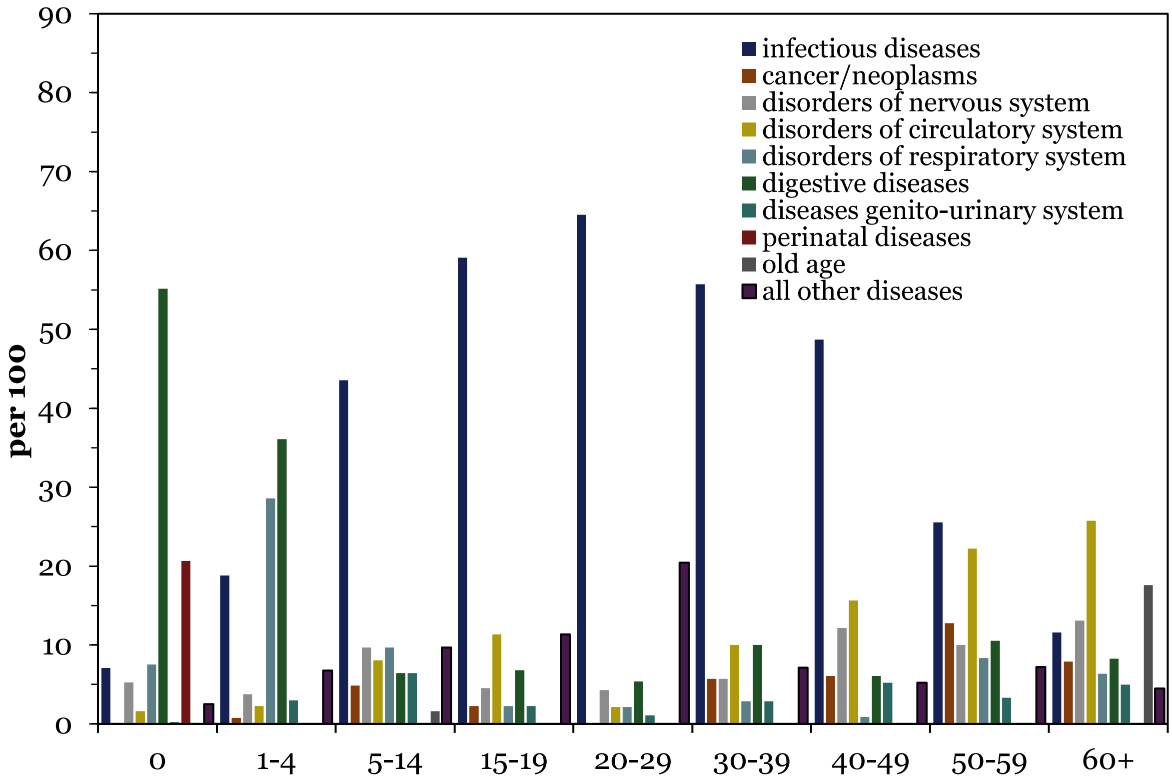
Source: Calculated by the author using HMD.

Figure 6. 9 Cause-specific distribution by age-group for males, Hermoupolis, 1916-1929



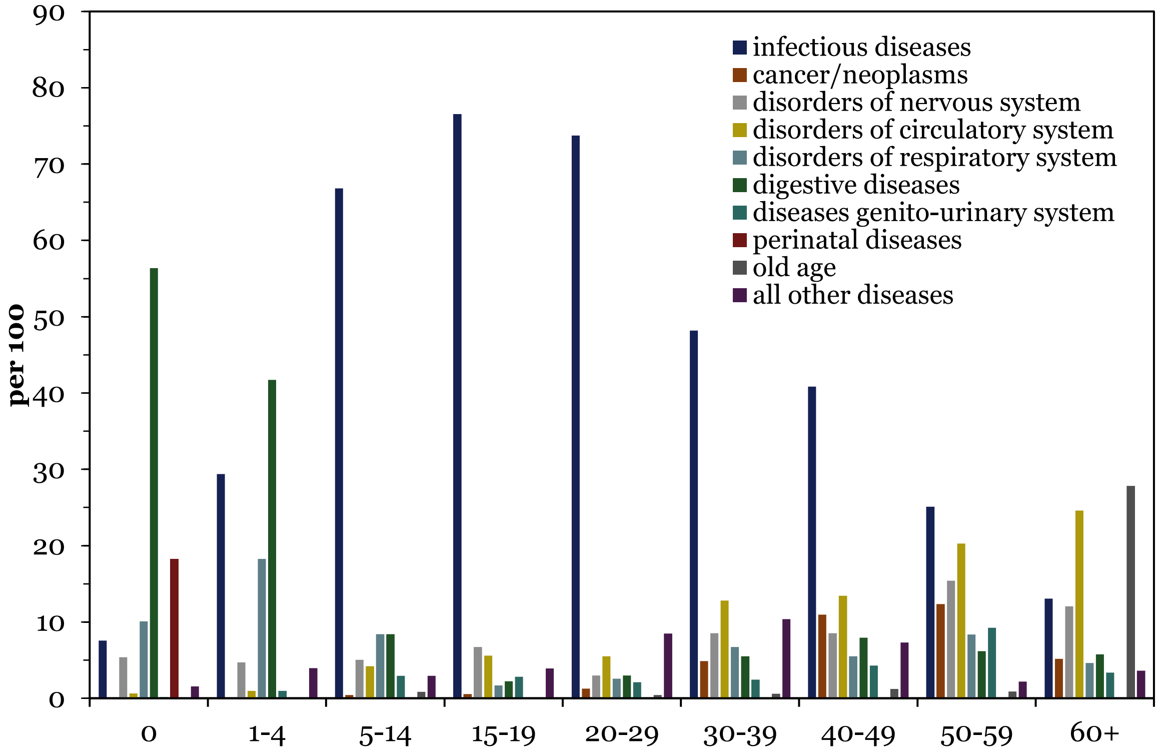
Source: Calculated by the author using HMD.

Figure 6. 10 Cause-specific distribution by age-group for males, Hermoupolis, 1930-1940



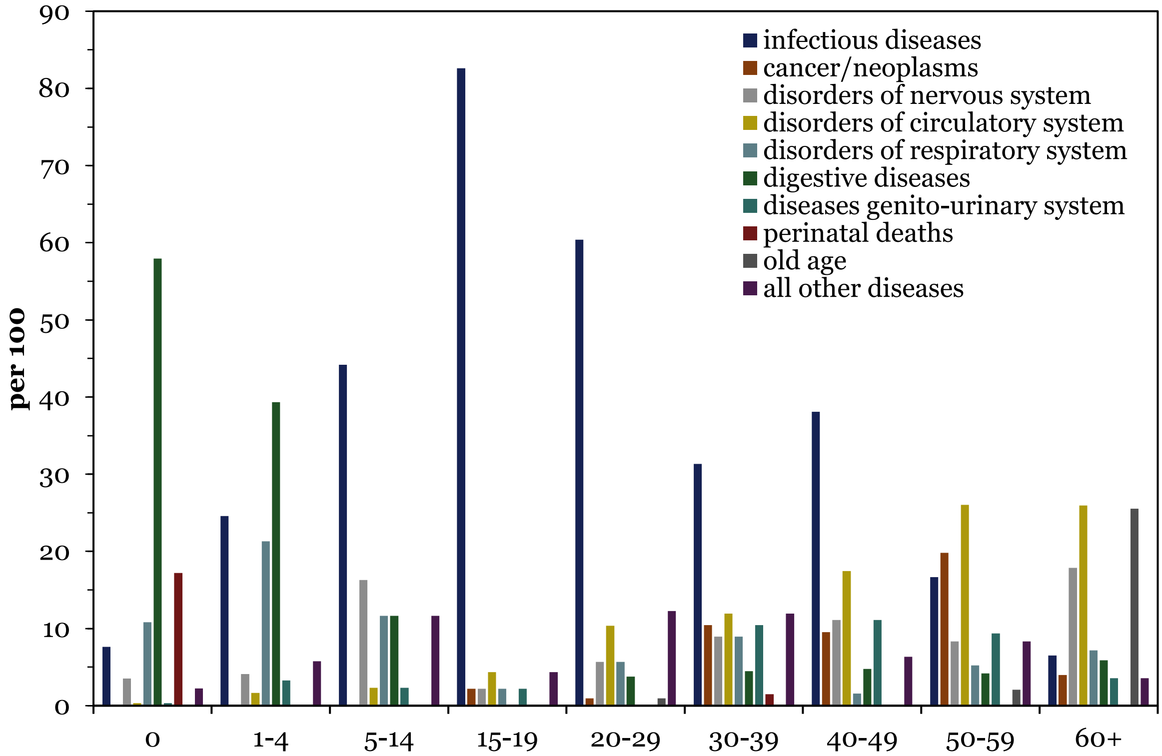
Source: Calculated by the author using HMD.

Figure 6. 11 Cause-specific distribution by age-group for females, Hermoupolis, 1916-1929



Source: Calculated by the author using HMD.

Figure 6. 12 Cause-specific distribution by age-group for females, Hermoupolis, 1930-1940



Source: Calculated by the author using HMD.

Table 6. 4 Cause-of-death distribution per 1,000 deaths, Hermoupolis, 1916-1940

Causes	*1916*	*1917*	*1918*	*1919*	*1920*	*1921*	*1922*	*1923*	*1924*	*1925*	*1926*	*1927*	*1928*	*1929*	*1930*	*1931*	*1932*	*1933*	*1934*	*1935*	*1936*	*1937*	*1938*	*1939*	*1940*
Typhoid and typhus	17	14	16	19	6	10	21	29	10	2	8	13	2	9	0	8	18	3	12	0	3	6	0	6	0
Influenza	19	24	174	41	32	66	13	24	28	17	21	26	30	20	13	45	26	30	26	51	10	38	70	28	20
Dysentery	4	3	23	5	4	10	10	27	6	5	0	6	8	3	3	5	0	3	14	10	6	13	0	3	0
Tuberculosis	179	161	150	149	188	142	133	195	173	181	148	154	142	155	153	141	111	160	122	128	105	101	117	108	136
other infectious diseases	25	48	10	105	47	27	133	41	48	20	16	38	81	20	7	27	26	15	20	29	22	16	20	37	34
Cancer/neoplasms	29	33	22	29	56	47	33	16	34	17	47	26	28	46	43	48	37	54	38	51	45	60	64	43	41
Diabetes, rheumatisms	8	0	3	3	11	5	6	5	4	10	8	11	10	6	13	3	3	12	6	16	13	13	13	6	7
Disorders of the blood	4	3	0	2	0	0	0	0	4	2	8	4	2	0	3	3	8	6	0	10	3	0	3	3	7
Alcoholism	0	2	0	0	0	0	0	3	2	0	3	2	6	3	3	3	0	0	3	0	0	0	0	0	0
Disorders of the nervous system	115	86	59	81	92	105	100	75	93	87	127	96	95	132	123	66	118	111	81	99	73	91	157	120	115
Disorders of the circulatory system	142	136	142	101	118	150	98	108	139	129	116	124	112	123	173	154	150	142	200	141	175	123	130	142	176
Disorders of the respiratory system	113	98	89	137	120	110	113	123	119	194	116	98	120	95	97	138	126	96	110	67	124	66	74	94	92
Diarrhoea/enteritis 0-1	62	52	43	53	73	83	69	83	58	52	119	113	93	112	73	80	118	60	70	86	48	79	54	128	85
other digestive diseases	58	50	53	41	45	37	63	51	46	55	55	56	30	46	57	53	42	81	61	54	48	35	50	51	64
Diseases of the genito-urinary system	23	47	33	31	28	22	31	32	34	27	42	17	20	29	20	35	42	21	23	32	41	47	23	51	41
Delivery complications and pregnancy	0	2	1	2	6	7	2	13	8	5	3	2	6	3	7	5	3	3	9	6	3	6	13	0	0
Disorders of the skin and subcutaneous tissue	2	3	1	0	0	0	0	2	0	0	0	0	4	6	0	0	0	3	3	3	0	13	0	3	3
Disorders of the musculoskeletal system	0	2	2	0	0	5	0	3	0	2	3	2	2	0	3	3	3	6	6	0	0	0	0	0	0
Congenital transformations	4	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	3
Perinatal complications	47	41	22	69	66	51	33	21	30	40	34	38	55	37	47	37	24	24	32	67	48	50	47	37	34
Old age	74	105	94	50	66	66	65	94	105	67	71	92	89	92	83	82	95	93	99	96	108	148	97	85	88
Accidents or poisoning	8	18	11	14	4	2	17	6	10	15	13	19	16	6	17	11	5	12	12	16	38	28	33	17	20
Ill-defined and unknown	21	9	15	15	9	10	19	8	8	17	8	11	6	9	13	5	5	0	9	10	25	22	17	11	7
Malnutrition/starvation	4	8	6	3	0	0	8	3	0	2	5	6	2	0	3	3	5	3	0	6	6	0	0	6	10
Atrophy/athrepsia 0-1	43	56	30	48	30	44	31	38	40	52	29	45	39	52	43	45	34	60	46	22	54	44	13	20	17

Source: Calculated by the author using HMD.

Chapter 7: Infant and early childhood diarrhoeal mortality in Hermoupolis, 1916-1940

7.1 Introduction

Cause-specific mortality analysis results showed that more than half of infant deaths and a significant proportion of childhood deaths which occurred in most of the years from 1916 to 1940 in Hermoupolis were attributed to diarrhoeal diseases. Using age and cause-specific mortality results, the aim in this section is to explore the pattern and trend of diarrhoeal mortality amongst infants and young children during the period when cause-of-death reporting is available. Hot weather has been associated with increased prevalence of diarrhoeal diseases leading to high levels of infant mortality in the summer months. Seasonality indexes have therefore been calculated in order to analyse diarrhoeal mortality even further. Breastfeeding and infant feeding practices are discussed using evidence from the available oral histories. Finally, whether the lack of clean water in the city affected infant and child mortality is also discussed.

Diarrhoea was the main killer of infants in nineteenth- and early twentieth-century Europe.[1] Such mortality was rare in the first months of life (unless the infant was artificially fed from birth) and was less commonly experienced by all children between one and five years of age during the nineteenth and early twentieth centuries. Diarrhoea also continued to be one of the leading causes of death among infants even in periods when outbreaks of infectious diseases occurred.[2] Despite the importance of infant diarrhoeal mortality in Northern Europe, it seems that diarrhoeal diseases were more important in the southern European countries because of the invariably hot summers.[3] Caselli argued that diarrhoeal diseases were responsible for the majority of infant deaths in Southern Europe.[4]

As early as the 1870s, diarrhoeal diseases were recognized as the most lethal causes of death in Greek contemporary literature, especially for infants aged between six

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[1] Woods *et al.*, 'The causes of rapid infant mortality, part I', p.360; Williams, *Infant and child mortality*, p.120; C. Rollet, 'Childhood mortality in high-risk groups: some methodological reflections based on French experience', C.A. Corsini and P.P. Viazzo (eds), *The decline of infant and child mortality: the European experience:1750-1990*, (the Hague:Martinis Nijhoff Publishers, 1997).
[2] Williams, *Infant and child mortality*, p.120.
[3] Schofield & Reher, 'The decline of mortality', p.16.
[4] Caselli, 'Long-term trends in European mortality', p.20.

months and two years.[5] The high incidence of infant diarrhoea was attributed to teething, early weaning, feeding with inappropriate food and very hot and dry summers.[6] Similar views were found in a later contemporary study of the mid-1920s: high infant diarrhoeal mortality was ascribed to the abandonment of infants by their own mothers, the replacement of breastfeeding with artificial feeding, the failure to follow specific hygienic standards and the insufficient nourishment of infants.[7] Diarrhoeal diseases also accounted for 32 per cent of the childhood mortality in Athens during the period between 1880 and 1890, of which 78 per cent were infants.[8] Valaoras estimated that diarrhoea was responsible for more than a quarter of both infant and childhood deaths in Greece in the mid-1930s.[9]

Before presenting the death rates due to diarrhoeal diseases in infancy and early childhood in Hermoupolis, it is necessary to discuss prevailed breastfeeding and infant feeding practices in Hermoupolis by also making references to the rest of the country.

7.2 Breastfeeding

Several studies have shown that a shift from artificial feeding to breastfeeding has been connected with a decline in infant mortality, although other studies have argued that breastfeeding has not always contributed extensively or exclusively to that decline.[10] Breastfeeding was beneficial not only for infants, but also for very young children, especially those raised in filthy environments with low standards of living, when it lasted for longer periods. The very close association between greater mortality and artificially fed infants means that we need to consider the role of the duration of breastfeeding, feeding practices and other factors such as sanitation, water facilities and infant care in general.[11] In addition, artificial feeding has been closely connected with diarrhoeal mortality, although inappropriate maternal care has also been seen as responsible.[12] The connection between type of feeding and infant mortality, moreover,

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[5] A. Zinnes, *E en Athinais thnetotis ton vrefon* (*Infant mortality in Athens*) (Athens, 1877), p.1.

[6] A. Zinnes, *Du role de la dentition dans la pathologie enfantine* (Athens, 1882), p.11 and A. Papapanagiotou, 'E thnetotis ton paidon en Athinais' (Child mortality in Athens), *Emerologion Efemeridos ton Kyrion tou 1891* (*Calendar of Women's Journal of 1891*), pp.34-35, cited by Korasidou, *Otan e arrostia apeilei*, p.196.

[7] M. Kaires, *To egkolpion tes maias* (*The midwife's handbook*) (Athens, 1927), p.10.

[8] Zinnis, *Du role de la dentition*, p.11.

[9] Valaoras, *Stoiheia viometrias*, p.169.

[10] Woods, *The demography of Victorian*, p.288.

[11] Reid, 'Infant feeding', p.153.

[12] K. Lee, 'Infant mortality decline in the late 19th and early 20th centuries: the role of market milk', *Perspectives in Biology and Medicine,* 50, 4 (2007), p.592.

changed over time as alternatives to breastfeeding developed.[13] In this section, I shall explore the infant feeding practices which took place in Hermoupolis during the first decades of the twentieth century. As there is not enough evidence to draw firm conclusions for the local level, sources from the whole of Greece will be used.

7.2.1 *Breastfeeding practices*

Mortality is said to be lower among breast-fed infants than artificially fed ones, but both methods depended, among other factors, on the environment, living standards, cleanliness and public hygiene. The chances of an infant dying increase during weaning. As a corollary, breastfeeding has been found to be more advantageous for infants during the first months of life when they are most vulnerable than at the end of the first year. Knodel and Kintner pointed out that in those populations with short-duration breastfeeding, infant mortality especially in the first months of life increased extensively. On the other hand, for breast-fed infants, mortality rose more rapidly during the later months of the first year than in the earlier months.[14] Other important factors affecting the relationship between infant mortality and breastfeeding were the duration of the breastfeeding and what and how alternative foods were administered.[15] Artificially fed infants had higher chances of dying especially in overcrowded, poverty-stricken areas with poor standards of cleanliness, and because such conditions were commoner in urban environments, the mortality gap between towns and countryside widened. Infants who were breast-fed for one or two months after birth had better survival chances than those who were bottle-fed, whilst infants who were breast-fed for six months had much better survival chances than either of the two aforementioned groups. Exclusively breast-fed infants also exhibited better resistance to illnesses than both artificially and partly artificially fed ones. The nutritional status of the mother seems to have been a very significant factor for breast-fed infants.[16] Through breastfeeding, mothers provided their infants with sufficient immunological protection to overcome the most unsanitary conditions.[17]

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[13] G.A. Condran & H.R. Lentzner, 'Early death: Mortality among young children in New York, Chicago, and New Orleans', *Journal of Interdisciplinary* History, 34, 3 (2004), p.339.
[14] Knodel & Kintner, 'The impact of breast feeding', pp.393, 396.
[15] V. Fildes, 'Infant feeding practices and infant mortality in England', *Continuity and Change*, 13, 2 (1998), p.256.
[16] V. Fildes, 'Breast-feeding in London, 1905-19', *Journal of Biosocial Sciences*, 24 (1992), pp.64-66; Williams & Galley, 'Urban- rural differentials', p.414.
[17] Williams & Galley, 'Urban- rural differentials', p.417.

In England and Wales, breastfeeding was the 'norm' for most mothers from the end of the eighteenth century onwards. Breastfeeding was the cheapest method of feeding a baby and as a result the most common feeding practice in the poorest areas.[18] In the same areas, however, high levels of early supplementation and premature weaning were found because mothers prepared their babies for their own return to work.[19] Artificial feeding, on the other hand, was an expensive practice and only wealthy mothers were likely to be able to afford it. In early-twentieth- century England and Wales, three to four fifths of infants were fed only with breastmilk, one fifth were artificially fed and only a small percentage had both. However, different geographic patterns of breastfeeding customs were observable.[20] Finally, breastfeeding seems to have declined significantly throughout the twentieth century, from almost 90 per cent at the beginning of the century to 51 per cent in mid-twentieth-century England and Wales.[21]

The long-tube feeding bottle which was used for artificial feeding in England and Wales became a 'death-trap' for infants. It was very popular among mothers and nurses because it could be used without the need to pick up the baby. This bottle was lethal because it was completely impossible to clean it.[22] The fact that many infant deaths occurred due to the use of the long-tube bottle led to attention being focused on the mother, and particularly on her "ignorance of infant care and management" by contemporary commentators in the early-twentieth century.[23]

The milk used by mothers as a substitute for breastfeeding was often contaminated and hence responsible for a substantial number of infant deaths during the nineteenth and early twentieth centuries.[24] It seems that there was no improvement in milk quality in England and Wales before the First World War, although Beaver did argue that a "radical change" in milk quality took place in 1895.[25] More recent studies, based mostly

[18] Fildes, 'Infant feeding practices', p.258.
[19] Ibid, p.253.
[20] Thorvaldsen, 'Was there a European', p.288; Fildes, 'Infant feeding practices', pp.254-56.
[21] Reid, 'Infant feeding', p.164.
[22] Ibid, pp. 263-64.
[23] J. Lewis, 'The social history of social policy: infant welfare in Edwardian England', *Journal of Social Policy*, 9, 4 (1980), p.467.
[24] Pooley & Pooley, 'Health, society', pp.160, 232.
[25] M. W. Beaver, 'Population, infant mortality and milk', *Population Studies,* 27, 2 (1973), p.251; P.J. Atkins, 'White poison? The social consequences of milk consumption, 1850-1930', *Social History of Medicine,* 5, 2 (1992), p.208.

on qualitative historical data, suggested the positive effect of the cleaning of the commercial milk supply on the decline of infant diarrhoeal mortality.[26]

Much milk production was unsanitary. The contamination of the milk started in the farms because dirt entered the pot during milking; unsterilized milk pots, coolers and churns were used; the straining of milk was done only through a strainer and fresh milk was mixed with stale.[27] Urban milk was more lethal than rural milk because the distance between supplier and customer was greater. It took longer to transport the milk and thus there were higher chances that the milk would become contaminated.[28] Condensed milk, which emerged in the 1880s, as well as the fresh milk, when transported over long distances was also extremely unsafe.[29] Condensed milk, low in vitamins and calorie deficient, could also be infected if the can was left open for a long time, and it could also attract flies.[30]

Milk, therefore, was the main source of disease transmission, because "it is the ideal medium for the growth of micro-organisms, containing all of the essentials nutrients".[31] Contaminated water was another disease vector; it increased the risk to infants because mothers mixed milk and water or used water on its own to feed their babies. Water could also affect infants' health indirectly because mothers could get ill from dirty water or from exposure while they were washing themselves.[32] Infected milk caused many infant diarrhoeal deaths with tuberculosis being responsible for the majority of those infant deaths, as it was the most fatal of the milk-borne diseases.[33] On the other hand, mother's milk has been found to be the ideal nourishment for infants as it provides substances which build up immunity and protect the infants by reducing the incidence of gastrointestinal infections.[34]

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[26] Lee, 'Infant mortality decline', p.597.
[27] Atkins, 'White poison?', p.212.
[28] Lee, 'Infant mortality decline', p.598.
[29] Atkins, 'White poison?', p.212.
[30] Ibid., p.222.
[31] Ibid., p.216.
[32] Lee, 'Infant mortality decline', p.591; R. Goff, 'Factors in the drop in United States infant mortality: 1900-1940', *Carnegie Mellon University Research Showcase*, 5 (2010), pp.7-8; Atkins, 'White poison?', p.214.
[33] Atkins, 'White poison?', p.218.
[34] R.M. Goldblum *et al.*, 'Antibody-forming cells in human colostrum after social immunisation', *Nature*, 30 (1975), p.797.

7.2.2 *Breastfeeding and feeding practices in Greece*

Even though it seems that breastfeeding was widespread in Greece, the relatively high levels of infant mortality in urban areas indicate that there may have been important geographical differences in its incidence and/or duration.[35] By using folklore evidence, Mpakole suggested that the duration of breastfeeding varied depending on the area, but usually lasted for one and a half years, or even longer. The prolongation of breastfeeding was perceived by contemporary women as a natural method of contraception.[36]

In Greece, no national statistics or studies on breastfeeding are available, so there is only a little evidence about its duration. Text books advising mothers about the feeding and care of infants are the main evidence we have at our disposal about breastfeeding practices in Greece over time, although folklore sources from around the country are available.[37] Oral histories available for Hermoupolis provide new insights into breastfeeding and infant feeding practices in early-twentieth century Greece.

As early as the mid-nineteenth century, breastfeeding was considered to be the fundamental medium in the fight against infant diseases, but mainly it was the most important proof of the responsibility of mothers for protecting their offspring's health.[38] Zinnes argued that nineteenth-century Athenian mothers breastfed their babies for at least a year or even more.[39] In the case of Mykonos, as in Paros, the average duration of breastfeeding was typically around 12 months.[40] In the case of Hermoupolis, oral evidence suggests that the minimum average duration of breastfeeding was between 8 and 12 months:

> *Q*. Did you breastfeed the [your] baby?
> *W*. Of course.
> *H*. All the children?
> *W*. All.
> *H*. She breastfed them all.

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[35] F. Pechlivani *et al.*, 'Infant feeding and professional advice in the first half of the 20th century in Greece', *Breastfeeding Review*, 16, 3 (2008), p.24.

[36] Hionidou, 'The adoption of fertility control', p.78; A.S. Mpakole, 'Paidike paradosiake diatrofe' (Traditional child's diet), *Epeteris Kentrou Laografias* (*Yearbook of the Hellenic Folklore Research Centre*), 29/30 (2004), p.166.

[37] A. Doxiadis, *Grammata pros meteras* (*Letters to mothers*) (Athens: Ekdoseis Gkreka, 1926).

[38] Anon, 'To protiston kathekon tes metros' (The primary responsibility of mothers), *Pandora* (1858), p.187, cited by Korasidou, *Otan e arrostia apeilei*, p.199.

[39] Zinnes, *E en Athinais thnetotis*, p.10.

[40] Hionidou, 'Infant mortality', p.166; Gavalas, *Demographic reconstruction*, p.208.

Q. For how long did you breastfeed them?

H. Almost a year.

W. How long did I breastfeed them? Seven months, and eight; [I breastfed them] for a long time.

Q. The eldest one? Your first one? For how long did you breastfeed him? Do you remember?

H. The eldest son probably more than the rest.

W. He was the eldest.

H. Probably more than [our] daughters.

W. They drank a lot of milk...[41]

In many cases, extended breastfeeding for more than a year was also found:

Q. Did the other women breastfeed their children; as a rule [common practice], did most of them breastfeed them?

A. Of course.

...

Q. For how long [did they breastfeed them]?

A. I was breastfed up to the age of three years.

Q. Was that common or was it long?

A. No, it was exceptional.[42]

Finally, an upper-class informant indicated that her first child was breastfed exclusively up to 18 months, without receiving supplementary food until that age:

A. I breastfed my first child for eighteen months. I didn't give him anything [else] and one day my mother-in-law came and said that the child should eat other food as well; [and she said to the] nanny 'go and buy milk'. And she got it, but I don't remember the brand ... I breastfed all my children.

Q. Did you breastfeed all of them for that long or less?

A. Less. We would give them other milk, because I didn't have that much milk anymore.[43]

Contemporary physicians strongly recommended breastfeeding by arguing that mother's milk was designed by nature to meet all the necessary nutritional needs of

[41] No.9 (Husband and Wife who lived in Ano Syros and were married in 1943).

[42] No.13. Similar evidence was also provided by No.19 (Husband and Wife who lived in Hermoupolis, were married in 1949, middle-class. He was born in Turkey in 1917; she was born in Syros in 1920).

[43] No.1 (female, her father was a factory owner and her husband as well, upper- high class, she was married in 1922).

infants and was more beneficial than any alternative food, even cow's milk, which was thought to be the second-best nourishment for infants.[44] Breastfeeding was the cheapest and easiest way of feeding a baby. Makkas disseminated the benefits of breastfeeding by circulating pamphlets, publishing articles in newspapers and journals and also sponsoring advertisements on how a mother should suckle her baby.[45] Advice about the duration of breastfeeding was provided in these text books, along with suggestions about how long breast-milk should be given to infants exclusively, when to start the supplementary feeding and the ideal weaning age.[46] Contemporary physicians argued that mothers should suckle their babies for about a year, with supplementary feeding starting at the third or the fourth month of an infant's life. However, different timings were suggested over time. It was also recommended that breastfeeding for the first fifteen days was vital for an infant's life even if the mother could not breastfeed her baby for longer and artificial feeding was given subsequently. Furthermore, it was recommended that weaning should be avoided during the summer time or when the baby was sick or was teething.[47]

In many folkloric traditions, it was supposed that the strange colour of the first mother's milk was a sign of bad quality and should be avoided. Subsequent research showed that this early colostrum does improve the baby's immune system.[48] Mothers, in contrast were advised by the Ministry of Hygiene to give their babies plain tea, chamomile or even anise.[49] For the first few days after birth, folkloric evidence also showed that different practices were used in order to get women to produce milk and be able to breastfeed new-borns, such as following specific diets, drinking herb juices or wearing stone necklaces.[50]

When a mother could not breastfeed, a relative, usually the infant's grandmother on the mother's side, an aunt, or a neighbour, was called upon to breastfeed the infant.[51]

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[44] Kaires, *To egkolpion tes maias*, pp.373-75.
[45] G. Makkas, *E prostasia tou paidiou* (*The protection of the child*) (Athens, 1921), pp.24-26.
[46] Ministry of Hygiene, *Meteres pos na threfete ta paidia os pou na ginoun dyo hronon* (*Mothers, how to feed your babies until they reach the second year*) (Athens, 1930); A.K. Charitakis, *To vivlio tes meteras* (*The mother's book)* (Athens: Ekdotikos oikos Petrou Demetrake, 1948).
[47] Ministry of Hygiene, *Meteres pos na threfete*.
[48] E. Karamanes & A. Mpakole, 'Metriko gala kai thelasmos: e proseggise ton laografikon katagrafon' (Maternal lactation and breastfeeding: a folkloric approach), *Epeteris tou kentrou Ellenikes Laografias*, 33 (2009-10), p.13.
[49] Ministry of Hygiene, *Meteres pos na threfete*.
[50] Karamanes & Mpakole, 'Metriko gala kai thelasmos', p.7.
[51] M. Chrysake, *Ta dyo prota hronia tou paidiou* (*The first two years of the child*) (Athens: Typografeio SK Vlastou, 1930), cited by Pechlivani *et al.*, 'Infant feeding', p.24.

Informants suggested that in many cases, when breast milk was insufficient, other women from the same neighbourhood, usually from poor families, would breastfeed those infants:

> *A*. Others [other mothers] did not have milk and the children were breastfed by the neighbour, who also had a child, such things. I had an uncle, who was the same age as the neighbour's child, and he was breastfed by the neighbour because my grandmother had no milk, they said.
>
> *Q*. And so the neighbour breastfed him.[52]

Furthermore, one male informant suggested that his wife had so much milk that there was enough to breastfeed other children as well:

> *Q*. Did she breastfeed her children or ...
>
> *A*. Of course, with her own milk, and I had even bought her those things, how are they called...
>
> *Q*. Yes?
>
> *A*. The pharmaceutical .... They [her nipples] had been cracked [because she had so much milk] and she was searching for other children to breastfeed them, because in the pre-war period ... her mother did the same, even my mother. When they had a baby, they were looking for other babies as well.
>
> *Q*. Yes?
>
> *A*. ... to breastfeed them with their own milk. Because they [the nipples] were suffering from something like thrombus [...] and they would say [...] bring your daughter or your son and they [other mothers] brought them. And my mother breastfed [them]. She breastfed three.
>
> [...]
>
> *Q*. Did she get money to do this [breastfeeding other babies]?
>
> *A*. No.
>
> *Q*. No.
>
> *A*. No, it was good for herself [to breastfeed other babies]
>
> *Q*. Right ...
>
> *A*. [the milk] to leave from her [to have the milk removed from her] ...
>
> *Q*. How long did she breastfeed them, do you remember?
>
> *A*. [...] She breastfed them, let's say, but also according to [the needs of] her own children, she breastfed them [her own children] for almost

[52] No.13. Similar evidence was also provided by No.11.

eight months, do you understand? Because in the meanwhile, their mother breastfed them also.

Q. No, I meant how long did she breastfeed her own child?

A. She breastfed [the baby]? My mother? I'll tell you, by the time one left [the breast], the next [baby] arrived.

Q. Your wife?... [How long did your wife breastfeed the children]?

A. Ah, long [time]. And this one [his daughter], I think, was breastfed until she was old, and my son [until he was] old.

Q. As old as one year old?

A. No, 18, 20 [months], she [breastfed them] up to then.[53]

Employing wet-nurses was also a common practice among the upper classes, especially in urban centres.[54] Oral evidence in Hermoupolis confirmed that wet-nurses also came to the city from neighbouring islands:

A. Rich families would bring women from other islands. They would bring women who – how do they call them - were breastfeeding babies. I don't remember what they called them.

Q. Wet-nurses?

A. Wet-nurses, right!

Q. Was that common?

A. Yes.

Q. Until when?

A. Until 1940, when the war started. Afterwards, everything changed.[55]

A female upper-class informant explained that:

A. My mother, they would bring wet-nurses back then, and me for instance ... no, my mother breastfed me. Maybe that's why I was stronger [healthier]. Who knows?

Q. Whereas for the rest of your siblings, did she [her mother] employ wet-nurses?

A. My siblings had wet-nurses.

...

A. The first wet-nurse who breastfed my son, I hired her as a babysitter for my first child.[56]

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[53] No.11.

[54] I. Toundassakis, *Parenté, marriage et succession dans le village de Vourkoti* (EHESS: Unpublished PhD thesis, 1995), cited by Karamanes & Mpakole, 'Metriko gala', p.5.

[55] No.13.

[56] No.1.

Wet-nursing was certainly practised from the beginning of the study period, although evidence is available only after the start of the twentieth century. It seems that it started to decline during the interwar period due to the fear of spreading syphilis and tuberculosis to the infants, although this is not evident in Hermoupolis.[57]

Contemporary physicians suggested that wet-nurses should only be hired when the mother was unable to breastfeed her own baby either because she was weak and ill, or she could not produce any milk. In 1926, a decree about 'infants' protection' was published, which ordered that each Prefecture should take care of all breast-fed infants who had been deprived of maternal care.[58] In order for a woman to become wet-nurse, she had to present proof that her own infant was older than four months or that it had died.[59] Makkas argued that a wet-nurse should not be allowed to suckle other infants if her own baby was less than seven months old and he also suggested that this measure, if adopted, could result in a decline in infant mortality rates.[60]

Wet-nurses, in addition, were employed by the local hospital in Hermoupolis due to the high number of foundlings in the city. Around a thousand cases of wet-nursing were recorded in the hospital records over the last decades of the nineteenth century, as a foundling could be given to more than two or even as many as seven in one case, different wet-nurses.[61] Many of these wet-nurses, according to Loukos, who has examined thoroughly the foundling lists of the local hospital, were from working-class and rather poor neighbourhoods of the city, such as Vrontado and Kserokampos.[62] In many cases, the wet- nurses took care of foundlings so they could earn money and contribute to their own family income. If a wet-nurse did not have enough breastmilk for both her own baby and the foundling, she had to buy cow's milk, which was rather expensive and sometimes her salary could not cover the milk expenses for everyday feeding. A contemporary report on the foundlings of Hermoupolis stated that the milk which they were given was of very bad quality and often impure. Instead, they were fed with flour pulps or the leftovers of the common and poor food of the fostering

57 Doxiadis, *Grammata pros meteras*.
58 *Tharros,* 21/04/1926, 166, B, p.1.
59 Ibid.
60 Makkas, E prostasia tou paidiou, p.5.
61 Similar outcomes have been found on Kephallenia by Gallant, who argued that some families received a disproportionately large number of foundlings from 1830 till 1834: T.W. Gallant, 'Agency, structure and explanation in social history: the case of the foundling home on Kephallenia, Greece, during the 1830s', *Social Science History*, 15, 4 (1991), p.497.
62 Loukos, 'Ta ektheta vrefe tes Ermoupoles', pp.251-52.

family.[63] Breastfeeding and in general the nourishment of the foundlings was a quite frequent topic in the meetings of Hermoupolis's municipal council, as the council was responsible for their funding as part of the annual budget of the local hospital.[64]

Many contemporary physicians or researchers attributed the high infant mortality rates mainly to the prevalent feeding practices. Kanellakes suggested that adulteration of milk with water, diluted the milk and caused the loss of all the necessary nutritional ingredients for infantile nourishment. The high prices of milk and infant feeding products in urban places had the consequence that mothers disobeyed doctors' suggestions and fed their babies with improper food.[65] The price of milk also was very high relative to the wages of the time, although in 1932 there was a reference in the local press indicating that the price of milk had not increased, unlike all other basic products.[66]

Veras showed that milk was also contaminated, especially in big urban centres, while Makkas suggested that a cleaner milk supply in cities would result in a decline in infant mortality.[67] The only evidence which was traced including information about the quality of milk in Greece was a report on public health by Foustanos in 1915. He stated that the only regular tests undertaken by the state at the time were examinations of the density of milk and whether it was mixed with water or other liquids. He continued by saying that the milk was never tested for contamination, but he indicated that farms, cows and milk-pots were never examined either. While he was serving as a medical practitioner in Hermoupolis, he pointed out that much of the milk distribution in the city or on the whole island was slightly contaminated. Foustanos highlighted a few times throughout his report the danger of contaminated milk and the inactivity of the state authorities in addressing the issue.[68] In addition, according

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[63] E. Arfanes, *Ypomnema peri ton ektheton* (*Statement concerning the foundlings*) (Hermoupolis, 1900), pp.20-22.

[64] *Minutes of the Municipal Council*, 1038, 62, 23 December 1888; 616, 25, 17 August 1926.

[65] Kanellakes, *Symvole eis ten melete,* p.17.

[66] Hionidou, 'Infant mortality', p.166; Korasidou, *Otan e arrostia apeilei,* p.196; Pechlivani *et al*., 'Infant feeding', p.24.

[67] Makkas, *E prostasia tou paidiou*, p.5; S. Veras, 'E ygiene tes diatrofes tes deyteres paidikes kai sholikes elikias en Elladi' (The hygiene of childhood and school-age nutrition in Greece), *Iatrika Hronika*, 116 (11/10/1937).

[68] I. Foustanos, 'E demosia ygeia. Ti den egeneto mehri semeron en te hora emon, ti tha ginei eis to mellon, ti yposhetai h neosystatheisa etaireia tes ygieines' (Public health: What has not happened in our country until today, what will happen in the future, what does the new established hygiene association promise), *Iatrike Proodos*, 11-2, K (1915), pp.*MB-MΓ*. A contemporary report suggested that milk in Athens was found to be contaminated in 1931: I. Ioakeimoglou, P. Papamarkou & K. Kinna, 'To gala ton Athinon' (Milk of Athens), *Asklepios*, B, 11 (1931), p.835.

to the annual report on public hygiene in the Cyclades in 1932, regular examinations of food and milk were taking place in Hermoupolis at the time. The milk was delivered into the city by peasants who only possessed a small number of cows, sheep and goats. The report also indicated that the available milk in the city was a mixture of cow and goat milk or cow and sheep milk. Weekly milk examinations showed that no milk adulteration was detected and therefore milk was regarded as being clean and healthy in 1932.[69] However, there were some, few references in the local press which discussed that contaminated milk was sold in the local market of Hermoupolis.[70]

Mothers from the lower classes were afraid to feed their children with either cow or goat milk, because they thought that the milk was responsible for the prevalence of diarrhoea.[71] However, Hionidou reported that on Mykonos whenever breast milk was not available and the need for artificial feeding arose, cornflour pap or flour or semolina were used by mothers.[72] Working-class mothers in Athens in the nineteenth century started giving supplementary feeding from as early as the second month.[73] Such nutritional supplements increased over time until the infant reached the first year of age, when it was given proper adult food.

Already in the late 1890s, there were references in an Athenian newspaper promoting the new Nestlé powdered milk, imported from Switzerland, as one of the best sources of nourishment for infants and young children.[74] By 1914, the Nestlé & Anglo-Swiss Condensed Milk Company was established in Athens.[75] From the 1930s onwards, the use of Nestlé condensed milk or milk powder instead of cows' milk – even in rural areas – was widespread and, according to some commentators, it seems this contributed to the decrease in infant deaths due to diarrhoeal diseases (Plates 7.1 and 7.2).[76] In the mid-1930s, an advertisement for formula milk appeared in the local press of Hermoupolis (Plate 7.3). This advertisement claimed that it was the best food for children, the elderly and those who were recovering from illnesses. It was available in

[69] GSAS, YPA, YP1308/1932, *Etesia ekthese* (1932).
[70] *Helios*, 14/08/1894, 490, K; *Tharros,* 19/08/1932, 503, Z, p.1.
[71] Zinnes, *E en Athinais thnetotis*, p.10.
[72] Hionidou, 'Infant mortality', p.166.
[73] Zinnes, *E en Athinais thnetotis*, p. 10.
[74] *Acropolis*, 2/2/1899.
[75] http://www.nestle.gr/aboutus/history (access in May 2018).
[76] A. Aggelopoulou & S. Loumide, *Nestlé 100 hronia sten Ellada* (*Nestlé 100 years in Greece*) (Athens: Elleniko Logotehniko kai Istoriko Arheio, 2001), p.35, cited by M. Papathanasiou, *Megalonontas ston oreino horo, paidia kai paidike elikia sto Krokyleio Doridas tis protes dekaeties tou 20ou aiona* (*Growing up in mountainous areas, children and childhood in Krokyleio Doridos in the first decades of the 20th century*) (Athens: EIE, 2003), p.108.

pharmacies and food stores.[77] The availability of formula milk in Hermoupolis suggests, of course, that water was also used for the milk-preparation of infants.

Plate 7. 1 Advertisement for Nestlé powdered milk in the medical journal *Iatrike Proodos*

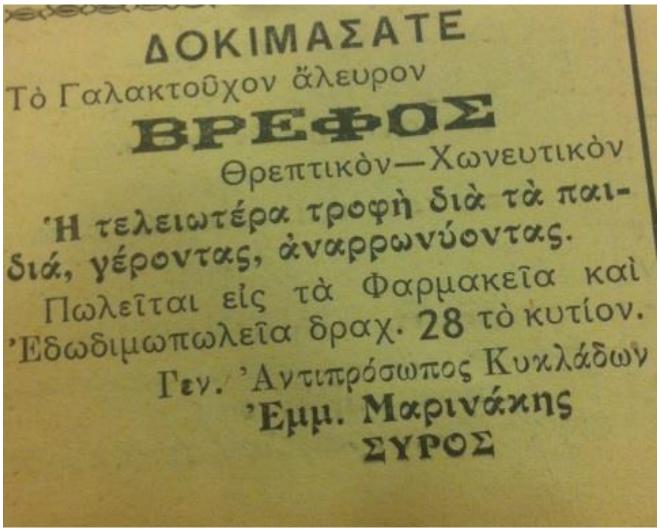
Note: The advertisement essentially says: Powdered milk Nestlé, great nourishment.
Source: *Iatrike Proodos*, May 1914, ΙΘ*,* p.ΠΔ.

Plate 7. 2 Advertisement for condensed milk in the medical journal *Asklepios*

Note: The advertisement reads: Lombard [Swiss] milk *Trofos* (wet-nurse), Best of all.
Source: *Asklepios,* November 1931, B, 11, p.834.

[77] *Tharros*, 8/12/1933, 575, Θ, p.2.

Plate 7. 3 Advertisement for powdered milk in the local newspaper *Tharros*



Source: *Tharros*, 8 /12/1933, 575, Θ, p.2.
Note: The advertisement reads: Try the powdered milk *Vrefos* (infant). Nutritious-Digestive. The best food for children, the elderly and those who recovering from illnesses. It is available in pharmacies and groceries for 28 drachmas per can.

7.3 Diarrhoeal mortality

7.3.1 *Infant and childhood mortality due to diarrhoeal diseases, 1916-1940*

Cause-of-death reporting of infant and childhood deaths in past populations was rather inaccurate, mainly because the description of the symptoms was vague, but it seems that the quality of reporting of those causes of death gradually changed.[78] There were also problems concerning the diagnosis of diarrhoeal diseases, as many conditions, such as enteritis, infective enteritis, gastro-enteritis, dysentery and other diseases of the stomach, were classified under ‘infantile diarrhoea’.[79] Keeping this in mind, the broader group consisting of all diarrhoeal diseases has been used for the purposes of this study. Thus, under the heading of diarrhoeal diseases I have included also all those deaths for which the cause of death was recorded as ‘diarrhoea’, ‘gastroenteritis’ or ‘enteritis’.[80] Furthermore, infant deaths classified under the added

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[78] H. Kintner, ‘Classifying causes of death during the late nineteenth and twentieth centuries: The case of German infant mortality’, *Historical Methods: A Journal of Quantitative and Interdisciplinary History*, 19, 2, (1986), p.47; Alter & Carmichael, ‘Studying causes of death’, p.46; Williams, ‘The reporting and classification’, p.62; J. Sundin, ‘Child mortality and causes of death in a Swedish city, 1750-1860’, *Historical Methods*, 29, 3 (1996), pp.94-95; Condran & Lentzner, ‘Early death’, p.317.
[79] Atkins, ‘White poison?’, p.218.
[80] Dysentery was classified under the heading of ‘infectious diseases’ following the ICD-4. It has therefore been excluded from our calculations. It should be noted, however, that ‘dysentery’ was used only rarely as a cause of death for infants or young children.

heading 'atrophy/athrepsia', as explained in section 6.3, were included in the calculation of infant diarrhoeal mortality. For young children, the deaths classified under 'malnutrition/starvation' in years 1-4 were also included in the calculation of the respective rate. Finally, in order to facilitate comparisons with the national rates of infant diarrhoea, the diarrhoeal rate for the first two years of age has been calculated as well, as this age-group was used in the vital statistics.

Diarrhoeal diseases were the largest category of causes of death in this period accounting for about half of all infant deaths in Hermoupolis, followed only by perinatal diseases and respiratory diseases (Figure 7.1). The rate of diarrhoeal diseases would be even higher if 'convulsions' were included in the broad group of digestive diseases. Nonetheless, this is a questionable assumption as it is a symptom mainly present only in the terminal stage – giving no indication of the underlying disease.[81] Studies in Tartu (Estonia) and Derbyshire (England) have shown that almost 13 per cent of all infant deaths were attributed to convulsions.[82] Given Kintner's argument that most infant deaths from convulsions might in fact be linked to digestive diseases, the related percentage of deaths due to convulsions was calculated for this study.[83] Only those infant deaths which occurred after the first two weeks of life, and when the cause of death was reported either as eclampsia or as convulsions (*spasmoi*) were included.[84] Four per cent of the infant deaths in the data set were attributed to convulsions, an insignificant proportion which will not be included in the diarrhoeal diseases but in the nervous system diseases category, as ICD-4 indicates (convulsions of infants under five years).

It has been found that deaths from diarrhoeal diseases were rare during the neonatal period, because most of those infants who died within the first month of life had not yet been weaned.[85] The main cause of neonatal deaths is considered to be specific conditions originating in the perinatal period. In Hermoupolis, it was calculated that on average 20 per cent of all infant deaths were due to perinatal conditions. Figure 7.2,

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[81] B. Luckin, *Pollution and control: a social history of the Thames in the nineteenth century* (Bristol: Adam Hilger, 1986), pp.102-104.

[82] Jaadla & Puur, 'The impact of water supply', p.174; A. Reid, 'Infant feeding practices and post-neonatal mortality in Derbyshire, England in the early twentieth century', *Population Studies*, 56, 2 (2002), p.158.

[83] Kintner, 'Classifying causes of death', p.52.

[84] Jaadla & Puur, 'The impact of water supply', p.174.

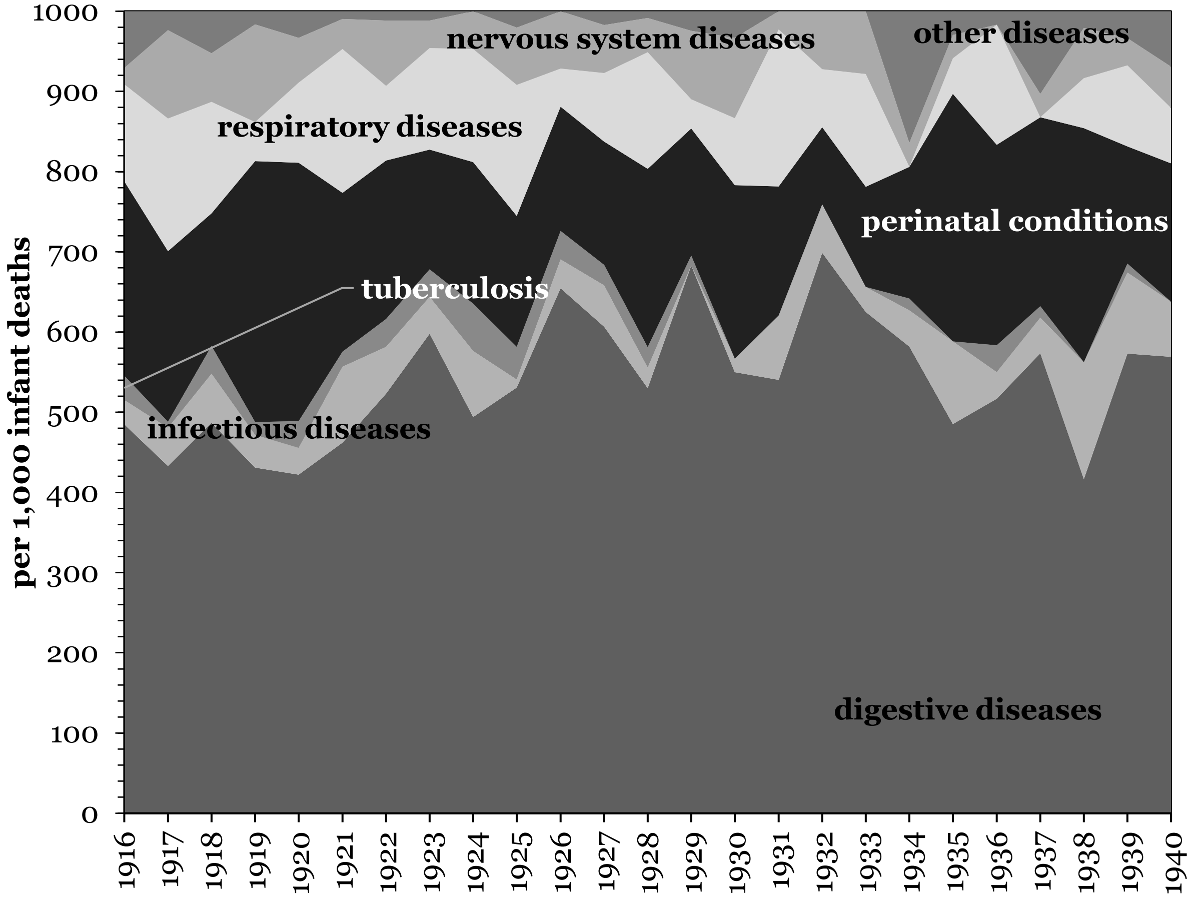
[85] A.S. Cunningham, 'Breast-feeding and morbidity in industrialized countries: an update, in D. B Jelliffe & E.F.P Jelliffe (eds), *Advances in international maternal and child health* (Oxford: Oxford University Press, 1981), cited by Fildes, 'Breast-feeding in London', p.65.

however, shows that 6 per cent of all infant deaths attributed to diarrhoeal diseases were of infants aged less than one month. Even though this is a relatively low percentage, especially when compared with the distribution of deaths in the following months, it is a rather surprising finding as it would be expected that all infants would be breast-fed during the first month of life and therefore protected.[86]

High levels of infant deaths due to diarrhoeal diseases were found in the second and third month of life, accounting for 26 per cent of all infant diarrhoeal deaths during the study period. Knodel and Kinter argued that the most likely period for an infant to die as a result of artificial feeding is between the third and the sixth month.[87] In the case of Hermoupolis, as can been seen in Figure 7.2, 36 per cent of all infants who died from diarrhoeal diseases were between the third and the fifth month, whereas 23 were between the sixth and the eight month. It seems, therefore, that most infant diarrhoeal deaths were concentrated amongst infants of less than eight months. As discussed in section 7.2.2, the minimum average duration of breastfeeding has been found to be 8 to 12 months. Since infants were dying while being breast-fed, it seems that other factors may have affected infant diarrhoeal mortality in Hermoupolis. One possible reason might be that supplementary food which was given to those infants together with breastfeeding and before weaning was more likely to be contaminated as a result of the lack of clean water in the city.

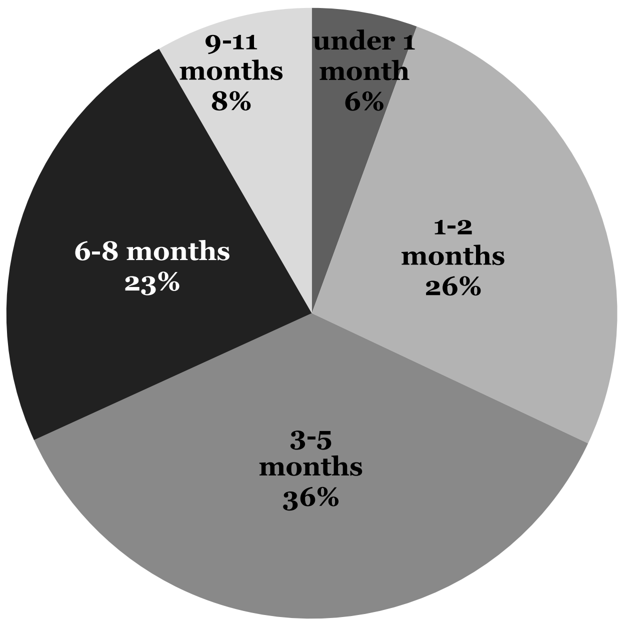
[86] Even though, as discussed in section 7.2.2, oral evidence suggests that there were mothers who did not have any milk even from the first day and therefore they could not breastfeed their own babies.
[87] Knodel & Kintner, 'The impact of breast feeding', p.402.

Figure 7. 1 Cause-of-death distribution of infant deaths per 1,000, Hermoupolis, 1916-1940



Source: Calculated by the author using HMD.

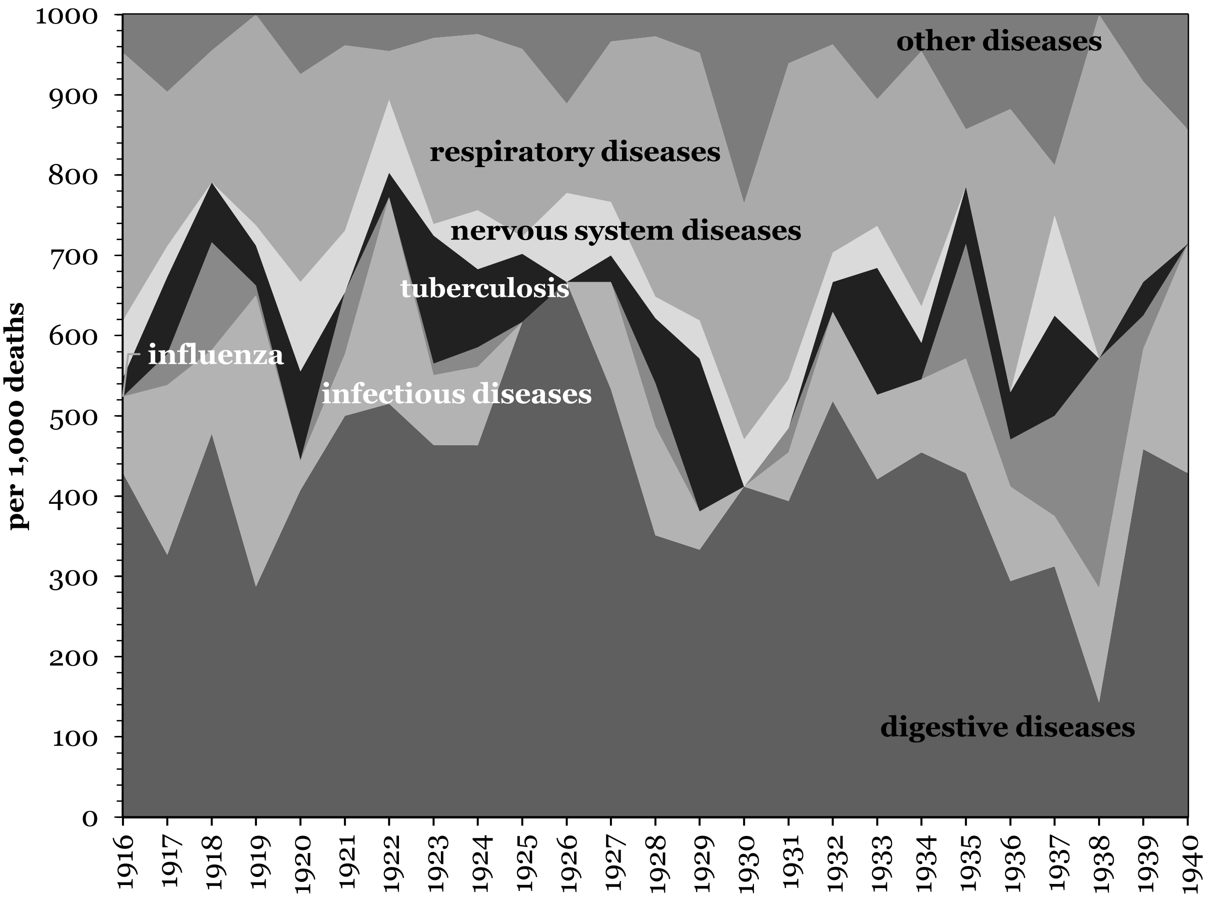
Figure 7. 2 Percentage distribution of infant deaths due to diarrhoeal diseases, Hermoupolis, 1916-1940



Source: Calculated by the author using HMD.

Diarrhoeal diseases were a leading cause of death not only for infants but also for children in their second year of life (Figure 7.3). The levels of diarrhoeal mortality among these children were slightly lower than those of infants; yet very high levels were found in the mid-1920s, most likely due to the refugee influx from Asia Minor. Similar increases were found amongst infants. Many refugees in infancy and early childhood were found to have died from diarrhoeal diseases, although it is not possible to estimate their real contribution to total diarrhoeal mortality as such information is only partially available. The refugees were located in temporary settlements which lacked rudimentary facilities and did not meet basic rules of public hygiene, as has been discussed in Chapter 3. It is expected, therefore, that such unhealthy conditions may have affected not only those who lived in those settlements but also people who lived in nearby areas.

Figure 7. 3 Cause-of-death distribution of early-childhood deaths (1-2 years) per 1,000, Hermoupolis, 1916-1940

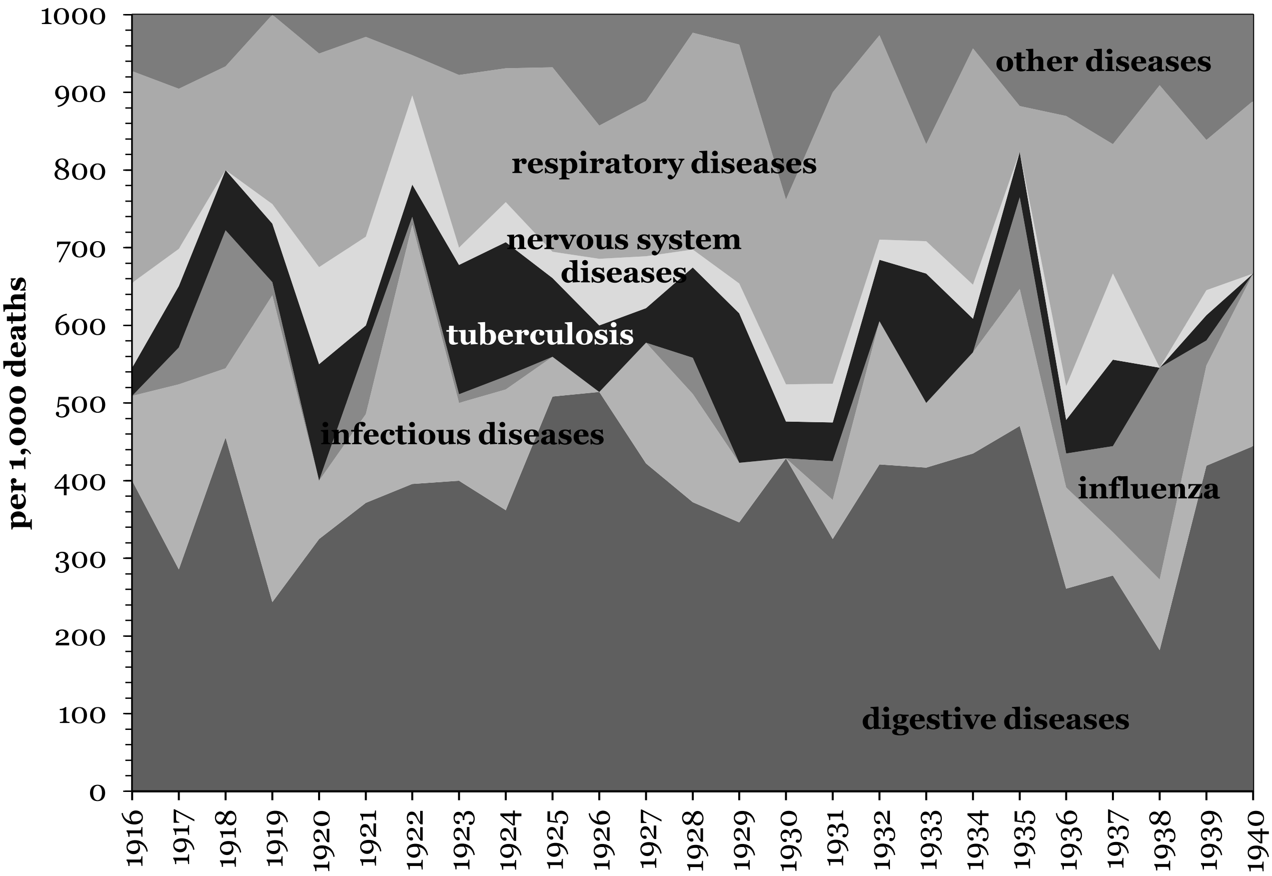


Source: Calculated by the author using HMD.

The early childhood mortality rate attributed to diarrhoeal diseases reached very high levels of more than 40 per cent of all childhood deaths in the mid-1920s and mid-

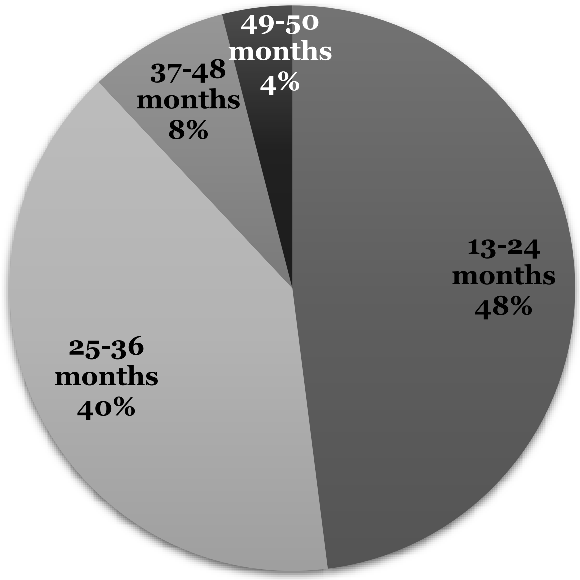
1930s (Figure 7.4). In addition, Figure 7.5 shows the distribution of childhood deaths attributed to diarrhoeal diseases by single year of age. Almost half of those deaths occurred among children in their second year of life (1-2 years, that is 13-24 months), and 40 per cent in the third year (2-3 years, that is 25-36 months).

Figure 7. 4 Cause-of-death distribution of early childhood deaths (1-4 years) per 1,000, Hermoupolis, 1916-1940



Source: Calculated by the author using HMD.

Figure 7. 5 Percentage distribution of early childhood deaths (1-4 years) due to diarrhoeal diseases, Hermoupolis, 1916-1940



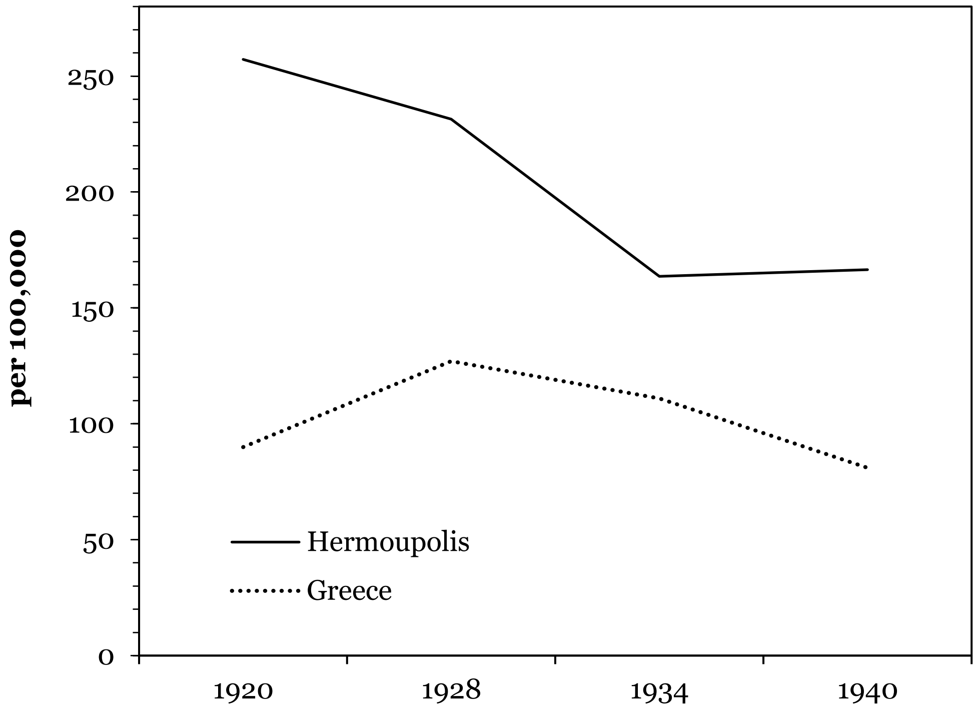
Source: Calculated by the author using HMD.

Finally, a comparison of cause-specific mortality between Hermoupolis and Greece as a whole shows that the national death rates for the first two years of life due to diarrhoea and gastroenteritis were much lower than those of Hermoupolis (Figure 7.6). A possible explanation for this significant disparity may be that rural areas are included in the national estimates, where lower infant mortality levels are usually observed. In Mykonos, for instance, it has been estimated that 34 per cent of all infant deaths were attributed to diarrhoea during the period 1919-1928.[88] The lower rates in Mykonos compared with those in Hermoupolis are additional evidence that the 'urban-sanitary-diarrhoea' thesis, as suggested by Woods, was clearly operating in Greece at least for the first few decades of the twentieth century. It should be noted, however, that in Athens it has been found that 25 per cent of all infants died from diarrhoeal diseases from 1932 until 1938.[89] This rate seems to be much lower than the one calculated in Hermoupolis for the same period, though, according to Kanellakes, cause of death was not available for all deaths in Athens and 'unknown' causes of death was recorded for 15 per cent of all infant deaths during the same period.[90] In Hermoupolis, however, much lower levels were found, usually 1 to 2 per cent lower,

[88] Hionidou, 'Infant mortality', p.162.
[89] Kanellakes, *Symvole eis ten melete,* p.99.
[90] Ibid., p.97.

except for 1937 when it increased to 5 per cent. Evidence presented in section 6.4 showed that cause-of-death registration has been found to be problematic in 1936-1938 as high number of deaths were attributed to vague conditions such as 'old age'.

Figure 7. 6 Distribution of diarrhoea and enteritis under the age of two per 100,000 population, Hermoupolis and Greece, 1920-1940



Note: The rates for Greece were calculated by the author for 1922, 1928, 1934 and 1938 using the average number of deaths attributed to diarrhoea and the population of the country around those years. The methodology for the cause-specific mortality results in Hermoupolis has been discussed extensively in section 6.3.
Sources: Calculated by the author using HMD; Vital statistics (1921-1938).

Overall, the data presented in this section have shown that diarrhoeal mortality was high amongst those in the first five years of life, especially during infancy, even until the last years of the study period. The next section will further explore such deaths by focusing on their seasonality. As well as the seasonality of deaths due to diarrhoeal diseases, the seasonality of births and deaths over the entire period under study will be also discussed.

7.3.2 *Seasonality*

Diarrhoeal diseases presented an extreme summer peak, unlike other causes of death in childhood which did not exhibit a typical seasonal pattern.[91] Since infant mortality varied markedly throughout the year, with the summer months being the most

[91] Condran & Lentzner, 'Early death', p.322.

threatening for infants, particularly from diarrhoea, this section will present an exploration of the seasonal pattern of deaths among infants and children. The seasonality of infant and childhood deaths throughout the period under study and also the seasonality of those deaths attributed to diarrhoeal diseases from 1916 until 1940 – using a simple method to examine monthly fluctuations – have been calculated.

Babies had a higher risk of dying from extreme weather conditions. Both temperature and precipitation had a severe impact on infant mortality. Quality of air and the cleanliness of water and the related state of the milk market were regarded as the main mediums to be affected by the hot and cold temperatures. Very hot summers in combination with the multiplication of the fly population resulted in higher risk of infection from accumulated human faeces in filthy middens and ash-pits.[92] Hot temperatures were initially blamed for the increased infant mortality due to diarrhoeal diseases throughout the summers. In the course of time, however, with the evolution of germ theory, researchers argued that contaminated milk, probably as a result of early weaning, together with contaminated water and other forms of food, were connected to the prevalence of diarrhoeal diseases.[93]

As Woods *et al.* convincingly argued for late-nineteenth-century England and Wales, unhealthy urban conditions are considered to be the most likely reason for the noteworthy increase in infant mortality in the 1890s. Poor urban sanitation in combination with hot and dry summers resulted in a significant increase in diarrhoea and dysentery incidents among infants, especially between the first and the eleventh month of life ('urban-sanitary-diarrhoea').[94] Similar trends have been observed in several studies, such as that by Knodel, who suggested that more infant deaths occurred during the late winter but even more so during the summer months.[95] Caselli pointed out that the propagation of digestive diseases was more likely in the hotter Mediterranean countries due to the summer peaks of excess infant mortality.[96] Thus

[92] G. Mooney, 'Did London pass the 'sanitary test'? Seasonal infant mortality in London, 1870-1914', *Journal of Historical Geography,* 20, 2 (1994), p.165; P. Hugh, 'Shifts in the seasonality of infant deaths in nine English towns during the 19th century: a case for reduced breast feeding?' *Explorations in Economic History*, 34, 4 (1997), p.374.
[93] Lee, 'Infant mortality decline', p.588.
[94] Woods *et al.*, 'The causes of rapid infant mortality, part I', p.360; Williams & Mooney, 'Infant mortality', p.185.
[95] Knodel, 'Seasonal variations', p.221.
[96] Caselli, 'Long-term trends', p.19.

climatic differences created different patterns of seasonality between northern and southern European countries.[97]

Even though there are no detailed data available concerning temperature levels on the island of Syros, temperatures above 30C during the summer months, as Table 7.1 shows, indicate that summers on the island were very hot.When extreme hot or cold temperatures occurred on the island, the local press did mention it. For instance, in 1883 an article regarding the increased incidence of diarrhoeal diseases due to the 'unbearable' heatwaves in Hermoupolis appeared in a local newspaper.[98] In addition, Fragkides reported that winters in Hermoupolis during the last quarter of the nineteenth century were rather mild, without the cold winds of the mainland (Table 7.1). The coldest months were January, and especially the last period of the month when there was a high possibility of snow, and February.[99] During the same period, June seems to have been the hottest month of the year, with May, July and August following, although somewhat cooler and windier.[100] Between 1887 and 1894, the highest temperature which had been recorded on the island was 24C, the lowest -3.2C, and the mean temperature for the entire year was 15C.[101]

Table 7. 1 Temperatures in Hermoupolis, 1887-1893

Temperature (C)	*1887*	*1888*	*1889*	*1890*	*1891*	*1892*	*1893*
Highest	32	31	33	34	33.5	31	31.5
Minimum	2	3	1.5	3	1	5	2
Mean	17	16.3	18.3	18	18.2	18.6	16.5

Source: Fragkides, *Nesos Syros,* p. 65.

Tables 7.1 and 7.2 show the temperatures in Hermoupolis and Athens respectively.[102] It seems that similar temperature levels occurred in both cities, with Hermoupolis exhibiting warmer temperatures in the late nineteenth century. Moreover, it is to be

[97] Ramiro & Sanz, 'Structural changes', p.75.
[98] *Panope*, 5/06/1883, 944, ΙΓ, p.2.
[99] The coldest winters were recorded in 1882, 1886, 1890 and 1894. The minimum temperature recorded during the winter time between 1880 and 1894 was -3C, the highest 14C, and the mean temperature was around 8C.
[100] The hottest summers were recorded in 1882, 1887 and 1890, when the peak temperature in mid-June was 34C. It should be also noted that in 1923, Greece decided to adopt the Gregorian calendar and in order to be in agreement with the new calendar, the country missed fifteen days, with 15 February 1923 being followed by 1 March 1923.
[101] Fragkides, *Nesos Syros*, pp.33-34
[102] F. Exner *et al.*, *World Weather Collections,* 79 (Smithonian Miscellaneous Collections, 1929), pp.530-31; 90 (Smithsonian Miscellaneous Collections, 1934), p.220.

expected that Hermoupolis would show higher levels of humidity because it is on an island. According to Table 7.2, the highest temperatures occurred from June until September and the lowest from December to February, whilst the wettest period was from November until February. Zinnes studied infant mortality in Athens and suggested that the heatwave was especially intense in June and July.[103]

Table 7. 2 Average temperature and precipitation per month in Athens, Greece, 1895-1930

Month	*Temperature in degrees C (1895-1920)*	*Temperature in degrees C (1921-1930)*	*Precipitation in millimetres (1895-1920)*	*Precipitation in millimetres (1921-1930)*
January	9.10	9.17	52.2	52.8
February	9.69	9.02	42.2	47.6
March	11.19	11.58	29.5	33.2
April	14.78	15.58	21.9	12.7
May	19.02	20.22	21.1	24.0
June	23.46	24.16	17.5	14.7
July	26.61	27.42	7.2	1.9
August	26.43	27.55	12.4	3.4
September	23.00	24.04	16.7	20.5
October	18.88	19.14	39.9	46.5
November	14.03	15.45	66.2	59.6
December	11.16	11.19	66.9	70.2
Year	**17.32**	**17.87**	**393.7**	**387.1**

Source: Exner *et al.*, *World Weather Collections*, p.220.

Since monthly variations in births affected the monthly variations in infant deaths, the seasonality of births is presented in Figure 7.7 in order to compare the seasonality of the two vital events. The deaths contain all those events which occurred throughout the study period, whereas the births include all those births for every census year and the following year (apart from 1941) of infants and young children with a reported age at death 0 to 15 months, which were linked to a death. The limited availability and use of births for the calculation of the seasonality indexes is a limitation of this study and therefore the results of birth and conception seasonality should be treated with caution. Nevertheless, these calculations involve a significant percentage of all births and involve 'random' years.

[103] Zinnes, *E en Athinais thnetotes*, p.4: mean temperature from May to August fluctuated from 19 to 29C to 31 to 39C, with the lowest being 10.66 to 21.5C.

Index values, following Knodel's methodology, have been calculated in order to study the seasonal variations in the number of vital events.[104] This was possible by calculating the proportion of annual events which occurred in each month and dividing them by the number of days in each month. In order to take into consideration the leap years, each year is regarded as having 365.25 days and February is regarded as having 28.25 days. An index above 100 will suggest that the number of events (for instance infant deaths) during a specific month is higher than expected, and an index below 100 will imply that fewer events than expected occurred.[105]

Figure 7.7 shows that seasonality of births was not as acute as that of infant deaths, with the main peaks in January, March, October and November. Similar results have been found on the island of Mykonos during the same period.[106] On both islands it seems that the birth rate was lower than average from March until August. From September to November the rate increased significantly, whereas in December it fell slightly. Studies of other Greek islands in the nineteenth century have shown close agreement with these results.[107] When the seasonality of conceptions is explored, simply changing each month to the one that precedes the birth by nine months suggests a pattern of relatively low conceptions from August to October and rather high during the winter and autumn months with the exception of March.[108] The very low levels in March must be connected to the Lent period, when fasting – including sexual abstinence – was prescribed by the Orthodox Church.[109] The trend of lower conceptions over the warmest months (May and June) has been associated with the possible effects of the temperature on coital frequency. The working pattern of

[104] Knodel, 'Seasonal variations', p.212.

[105] Ibid., p.212; Hionidou, *The demography of a Greek island*, p.45.

[106] Hionidou, *The demography of a Greek island*, p.45.

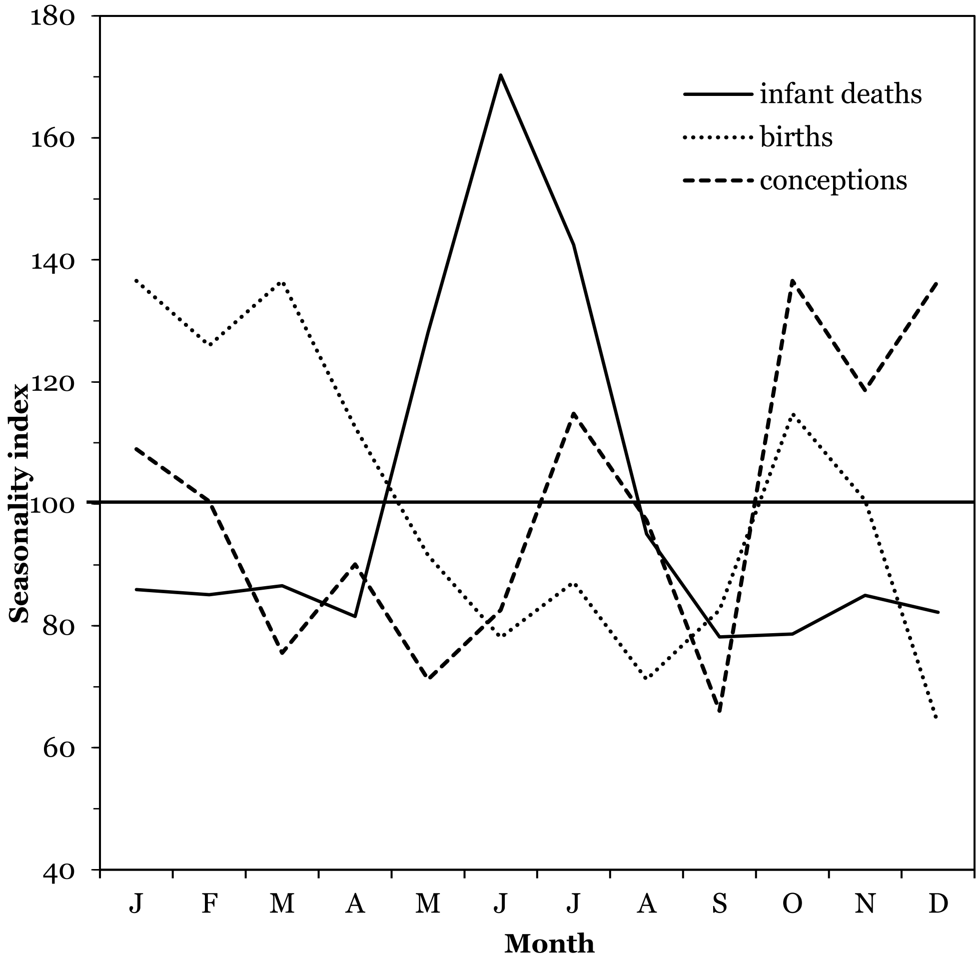
[107] I. Dekigalas, *Statistike tes nesou Theras* (*Statistics of the island of Thera*) (Syros, 1850), cited by Hionidou, *The demography of a Greek island*, p.45; M. Tomara-Sideri, 'Oikonomike dynamike kai demografike metavase' (Economic dynamics and demographic transition), *Greek Review of Social Research*, 80 (1991), p.84.

[108] For the purposes of this current study, we assumed that all conceptions took place nine months before the corresponding births. We are nevertheless aware of the fact that only two thirds of conceptions result in a birth nine months later: J. Bongaarts, 'A method for the estimation of fecundability', *Demography*, 12, 4 (1975), p.650.

[109] Clon Stefanos, 'Greece, Geographie medicale', in A. Dechambre (director), *Dictionnaire Encyclopedique des Sciences Medicales* (Paris: G. Masson & P. Asselin, 1884), p.454, cited by Hionidou, *The demography of a Greek island*, p.46. Oral evidence from Mykonos confirms that this continued in the first half of the twentieth century: Hionidou, 'The adoption of fertility control', p.76. A very similar pattern of declining conception after the beginning of the Lent was found in the pre-industrial Spanish town of Cuenca: D.S. Reher, *Town and country in pre-industrial Spain. Cuenca, 1550-1870* (Cambridge: Cambridge University Press, 1990), pp.103-05.

fishermen and sailors, a significant proportion of the male population of Hermoupolis, meant that they were away for most of the summer starting from Easter time but they stayed around the island during the winter.[110] Moreover, the peak summer months of infant mortality were also the months of relatively low number of conceptions. The reverse connection between the seasonal pattern of infant deaths and conception reinforces the view of the negative psychological reaction which parents experience after the loss of an infant.[111]

Figure 7. 7 Seasonal patterns of infant deaths, births and conceptions, Hermoupolis, 1859-1940



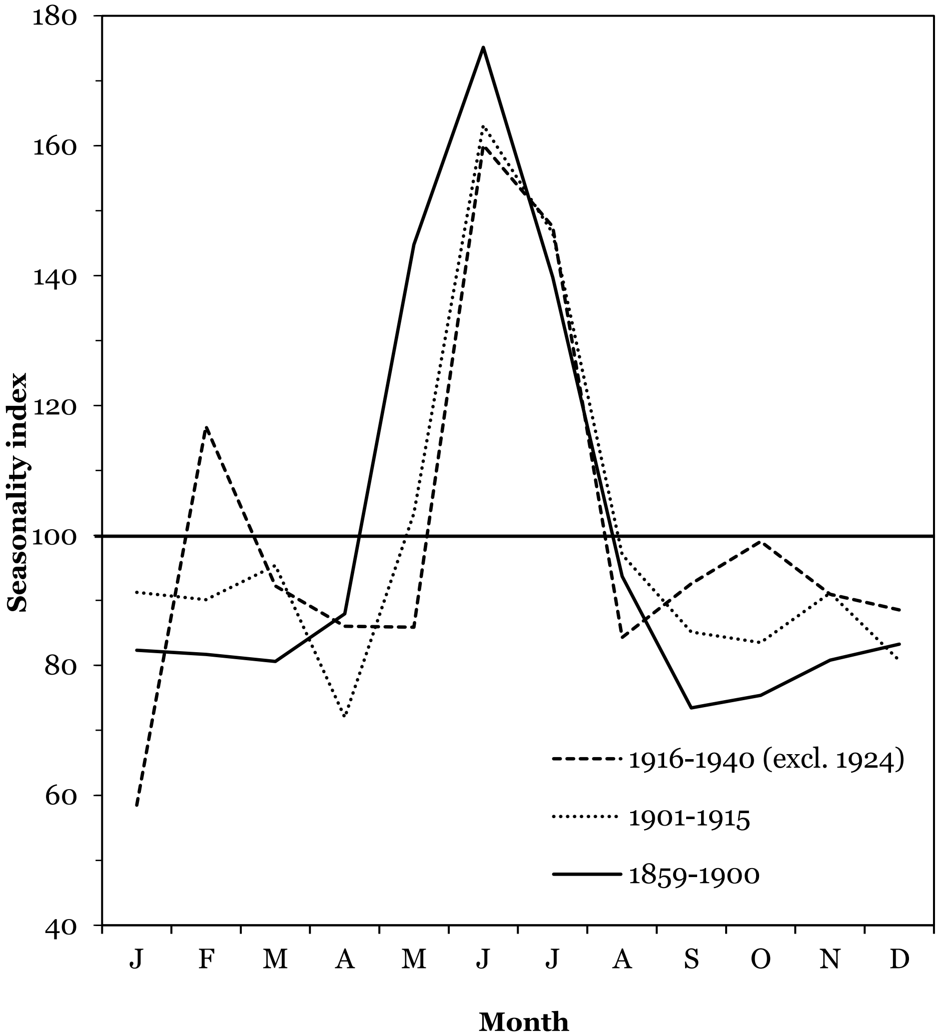
Source: Calculated by the author using HMD.

[110] Hionidou, *The demography of a Greek island*, p.46; C. Loukos, 'To demotologio tes Ermoupoles' (Municipal rolls of Hermoupolis), *The City in Modern Times*, http://cities.ims.forth.gr/docs/Municipal.Hermoupolis.pdf (access in March 2018), p.17; K. Anagnostake, 'Demiourgia, anaptykse, akme kai parakme tes Ermoupoles mesa apo ten epeksergasia ton epaggelmaton ton demotologion' (Creation, development, prosperity and decline of Hermoupolis through the elaboration of the citizens' professions cited in the municipal rolls), *The City in Modern Times*: http://cities.ims.forth.gr/docs/Municipal.Hermoupolis.Anagnostaki.pdf (access in March 2018), p.41.

[111] D. Scott Smith, 'A Homeoastic demographic regime: patterns in West European family reconstitution Studies', in R.D. Lee (ed.), *Population patterns in the past* (New York: Academic Press, 1977), p.42.

A division into three periods has been adopted in Figure 7.8 in order to detect any differences in infant mortality over time. The first period contains the infant deaths during the second half of the nineteenth century; the second those which occurred within the first 15 years of the twentieth century; and the third period includes infant deaths from 1916 to 1940, the period when cause-specific mortality rates were able to be calculated. Due to the change from the Julian calendar to the Gregorian in 1924, it was decided to exclude the events of that year from the calculations of the seasonal indices as no gap in registration was found.[112] In all three periods, the main peak of infant deaths occurred in the hottest months, from May to August. Infant mortality was much higher in May-June and lower in January, April and September. During the rest of the year, infant mortality was under the average rate of infant deaths, apart from the third period, when infant mortality increased significantly in February.

Figure 7. 8 Seasonality of infant deaths, Hermoupolis, 1859-1940



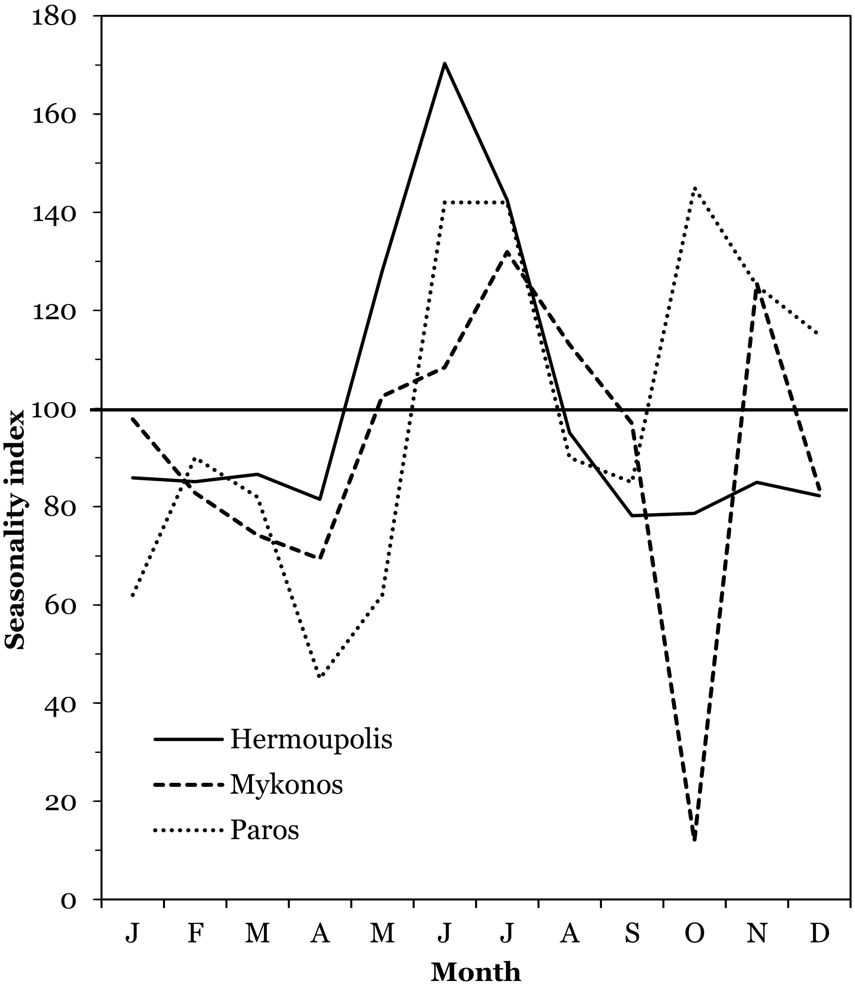
Source: Calculated by the author using HMD.

[112] Hionidou, *The demography of a Greek island*, p.45.

The prolonged summer peak indicates the prevalence of diarrhoeal diseases, which were the major killer in infant and early-childhood deaths in Greece at the time.[113] Similar results have been also found on the neighbouring islands of Mykonos and Paros, although not all illnesses proved fatal.[114] As can be seen in Figure 7.9, all three populations exhibited an infant diarrhoeal peak over the summer months, with the rate in Hermoupolis being much higher than that in the other two. The only noteworthy discrepancies which can be observed are the much lower levels in April and much higher in October for Paros and the extremely low rate in October followed by an increase in November for Mykonos. Williams has suggested that the comparison of the seasonal pattern of deaths between urban and rural populations enables us to investigate the extent of the dangers of the urban environment amongst particular age-groups, often revealing socio-economic differences between societies.[115] It can therefore be suggested that the urban environment of Hermoupolis proved to be more fatal during the summer months for infants compared with the neighbouring –non-urban – populations of Mykonos and Paros.

[113] T. Zavitsanos, *E thnesimotes tes nepiakes kai prosholikes elikias en Elladi, 1921-1960* (*Childhood mortality and pre-school mortality in Greece, 1921-1960*) (Athens, 1964), p.8.
[114] Hionidou, *The demography of a Greek island*, p.48; Gavalas, *Demographic reconstruction*, p.219.
[115] N. Williams, 'Death in its season: class, environment and the mortality of infants in nineteenth-century Sheffield', *Social History of Medicine,* 5, 1 (1992), p.75.

Figure 7. 9 Seasonality of infant deaths in Hermoupolis, Mykonos and Paros



Note: The rate in Hermoupolis refers to the period 1859-1940 (excluding 1924), in Mykonos 1859-1959 (excluding 1924, 1941 and 1942), and in Paros1894-1947 (excluding 1942).
Sources: Hionidou, *The demography of a Greek island*, p.48; Gavalas, *Demographic reconstruction*, p.219; HMD.

Contemporary observers attributed high infant mortality in the summer months to the high prevalence of diarrhoeal diseases:

> That disease [diarrhoea] is endemic from mid-May till mid-September, almost all the children younger than three years, with only few exceptions, suffer from it; almost half of those afflicted die.[116]

Furthermore, according to Stephanos, the infant mortality peak for most parts of the country was found either in July or in August and it was attributed to diarrhoea.[117] The

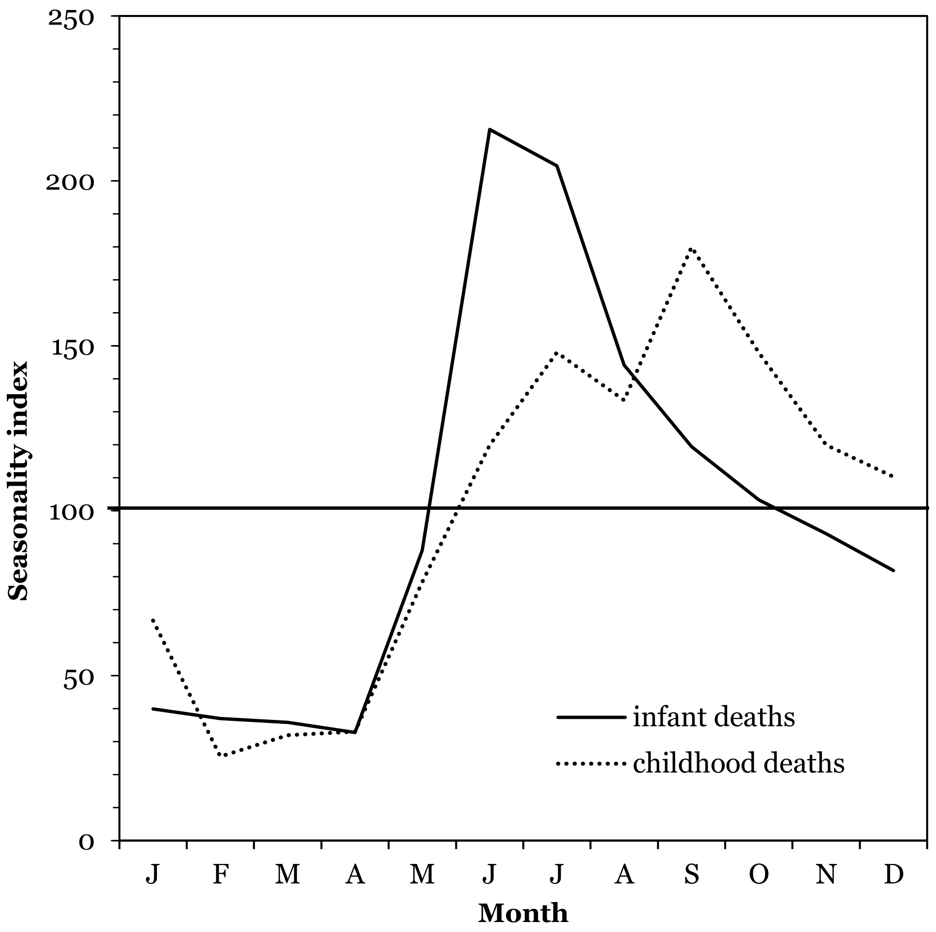
[116] G.X. Prinaris, 'Peri tes endemouses vrefoktonou nosou' (On the endemic infant-killing disease), *O Neos Asklipios*, Athens 1848, pp.149-152, cited in P. Soutzoglou- Kottaride, *Paidi kai ygeia* (*Child and health*) (Athens: Dodoni Press, 1991), p.372 and translated by Hionidou, *The demography of a Greek island*, p.48.
[117] Clon Stefanos, 'Greece, Geographie medicale', p.462, cited by Hionidou, *The demography of a Greek island*, p.48.

sharp rise in the temperature levels during the late spring and early summer months affected the intestines of infants and it was found to be associated with the high incidence of infant diarrhoea, according to the contemporary physician I.P. Kardamates.[118]

Given that continuous reporting of cause of death is available from 1916, the seasonality of infant and early childhood deaths attributed to diarrhoeal diseases in the period under study could be calculated and is presented in Figure 7.10. Table 7.3 shows also the seasonal distribution of infant and childhood deaths in Hermoupolis on a quarterly basis according to the age at death when attributed to diarrhoeal diseases. The noticeable peak in infant diarrhoeal mortality over the summer time and for children during the autumn months is evident. At all ages under one year, apart from those in the neonatal period, most infant deaths occurred between May and September (Figure 7.11). The high levels of neonatal deaths in autumn and winter, with a significant peak in December, could be associated with the rather high levels of birth seasonality at the same time. Although most deaths were concentrated over the summer, the greater part occurred in June and July. It is assumed that other factors may have influenced the seasonal pattern, such as living in an unhealthy environment, or factors which might affect particular socio-economic groups such as poverty. Unfortunately, such associations cannot be examined here due to the lack of spatial data.[119]

[118] I. P. Kardamates, 'E para to paidio epidemike dysenteria kai ai par' emin dysenteroeideis nosoi' (Infant epidemic dysentery and adult dysenteric diseases), *Iatrike Proodos* (1905), p.37.
[119] Williams, 'Death in its season', p.87.

Figure 7. 10 Seasonality of infant and early childhood deaths attributed to diarrhoeal diseases, Hermoupolis, 1916-1940



Source: Calculated by the author using HMD.

Diarrhoeal diseases killed mainly infants and one-year-olds as they were likely to dehydrate more rapidly than older children. For infants, summer deaths peaked up to the age of three to five months, which seems to be a result of the birth peak in March (Figure 7.11). High levels were also found in the summer for infants at the age of eight months. This seems also to be in accordance with the birth seasonality results. More specifically, high levels of births occurred in October, which means that by June or July, those infants had reached the eighth month of life, the mean minimum duration of breastfeeding. That was the time when solid food was introduced to them. After reaching eight months, the summer peaks decreased to some extent, as older infants were less likely to succumb to diarrhoea, even though the proportion of the weaned infants would have been greater than at earlier ages. It has been suggested in the literature that children who contracted diarrhoea during the second year of life and died from it were either weaned later or during the winter; they survived the summer but died in the following months. Children in their second year of life had presumably survived exposures to diarrhoeal diseases by gaining enough weight to resist future attacks of illness without dehydrating.[120] This pattern could also be the reason why children in their first and second year in Hermoupolis exhibited high mortality levels in September and October (Figure 7.12).[121] Most deaths due to diarrhoeal diseases for young children between the first and the second year occurred in autumn, yet a significant number of them also took place over the summer months. So even if they got diarrhoea during the summer months, they survived for longer as they were stronger than infants.

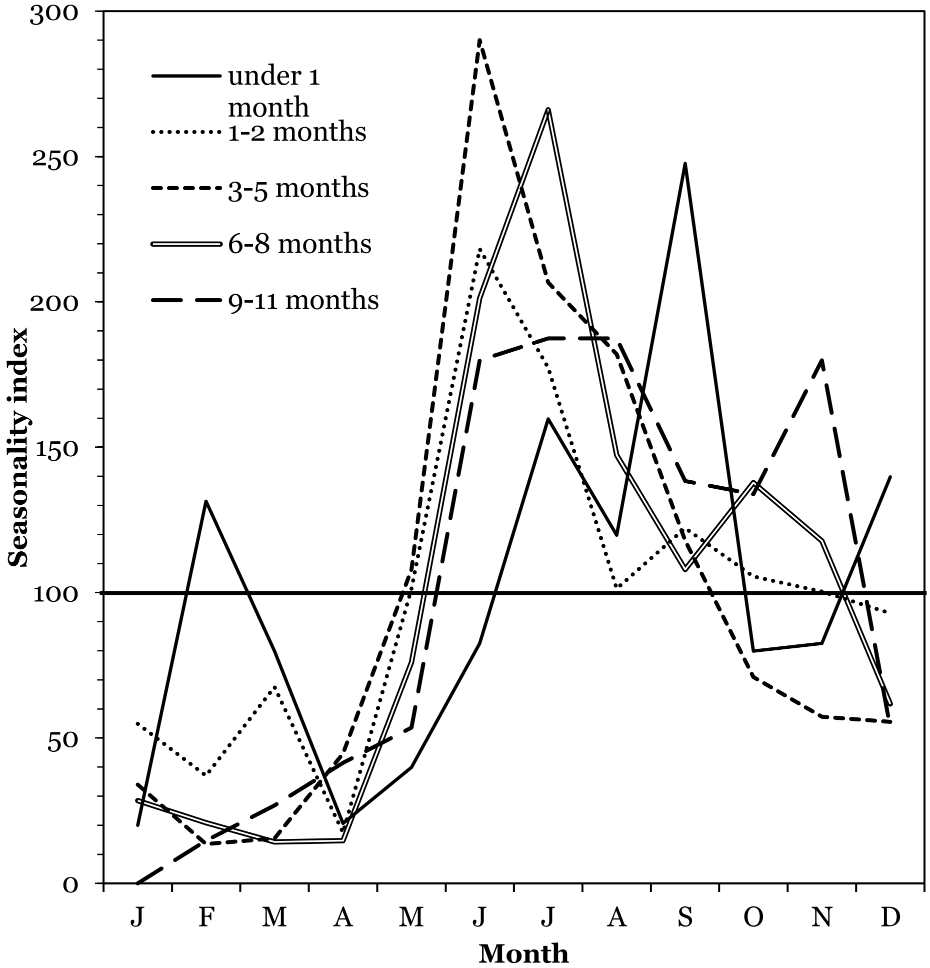
Table 7. 3 Seasonal distribution (%) of infant and childhood deaths on a quarterly basis according to age and attributed to diarrhoeal diseases, Hermoupolis, 1916-1940

Age at death	***(No. of deaths)***	***December-February***	***March-May***	***June-August***	***September-November***
Months					
Under 1	(108)	31	17	25	27
1-2	(176)	22	16	32	31
3-5	(425)	9	14	53	23
6-8	(290)	10	12	52	26
9-11	(165)	7	8	53	32
Years					
1	(192)	13	14	35	39
2	(160)	21	9	34	36
3	(32)	19	9	31	41
4	(16)	44	13	19	25

Source: HMD.

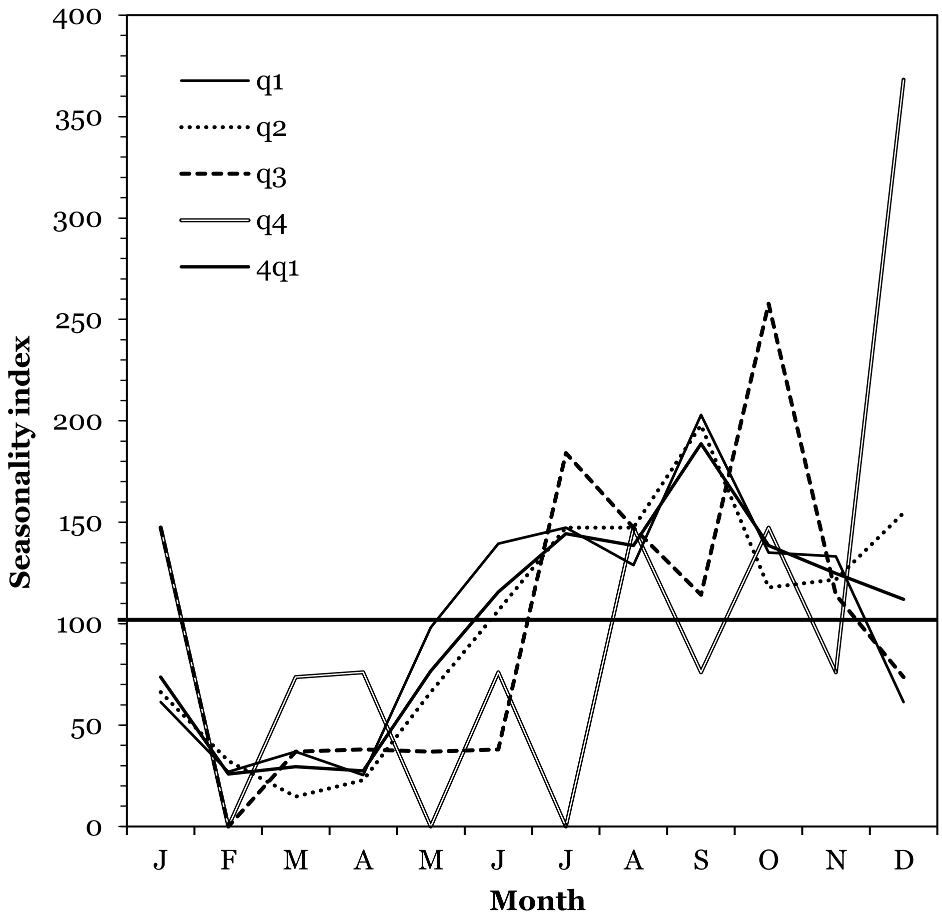
[120] Condran & Lentzner, 'Early death', p.327.
[121] The number of deaths due to diarrhoeal diseases during the third and fourth years of life were very small (23 and 16 respectively, as shown in Table 7.3), and therefore are not discussed. For example, Figure 7.12 shows a high level of seasonal mortality due to diarrhoeal diseases in December for children in the fourth year of life; however, the number of deaths involved was only five during the period 1916-1940, prohibiting any meaningful analysis.

Figure 7. 11 Seasonality of infant deaths attributed to diarrhoeal diseases, Hermoupolis, 1916-1940



Source: Calculated by the author using HMD.

Figure 7. 12 Seasonality of childhood deaths attributed to diarrhoeal diseases, Hermoupolis, 1916-1940



***Source*:** Calculated by the author using HMD.

The findings of the seasonality analysis show that hot and dry summers in Hermoupolis caused a large number of infant deaths. It was that time of the year when infants had a great risk of dying due to diarrhoeal diseases; diarrhoea itself caused the majority of such deaths. Even though this is not a new finding as it was reported by many local contemporaries, this current study confirms the expected historical patterns. Moreover, it seems that the summer months were not only a threat for infants in the last months of their first year but also for almost all ages under one year. Higher diarrhoeal mortality for young children occurred in September, as they seem to have been stronger than infants and even if they became ill at the same time as the infants, they survived for longer. The high infant mortality amongst infants aged from one to eight months found in both sections while they were being breast-fed suggest that another reason may be responsible for this pattern. Early initiation of supplementary food may explain why infants were dying from diarrhoeal diseases at such young ages; however, no evidence for this has been traced. Moreover, evidence from the local press showed that powdered milk was available on the island, which suggests that water was also used for its preparation. As suggested previously in this thesis, the water was found to be mostly contaminated; hence, it can be assumed that it was an important medium for the high prevalence of diarrhoeal diseases especially among the very young. As the city relied on public springs, it is known that during the summer months less water is available on the islands due to droughts, so it can be reasonably assumed that the available contaminated underground water or water stored in cisterns, which were never cleaned, was one of the main reasons for the high rates of diarrhoeal mortality in the summer months.

7.4 Conclusions

This chapter has identified that diarrhoeal diseases were responsible for the high mortality levels amongst the very young (0-4 years). Seasonality analysis results indicate that the hot summers in Hermoupolis caused a large number of infant deaths. Most of those infant deaths occurred before the eighth month of life and while the infants were still breastfeeding. Oral evidence has shown that breastfeeding was a widespread practice amongst all social classes in Hermoupolis and its minimum duration was 8 to 12 months. The restricted access to clean water in the city is considered to have been the most important factor as when supplementary food or formula milk was given to infants it was mixed with water. Furthermore, the milk supply has been found to be relatively clean, as regular tests were carried out by the local authorities at least in the 1930s. Even so, if the clean milk was mixed with contaminated water, it would turn into a fatal medium for the transmission of the diarrhoeal diseases amongst the young children in Hermoupolis. A further examination of the diarrhoeal diseases in infancy and childhood in other places, urban and rural, will enable deeper exploration of this issue which may prove one of the most important influences shaping the mortality patterns in Greece during the studied period.

Chapter 8. Tuberculosis mortality in Hermoupolis, 1916-1940

8.1 Introduction

This chapter focuses extensively on tuberculosis mortality in Hermoupolis for the period when continuous cause-of-death reporting is available, 1916 -1940. Contemporary reports estimated that Greece exhibited almost the highest levels of tuberculosis mortality in Europe, and within the country, Hermoupolis was ranked at the top. The early twentieth century witnessed the launching of an anti-tuberculosis campaign in Greece, which was supported mostly by philanthropists since state intervention was limited. The actions taken by the local authorities in Hermoupolis, if any, are discussed along with the results of the tuberculosis mortality analysis by sex and age-group.

8.2 Tuberculosis

In mid-nineteenth-century England and Wales, more than one tenth of all mortality was attributed to respiratory tuberculosis. It has been estimated that more than a third of the total mortality decline between the 1860s and the 1890s was caused by declining pulmonary tuberculosis.[1] Even though the disease affected all social classes, it seems that the poor and especially the working classes were at higher risk. Poor diet, overcrowded housing and working conditions, particularly in the urban areas, poor ventilation and poor public hygiene all contributed to the high tuberculosis mortality. At the time, little was known about its treatment and no mediums with which to confront the virulence of the bacillus had yet been found.[2] McKeown suggested that improving nutrition was the main explanation for the decline of air-borne diseases, primarily tuberculosis, which he showed was responsible for half of the mortality decline in the nineteenth century along with falling rates of pneumonia and bronchitis.[3] On the other hand, Szreter pointed out that social intervention contributed to the decline in tuberculosis mortality as part of the general fall in infectious diseases.[4] At the beginning of the twentieth century, tuberculosis mortality declined significantly, accounting for

[1] Woods, *The demography of Victorian*, p.340; I. Wilson, 'The historical decline of tuberculosis in Europe and America: its causes and significance', *Journal of the History of Medicine and Allied Sciences*, 45 (1990), pp.366-96.
[2] A. Mercer, *Diseases, mortality and population in transition* (Leicester: Leicester University Press, 1990), p.98.
[3] McKeown & Record, 'Reasons for the decline', pp.345-82; McKeown, *The modern rise,* pp.137-38.
[4] Szreter, 'The importance of social', pp.16-17.

only one out of eight deaths.[5] Similar patterns took place in other European populations such as in Scotland, Belgium and the Netherlands.[6] The reasons for the tuberculosis decline include rising living standards, better housing, better hygiene and sanitary reforms and improvements in environmental conditions.[7]

Several age-groups were affected by tuberculosis disproportionately. The most affected age-groups were for both sexes between 20 and 50, but especially women. Tuberculosis was responsible for more than one death in three among men aged between 15 and 44, half of female deaths aged 15-24 and one quarter of female mortality in the age-group 25-44, even in the early twentieth century.[8] In Sweden, tuberculosis was higher among women "in early youth and during their reproductive period".[9] Various studies have linked excess female mortality, especially in adolescence and young ages, with the incidence of respiratory tuberculosis. One of the main reasons for the excess female tuberculosis mortality was poor nutrition for females, especially in rural areas, which seems to have increased susceptibility to the disease.[10] In addition, Anderson suggested that excess incidence of tuberculosis among females was "a by-product of a contemporary insistence on trying to keep the male 'breadwinner' well fed even during hard times".[11] Another very important reason, which mainly applies to rural places, was the return migration to their native areas of out-migrants in order to receive care by

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[5] L. Bryder, *Below the magic mountain: A social history of tuberculosis in twentieth-century Britain* (Oxford: Clarendon Press, 1988), p.1.
[6] J.F. Murray, 'Tuberculosis and World War I', *American Journal of Respiratory and Critical Care Medicine*, 192, 4 (2015), p.412.
[7] McKeown, *The modern rise*, p.68; G. Gronjé, 'Tuberculosis and mortality decline in England and Wales, 1851-1910', in R. Woods & J. Woodward (eds), *Urban disease and mortality* (London: Batsford Academic and Educational, 1984), p.99; Szreter, 'The importance of social', pp.11-12; Hardy, *The Epidemic streets*, pp.211-13; B. Puranen, 'Tuberculosis and the decline of mortality in Sweden', in R. Schofield, D. Reher & A. Bideau (eds), *The decline of mortality in Europe* (Oxford: Clarendon Press, 1991), pp.105-15; Vögele, *Urban mortality change,* p.145; Woods, *The demography of Victorian*, p.340; E. Vynnycky & P.E.M. Fine, 'Interpreting the decline in tuberculosis: the role of secular trends in effective contact', *International Epidemiological Association*, 28 (1999), pp.330-31.
[8] Bryder, *Below the magic*, p.1; G. Cronje, 'Tuberculosis and mortality', pp.83-89.
[9] Puranen, 'Tuberculosis', pp.104-05.
[10] A. Hinde, 'Sex differentials in phthisis mortality in England and Wales, 1861-1870', *The History of the Family*, 20, 3 (2015), p.367; K. McNay, J. Humphries & S. Klassen, 'Excess female mortality in nineteenth-century England and Wales: A regional analysis', *Social Science History*, 29, 4 (2005), p.670.
[11] M. Anderson, 'The social implications of demographic change', in F.M.L. Thompson (ed.) *The Cambridge social history of Britain,1750-1950: People and their environment*, vol.2 (Cambridge: Cambridge University Press, 1990), p.19.

relatives.[12] Although during the second half of the nineteenth century mortality attributed to tuberculosis declined at every age, it remained more common amongst women.[13] By the mid-twentieth century, and after the intervention of effective antibiotic drug therapy, tuberculosis mortality for both sexes declined significantly, accounting only for 5 and 4 per cent of male and female deaths respectively.[14] Finally, in most populations the age-pattern of female tuberculosis mortality remained relatively stable even until the 1940s, whereas for males the age distribution shifted to the older ages.[15]

8.3 Tuberculosis in Greece

8.3.1 *National tuberculosis mortality in the early twentieth century*

The scarcity of national statistics concerning tuberculosis mortality in Greece prior to 1921, is the main reason for the lack of national rates of tuberculosis in Greece. From the beginning of the twentieth century, contemporary physicians and hygienists attempted to estimate the levels of tuberculosis mortality in Greece at the time, but without great success. The real levels of tuberculosis in the first two decades of the twentieth century still remain an unsolved puzzle.

One of the first studies estimated that more than 10,000 deaths due to tuberculosis occurred in Greece annually during the first decades of the twentieth century and suggested that every tuberculosis death was equivalent to three consumptives.[16] Patrikios also argued that tuberculosis mortality in Greece was among the highest in Europe.[17] By dividing Greece in urban and rural areas according to their population size, Kardamates estimated that the national levels of tuberculosis mortality during the period 1899-1908 was 18 per 10,000. [18] In addition, by employing tuberculosis mortality data for 1906 and the 1907 census, Foustanos estimated that tuberculosis mortality in Greece in 1906 ranged from 10 to 36 per 10,000 according to the

[12] Cronje, 'Tuberculosis and mortality', p.95; Hinde, 'Sex differentials', p.371; A. Reid & E. Garrett, 'Mortality, work and migration. A consideration of age-specific mortality from tuberculosis in Scotland, 1861-1901', *Historical Life Course Studies*, 6, 1 (2018), p.126.
[13] Hinde, 'Sex differentials', p.370; Woods & Shelton, *An atlas*, p.97.
[14] Bryder, *Below the magic*, p.1.
[15] R. Davenport, 'Year of birth effects in the historical decline of tuberculosis mortality: A reconsideration', *PLOS ONE*, 8, 12 (2013), p.11.
[16] K. Savvas, *Egheiridion ygieines* (*A textbook of hygiene*) (Athens: Estia, 1915), p.15.
[17] V. Patrikios, *E fthisis en Elladi* (*Phthisis in Greece*) (Athens, 1901), pp.64, 68, 73.
[18] I. Kadamates, 'H ek fymatioseos noserotes kai thnesimotes en Elladi' (Tuberculosis morbidity and mortality in Greece), *Iatrike Proodos* (1917), p.94.

population size of each settlement category, with the national average being 25.[19] By comparing his results with those of France, he questioned the severity of the incidence of tuberculosis in the country and he suggested that the annual number of tuberculosis deaths was less than 4,000 and not 9,000 as previous studies had shown.[20] Both Kardamates and Foustanos showed that the biggest urban centres of the country suffered from much higher levels of tuberculosis when compared with the rural ones. However, both national rates seem to be the direct average of the different figures as calculated in each settlement category (ignoring the different population size of each of these categories) rather than the actual rates, as in both cases when we tried to verify these rates, we extracted different figures.[21]

Rondopoulos's study for the period 1890-1914 seems to have employed the most accurate methods. According to his findings, 38,534 deaths were attributed to tuberculosis (22,008 males and 16,525 females) over the period 1890-1914. He estimated that the level of tuberculosis mortality for the fourteen largest cities in the country was 40.8 per 10,000 over the study period. This rate seems to be rather high compared with the levels found in other European countries. Moreover, Rondopoulos argued that variations in tuberculosis mortality levels were in accordance with changes in the population size of the urban settlements. The only exception was Hermoupolis, where, although the population declined (22,104 inhabitants in 1889 to 18,132 in 1907), tuberculosis mortality increased.[22]

According to a report from the Panhellenic Anti-Tuberculosis Association in 1918, tuberculosis mortality seems to have increased substantially in the years during and following the Balkan Wars and the First World War. Apart from the worsening of living standards as an immediate effect of the unstable national financial situation in the mid-1910s, another reason particularly responsible for the increased male tuberculosis mortality was military mobilization. Physicians did not have enough time to examine all recruits rigorously and therefore many consumptives joined the army. Many healthy

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[19] I. Foustanos, 'E alethes noserotes kai thnesimotes ek fymatioseos en Elladi' (The real morbidity and mortality due to tuberculosis in Greece), *Iatrike Proodos* (1917), pp.121-26.
[20] Patrikios, *E fthisis en Elladi*, p.64.
[21] In the case of Foustanos, when the total number of tuberculosis deaths is divided by the total population of Greece, the result is almost 15, whereas his rate was 25 per 10,000 [(3,745 / 2,541,952) *10,000≈15]. Similarly, for Kardamates, he estimated that tuberculosis mortality was 18 per 10,000, while our calculations showed that it was 11 [(2,962/2,631,952) *10,000≈11].
[22] P. Rondopoulos, 'H en Elladi ek fthiseos thnesimotes kata ten eikosipentaetian 1890-1914' (Phthisis mortality in Greece during the twenty-five-period 1890-1914), *Iatrike Proodos* (1917), pp.100-02, 138-41.

men, who were in moderate physical condition when they joined the army, were probably infected with tuberculosis which because of the harsh fighting conditions further developed. Those consumptives, when returned home, infected members of their families.[23]

In 1921, the first national cause-of-death statistics were published, in which the number of deaths attributed to each cause were listed separately. In Table 8.1, national tuberculosis mortality rates per 100,000 inhabitants for the period 1921-1938 have been calculated and presented. According to these rates, the pulmonary form of tuberculosis was more deadly than any other form of the condition throughout the studied period. In 1923, tuberculosis mortality increased possibly as a result of the influx of refugees from Asia Minor. They were at particular risk from the poor hygiene conditions in which they lived in the early years and also their poor nutritional status during the same years. Tuberculosis mortality stayed at levels above 160 per 100,000 until 1932, but from 1933 onwards it seems that a declining trend was in progress. According to Papakostas, this downward trend was much slower in urban centres, as a result of the urban penalty existed in Greece at the time.[24]

[23] Panellenios Syndesmos kata tes fymatiosis (Panhellenic Anti-Tuberculosis Association), *Logodosia 1918* (*Proceedings 1918*) (1919), pp.4-5; G. Anagnostopoulos, *E episteme kai e koinonia eis ton agona kata tes fymatiosis* (*Science and society in the anti-tuberculosis campaign*) (Piraeus, 1928), p.28, cited by Y. Stoyannides, *Sanatoria kai to koinoniko zetema tes fymatiosis sten Athena, 1890-1940* (*Sanatoria and the social question of tuberculosis in Athens, 1890-1940*) (University of Thessaly: Unpublished PhD thesis, 2016), p.102.

[24] G. Papakostas, 'Organosis antifymatikou agona' (Organizing the anti-tuberculosis struggle), *Arheia Ygieines* (December 1937), p.334.

Table 8. 1 Tuberculosis-specific mortality per 100,000, Greece, 1921-1938

Year	*Pulmonary tuberculosis*	*Other forms of tuberculosis*	*Total tuberculosis*
1921	124	12	136
1922	127	20	147
1923	144	28	172
1924	140	21	161
1925	132	28	160
1926	136	25	161
1927	140	29	169
1928	137	31	168
1929	139	34	173
1930	132	32	164
1931	130	33	163
1932	131	32	163
1933	123	31	154
1934	117	30	147
1935	113	25	138
1936	105	25	130
1937	102	27	129
1938	94	23	117

Note: Rates calculated by the current author using the number of deaths attributed to tuberculosis and the population as recorded in the annual publication of the vital statistics.
Source: Vital statistics (1921-1938).

In the next section, the main characteristics of the national anti-tuberculosis campaign during the first decades of the twentieth century are outlined. After this description, it will be possible to construct a clearer picture regarding the high national levels of tuberculosis mortality and its fluctuations over the study period.

8.3.2 The anti-tuberculosis campaign in Greece (1900-1940)

Even though tuberculosis was identified as a threat and was already included among the infectious diseases in 1836, it attracted the attention of the medical community only by the late nineteenth century after the discocery of the tubercle bacillus by Rober Koch.[25] At the beginning of the twentieth century, the inability of the Greek state to organize services to confront the high rates of tuberculosis mortality and morbidity

[25] B.D. 'Peri empodismou tes metadoses ton molysmatikon astheneion' (Royal decree concerning the transmission of infectious diseases), *FEK*, 31/12/1836; Papakostas, 'Organosis antifymatikou agona', p.338; G. Vlastos, *E antimetopise tes fymatioses sten Ellada kata te diarkeia tou 20ou aiona* (*The therapeutical approach of tuberculosis in Greece during the 20th century*) (University of Ioannina: Unpublished PhD thesis, 2005), p.12.

left enough space for private initiatives to propose actions against the disease.[26] Nonetheless, Greek physicians were well informed concerning discussions and findings on hygiene and the anti-tuberculosis campaigns which were taking place elsewhere in Europe.[27]

In 1901, the First Panhellenic Medical Congress discussed extensively the high prevalence of phthisis in Greece, but also the lack of sanatoria-based treatment in the country. One of the main outcomes of the Congress was the foundation of the Panhellenic Anti-Tuberculosis Association, which marked the beginning of the anti-tuberculosis campaign in Greece.[28] One of the initial aims of the association was to promote the sanatorium treatment in the country.[29] In 1905, the first national tuberculosis clinic in Athens, the *Soteria* sanatorium with 52 hospital beds, opened on the initiative of philanthropists.[30] With the lack of similar institutions in the rest of the country, the only available hospital beds for consumptives were in the general hospitals.[31] Even though the first Conference Against Tuberculosis took place in 1909, where the first results concerning tuberculosis mortality for the 12 largest cities of Greece were presented, no specific measures to deal with tuberculosis were suggested or followed. The main outcome of this conference was to raise awareness of the importance of tuberculosis as a national threat.[32]

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[26] Y. Stoyannides, *Sanatoria kai to koinoniko zetema tes fymatiosis sten Athena, 1890-1940* (*Sanatoria and the social question of tuberculosis in Athens, 1890-1940*) (University of Thessaly: Unpublished PhD thesis, 2016), p.148.

[27] Ibid.

[28] Anon., 'Proto Panellenio Iatriko Synedrio' (First Panhellenic Medical Congress), *Iatrike Proodos* (1901), pp.129-37; V. Theodorou, 'Oi giatroi apenanti sto koinoniko zetema, o antifymatikos agonas stis arhes tou 20ou aiona (1901-1926)' (Doctors' attitude towards the social issue, the struggle against tuberculosis in the beginning of the 20th century (1901-1926)), *Mnimon* 24 (2002), p.148.

[29] Vlastos, *E antimetopise tes fymatioses,* pp.20-21.

[30] L. Papastefanaki, "Politics, modernization and public health in Greece: the case of occupational health, 1900-1940", in C. Promitzer, S. Trubeta & M. Turda (eds), *Hygiene and eugenics in Southeastern Europe to 1945* (Central European University Press, 2011), p.175; Theodorou, 'Oi giatroi apenanti', p.160. Soteria sanatorium has been studied extensively: K. Kates, *Nosokomeio nosematon thorakos Athenon 'E SOTERIA':istorike melete* (*Hospital of chest diseases 'SOTERIA': an historical study*) (Athens: National and Kapodistrian University of Athens, 1984); G. Stavrakis, *1902-2002 Enas aionas 'Soteria'* (*1902-2002, a century of 'Soteria'*) (Athens, 2002); K. Chatzikonstantinou & L. Sapounaki-Dracaki, 'Two sanatorium cases in the greater Athens area: ideal curative environments or perfect social exiles?', *Histoire urbaine*, 39 (2014), pp.142-51; Stoyannides, *Sanatoria kai to koinoniko zetema*, p.208.

[31] Papakostas, 'Organosis antifymatikou agona', p.338; Vlastos, *E antimetopise tes fymatioses,* p.37.

[32] V. Patrikios, 'E poreia tes fthises en Elladi kata ten teleytaia dekaetia' (The course of phthisis in Greece during the last decade), *First Conference Against Tuberculosis* (1909), pp.483-501, cited by Theodorou, 'Oi giatroi apenanti', p.171.

In 1909 another sanatorium was founded by private charity in Pelio.[33] In 1910, the Greek state, for the first time, partially funded the *Soteria* sanatorium and the Panhellenic Anti-Tuberculosis Association.[34] In 1912, the second Conference Against Tuberculosis was held in Volos and focused mostly on the protection of children from the disease. In 1914, by passing a royal decree, which enforced hygiene regulations in typesetting shops, a particularly stricken work-area, the transmission of tuberculosis was associated with filthy workplaces and unhealthy working conditions.[35] From 1914 onwards, more sanatoria were established, either by the state or private charities, such as that on the mountain of Parnetha, north of Athens. In 1920, the first hospital specializing in the surgical treatment of tuberculosis for children was founded by the Panhellenic Anti-Tuberculosis Association in Athens, the *Asklipio Voulas*.[36] However, during the period 1912-1922, which was one of the most turbulent periods in the history of Modern Greece, the involvement of the Greek state in the anti-tuberculosis campaign was postponed. Instead, charities with the support of the medical community were still the only active financial components and contributors of the campaign.[37]

By reconstructing the public health system in the early 1920s, the Greek state attempted to map out for the very first time a national anti-tuberculosis campaign by issuing a law which decreed the foundation of anti-tuberculosis dispensaries, tuberculosis hospitals and sanatoria, funded and organized by the state in collaboration with local councils, municipalities, the Church and port authorities.[38] An addendum to this law in the same year provided for the training of doctors in Switzerland in order to direct those

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[33] Pelio is a mountain at the region of Thessaly in central Greece.

[34] Papakostas, 'Organosis antifymatikou agona', p.338.

[35] V.D. 'Peri kanonismou ygieines ton typographeion' (Royal Deecree concerning the hygiene regulations of printing works), *FEK*, 36, 11/12/1914; Y. Stoyannides, '"Apagoreuetai to ptyein": Politikes diaheirises tes fymatioses stous horous ergasias ("No spitting": Dealing with TB in the workplace)', *O Kosmos tes Ergasias*, 4 (2017), p.32.

[36] Papakostas, 'Organosis antifymatikou agona', p.338.

[37] Stoyannides, *Sanatoria kai to koinoniko zetema*, p.195.

[38] Law 1979, 'Peri tes idryseos antifymatikon iatreion, nosokomeion, anarroterion kai oreinon theapeuterion' (Concerning the foundation of dispensaries, tuberculosis hospitals, sanatoria and preventoria), *FEK*, 33, 28/1/1920; Theodorou & Karakatsani, 'Health policy', p.56.

institutions to focus on the treatment of tuberculosis.[39] Nonetheless, this attempt was interrupted by the influx of refugees from Asia Minor in 1922-23. [40]

From 1924 until 1927, no action was taken against tuberculosis by the Greek state apart from funding the *Sotiria Sanatorium*, while private charities continued to fund the establishment of sanatoria in other parts of the country. In 1925, the Hellenic Anti-Tuberculosis Association (*Ellenike Antifthisike Etaireia*) was established, with its main aim being the re-organisation of the anti-tuberculosis movement in Greece. The members of the Hellenic Anti-Tuberculosis Association founded dispensaries in Athens and Piraeus and in other parts of the country, which ceased to operate mainly due to the lack of financial resources during the following years. The association also organized public lectures and published articles to enlighten the population about the transmission of the disease.[41]

In 1929, the state attempted to reform the public health system by placing a special focus on the high levels of tuberculosis. The actions included the reformation of regional public health by establishing hygiene centres which were equipped with social hygienic clinics, including anti-tuberculosis centres, and also the Centre for Tuberculosis Treatment within the *Sotiria Sanatorium* (*Fymatiologiko Kentro*). Even though the state attempted to address the high incidence of tuberculosis in the country by establishing these preventive anti-tuberculosis centres, they survived for only two years. From 1932 onwards, the state carried on the fight against tuberculosis, although only a few of laws were implemented. One of the few exceptions was Law 6008, which laid the foundation for a regional health-care system by increasing number of hospital beds in the already existing institutions or by creating new smaller institutions in several parts of the country.[42] During the last years of the period under study, 1936-1940, the period of Metaxas's dictatorship, it was claimed that the infrastructure of the anti-tuberculosis campaign was further strengthened. According to Zaharias, many existing sanatoria

[39] Law 2358, 'Addendum to Law 1979 Peri tes idryseos antifymatikon iatreion, nosokomeion, anarroterion kai oreinon theapeuterion' (Concerning the foundation of dispensaries, tuberculosis hospitals, sanatoria and preventoria), *FEK,* 147, 29/06/1920.

[40] K. Kyriazides, *Ta pepragmena tes Ygeionomikes yperesias tou Ypourgeiou ton Esoterikon kata ten dekaetia 1911-1921* (*The activities of the Sanitary Service of the Ministry of Interior Affairs*) (Athens, 1929), p.59, cited by Stoyannides, *Sanatoria kai to koinoniko zetema*, p.204.

[41] Papakostas, 'Organosis antifymatikou agona', pp.338-39; P. Pampoukes, *O Agon kata tes fthiseos* (*The fight against phthisis*) (Athens, 1927), cited by Stoyannides, *Sanatoria kai to koinoniko zetema,* p.104.

[42] Law 6008, 'Peri organoseos peripheriakes Ygeionomikes Yperesias toy Ypourgeiou Kratikes Ygieines kai Antilipseos' (Concerning the organizing of the regional Hygiene Service of the Ministry of Public Hygiene and Awareness), *FEK*, 27/01/1934.

around the country were expanded (such as in Chania, Mytelene, Kavala and Thessaloniki) over the period 1936-1940.[43] There was a plan for further expansion of the health-care infrastructure but it was never completed because of the outbreak of the Second World War.[44] Metaxas, therefore attempted to establish his authority by improving the public health of the country and more especially by dealing with the very high levels of tuberculosis mortality and morbidity in the country at the time. After having studied Metaxas's plan in great detail, Stoyannides argued that it was a rather ambitious and far-reaching plan compared with those of the previous governments.[45]

To summarise, the very limited funds of the anti-tuberculosis campaign in Greece, the lack of medical care together with very poor living conditions, diet and working conditions among the lower social classes, contributed to the persistent spread of the disease in the country during the first four decades of the twentieth century.[46]

The next section will look at the way in which the local authorities in Hermoupolis dealt with tuberculosis.

8.4 Tuberculosis in Hermoupolis (1900-1940)

Fragkides, among others, argued that tuberculosis was the most important killer in Hermoupolis as well as in the rest of the country. According to contemporary estimates, tuberculosis was responsible on average for 103 out of 635 annual deaths in the late-nineteenth century.[47] In many contemporary medical reports, tuberculosis was also identified as "the worst 'wound' of the very poor public hygiene in Hermoupolis".[48] It was, therefore, believed at the time that Hermoupolis exhibited the highest rates in Greece, even higher than Athens.[49]

Foustanos repeatedly challenged the accuracy of these estimates, as it was not clear whether the number of deaths from the whole island of Syros or just from the city of Hermoupolis had been used in the calculations. He concluded that these high levels of

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[43] K. Zaharias, *E ekselikse tes fymatioses sten Ellada kata ton teleytaio aiona* (*The tuberculosis evolution in Greece during the last century*) (National and Kapodistrian University of Athens: Unpublished PhD thesis, 2007), pp.98-99.
[44] Papakostas, 'Organosis antifymatikou agona', p.339; Zaharias, *E ekselikse tes fymatioses*, p.98.
[45] Stoyannides, *Sanatoria kai to koinoniko zetema,* p.218.
[46] Papastefanaki, 'Politics, modernization', p.170.
[47] Fragkides, *Nesos Syros*, p.56.
[48] N. Goulandres, 'E fymatiosis para to lao, therapeuterion kai iatreion en Syro' (Tuberculosis of the people, sanatorium and dispensary in Syros), *Syllogos Ygieines Syrou* (1921), p.10.
[49] K. Gourgoulianos (ed.), *Giati fovomaste te gripe? Apo ten eksaplose ton loimokseon sten pandemia tes gripes* (*Why are we afraid of the flu? From the spread of infectious diseases to the influenza pandemic*) (Athens: Metaihmio, 2009), p.136.

tuberculosis mortality in Hermoupolis were an artificial result of the use of data reffering to two different population groups: the number of tuberculosis deaths on the whole island of Syros along with the population of Hermoupolis (18,132) rather than that of whole island of Syros (22,238).[50]

In addition, according to Arfanes's estimates which can be seen in Table 8.2, Hermoupolis's levels reached 54 per 10,000 during the period 1899-1908, much higher than in any other city in Greece at the time. The next highest was Corfu with 40 per 10,000 followed by Patras, Athens and Piraeus. Arfanes also suggested that 1,102 deaths attributed to tuberculosis occurred within that period in Hermoupolis, with an average number of 122 deaths per year. During the next nine-year period 1909-1917, tuberculosis mortality in Hermoupolis remained still at very high levels, fluctuating between 40 and 56 per 10,000 (Table 8.3).[51]

Table 8. 2 Mortality rates due to tuberculosis in various urban settlements in Greece, 1899-1908

Town/city	*Rate per 10,000 inhabitants*
Athens	36.78
Piraeus	31.44
Patras	38.07
Trikala	27.23
Corfu	40.88
Larissa	23.06
Zante	25.41
Kalamata	30.10
Pyrgos	25.42
Volos	24.96
Tripole	15.94
Syros	**54.44**

Source: Arfanes, 'E fymatiosis en Syro', p.2.

[50] Foustanos, 'E alethes noserotes', pp.124-25.
[51] Arfanes, 'E fymatiosis en Syro', pp.2-3: It is not very clear which data were employed by Arfanes to estimate tuberculosis mortality rates.

Table 8. 3 Tuberculosis mortality levels, Hermoupolis, 1909- 1917

Year	*Rate per 10,000 inhabitants*	*N. of deaths*	*Percentage of TB deaths to all deaths*
1909	44	88	16.8
1910	46	93	15.7
1911	56	113	18.6
1912	45	90	19.3
1913	46	92	19.2
1914	52	104	21.9
1915	42	84	16.5
1916	45	91	17.3
1917	53	107	15.5

Source: Arfanes, 'E fymatiosis en Syro', p.2.

In a public letter to the Prefect of the Cyclades, Arfanes wondered how it was possible for Hermoupolis to exhibit such high levels of tuberculosis mortality while the city had a municipal disinfection service, two hospitals, a hospital for infectious diseases and another one specializing in the treatment of smallpox, and also a significant number of philanthropic institutions: two orphanages, a foundling hospital, a poorhouse and a lunatic asylum.[52] It seems that there were no initiatives addressing tuberculosis before 1915, as no such evidence has been found. The earliest source which was traced was a public letter from the Medical Association of Syros to the Prefect of the Cyclades in 1915. In that letter, the members of the Association requested the foundation of a dispensary in Hermoupolis; however, it seems that no action to achieve this was ever taken.[53]

A few years later, Arfanes also proposed to the Hygiene Association of Syros the foundation of a sanatorium. Such an institution would serve not only to treat the disease but would mainly be used for the isolation and hospitalisation of those patients in the final stage of the disease and also to replace the room for poor consumptives at the local hospital.[54] This hospital room was operating for almost ten years, up to 1916, and it was called *Kaiadas,*[55] and the Italian quotation *Lasciate ogni speranza voi ch'entrate*[56] was written on the wall. After the closure of this hospital room in 1916, consumptives from

[52] Ibid., pp.4-5.
[53] *To Vema*, 19/02/1915, 216, Δ, pp.1-2.
[54] Arfanes, 'E fymatiosis en Syro', pp.8-9.
[55] According to the myth, Kaiadas was the gorge where the Spartans abandoned their weak and deformed infants but also their enemies, war prisoners and criminals.
[56] 'Abandon all hope, you who enter here' (Dante, *The Divine Comedy*, Canto III, line 9).

across the whole island had no access to medical care and as a result the poorest of them started to beg for money on the main streets of Hermoupolis and in the local cafés.[57]

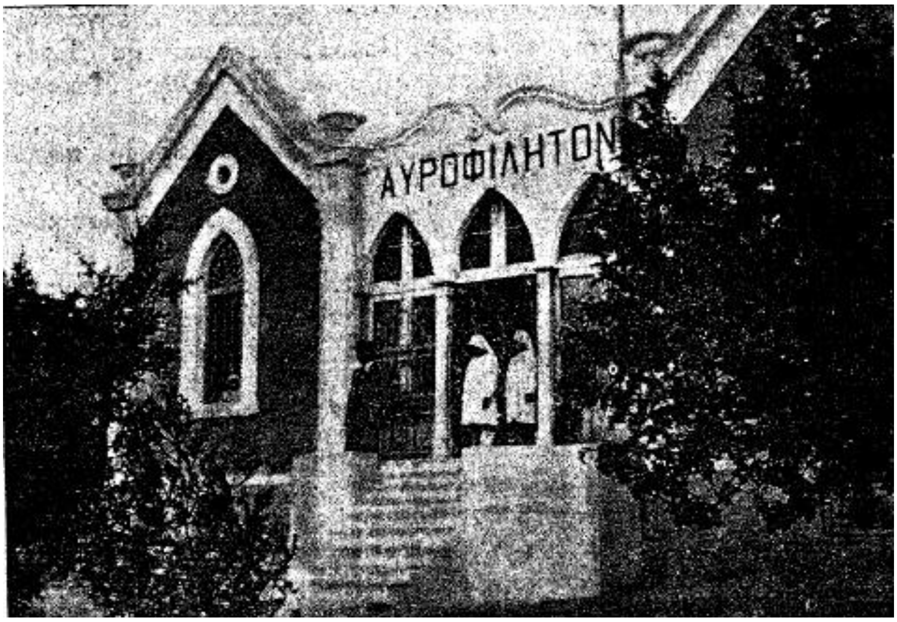
The Hygiene Association of Syros was founded by the Medical Association of Syros and philanthropists of the city in 1918 with the principal task of dealing with the high incidence of tuberculosis on the island. As previously stated, there were no measures taken against the disease by the state, especially outside Athens, before the 1930s, so the action of a local association similar to that in Athens seemed necessary for the anti-tuberculosis campaign at the local level in Hermoupolis. In his report, Arfanes gave an extensive description of the main aims and future plans of the Association as well as the main treatments for tuberculosis as they had been introduced and implemented in the main hospitals and sanatoria in Europe. After being initially funded mainly by philanthropists, the Association sought to establish preventoria and sanatoria equipped with medical and x-ray laboratories and also to set up a dispensary for the purpose of educating the public in preventive measures.[58] From the first year of the foundation of the Hygiene Association of Syros, it attempted to encourage the local authorities to establish a temporary sanatorium in Hermoupolis. The request was accepted by the municipal council which granted the smallpox hospital for the accommodation of a temporary sanatorium, but there is no evidence that this was ever carried out.[59]

In May 1919, the first dispensary was founded in Hermoupolis, where consumptives, mainly from the working classes, could receive medicine, milk and meat.[60] In the same year, the first sanatorium in Hermoupolis, called *Avrofilito*, opened on also the initiative of the Hygiene Association of Syros (Plate 8.1). This was made possible through the donation of a mansion by Leonidas Empeirikos in the location of Episkopeio, 5 kilometres from Hermoupolis.[61] The building was considered to be situated in an excellent location for the establishment of the first anti-tuberculosis clinic. Furthermore, because the existing building could not cover the needs of the whole island, Emperikos financed the construction of a new building, *To Neon Empeirikeion Peripteron* (Plate 8.2), right next to the existing one. The sanatorium contained 25-30 hospital beds. An incinerator and an autoclave were constructed within the sanatorium

[57] Arfanes, 'E fymatiosis en Syro', p.9.
[58] Ibid.
[59] *Minutes of the Municipal Council,* 504, 171, 15 March 1919; 505,172, 21 March 1919.
[60] Travlos & Kokkou, *Ermoupole. E demiourgia*, p.32.
[61] Leonidas Empeirikos: ship-owner, co-founder of the National Steamboat Company of Greece, member of the Greek Parliament and Minister of Food (*Ypourgos Episitismou*) in 1917-18.

for the combustion of litter and the disinfection of the personal belongings of the consumptives, such as clothing and bedding.[62]

Plate 8. 1 Illustration of the Hermoupolis Sanatorium *Avrofiliton*



Source: Gerasimides, *To panorama tes Syrou*, p.66.

Plate 8. 2 Illustration of the second building at the *Avrofiliton* Sanatorium of Hermoupolis, the *Neon Emperikon*.

Source: Goulandres, 'E fymatiosis para to lao', p.20.

[62] Goulandres, 'E fymatiosis para to lao', pp.12-16; K. Gerasimides, *To panorama tes Syrou* (Syros's panorama) (Syros: Keryks ton Kykladon, 1933), p.67.

During the first few years after the foundation of the Hygiene Association of Syros, both the sanatorium and the dispensary succeeded in operating from charitable donations only, and without any financial support from the state. In the 1930s, however, the Association was funded jointly by the Ministry of Hygiene and the Municipality of Hermoupolis, as its members could not ensure the effective service of the institutions due to the lack of financial resources.[63] The inefficient service and the under-funding of the Hermoupolis dispensary is confirmed in a public letter from the medical officer of the Prefecture of the Cyclades to the Minister of Health in 1929. He pointed out that in the dispensary, even though consumptives could receive their medicine there, they were not examined on a regular basis by the physicians, nor did they have any further tests or x-rays. For this reason, he recommended that reorganization and extra funding of the dispensary by the state was necessary to ensure its service.[64] Nonetheless, as the evidence has shown, it seems that these issues were never resolved. In 1934, the head of the Hygiene Association of Syros made a public plea to the rich of the city for funding for the Sanatorium due to the lack of financial support from the state or from philanthropists.[65]

All medical reports confirm that limited actions were taken against tuberculosis in Hermoupolis either by the local authorities or by the state. In the 1939 medical report, the medical officer of the Cyclades reported that a much bigger sanatorium was to be established in Hermoupolis, funded jointly by both philanthropists and the state, which would serve patients from the whole Cyclades region. However, this plan was never accomplished because of the outbreak of the Second World War.[66] The funding for a new sanatorium was 'sacrificed' for the construction of a new hospital in 1956 due to the lack of financial resources.

Finally, the only measure taken by the local authorities from the beginning of the twentieth century against tuberculosis on the island was disinfecting the households of consumptives. Hermoupolis had the first municipal disinfection service in Greece, established in 1903 and funded principally by the municipal authorities.[67] However,

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[63] GSAS, YPA, YP1310/1930-1937, *Etesia ekthese* (1936); *Minutes of the Municipal Council*, 804, 67, 1 February 1937.

[64] GSAS, YPA, YP965/1929, *Epistole tou Nomiatrou Kykladon pros to Ypourgeio Ygieines, Pronoias kai Antilepseos,* (*Public letter from the medical officer of the Prefecture of the Cyclades to the Minister of Health, Welfare and Care*), 6 Mar 1929.

[65] *Kykladika Nea*, 21/11/1934, EA, 2, 19, p.1.

[66] GSAS, YPA, YP1310/1930-1937; *Etesia ekthese* (1936)

[67] *To Vema*, 19/02/1915, 216, Δ, pp.1-2.

contemporary medical reports suggest that the Hermoupolis disinfection service was understaffed and that the existing staff were neither well trained nor experienced, and that the steriliser was in very poor condition.[68]

Even though no specific preventive policies were developed against tuberculosis before the early 1920s, it is evident that contemporary physicians, medical officers and philanthropists were promoting measures to reduce tuberculosis mortality in Hermoupolis.

In the next section, I shall explore the levels of tuberculosis mortality in Hermoupolis as far as cause-specific mortality analysis has revealed using civil registration data. Examining mortality by sex and age-group is expected to shed more light on the epidemiological profile of the city and produce a foundation for further analysis of tuberculosis mortality in other parts of the county.

8.5 Tuberculosis mortality levels in Hermoupolis, 1916-1940

During the years 1916-1940, more than 1,500 people in Hermoupolis were recorded as having died from tuberculosis, accounting for nearly 15 per cent of total mortality. More than one-third of these deaths occurred in the age-groups 15-34 for both sexes. Those aged 15-24 were the most affected; almost half of all deaths within these age-groups were attributed to tuberculosis.

Tuberculosis-specific mortality rates have been calculated for the years 1920, 1928, 1934 and 1940 by employing the methodology described in section 6.3. Age-specific and sex-specific tuberculosis mortality rates were calculated only for 1920 and 1928 using the average number of deaths attributed to tuberculosis and the age-structure, as used for the construction of the life tables (section 4.3.1). In addition, the distribution of tuberculosis in proportion to the total number of deaths by sex and by age, using the average number of deaths, as employed for the cause-specific mortality rates, have been calculated. It should be noted, however, that the numbers are very small when disaggregated by sex and age-group (less than 10 per age-group and sex per year). Even though these rates have been calculated in this study, they are discussed only to a very limited extent.

Tuberculosis killed most people among all infectious diseases. Almost half of the deaths from infectious diseases were due to tuberculosis, and more than half of these deaths were due to its pulmonary form. When pulmonary tuberculosis is separated from other

[68] Ibid., p.2; Tsakalotos, *Peri tes demosias ygeias*, pp.22-23.

forms of tuberculosis, it seems that its decline was faster and responsible for much of the fall in the overall tuberculosis mortality in the 1920s (Figure 8.1).

Even though, evidence from other Greek populations suggests that other causes were reported instead of tuberculosis and maybe responsible for the under-reporting of the disease in the death certificates, this does not seem to be the case in Hermoupolis:

> *Q*. Let me ask you, what was the behaviour of the [local] people towards consumptives? Did you avoid them? Did you...?
>
> *A*. There was a fear, let's say, but certainly not to avoid/detest them completely. You empathised with them, but you were not in frequent contact, you avoided somehow [contact].
>
> *Q*. Did they try to conceal that they had tuberculosis?
>
> *A*. Hmm, no, they would try to, but I don't remember very well of course ...
>
> *Q*. Yes.
>
> *A*. ...but certainly, even and, they felt of course they were at disadvantage.[69]

Sideres pointed out that pleurisy (*pleyritida*) and scrofula (*choiradose*) were used instead of tuberculosis on Leykada in the 1820s.[70] Moreover, Rondopoulos argued that many families insisted on reporting the cause of death as chronic bronchial catarrh (*chronios vrochikos katarrous*) instead of tuberculosis.[71] In the Hermoupolis data, these specific causes of death appeared only very rarely. It is therefore assumed that no significant misreporting of tuberculosis took place in Hermoupolis, partly because of its extremely high rates in the city at the time. Besides, according to oral evidence it was difficult to conceal tuberculosis, as it was clearly visible, but this may refer to the last stages of the illness:

> *Q*. Did people conceal it [tuberculosis] or did you know [who suffered from tuberculosis]?
>
> *W*. It was visible.
>
> [...]
>
> *Q*. How was it visible?
>
> *W*. The person came to have the colour (xxx).
>
> *H*. The colour, the colour...

[69] No.1 (Male born in 1914 in Hermoupolis, civil servant, lived in Hermoupolis all his life).

[70] N. Sideres, 'Arrosties kai arrostoi ste Leykada ton 19o aiona' (Diseases and patients in Leykada during the 19th century), *Ta Istorika*, 1 (1983), pp.114-15.

[71] P. Rondopoulos 'E en Elladi fthiseos thnetotes kath' elikian, fylon kai epaggelma en 12 polesin kata ten teleutaia dekaetia 1899-1908' (Phthisis mortality in Greece per age, sex and occupation in 12 cities during the last decade 1899-1908) (1909) p.504, cited by Moustane, *Oi demographikes ekselikseis*, p.255.

Q. Didn't they try to conceal it?

W. (xxx)

H. They were bedridden, they couldn't walk.

Q. Did people avoid the consumptives?

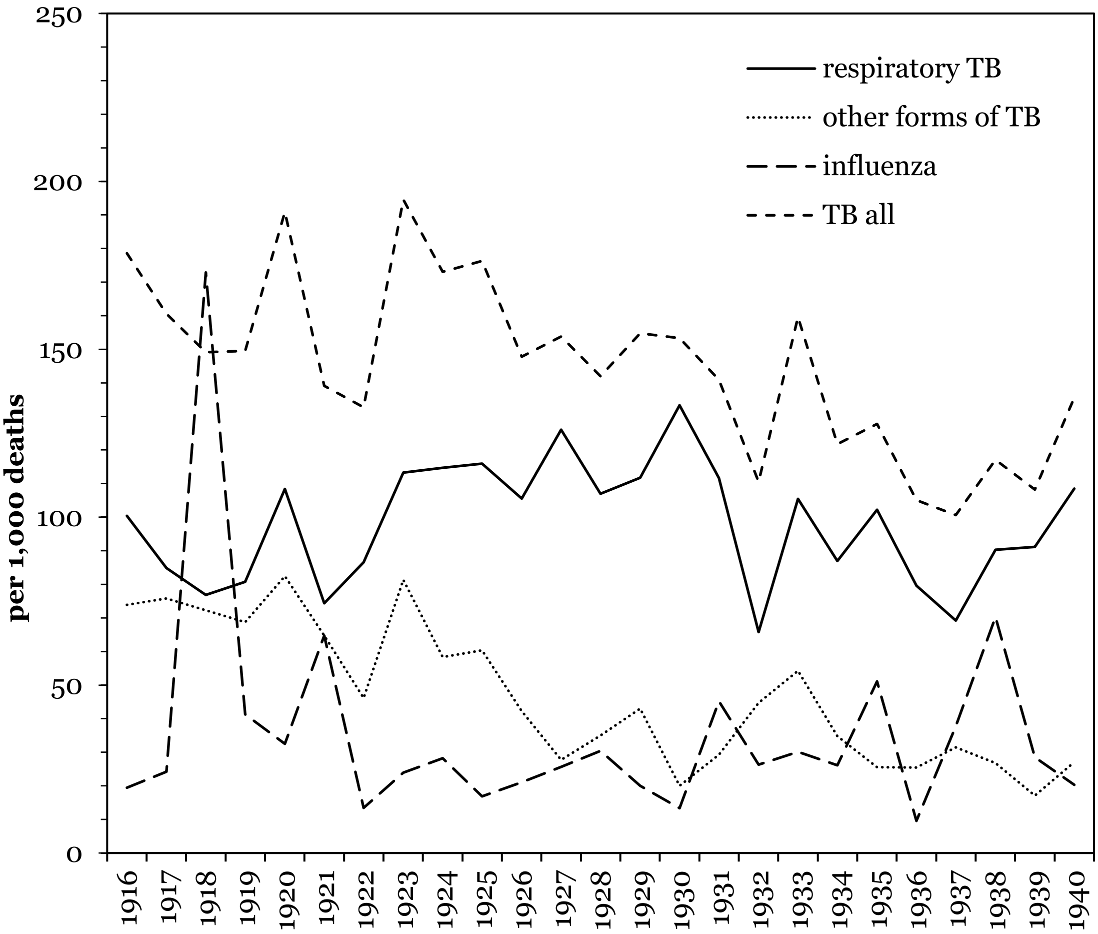
H. No, but they didn't go out, they didn't provoke [encounters]. They stayed in their houses. There were many of those, let's say.[72]

The high levels of tuberculosis calculated in Hermoupolis confirm all the contemporary estimates claiming that Hermoupolis's rates were the highest in the country. More specifically, tuberculosis mortality was responsible for 500 deaths per 100,000 inhabitants in 1920, as discussed in section 6.5.1. The 1920 rate was calculated using the average number of deaths attributed to tuberculosis for the years 1916 to 1924, thereby including the years of the lethal influenza pandemic. Tuberculosis seems to have decline only by very little during the pandemic year.[73] Figure 8.1 shows the percentage distribution of tuberculosis deaths to the overall mortality and indicates that the tuberculosis mortality declined significantly from 1920 to 1928. This is confirmed also in the cause-specific analysis results (Table 6.3 and Figure 8.2), which show that tuberculosis deaths almost halved in 1928, reaching 283 per 100,000 (average mortality between 1925 and 1931). In the 1930s, overall tuberculosis mortality continued to decline, reaching 208 per 100,000 in 1934 and 192 in 1940. Nevertheless, in the last 6 years of the study period, the declines seem to have stalled.

[72] No.2.

[73] More specific rates regarding the evolution of tuberculosis during the main wave of the influenza pandemic in Hermoupolis are presented in section 9.3, Figures 9.11 and 9.12.

Figure 8. 1 Annual distribution of deaths due to tuberculosis and influenza per 1,000 deaths, Hermoupolis, 1916-1940



Source: Calculated by the author using HMD.

In the literature the decline of tuberculosis mortality has been connected with improvements in living standards and especially nutrition, changes in virulence of the infective organism or in the environmental conditions, poverty eradication, housing improvement and sanitary improvements.[74]

In Hermoupolis, there is no evidence to suggest that any changes in diet took place during that time but in contrast undernourishment may be responsible for its high levels. Babanasis argued that "undernourishment was a massive problem throughout the interwar period" in Greece.[75] In the 1930s, contemporary physicians linked also the high levels of undernourishment around the country with the high prevalence of

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[74] McKeown, *The modern rise*, p.153; Woods & Shelton, *An atlas*, pp.143-44; Woods, *The demography*, pp.340, 359, Pooley & Pooley, 'Health, Society', pp.171-2; Vögele, *Urban mortality change*, p.148; Gronjé, 'Tuberculosis and mortality', p.99; Szreter, 'The importance of social', pp.16-17; Harris, 'Public health, nutrition', pp.399, 402-03.

[75] S. Babanases, 'E diamorfose tes ftoheias sten Ellada tou 20ou aiona' (The formation of poverty in Greece in the 20th century), *The Greek Review of Social Research*, 42-43 (1981), p.113.

tuberculosis.[76] Moreover, soup kitchens operated in the city in the 1920s and 1930s due to the very low living standards and high unemployment within the working classes.[77] Whilst, it has been argued that improvements in diet in Greece occurred only in the 1950s.[78]

According to contemporary public health reports the main reason for the propagation of tuberculosis in Hermoupolis was unhealthy housing.[79] Poor housing in combination with low incomes and high unemployment were found to be highly connected with tuberculosis mortality in early twentieth-century Glasgow or even more recently in 1980s-Liverpool.[80] Most of the working-class houses in Hermoupolis were damp and sunless.[81] It is believed also that the foundation of the sanatorium and the dispensary in 1919 may have contributed in the reduction of tuberculosis mortality but only to a very limited extent due to the ineffectiveness of sanatorium treatment, if any, prior to the late 1940s.

In addition, a reason that is probably more connected with the high incidence of tuberculosis in Hermoupolis rather than its decline is the industrial activity of the city. Most of the factories that were examined in Greece by state labour inspectors in the mid-1910s were found to be unhealthy and dangerous.[82] Similar conditions were found by Tsakalotos in Hermoupolis at the same time. Extremely poor working conditions were existent in every factory in the city, which he visited, with complete lack of medical care, air extractors and toilets, while food that was provided to the

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[76] V. Theodorou, 'Ypositismos kai fymatiose sto Mesopolemo: ygieine diatrofe kai organose mathetikon syssition (1928-1932)' (Undernourishment and tuberculosis in the interwar period: healthy diet and organisation of student soup-kitchens (1928-1932)), *Mnimon*, 30 (2009), p.258.
[77] *Tharros,* 17/01/1925, 43, B, p.1; 22/4/1925, 70, B, p.1; 26/01/1929, 313, E, p.1; 23/06/1933, 549, H, p.1. For a further disccusion on soup kitchens in Greece during the interwar period see Theodorou, 'Ypositismos kai fymatiose', pp.242-53.
[78] Babanases, 'E diamorfose tes ftoheias', p.114; G. Gutenschwager, *E politike tes ygeias ste neotere Ellada* (*The political economy of health in Modern Greece*) (Athens: National Centre of Social Research, 1989), p.68.
[79] GSAS, YPA, YP917, *Etesia ekthese* (1931).
[80] N. McFarlane, 'Hospitals, housing, and tuberculosis mortality in Glasgow, 1911-51', *The Society for the History of Medicine*, 2 (1989), p.84; D.P.S Spence *et al.*, 'Tuberculosis and poverty', *British Medical Journal*¸ 307 (1993), p.760.
[81] GSAS, YPA, YP917, *Etesia ekthese* (1931).
[82] L. Papastefanaki, 'Demosia ygeia, fymatiose, kai epaggelmatike pathologia stis ellenikes poleis stis arhes tou 20ou aiona: e antifatike diadikasia tou astikou eksychronismou' (Public health, tuberculosis and occupational pathology in the Greek towns in the beginning of the 20th century: the controversial process of the bourgeois modernisation), *Praktika synedriou Eleftherios Venizelos kai ellenike pole* (*Proceedings of the conference Eleftherios Venizelos and the Greek city*) (Athens: National Research Foundation 'Eleftherios K. Venizelos', Technical Chamber of Greece & National Technical University of Athens, 2005), p.164.

workers was found to be insufficient.[83] Even though industrial activilty was in decline in Hermoupolis, in the first half of the twentieth century, textile manufacture had revitalised – to a certain extent – the economy of the island. Whilst up to 1929 the activity of textile manufacturing developed rapidly, it decelerated significantly during the next decade.[84] Therefore, the decline in tuberculosis in the late 1920s may have been a product of the decline in industrial activity in the city. Moreover, the the Greek legislation enforced hygiene regulations in specific industries in 1914, as discussed in section 8.3.1, which seems to have led gradually to improvements in working conditions in many industries around the country over the next decades. Meanwhile, the Greek governments passed new laws regarding the protection of the workers by providing in many cases benefits or medical care to consumptive workers. Even though there is no evidence to make such links in Hermoupolis, better treatment of the industrial labour force not only by the state but also by their employers in relation to working conditions may have contributed to the decline in tuberculosis mortality from the late 1920s onwards.[85] This is an issue which clearly needs further exploration in order to draw more secure findings.

After outlining possible factors that may have influenced the decline of tuberculosis in the 1920s and its further decline in the 1930s, the ultimate reason remains unclear. Further research of other Greek populations may reveal more secure findings.

Levels of tuberculosis mortality in Hermoupolis have been compared with the national levels for the period, when the vital statistics allowed the calculations of such rates (Figure 8.2). As this study has been discussed extensively in Chapters 4 and 5, a main reason for the very important discrepancies between Hermoupolis's and the national mortality levels was the under-registration of vital events mainly in the rural parts of the country, especially in the early part of the 1920-1940 period. This may be partly the reason for the rather low national levels of tuberculosis. A closer glance at Figure 8.2 shows that in the early 1920s, tuberculosis mortality was almost double in Hermoupolis

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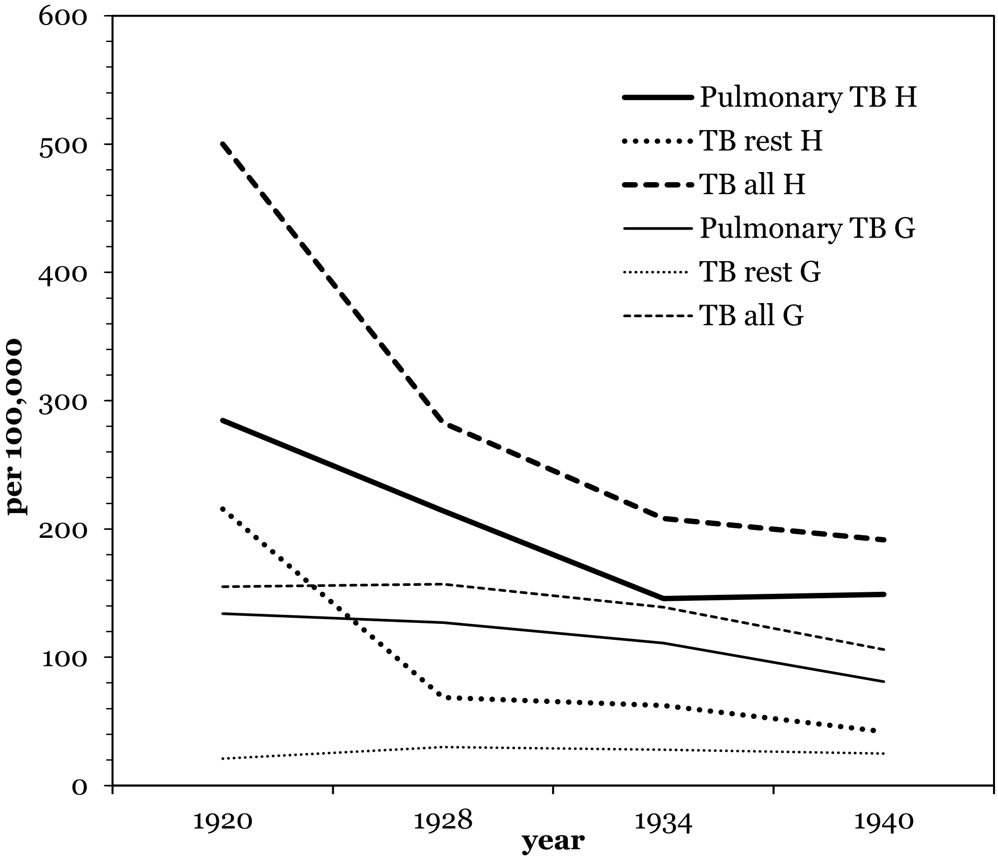
[83] Tsakalotos, *Peri tes demosias ygeias*, pp.26-7.

[84] Papastefanaki, 'To "patriko endiaferon"', pp.159-60.

[85] The link between tuberculosis and the legislation for the protection of consumptive workers in Greece in the interwar period has been discussed extensively in Stoyannides, *Sanatoria kai to koinoniko zetema*, pp.221-54; 'Apagoreuetai to ptyein'. See also L. Papastefanaki, 'Apo ten "Ygieine ton Epitedeumaton" sten "Eyksemenen noseroteta tes ergatikes takseos": E eppagelmatike Ygeia sten Ellada 1870-1940' (From the "Hygiene of Trades" to the "Increased morbidity of the working class": Occupational Health in Greece, 1870-1940), in I. Kyriopoulos (ed.), *Demosia ygeia kai koinonike politike: o Eleftherios Venizelos kai e epohe tou* (*Public health and social policy: Eleftherios Venizelos and his time*) (Athens: Papazissi, 2008), pp.271-74; 'Politics, modernization, pp.174-81

compared to that of Greece as a whole. By 1928, tuberculosis-specific mortality declined substantially, while the rates for Greece remained almost at the same levels. By that time, the vital statistics were of better quality and should be treated as more realistic rates. The discrepancies between the two rates were further reduced after the continuous and significant decline of Hermoupolis's rate in the 1930s. In both cases, pulmonary tuberculosis seems to have been the most dangerous form of tuberculosis throughout the study period.

Figure 8. 2 Tuberculosis-specific mortality, Hermoupolis and Greece, 1920-1940 (rates per 100,000)



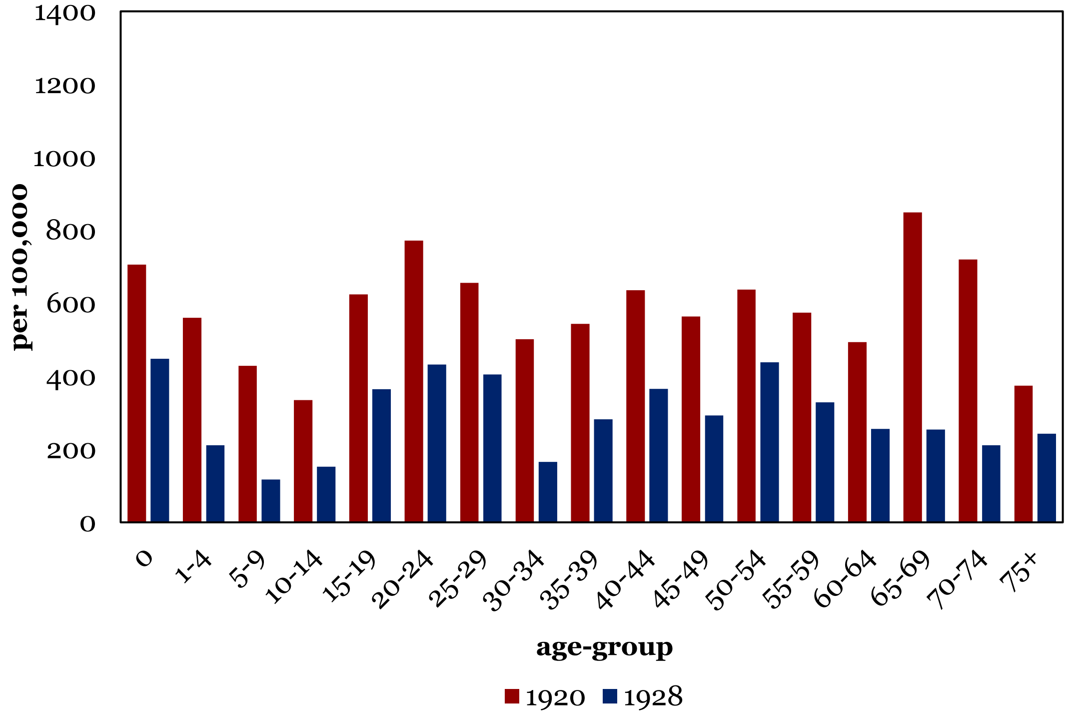
Note**:** The rates for Greece have been calculated for 1922, 1928, 1934 and 1938 using the average number of deaths attributed to tuberculosis and the population of the whole country, see section 6.3.
Sources**:** HMD; Vital statistics.

Evidence from other urban areas has confirmed the urban-rural differences regarding tuberculosis mortality in Greece. A study of the city of Patras indicates a very high incidence of tuberculosis there in the early twentieth century. Tuberculosis mortality in Patras remained stable for most of the first half of the twentieth century, apart from the period between the First World War and the influx of refugees from Asia Minor. Eliopoulos estimated that tuberculosis mortality in 1907 was 24.65 per 10,000 inhabitants, in 1928 17.7 and in 1940 it declined further to 12.7.[86] When the rates in Patras are compared with those in Hermoupolis, it seems that Hermoupolis exhibited much higher levels and this is most evident in 1940 when the rate there was 19.2. High tuberculosis levels were also found (10 per cent of all deaths) in the city of Volos at the beginning of the twentieth century.[87] Rates in Hermoupolis were found to be extremely high when compared with the rates calculated by Hionidou for various urban or semi-urban populations during the period 1937 to 1940: in Hios town, 104 per 100,000; in Vrontados 80; and on Mykonos 73. Hionidou's calculations also show that tuberculosis mortality in rural Syros in 1937-1940 was much lower (54 per 100,000) than that of Hermoupolis. Very similar levels to that of Hermoupolis were also found in Ano Syros. It is, therefore, reasonable to suggest that the very high incidence of tuberculosis on the island of Syros was an urban phenomenon.[88] One reason for these extreme urban-rural differences on a single island, apart from overcrowding, bad housing and unhealthy working conditions in Hermoupolis, could also be better availability of food in the rural parts of the islands. The availability or access to land was also a major reason for the much lower levels of mortality during the famine in the rural parts of the island compared to Hermoupolis or Ano Syros.[89]

When tuberculosis mortality is examined by age-group, it is evident that in 1920 it was relatively high in every age-group (Figure 8.3). Nonetheless, higher levels were found in the age-groups 0-4, 15-29, 40-54 and 65-74. High tuberculosis mortality among infants has been connected to contaminated milk supply in the literature.[90] As shown in Chapter 7, milk supply in Hermoupolis was found to be clean and therefore should not be responsible for the tuberculosis incidence among infants. Infants were probably infected by whoever breastfed them, whether that was their own mother or another woman who breast-fed them. In 1920, tuberculosis mortality was also highly concentrated in older adults and specifically in the age-groups 65-74 years. In 1928, tuberculosis seems to have declined significantly in every age-group, with high levels concentrated still in infancy, young adulthood and in the age-group 50-54.

[86] P.G. Eliopoulos, 'Matters of life and death in a Mediterranean port city. Infrastructure, housing and infectious disease in Patras, 1901-1940', *Hygiea Internationalis*, 9, 1 (2010), p.267.
[87] Moustane, *Oi demographikes ekselikseis*, pp.254, 256.
[88] Hionidou, *Famine and death*, p.206.
[89] Ibid., pp.164-65.
[90] Atkins, 'White poison?', p.218.

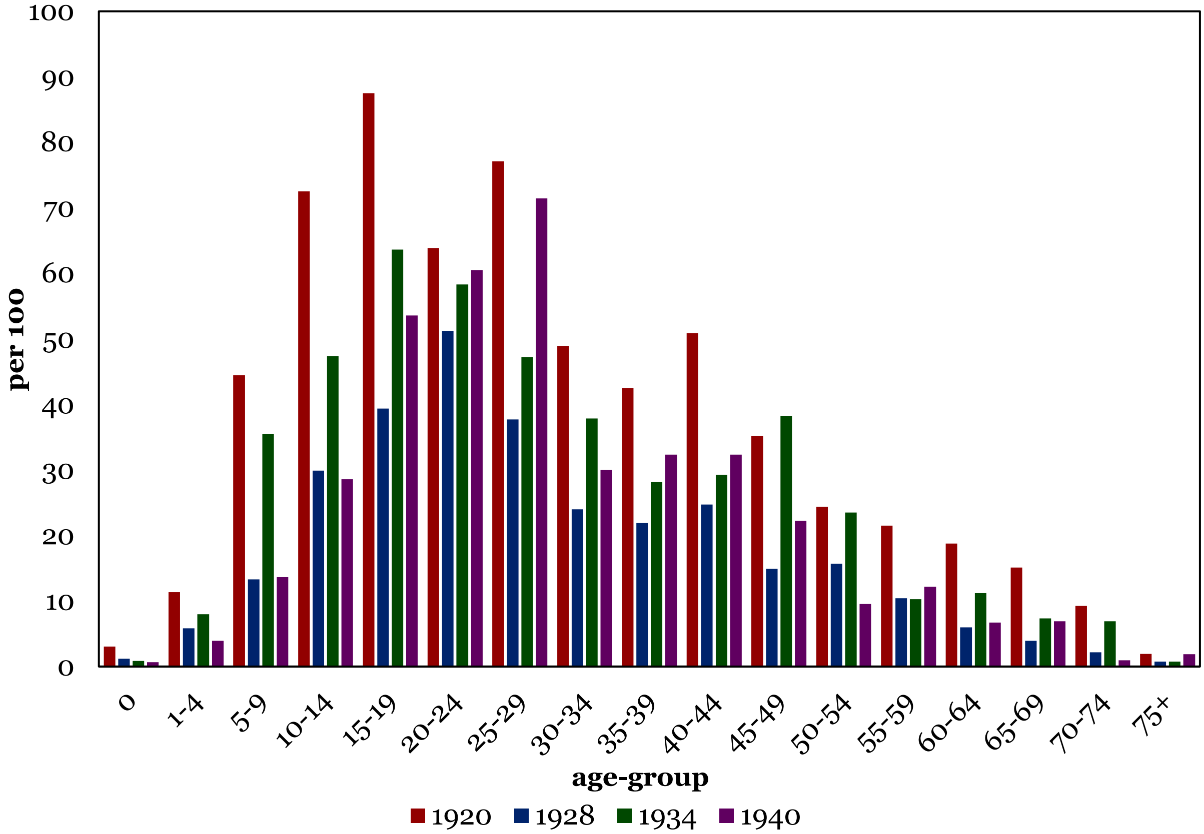
Figure 8. 3 Age-specific tuberculosis mortality rates, Hermoupolis, 1920 and 1928 (rates per 100,000)



Source: Calculated by the author using HMD.

Due to the lack of an age-structure of the population in 1934 and 1940, the distribution of tuberculosis deaths per 100 deaths by age-group has been calculated. Figure 8.4 clearly shows that tuberculosis mortality was concentrated among specific age-groups. In 1934, when the rates are compared with those in 1928, it seems that the distribution of tuberculosis deaths to all deaths by age-group increased almost at every age-group apart from the very young and the very old. Young adults seem to have been affected significantly in 1934 as in 1928, but the rates are much lower when compared to those in 1920. By 1940, although tuberculosis further declined almost in every group, high percentages were found among young adults, that is in the age-group 15-29 years. It seems therefore that – throughout the period when cause-of-death information is available – tuberculosis killed the most active part of the labour force in Hermoupolis. The high tuberculosis mortality within Greece was associated with poor living conditions, diet and working conditions right from the very beginning of the anti-tuberculosis campaign. It is possible, therefore, to hypothesise that those working in textile manufacture, the main industry in the city at the time, or in any other factory, may have experienced higher risk of dying from tuberculosis as a result of higher exposure to transmission due to overcrowding and unhealthy working conditions. A future analysis of tuberculosis mortality by occupation will shed more light on this.

Figure 8. 4 Percentage distribution of tuberculosis deaths by age-group, Hermoupolis, 1916-1940



Source: Calculated by the author using HMD.

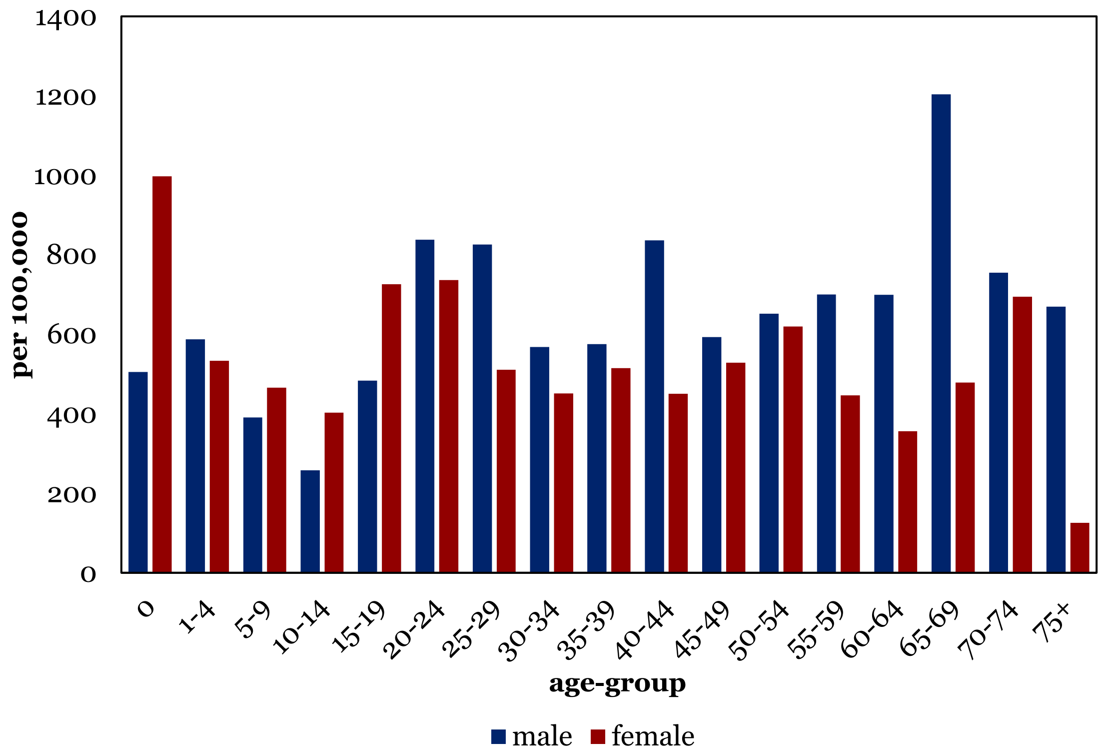
As already stated, when the number of tuberculosis deaths were disaggregated by sex and age-group, these were very low, so analysis by sex should be treated with caution. Tuberculosis mortality was always higher among men (Figures 8.5 and 8.6). Although tuberculosis mortality declined for both sexes, the decline was more extensive for women than for men in 1928. Female tuberculosis mortality was concentrated in infancy and childhood, early adulthood and among the elderly in 1920. In 1928, the peak was concentrated in infancy and in the age-groups 15 to 29 years. For males, tuberculosis mortality was high in every age-group, but particularly high in the age-groups 20-29, 40-44 and 65- 69 years in 1920, whilst in 1928 mortality was mainly concentrated within adults in the age-groups 20-24, 35-44 and 50-54 years.

The relatively high mortality due to tuberculosis among women in young adulthood is most likely to be the result of the existence of textile manufacture in the city, because they made up the largest proportion of the workforce. As discussed in section 5.6, Papastefanaki showed that 76 per cent of all workers in a single textile factory in

Hermoupolis in 1920 were women, mostly young adults.[91] High tuberculosis mortality or even excess tuberculosis mortality among women has been also associated with textile manufacture in Belgium and Scotland due to the predominance of the young women in the textile labour force.[92]

In Patras, tuberculosis killed mostly males in every age-group, but especially between 21 and 30, and women mainly between 11 and 20.[93] Similar age-groups also were affected in Volos.[94] No evidence is yet available for rural populations across Greece.

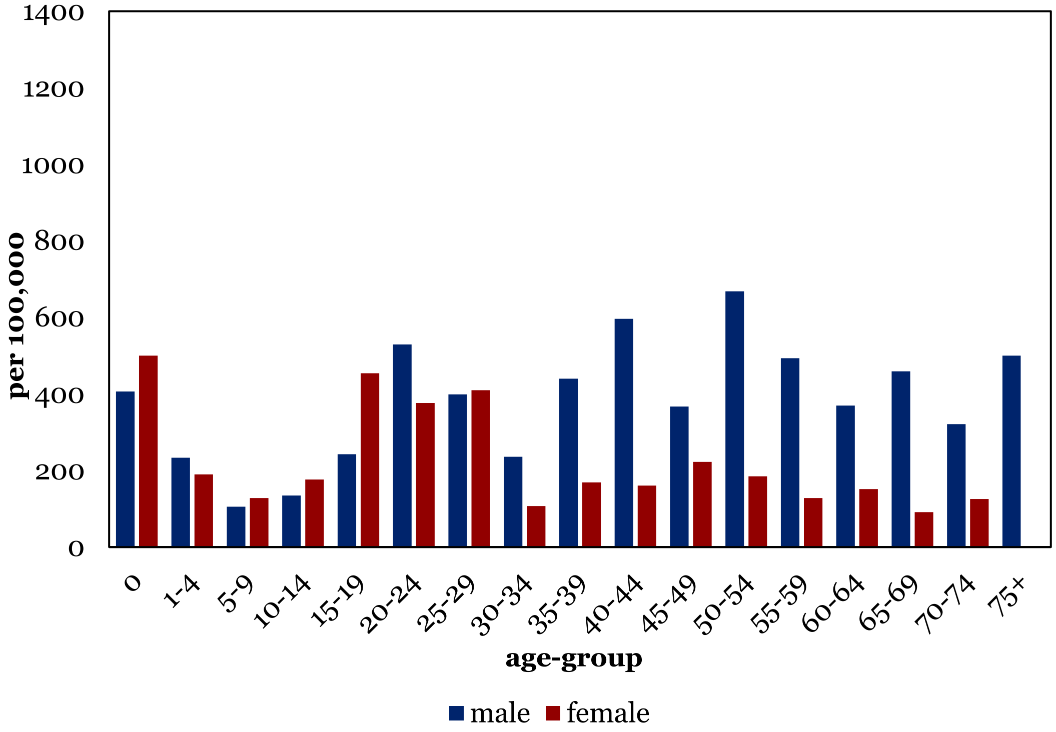
Figure 8. 5 Age- and sex-specific tuberculosis mortality, Hermoupolis, 1920 (rates per 100,000 inhabitants)



Source: Calculated by the author using HMD.

[91] Papastefanaki, 'To "patriko endiaferon"', p.167.
[92] I. Devos, 'La régionalisation de la sumortalité de jeunes filles en Belgique entre 1890 et 1910', *Annales de démographie historique* (1996), pp.399-400; Reid & Garrett, 'Mortality, work and migration', p.125.
[93] Eliopoulos, 'Matters of life', pp.264-71.
[94] Moustane, *Oi demographikes ekselikseis*, pp.254, 256.

Figure 8. 6 Age- and sex-specific tuberculosis mortality, Hermoupolis, 1928 (rates per 100,000 inhabitants)



Source: Calculated by the author using HMD.

8.6 Conclusions

In this chapter, I have discussed the evolution of tuberculosis mortality in Hermoupolis for the period 1916-1940. According to contemporary estimations, Hermoupolis exhibited the highest levels of tuberculosis mortality in the country. These high levels are confirmed by the current study, which produced cause-specific mortality rates. The analysis outlines that tuberculosis mortality in Hermoupolis declined significantly by the end of the study period. The reason for this noteworthy decline is not clear and further research is required.

This study calculated the mortality attributed to tuberculosis by age-group and by sex. The results of these calculations show that mortality from tuberculosis declined in every age-group and it did so more for females than for males. The age distribution of deaths was high in infancy, early adulthood, particularly between the ages 15 and 29, and among the elderly.

Mainly it was philanthropists and individual physicians who attempted to fill the gap left by the state and local authorities in Hermoupolis to tackle the very high levels of tuberculosis mortality and morbidity. Possible reasons for these high levels have been found to be the lack of sanitary reforms, low living standards, poor nutrition, overcrowding and poor housing. Unhealthy working conditions due to textile manufacture in the city are very likely to be a very significant reason for the exceptionally high levels of tuberculosis mortality in Hermoupolis. The foundation of the sanatorium in 1919 had only limited effect due to the ineffectiveness of the sanatorium treatment at the time. The reasons for the significant decline in tuberculosis mortality still remain unknown. A possible link with improvements in working conditions in the local textile factories clearly needs further investigation.

Further research is also required to establish the levels of tuberculosis mortality in rural parts of the country, which have been found in the literature to exhibit different patterns.[95] In addition, study of the hospital registers would reveal levels of tuberculosis morbidity in Hermoupolis and should therefore uncover further evidence regarding the age and sex distribution of tuberculosis in the city. How food consumption changed in the first half of the twentieth century in Hermoupolis and whether it had contributed to the evolution of tuberculosis mortality is a very interesting issue for future exploration. Further research also in other Greek populations may help us to understand the reasons for the tuberculosis decline in Hermoupolis, as recorded during the study period. Finally, a demographic approach to link tuberculosis mortality with occupation is necessary to understand the mechanisms and the reasons for the high levels of tuberculosis in Hermoupolis.

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[95] Anderson, 'The social implications', p.19; Woods & Shelton, *An atlas*, p.109; Hinde, 'Sex differentials', pp.369, 384.

Chapter 9. The 1918 influenza pandemic in Hermoupolis

9.1 Introduction

The centenary of the 1918 Spanish influenza pandemic has been the subject of interest among researchers from various disciplines, including historical demography, medical history and epidemiology. Reports focusing on the different origins of the influenza pandemic, the course of the epidemic, age-specific mortality patterns and the transmission of the virus across the world have been published. The origins of the 1918 influenza pandemic together with the causes of its transmissibility and virulence are still unknown, and the atypical age pattern of the deaths which it caused remains a long-lasting mystery.[1]

Only very little evidence is available regarding the impact of the 1918-19 influenza pandemic in Greece, as vital statistics became available only in 1921. However, a limited number of studies have been conducted for local populations rather than for the whole country. A few contemporary reports, mainly concerning Athens, are also available.

This current study is the first to employ historical demographic methods to explore the pattern of the influenza pandemic in a Greek population. Evidence from this study shows that the mortality increases over the course of the pandemic were extra-ordinary in Hermoupolis. In order to assess the levels of the pandemic in Hermoupolis, the 1918-19 rates will be compared with those from the pre-pandemic and post-pandemic periods.

9.2 A literature review

The influenza pandemic in 1918-19 was the most lethal pandemic in contemporary world human history. According to global estimates, it killed about 40-100 million people in three waves.[2]

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[1] C. Viboud *et al.*, 'Age- and sex-specific mortality associated with the 1918-1919 influenza pandemic in Kentucky', *Journal of Infectious Diseases*, 207 (2013), p.721.

[2] A. Crosby, *America's forgotten pandemic* (Cambridge: Cambridge University Press, 2003); D. Patterson & G. Pyle, 'The geography and mortality of the 1918 influenza pandemic', *Bulletin of the History of Medicine*, 65, 1 (1991), pp.14-15; N. Johnson & J. Mueller, 'Updating the accounts: Global mortality of the 1918-1920 'Spanish' influenza pandemic', *Bulletin of the History of Medicine*, 76, 1 (2002), p.114; C.J. Murray *et al.*, 'Estimations of potential global pandemic influenza mortality on the basis of vital registration data from 1918-20 pandemic: a quantitative analysis', *Lancet*, 368 (2006),

The origin of the influenza virus in 1918 is still unknown, since it was not possible to isolate it. No contemporary serological studies are available because the viral aetiology of the disease was unknown at the time.[3] Neither has historical or epidemiologic research succeeded yet in locating the geographic origin of the virus.[4] Several places around the world such as Asia, a British Army camp in France, the US or even Spain have been proposed as the origins of the pandemic. Initially, the pandemic was called the Spanish flu, a name which is used even today when referring to the 1918-19 influenza pandemic, but virologists and epidemiologists have established that the virus did not originate in Spain.[5]

It has been established that there were three waves. The pandemic spread in almost all places in the world at the same time, and the whole extent of the pandemic, including all three waves, lasted about twelve months. The first two took place at an unusual time of the year for an influenza virus to spread, but the inter-wave periods were so short that they were unnoticeable in some populations.[6] The first wave of the outbreak started in spring 1918, lasted until August 1918 and was relatively mild. The second wave, responsible for the majority of the deaths, started in most countries in September or October 1918, with peaks in October or November and less often in December. A third wave, next in importance to the second, developed in a few countries at the beginning of 1919.[7]

Europe experienced mainly one main autumn wave, whereas in the US two main autumn mortality peaks occurred within the second wave.[8] The much higher death toll in Europe than in the US during the influenza pandemic can be regarded as a consequence of the First World War.[9] Furthermore, all southern European countries (including Italy, Spain, Portugal and Bulgaria) experienced one sharp mortality peak,

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pp.2212-13; J. Taubenberger & D. Morens, '1918 influenza: the Mother of all pandemics', *Emerging Infectious Diseases*, 12 (2006), p.15

[3] Patterson & Pyle, 'The geography and mortality', p.4.

[4] Taubenberger & Morens, '1918 influenza', p.16.

[5] C. Potter, 'Chronicle of influenza pandemic', in K. Nicholson *et al.* (eds), *Textbook of influenza* (London: Blackwell Science, 1998), p.9; N. Johnson, *Britain and the 1918-19 influenza pandemic: A dark epilogue* (London: Routledge, 2006), pp.38-43; A. Trilla *et al.*, 'The 1918 'Spanish flu' in Spain', *Clinical Infectious Diseases*, 47 (2008), p.668.

[6] Taubenberger & Morens, '1918 influenza', p.17.

[7] C. Langford, 'The age pattern of mortality in the 1918-19 influenza pandemic: an attempted explanation based on data for England and Wales', *Medical History*, 46 (2002), pp.1-2, 5.

[8] M. Bootsma & N. Ferguson, 'The effect of public health measures on the 1918 influenza pandemic in U.S. cities', *PNAS*, 104, 18 (2007), p.7588.

[9] S. Ansart *et al.*, 'Mortality burden of the 1918-1919 influenza pandemic in Europe', *Influenza and Other Respiratory Diseases*, 3 (2009), pp.100-01.

although several mild waves might have occurred. In contrast, other northern European countries experienced two or even several successive peaks. The virus reached remoter places somewhat later (for example, Australia in January 1919), and only a few populations never experienced the influenza pandemic at all (Iceland and American Samoa) as a result of quarantines being enforced, although actually this did not prevent the introduction of the pandemic influenza virus strain everywhere else.[10] It has also been suggested that higher mortality occurred in coastal locations, urban centres and places with high levels of connections, such as ports, than in rural and isolated areas.[11] Evidence from England and Wales shows that cities and towns experienced 30-40 per cent higher death rates than rural areas on average.[12]

Previous studies have suggested that individuals were infected by the virus indiscriminately and regardless of their social status or spatial distribution.[13] More recent reports, however, have contradicted that by proposing that socio-economic and demographic factors affected the mortality patterns during the pandemic.[14] Strong correlations have been found between pandemic mortality and per-head income, occupational class, apartment size, literacy, home-ownership and unemployment.[15]

The main characteristic of the 1918-19 influenza pandemic was the disproportionate increase in mortality rates among young adults compared with the pre-pandemic years. The age-specific rates of the pandemic when plotted produce a W-shaped curve, unlike the expected and historically familiar U-shaped curve, which refers to the main mortality peaks among infants and the elderly. This W-shaped curve was similar to the

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[10] Patterson & Pyle, 'The geography and mortality', pp.11, 13; G. Shanks *et al.*, 'Epidemiological isolation causing variable mortality in island populations during the 1918-1920 influenza pandemic', *Influenza and Other Respiratory Viruses*, 6, 6 (2012), p.420.
[11] Johnson, *Britain and the 1918-19 influenza*, pp.62-3; Johnson & Mueller, 'Updating the accounts', p.106; S-E. Mamelund *et al.*, 'Influenza-associated mortality during the 1918-1919 influenza pandemic in Alaska and Labrador', *Social Science History*, 37, 2 (2013), p.178.
[12] G. Chowell *et al.*, 'The 1918-1919 influenza pandemic in England and Wales: spatial patterns in transmissibility and mortality impact', *Proceedings of the Royal Society*, 275 (2008), p.506.
[13] Crosby, *America's forgotten pandemic*.
[14] D.C. Pearce *et al.*, 'Understanding mortality in the 1918-1919 influenza pandemic in England and Wales', *Influenza and Other Respiratory Diseases*, 5 (2010), p.94; G. Chowell & C. Viboud, 'Pandemic influenza and socioeconomic disparities: Lessons from 1918 Chicago', *PNAS*, 113, 48 (2016), p.13558.
[15] S-E. Mamelund, 'A socially neutral disease? Individual social class, household wealth and mortality from Spanish influenza in two socially contrasting parishes in Kristiania 1918-19, *Social Science and Medicine*, 62 (2006), pp.932-33; '1918 pandemic morbidity: The first wave hits the poor, the second wave hits the rich' *Influenza and Other Respiratory Viruses* (2018), pp.3-4; Murray *et al.*, 'Estimations of potential global', p.2214; K.H. Grantz *et al.*, 'Disparities in influenza mortality and transmission related to sociodemographic factors within Chicago in the pandemic of 1918', *PNAS*, 113, 48 (2016), p.13840.

traditional U-shaped curve but with an additional third clear peak of deaths in young adults aged 20-40 and mainly those aged 25-35.[16] Even though this seems to have been taking place in every studied population, research from geographically isolated areas did not confirm the expected W-shaped age pattern during the pandemic period.[17]

Those in the age-groups 5-14 exhibited a disproportionate fatality due to influenza-related diseases, although rates among these age-groups were lower than those in other age-groups.[18] Much of the earlier research has concentrated on the mortality during infancy, early childhood and old age, which were the ages most vulnerable to death from the influenza virus; however, they were not the 'introducers of influenza into the household'. In contrast, those who were more likely to spread the disease were school children and employed persons because of their mobility and contact with other humans.[19]

However, more recent research has focused on the mortality patterns among young adults and adults, due to the exceptionally high death rates among those age-groups. Almost half of the deaths due to influenza or related diseases during the 1918-19 pandemic occurred among young adults. The main reasons responsible for this unique age-pattern have not been explained yet and only hypotheses have been proposed.[20] One of the suggested explanations for this, suggested that adults who were older than thirty during the pandemic were protected because of their previous exposure to H1N1 viruses which might have circulated widely during earlier influenza pandemics, such as that of 1889, or even prior to that.[21] Significant evidence for this argument is provided by the negative excess mortality among the elderly during the pandemic. Although old-age mortality was high during the pandemic, it was lower compared with the pre-pandemic period.[22]

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[16] Taubenberger & Morens, '1918 influenza', p.19; G. Chowell *et al.*, 'Spatial-temporal excess mortality patterns of the 1918-1919 influenza pandemic in Spain', *BMC Infectious Diseases*, 14,371 (2014), pp.1-2.

[17] S-E. Mamelund, 'Geography may explain adult mortality from the 1918-20 influenza pandemic', *Epidemics*, 3 (2011), p.59.

[18] Taubenberger, '1918 influenza', p.75;

[19] W. Glezen, 'Emerging infections: pandemic influenza', *Epidemiologic Reviews*, 18, 1(1996), p.69; I. Longini *et al.*, 'Estimating household and community transmission parameters for influenza', *American Journal of Epidemiology*, 115, 5 (1982), p.742.

[20] Viboud *et al.*, 'Age- and sex-specific mortality', p.721.

[21] Langford, 'The age pattern', p.14; J. Luk *et al.*, 'Observations on mortality during the 1918 influenza pandemic', *Clinical Infectious Diseases,* 33 (2001), p.1377.

[22] Ibid., p.1375; J. Taubenberger, 'Seeking the 1918 Spanish influenza virus', *ASM News*, 65 (1999), p.473-78.

Another hypothesis suggests that the case was a "cytokine storm, that is, hyperreaction of the immune system that could potentially cause severe damages in the host". This reason is more likely to have been responsible for the high number of deaths among young adults, who have stronger immunity, and the lower mortality among the very young and the elderly, who have weaker immune systems.[23]

During the period of the pandemic, it has also been said that one or more risk factors were present, such as comorbidities, which increased the risk of death for young adults; although these risk factors would not necessarily influence the age-specific death patterns. More than one disease may have occurred in the same person simultaneously or sequentially. It has been found by using evidence from the US that tuberculosis patients had a higher risk of dying from influenza compared with those who were not suffering from tuberculosis.[24] Indeed, tuberculosis mortality, especially among young adults, did increase during the pandemic. It seems, however, that the age-specific tuberculosis mortality, when plotted, takes a very similar shape to the W-shaped curve.[25] Whether the rise in mortality within specific age-groups during the pandemic was the result of an increased tuberculosis mortality has also been raised in the literature.[26]

In the next section, I shall seek to shed light on influenza mortality in a Greek population, for which only scarce evidence is available.

9.3 The 1918 influenza pandemic in Hermoupolis

In this section, I shall explore the course of the mortality pattern during the 1918-19 influenza pandemic in Hermoupolis. Although this is one of the very few studies to discuss the course of the pandemic in Greece, the complete lack of qualitative sources at the local level is a significant limitation of the study. To overcome this, a study of the Athenian press, that is available on-line, was made.

Examination of the Athenian press over the course of the pandemic shows that the press only rarely gave any publicity to the outbreak. It seems therefore that, as in many

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[23] W. Oei & H. Nishiura, 'The relationship between tuberculosis and influenza deaths during the influenza (H1N1) pandemic from 1918-19', *Computational and Mathematical Methods in Medicine* (2012), p.2.

[24] A. Noymer, 'The 1918 influenza pandemic hastened the decline of tuberculosis in the United States: an age, period, cohort analysis', *Vaccine*, 29, 2 (2011), pp.B38-B41.

[25] Oei & Nishiura, 'The relationship between', pp.2, 5-6.

[26] J. Winter & J. Robert, *Capital at war: Paris, London, Berlin 1914-1919* (Cambridge: Cambridge University Press, 1997), pp.468-70, cited by Langford, 'The age pattern', p.7.

other European countries, the Greek government may well have censored all news relating to the pandemic out of fear of a decline in public support or troop morale in regard to the First World War and turbulent political events.[27]

The course of the 1918-19 influenza pandemic in Greece has not been explored partly because of the absence of qualitative sources. Countries bordering the Mediterranean Sea or in the Balkans were found to have experienced the highest excess mortality within Europe during the pandemic: Italy (+172%), Bulgaria and Portugal (+102%) and Spain (+87%).[28] Since heavy mortality was experienced in countries which exhibited similar demographic trends to that of Greece, it is reasonable to expect that an equally severe occurrence of the influenza pandemic took place in Greece as well.

Several mortality rates have been calculated for the purposes of this study to establish the levels of the influenza pandemic in Hermoupolis. Apart from the annual, monthly and weekly influenza death rates, age-specific mortality and excess mortality in each age-group were calculated for the years before, during and after the pandemic year, and also for the most severe pandemic wave. The 1920 published age-structure was used because of the lack of similar data for 1918. Furthermore, deaths due to pneumonia have been included in the calculations (P&I) as, according to the literature, most of the influenza-related deaths were actually caused by the secondary respiratory diseases and the most common bacterial pneumonia strains rather than by influenza itself.[29]

The significant increase in CDR in 1918, as shown in Figure 9.1, seems to have been a result of the influenza pandemic, as it declined significantly in the year immediately following the pandemic. This is also evident in Figure 9.2, in which the number of deaths due to influenza are plotted per year from 1916 onwards, when continuous reports of causes of death are available. The 1918 mortality rate attributed to the influenza pandemic, calculated from civil registrations, was rather high, following the high mortality in the rest of the world at the time. Valaoras pointed out that "the influenza epidemic swept the country in 1918-1919".[30] However, no evidence is available about the levels of the influenza pandemic at the national level as vital statistics are not available before 1921, and therefore no comparisons can be made.

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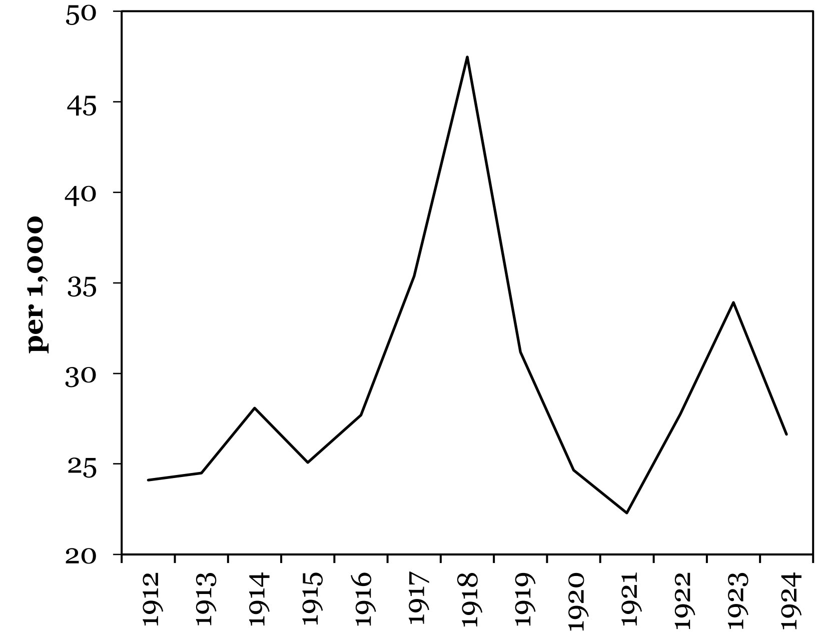
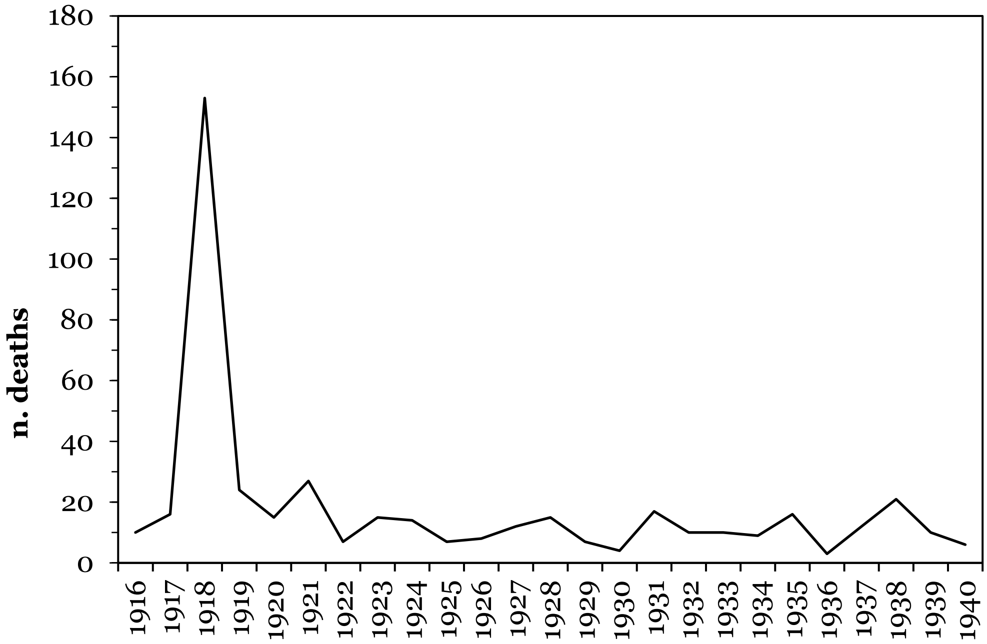
[27] Chowell *et al.*, 'Spatial-temporal excess', p.1.
[28] Ansart *et al.*, 'Mortality burden', pp.100-01.
[29] D. Morens & A. Fauci, 'The 1918 influenza pandemic: insights for the 21st century', *Journal of Infectious Diseases*, 195 (2007), p.1019.
[30] Valaoras, 'A reconstruction', p.127.

Figure 9. 1 CDR around the years of the influenza pandemic, Hermoupolis, 1912-1924



Source: Calculated by the author using HMD.

Figure 9. 2 Number of deaths from influenza per year, Hermoupolis, 1916-1940



Source: HMD.

Despite the lack of any specific sources from which to study the influenza pandemic in Greece, two short contemporary reports were found in international journals. The first report was published in *Public Health Reports* in 1919 by Dr T.F. Filtzos, an American consulate-general, and the second one in *JAMA* by the physician P.J. Rondopoulos in the same year. Both refer mainly to the area of Athens and Piraeus. Kopanaris, however, pointed out that the influenza pandemic was more fatal in Thessaloniki with 5,284 deaths than in Athens with 1,668 in 1918.[31] Evidence from the Athenian press shows that the influenza pandemic was very severe in the region of Macedonia but also in the city of Patras.[32]

The second wave of the pandemic was found to be the most severe in the country, while the first mild wave seems to have started in May:

> Influenza appeared suddenly in Greece during May 1918, but the cases at first were mild and the illness soon passed off. The infection was also present in May and June in the Allied army in the Balkans … and soon became apparent that … the disease was epidemic influenza.
>
> In the French army in Macedonia, the epidemic of May and June was said to have been characterised by its sudden appearance, its rapid extension, its extremely infectious nature and the predominance of the thoracic symptoms.[33]

More references were found to the prevalence of the pandemic in Athens and Thessaly during June and July.[34] Rondopoulos suggested that:

> The first wave of influenza in June and July was comparatively mild, but the October wave had a mortality of 15.5, 22.7 and 24.23 per cent in different localities. The maximum mortality was in the army hospitals reaching 50.7 per cent in some of the hospitals at the war front.[35]

A very similar seasonal pattern was described by Filtzos:

> The first appearance of influenza in Greece occurred last summer, toward the end of May; … Since the month of September the epidemic became worse and caused a considerable rise in the mortality. Many cases complicated with broncho-pneumonia appeared then all over the country, and of these cases perhaps 50 per cent were fatal … the disease began to decrease toward the middle of December or rather began to lose its severe and fatal form.[36]

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[31] Kopanaris, *E demosia ygeia*, p.108.
[32] *Empros*, 4/10/1918; 24/10/1918.
[33] Anon, 'Greece', *Bulletin de l'Academie de Medecine*, 21 January 1919, p.259.
[34] Anon., '*Syzetesis peri grippes*' (Discussion on influenza), *Iatrike Proodos* (Nov 1917), p.222
[35] P.J. Rondopoulos, 'Influenza in Greece', *JAMA*, 72, 26 (1919), p.1947.
[36] T.G. Filtzos, 'Epidemic influenza in Greece', *Public Health Reports*, 34 (1919), p.507.

It, therefore, seems that the peak in influenza mortality in the capital occurred in October and November, followed by a significant decline in mortality in December, as shown also in Table 9.1.

Table 9. 1 Number of influenza deaths in Athens and Piraeus, Aug-Dec 1918

	Deaths from influenza	***Total deaths***	***Percentage Distribution (%)***
Athens (from Aug, 18)	108	613	18
Athens and Piraeus			
Sept, 18	115	771	15
Oct, 18	605	1,430	42
Nov,18	670	1,515	44
Dec, 18 (until 26)	229	771	30

Source: Filtzos, 'Epidemic influenza', p.507.

A similar pattern was found in the city of Patras, for which more evidence is available regarding the severity of the pandemic. A study by Tombros is probably one of the few existing studies to have explored the influenza pandemic in Greece using civil registration data. According to the evidence provided in that study, the pandemic in Patras started in the week beginning 29 September and its severe form lasted until the week ending 27 October (Figure 9.3).[37] Many references were found in the Athenian and national press about the severe extent of mortality due to influenza in Patras. There were not enough doctors in the city to cope with the increased needs so the Ministry of the Interior invited doctors from Athens or any part of the country by offering very high salaries for them to move to Patras.[38] The pandemic was confirmed in the cities of Ioannina and Volos, with peaks in October or early November, based on references in the local press or in the minutes of the municipal council meetings.[39]

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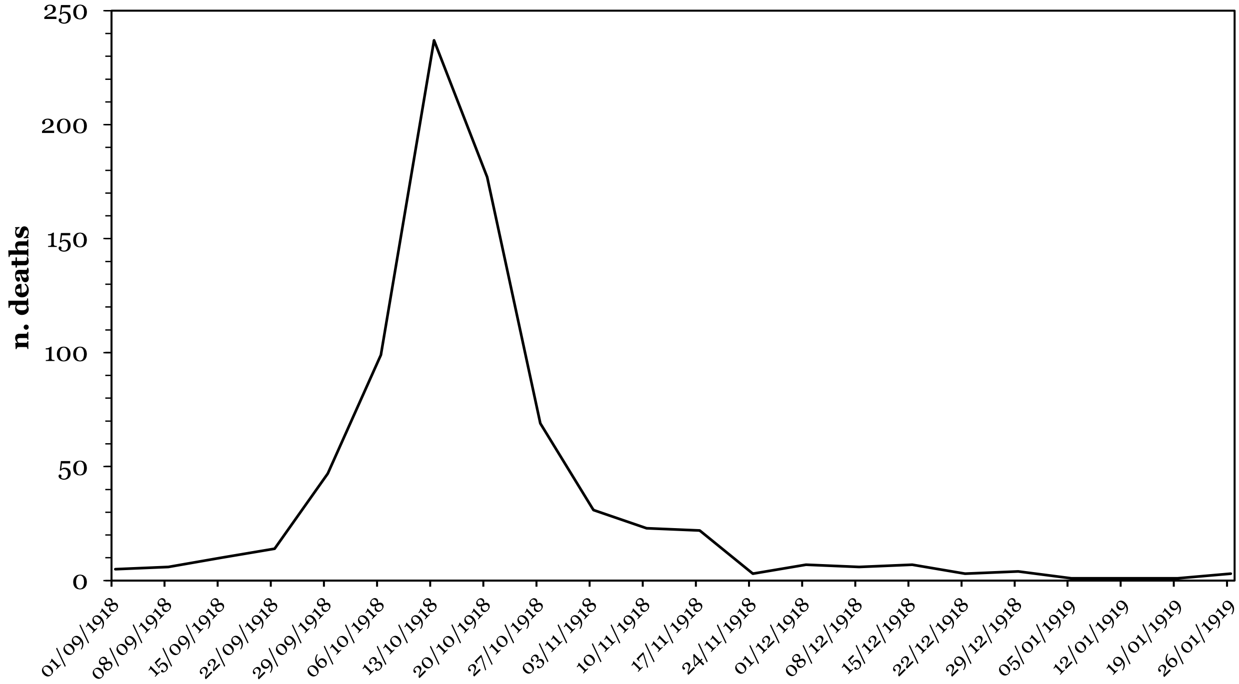
37 N. Tompros, 'E epipolazousa nosos einai e grippe: e makavria "algebra"' (The prevalent disease is the influenza: the morbid 'algebra'), in I. Athanasopoulou (ed.), *Noseroteta kai thnesimoteta sten Ellada ton 20o aiona: Iatrike kai demographike proseggise* (*Mortality and morbidity in Greece during the 20th century: a medical and demographic approach*) (Corfu: Ionio Panepistemio, 2009), pp.269-70.

38 *Ethnos*, 790, 15/10/1918.

39 Eliopoulos, 'Matters of life', pp.257-58; F. Karachaliou, 'To hroniko tes ispanikes gripes' (The chronicle of the Spanish flu), in K. Gourgoulianos (ed.), *Giati fovomaste te gripe? Apo ten eksaplose ton loimokseon sten pandemia tes gripes* (*Why are we afraid of the flu? From the spread of infections to the influenza pandemic*) (Athens: Metaixmio, 2009), pp.35-78; G. Tsoukalas *et al.*, 'The first announcement about the 1918 "Spanish flu" pandemic in Greece through the writings of the pioneer newspaper "Thessalia" almost a century ago', *Le Infezioni in Medicina*, 1 (2015), pp.79-82; Pappa, *Nosoi kai thnesimoteta*, p.27: 185 out of 225 deaths in October were due to respiratory diseases, without specifying which deaths were attributed to influenza.

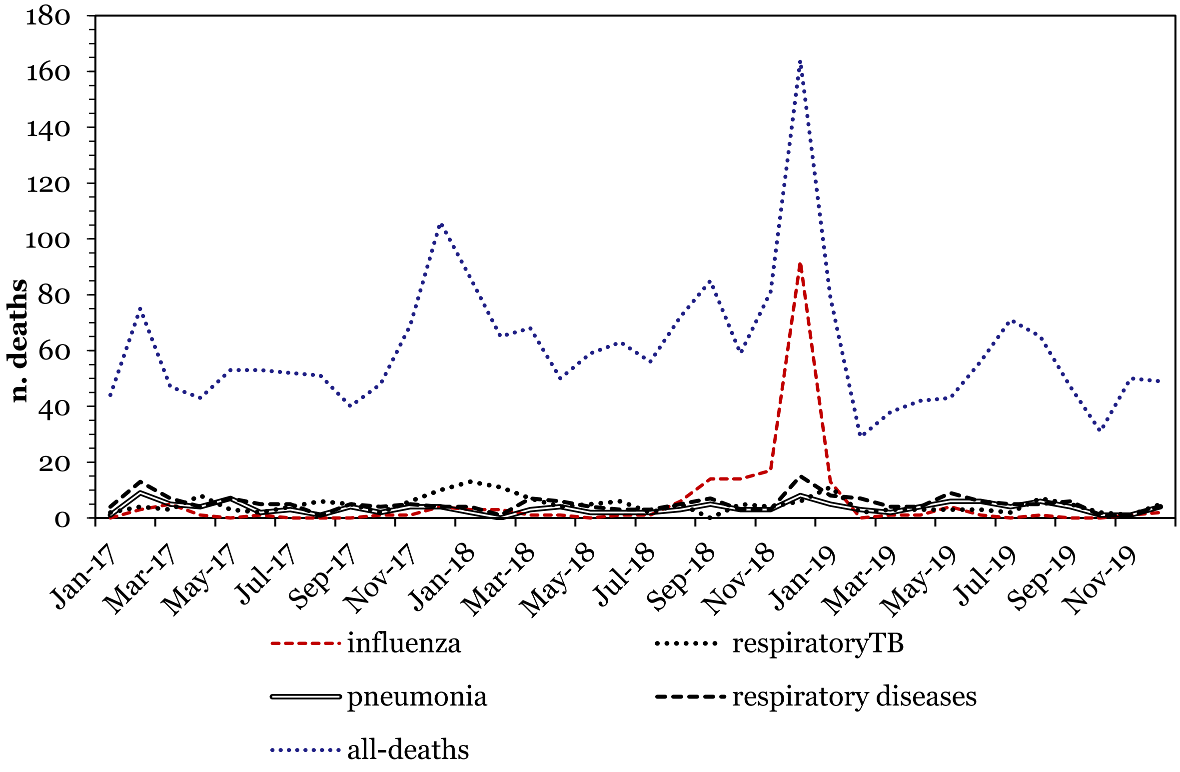
Figure 9. 3 Weekly mortality due to influenza, Patras, Sep 1918-Jan 1919



***Source*:** Tompros, 'E epipolazousa nosos', pp.269-70.

According to the literature, a herald wave occurred in spring 1918, which in most places was rather mild. As is evident in Figure 9.4, which shows the monthly number of deaths due to influenza, pneumonia, respiratory diseases, respiratory tuberculosis and all causes, this wave did not occur in Hermoupolis.

Figure 9. 4 Monthly mortality due to influenza, pneumonia, respiratory tuberculosis, Hermoupolis, Jan 1917-Dec 1919



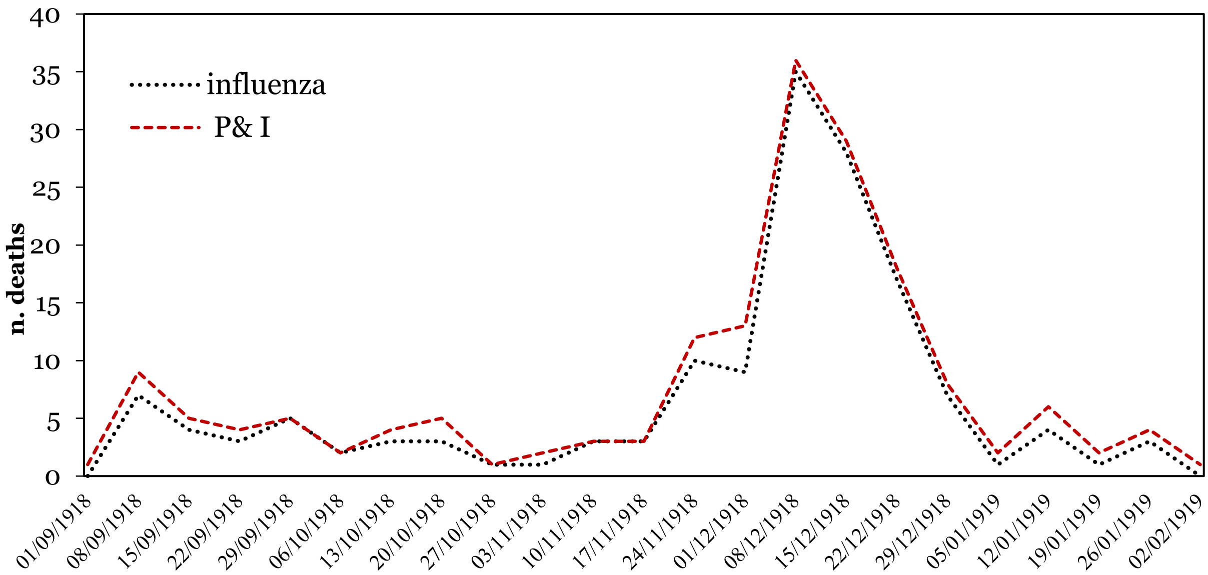
Source: HMD.

In Hermoupolis, the first incidence of the influenza appeared in the civil registers in July 1918. Even though mortality attributed to influenza exhibited rather significant levels in September and October in 1918, these levels were not as high as in the rest of the country. Mortality attributed to influenza started to increase extensively in the week ending 23 November, as can be seen in the weekly representation of the number of deaths (Figure 9.5). Mortality peaked in the week starting 1 December and it lasted up to the week ending 21 December. One sharp mortality wave, therefore, occurred in Hermoupolis in December, almost four weeks later than the peak on the Greek mainland.[40] Evidence from the Athenian press shows that severe outbreaks of influenza occurred in December also in several islands in the Aegean Sea, including

[40] Due to the lack of evidence in the local press of Hermoupolis, a limited search in the Athenian press was carried out for the purposes of this study. Apart from Hermoupolis or Syros, the search was extended to all the islands of the Aegean Sea in an attempt to identify whether a similar pattern occurred in other island communities. The search was restricted to the newspapers *Empros, Rizospastes, Ethnos* and *Akropolis*, available online at the Library of the Hellenic Parliament, during the period of the main autumn wave of the influenza pandemic between September 1918 and January 1919:
http://library.parliament.gr/Portals/6/pdf/digitalmicrofilms.pdf?ver=2018-05-09-104050-780
(access in June 2018).

Lesvos, Chios and Naxos,[41] although references were found to increasing incidences of influenza on the islands of Syros and Mykonos on November 20.[42] Hermoupolis therefore appears to have followed a similar timing in peak mortality as other island communities in the Aegean Sea. Further research in those populations will reveal more concrete results regarding the different timings of the second severe wave of the influenza pandemic in Greece.

Figure 9. 5 Weekly mortality due to influenza and together with pneumonia (P&I), Hermoupolis, Jan 1918-Feb 1919



Source: HMD.

Figure 9.6 shows age-specific death rates as they were calculated separately for the pre-pandemic (1916-17), 1918 and post-pandemic (1919-20) years.[43] When plotted, all three rates show the traditional U-shape curve, but in the pandemic year mortality was higher in almost every age-group compared with the pre- and post-pandemic periods. The most distinctive increases occurred in the young childhood, adulthood and elderly age-groups. When the same rates are calculated only for those deaths due to P&I, the

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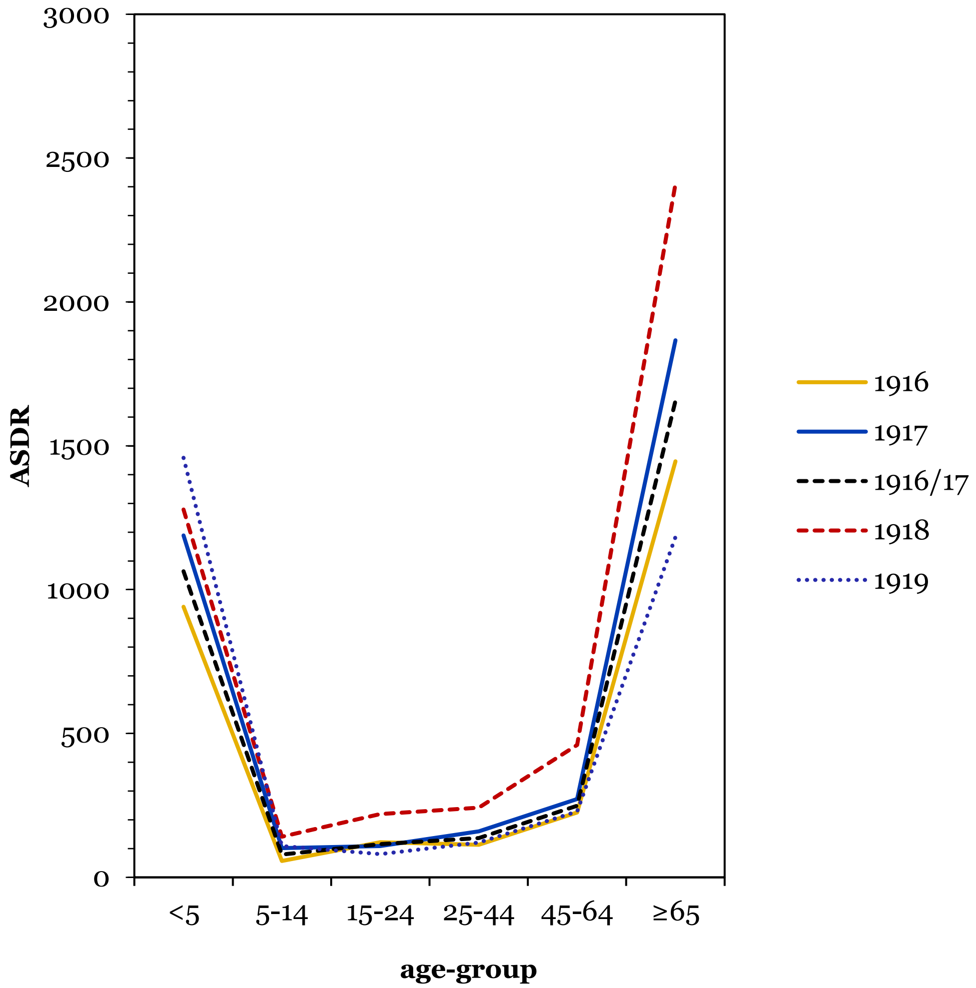
[41] *Ethnos,* 7961, 10/12/1918; 7962, 11/12/1918; 7967, 16/12/1918.
[42] *Ethnos,* 20/11/1918.
[43] It should be noted that CDR in 1917 had increased significantly from 28 in 1916 to 35 per thousand (Figure 9.1). Possible reason for this increase is the naval blockade of part of the country, leading to a food crisis. This crisis, however, has not been studied in-depth yet regarding to its incidence and impact on the overall mortality: Hionidou, *Famine and death*, p.111; T.W. Gallant, *Modern Greece* (London; Arnold, 2001), p.137. Therefore, in Figure 9.6, age-specific death rates are presented separately for 1916 and 1917. The same exercise took place for every calculation. Although discrepancies were found among all-causes, the differences in excess- mortality due to pneumonia/respiratory diseases, tuberculosis and influenza were minimal and thus are not presented separately for each year. Between 1916 and 1917, significant levels of excess mortality were found among infants due to higher incidence of diarrhoeal diseases (atrophy) and old-age for those above 65 years (Table 6.4).

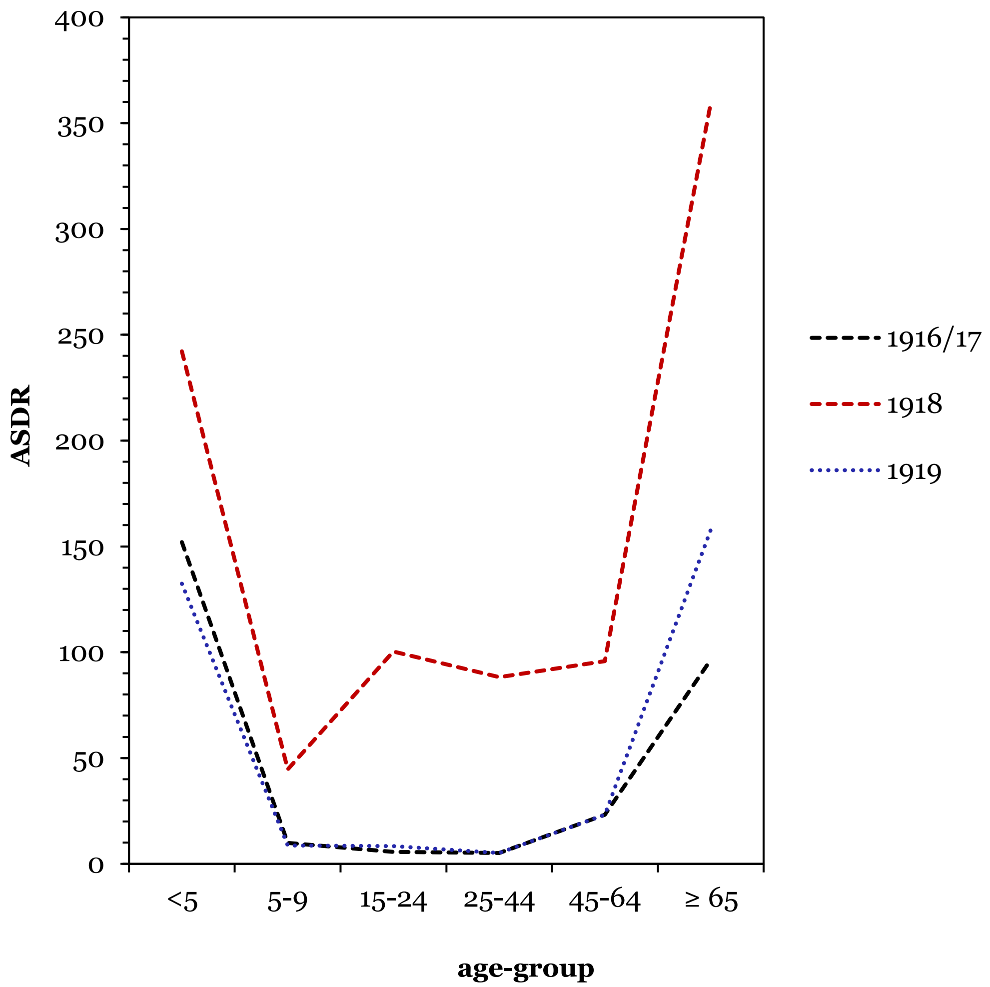
U-shape is only shown for the years before and after the pandemic, whereas in 1918 the rather expected W-shape is plotted (Figure 9.7). Even though age-specific death rates increased for young adults, the elderly and young children still experienced much higher levels.

Figure 9. 6 Age-specific death rates in the pre-pandemic period, 1918 and the post-pandemic period, Hermoupolis



Source: Calculated by the author using HMD.

Figure 9. 7 Age-specific death rates per 10,000 due to P&I in the pre-pandemic period, 1918 and the post-pandemic period, Hermoupolis



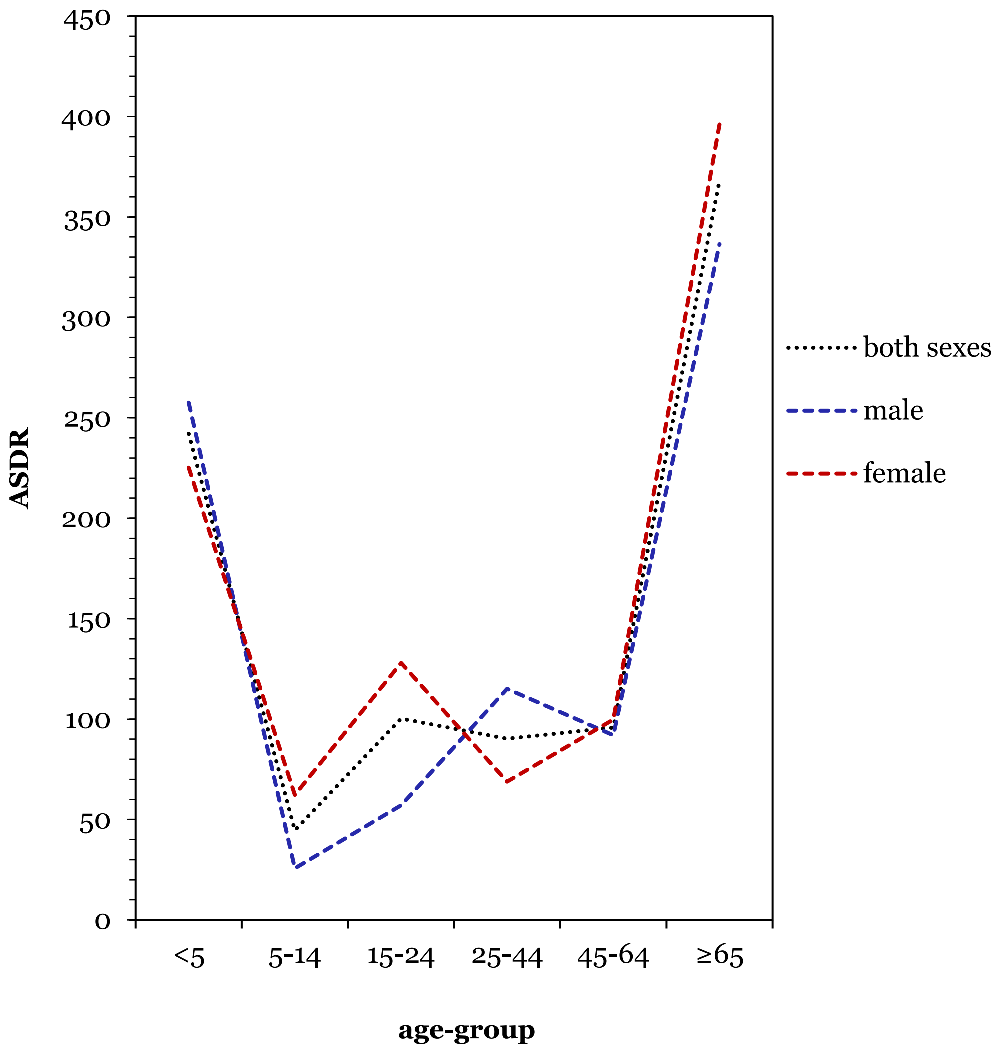
Source: Calculated by the author using HMD.

When the age-specific death rates are separated by sex, apart from the very high mortality levels among the elderly and the very young children, it becomes apparent that for each sex different age-groups were affected in different ways. As Figure 9.8 shows, high mortality levels were found for females in the 15-24 age group, whilst mortality among males in that group was much lower. The main reason for this variance must have been that young males were away from Hermoupolis at the time. Greece in 1918 was still participating in the First World War and at the same time preparing for the Greco-Turkish War that was to follow soon after. Men therefore, especially young adult men, did not return to the island, and even if they did, this would have happened after the end of the pandemic.[44] The increased levels of

[44] Very limited evidence is available regarding the military mobilization in the Cyclades. The British consul George B. Leon argued that the government in May 1917 forced men from the region to join the army: G.B. Leon, *Greece and the Great Powers, 1914-1917* (Thessaloniki, 1974), p.468.

mortality among men aged 25-44 may reflect the fact that not all of these men had been conscripted but also might include the men who returned from the war and were already sick or weakened.

Figure 9. 8 Age-specific and sex specific mortality rates per 10,000 due to P&I, Hermoupolis, 1918



Source: Calculated by the author using HMD.

For a more accurate estimate of influenza-related mortality, the annual excess age-specific mortality attributed to P&I was calculated. Excess mortality is the difference between the age-specific mortality during the pandemic year and the mortality observed in a non-pandemic year. This is a simple excess mortality rate which shows the pattern which occurred in every age-group and it estimates which age-groups suffered the most during the pandemic. The average mortality for 1916-1917, the years before the pandemic, was subtracted from the mortality rate of 1918.[45]

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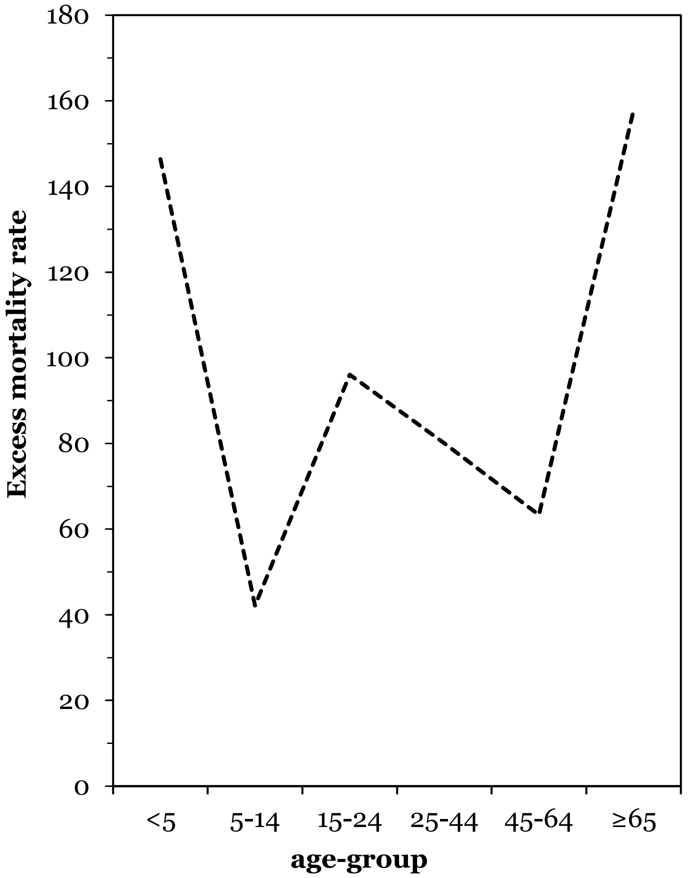
45 The ideal would be the use of the five-year average mortality before the pandemic year, but unfortunately continuous reports of cause of death are only available from 1916 onwards.

Figure 9.9 shows the curve of the excess mortality rate for P&I by age-group in the most severe pandemic wave in the period from autumn 1918 to winter 1919.[46] The influenza age mortality displays the expected W-shaped curve, with peak mortality among the elderly, young children and young adults.[47] Other studies estimated that the elderly experienced a negative excess mortality; however in Hermoupolis the largest positive excess mortality was found among individuals over 65 years.[48] Similar results to those of this study have been found in isolated communities in Alaska, where the elderly did not have lower than expected mortality.[49] In Hermoupolis, the pattern of excess mortality does not differ from the trend of age-specific mortality as calculated for 1918 apart from infancy, where the levels were the same during the pre- and pandemic years (Figure 9.10).

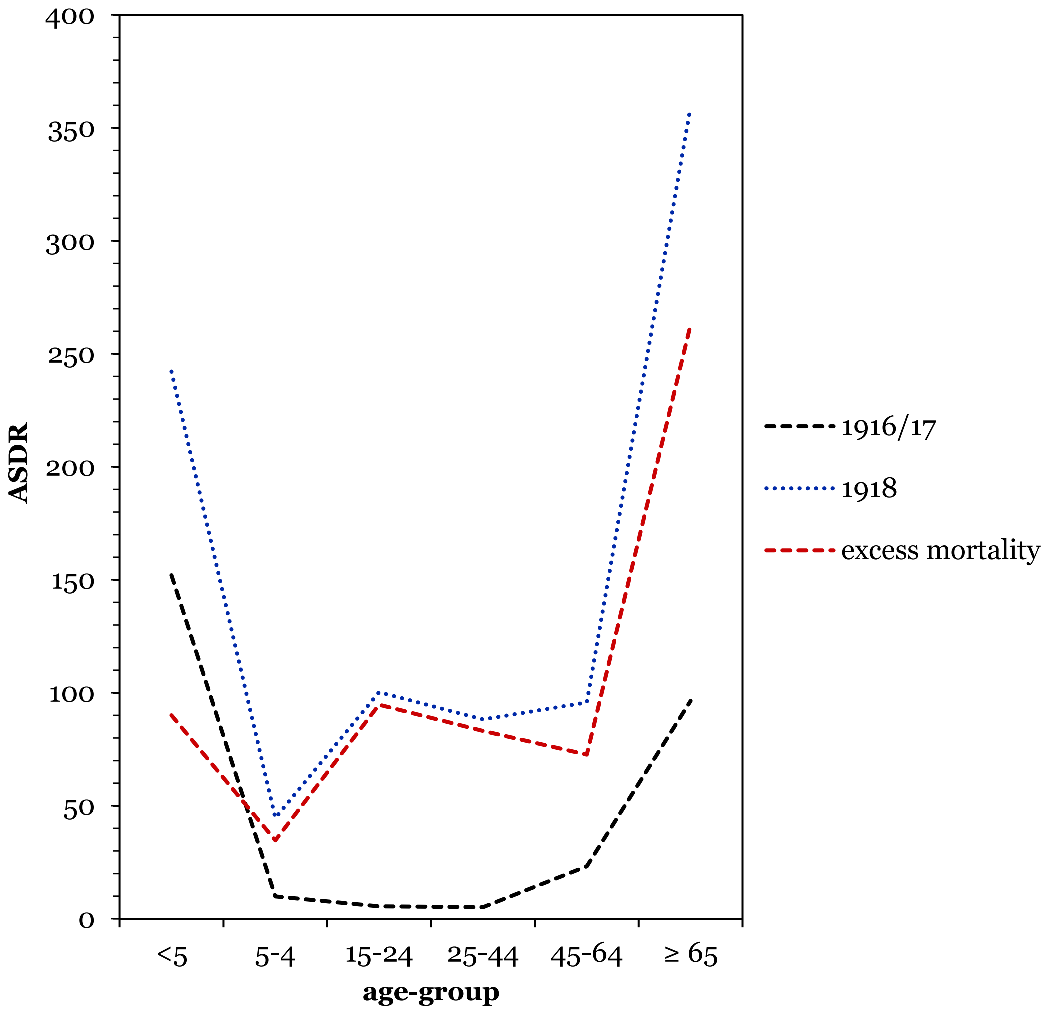
Figure 9. 9 Age-specific excess mortality rate per 10,000 population due to P&I in the second wave (autumn 1918-winter 1919), Hermoupolis



Source: Calculated by the author using HMD.

[46] The autumn wave in Hermoupolis occurred from September 1918 until January 1919. As a baseline, the same months in 1917-18 were used to calculate the excess mortality rate.
[47] Mamelund, 'Geography may explain', p.46.
[48] Luk et *al.*, 'Observations on mortality', p.1375; Mamelund, 'Geography may explain', p.46.
[49] Mamelund, 'Geography may explain', p.59.

Figure 9. 10 Age-specific mortality per 10,000 population due to P&I in 1916/7 and 1918, Hermoupolis



Source: Calculated by the author using HMD.

Excess mortality attributed to several causes of death for each age-group was calculated for 1918 in order to capture the impact of the pandemic on other diseases, using as a baseline the average rate from 1916-17. Figure 9.11, therefore, shows the curve of excess mortality rate for P&I, respiratory diseases, pulmonary tuberculosis and all-causes by age-group in 1918.[50] The influenza age mortality profile exhibited a broken-W curve when plotted on a graph, with peak mortality among the elderly, the youngest children and young adults.

Age-specific mortality attributed to several causes of death was calculated for the period when the severe wave occurred in Hermoupolis, September 1918 to January 1919 (Figure 9.12). All-causes mortality seems to have been affected by the trend of the

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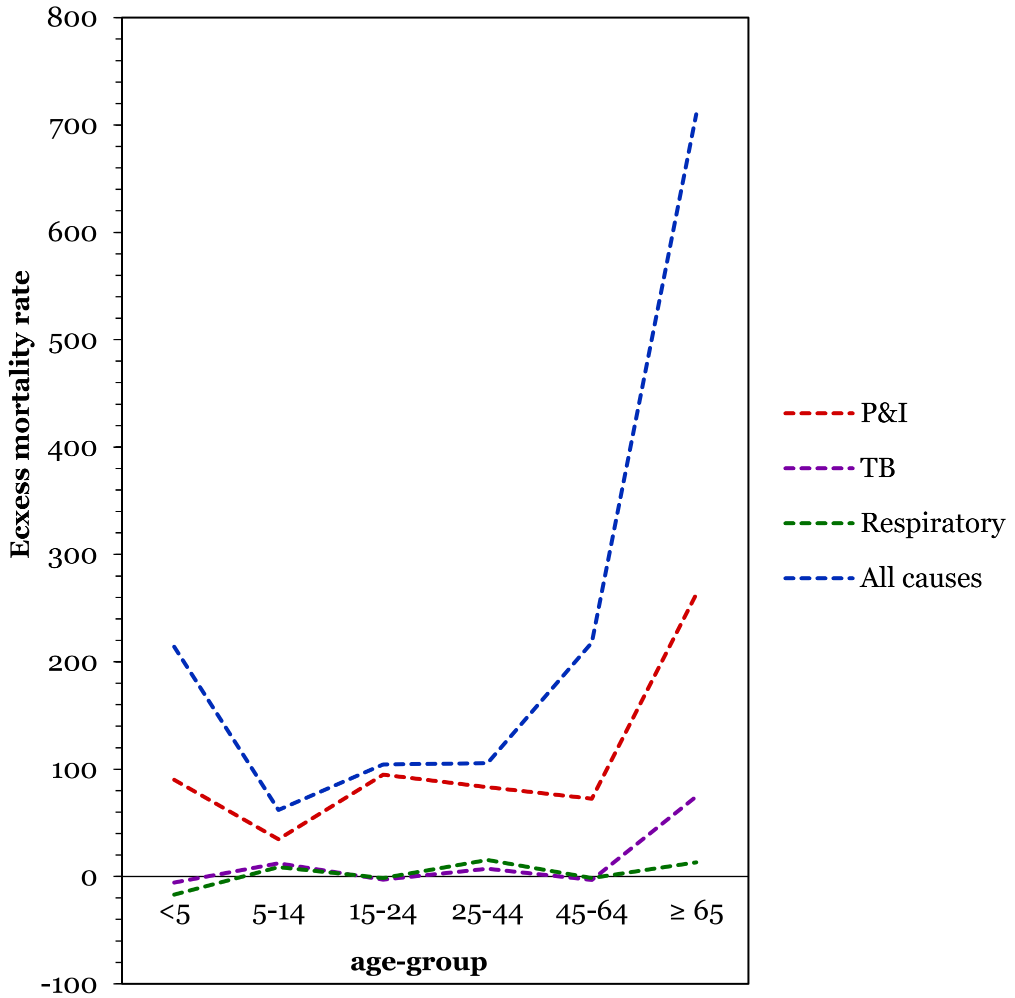
[50] S. Dahal *et al.*, 'Excess mortality patterns during 1918-1921 influenza pandemic in the state of Arizona, USA', *Annals of Epidemiology*, 28 (2018), p.277.

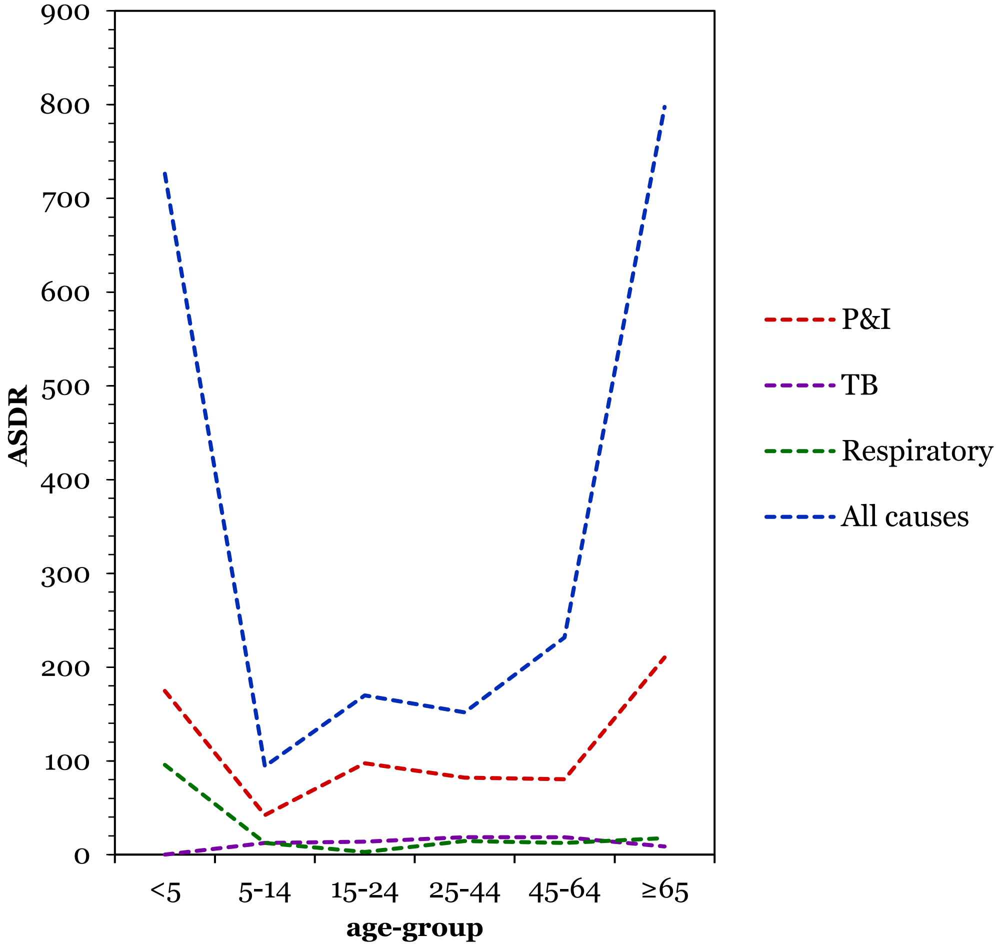
influenza with peaks in the same age-groups. Tuberculosis presented very low levels at the time of the pandemic apart from among young children. Respiratory diseases, which actually include deaths due to pneumonia, showed very minimal rates.

Figure 9. 11 Age-specific excess mortality per 10,000 population, Hermoupolis, 1918



Source: Calculated by the author using HMD.

Figure 9. 12 Age-specific mortality per 10,000 population during the main wave (autumn 1918-winter 1919), Hermoupolis



Source: Calculated by the author using HMD.

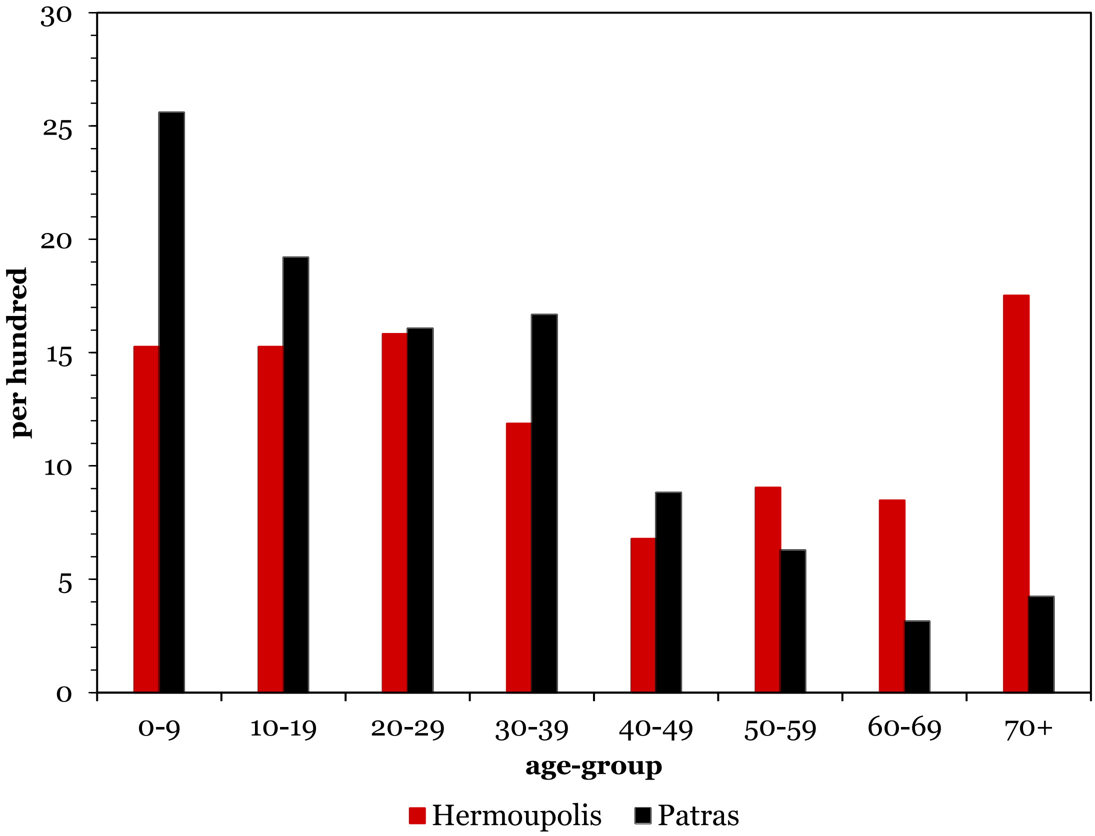
The percentage distribution of deaths due to influenza for each age-group against the total number of deaths was estimated for Patras, using evidence from Tompros's study.[51] The same rate was also calculated for Hermoupolis employing the same broader age-groups. These rates are presented in Figure 9.13, and it seems that different age-patterns developed in the two populations during the pandemic year. A quarter of the influenza deaths in Patras were of children aged 0-9 years, whereas in Hermoupolis much lower rates were found in the same age-group. Very similar rates were found among the adults in both cities.

Hermoupolis's rates were higher for those in the older age-groups, with a peak in the final age-group (<70 years), whereas Patras exhibited much lower mortality levels among the elderly. It, therefore, seems that a reverse age pattern was found between Patras and Hermoupolis. The discrepancies found between the two populations might

[51] Tompros, 'E epipolazousa nosos', pp.281-82.

also reflect different age structures of the two populations. Age-specific mortality rates in Patras will facilitate more secure comparisons with the rates in Hermoupolis.

Figure 9. 13 Percentage of influenza deaths per age-group in Hermoupolis and Patras, 1918



Sources: Calculated by the author using HMD; Tompros, 'E epipolazousa nosos', pp.281-82.

Despite the probable censoring of the pandemic in the press, the Athenian press made some references to the course of the pandemic in various places of the country. Even so, those references were rather minimal considering the high mortality and the extent of the epidemic across the world. It seems, therefore, that both the state and the press attempted to conceal the extent of the pandemic in Greece. The unstable financial and political situation of the country in 1918 should be taken into consideration: Greece was in the middle of a turbulent period of continuous wars; the Balkan Wars and the First World War until earlier in 1918. A series of disagreements between the King and the Prime Minister E. Venizelos (the National Schism) took place in 1915 regarding the involvement of the country in the First World War and that deepened the political and financial crisis in Greece.[52]

After examining the press in Patras during the severe wave in October, Tompros argued that the press was used by the local authorities and/or the state as a suppressive measure to dampen people's fear, and they tried to mislead the population by minimizing the real extent of the outbreak. Strikingly, while the peak mortality was occurring in Patras, the press there discussed the decline of the prevalence of influenza in the city. Tompros suggested that the local press had presented inaccurate evidence by reducing the real number of deaths attributed to influenza at the time.[53] A similar practice would be expected to be found in other places of the country, but especially in those populations where the pandemic was very severe.

Due to the lack of sources, it is not known yet how the state dealt with the pandemic, if at all. Filtzos, however, discussed in his report the reaction of the state and the people:

> The people were alarmed and the sanitary authorities were constrained to carefully go into the matter and issue instructions as to the nature of the disease and the necessary steps to be taken to avoid contamination and complications .... People were then instructed to avoid overcrowded places ... they were further informed that coughing and sneezing were the means of spreading the diseases from person to person. Owing to these prophylactic measures, or rather to the lapse of time, the diseases began to decrease toward the middle of December.[54]

Among the limited references in the press, it was found that Athenian physicians and public health authorities suggested measures to prevent the transmission of the influenza virus. These measures included avoiding meetings or gatherings in closed settings, avoiding direct contact with ill people, eating a healthy diet, walking often in fresh open air, ventilating homes, and resting as needed.[55] In Athens, school closures and bans of public gatherings were implemented from the first period of the

[52] M. Mazower, *Greece and the inter-war economic crisis* (Oxford: Oxford University Press, 1991), pp.86-90.
[53] Tompros, 'E epipolazousa nosos', pp.276-77.
[54] Filtzos, 'Epidemic influenza', p.507.
[55] *Ethnos*, 7900, 10/10/1918; *Empros* 7907, 17/10/1918.

outbreak.[56] The Athenian press argued that the implementation of preventive interventions reduced the transmission of influenza.[57]

9.4 Conclusions

In this chapter, the mortality pattern in Hermoupolis during the 1918-19 influenza pandemic has been presented and discussed. This study is the first to employ historical demographic methods to explore the impact of the influenza on mortality in a Greek population. The lack of qualitative sources in Hermoupolis during the period of the pandemic is considered to be a significant limitation on the study of the impact of the pandemic in the city.

The time-series of P&I in Hermoupolis displays a prolonged and intense wave in the autumn of 1918, almost four weeks later than on the mainland, following most likely a pattern similar to that in other Aegean islands. The key findings presented in this chapter include the increase of mortality rates in every age-group and the W-shaped curve which was found when age-specific excess mortality due to P&I was plotted. In addition, excess mortality showed the highest increases among the elderly and young children and lower increases for young adults, unlike most of the studies so far.

Further studies are clearly needed for a more comprehensive understanding of the impact of the influenza pandemic in Greece.

The next chapter will discuss the main reasons for the high levels of mortality in Hermoupolis and also the factors which contributed to the mortality decline in the first half of the twentieth century.

[56] *Empros*, 7907, 17/10/1918.
[57] *Empros*, 7920, 30/10/1918.

Chapter 10. Discussion and conclusions

10.1 Introduction

In exploring the patterns of mortality in Hermoupolis, I have focused on its levels and trends over time. The first part of this chapter brings together the findings presented in the previous chapters and offers an outline of the reasons why high levels of mortality prevailed in Hermoupolis. The second part provides a comprehensive overview of the factors which reduced the mortality during the first four decades of the twentieth century by suggesting that a combination of agents were responsible for this decline rather than a single one.

The third part of this chapter presents the main findings that can be drawn from the current study and answers the research questions posed in the introductory chapter. A synthesis of the findings will reveal the first complete history of the mortality change and the epidemiological regime in the city of Hermoupolis. Finally, questions that either remain unanswered or were beyond the purposes of this study and could be tackled in future work are also posed.

10.2 Urban penalty in Hermoupolis

This study has confirmed the wide urban-rural differences that existed in Greece throughout the period under study. Comparisons of Hermoupolis's mortality rates with those of Mykonos, a semi-urban population for which continuous calculations are available and two rural communities in Paros, suggest that urban mortality in Hermoupolis was much higher than that of non-urban populations.

Urban excess mortality has been studied extensively in the northern European demographic literature. Various reasons have been proposed for it, including high population density which facilitated the transmission of infectious diseases, poor living standards and lack of sanitary reforms. It has been suggested that excess mortality in the cities could be partly explained by registration inaccuracies: discrepancies between the number of individuals at risk and their corresponding events. Extensive migration has been also found to have affected urban mortality rates.[1] Inaccuracy in registration, including under-registration and age-misreporting, has been studied significantly less. In any case, it is important to take into

[1] Revuelta & Ramiro, 'Understanding infant mortality', p.19.

consideration the possible effect of the aforementioned factors in the following discussion as mortality statistics are important to understand urban environments.[2]

For Greece, under-registration of vital events has been said to have been extensive in rural parts of the country.[3] This is partly due to the interruption of the collection of vital statistics by the Central Statistical Office during the period 1889-1920. In order to overcome the very high levels of under-registration especially in rural areas, Valaoras and Siampos based their calculations of the national rates on extensive assumptions and not actual data. High under-registration also accounted for the discrepancies found between the national average CDR, estimated by both Valaoras and Siampos, and that of Hermoupolis throughout the period under study. However, it seems that this urban-rural gap had been closed by the end of the study period with a significant reason being, among others, improvements in vital registration collection.

However, under-registration was also of great importance in the largest urban centres of the country. Recent studies have shown that registration in Athens, Volos and Patras was incomplete and therefore responsible for the inaccurate estimates.[4] In contrast, evidence from Hermoupolis's database suggests that registration was relatively complete and improved significantly over time (Chapter 2); the only possible source of the 'loss' of both births and deaths was that of infants who died within a few hours or days after their birth. To overcome this at least around the census years, dummy births were created and thereby it was possible to correct all the rates that have been presented in this study.

In addition, Hermoupolis was a city that had been built very rapidly without town planning as a result of the arrival of refugees and extensive in-migration in the 1820s. The city's population increased rapidly from 150 inhabitants in 1821 to around 14,000 in 1828. In the subsequent decades, the population continued to increase up to 1889, when it peaked at 22,000 inhabitants. The fact that Hermoupolis had a busy port and noteworthy industrial activity were among the main reasons for the high levels of in-migration in the second half of the nineteenth century, as calculated by Hionidou.[5] In-

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[2] Ibid., p.20.

[3] Valaoras, 'Adynamies ton leksiarhikon', p.429.

[4] Dimitropoulou, *Athènes au XIX^e^ siècle*, p.104; Eliopoulos, *Oikonomikes kai koinonikes domes,* p.103; Moustane, *Oi demographikes ekselikseis*, pp.206-7.

[5] Hionidou, 'Nineteenth-century urban', p.407.

migration was linked with increases in mortality in urban centres.[6] Consequently, in-migration may had played a crucial role in the evolution of mortality in Hermoupolis during the second half of the nineteenth century. If the deaths of those migrants were accurately reported in Hermoupolis, while these same migrants were not captured by the censuses, then mortality rates could be heavily overestimated. The increase in CDR in 1923 is very likely such an instance: the arrival of 7,000 Asia Minor refugees in 1922, whose deaths were captured in Hermoupolis but they were not included in the census until 1928. However, the possible effect of in- and out-migration in mortality patterns in Hermoupolis remains a topic for further exploration.

Another important reason for the excess urban mortality which has been found in the literature and also confirmed in this study is the existence of health institutions, including hospitals. Studies of London and several urban centres in Spain, including Toledo and Salamanca, have shown that a significant percentage of the deaths registered in those cities were actually deaths of rural residents.[7] The existence of foundling hospitals in the Spanish cities of Madrid and Palma de Mallorca, was associated also with increased infant mortality in those places.[8] Hermoupolis had the first hospital in modern Greece which accepted foundlings and placed them with hired wet-nurses. Whether the hospital served the whole island or whether residents of other islands had travelled to the city to seek medical care are still unknown.[9] Yet, most of them would go to Athens's hospitals, which were believed to be better than the provincial ones. In addition, most Catholics of Syros would go to the French Catholic hospital in Ano Syros, with their deaths being registered there, as they were buried in the Catholic cemetery. Moreover, foundling deaths accounted for almost 10 per cent of all annual infant deaths for most of the period prior to 1920.[10] Loukos has suggested that an increased care of infants from the mid-1910s onwards, including the establishment of a foundling hospital in 1920, may have contributed to the decline of illegitimate mortality and ultimately of infant mortality in Hermoupolis.[11] Whether

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[6] Farinas, 'Mortality in hospitals', p.401.
[7] Ibid., p.405; Mooney *et al.*, 'Patient pathways', p.247.
[8] Revuelta & Ramiro, 'Understanding infant mortality', p.33; Pujadas, *L'evolució de la mortalitat*, p.437.
[9] The hospital was found to have served not only the whole of the island but also patients who resided elsewhere before, during and after the famine period: Hionidou, '"It was a bridge from life to death"', p.365.
[10] HMD.
[11] Loukos, 'Ethelontikes syssomatoseis', p.66.

these infants were of rural origin is highly unlikely due to the fact that mothers wanted to retain their anonymity and to conceal their association with the illegitimate infants.

The most significant reason for the high mortality is considered to be the poor environmental and hygiene conditions which, in combination with the port character of the city, made Hermoupolis an unhealthy Greek urban centre. Even though periods of quarantine were imposed on all ships arriving from other areas, regular outbreaks of disease occurred in the city especially during the second half of the nineteenth century (Figure 10.1). The insufficient and filthy sewers and the mostly contaminated available water in the city were considered to be responsible for huge number of young children dying from diarrhoeal diseases and the dissemination of infectious diseases among all ages. However, the introduction of underground water-supply in Hermoupolis in the mid-1920s, although not expanded across the whole city, may have had an indirect impact on the amelioration of death rates in the city.

In addition, the very poor living standards, especially among the working classes, after the decline of Hermoupolis into an insignificant Greek city in the late nineteenth century caused Hermoupolis to experience the highest so far calculated levels of mortality in the country. Given that Hermoupolis was a city that was built very rapidly in the 1820s without town planning and limited space between the sea front and the hills, population density is expected to have contributed to the high prevalence of infectious diseases and therefore responsible for high levels of mortality but also morbidity. High density also seems to have affected workplace and housing.[12] As suggested by Haines, workplace was an especially effective focus of contagious diseases due to their unhealthy environment.[13] The very high levels of tuberculosis found in Hermoupolis is very likely to be the main outcome of the unhealthy workplace environment as confirmed by contemporary studies.

The findings of this study therefore suggest, following the European trends, that the unhealthy urban environment in Hermoupolis was responsible for reducing the survival of its inhabitants.[14] Hermoupolis, however, experienced a continuous decline in mortality during the first four decades in the twentieth century, the reasons for which are discussed in the next section.

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[12] Reher, 'In search of the 'Urban Penalty'', p.120.
[13] M. Haines, 'Conditions of work and decline of mortality', in R. Schofield, D. Reher & A. Bideau (eds), *The decline of mortality in Europe* (Oxford: Clarendon Press, 1991).
[14] Kearns, 'The urban penalty', pp.222-23; Szreter & Mooney, 'Urbanization, mortality', p.92; Reher, 'In search of the 'Urban Penalty'', pp.105-06; Woods, 'Urban-rural differentials', p.43.

10.3 Why did mortality decline in Hermoupolis?

Studies from North-western Europe in the late-nineteenth and the early-twentieth centuries suggest several factors that contributed to the decline in mortality: improved living standards and the associated improvement of nutritional status, sanitary reforms, improvements in personal sanitation and advanced medical technology. Each of these factors will be discussed separately in this section.

Sharp spikes can be seen when annual CDR is plotted in Figure 10.1. Such wide fluctuations in mortality have been characterised by Vallin as 'crises' which interrupted the 'normal' trajectory of mortality.[15] In Hermouplis, these erratic fluctuations were more frequent in the second half of the nineteenth century rather than in the first decades of the twentieth century. In my attempt to explore the reasons for these fluctuations, I employed various qualitative sources, including the local press and public health reports. Due to the lack of causes of death prior to 1916, I explored mortality by age-group for the years around the major fluctuations in order to identify which age-groups were most affected.

Almost annual outbreaks of childhood infectious diseases – including diphtheria, scarlet fever, measles and, of course, smallpox – were found to have been responsible for most of the fluctuations in CDR in the second half of the nineteenth century. During the 1890s, however, mortality among young children declined, most likely as a result of the mass immunisations which were implemented by the local medical authorities in collaboration with the local government since the 1880s (Figure 4.11). At the same time, Hermoupolis experienced a deep financial and social crisis as a result of losing its role as an important commercial and transit centre between the East and the West. Consequently, unemployment, out-migration and a worsening of living standards characterised the society. During the first decades of the next century, investments in the textile industry balanced the shrinkage in the local economy by reducing unemployment and out-migration. Even though evidence from the local press reveals that the lower social classes suffered throughout the interwar period, it is expected that these improvements in the local economy would have contributed to a possible amelioration of the living standards in the city.[16] I do not argue that this factor initiated any decline in mortality, but it may have helped to stabilise the rates. Besides, there is little evidence to suggest that the nutritional status changed either in

[15] Vallin, 'Mortality in Europe', p.43.

[16] See Chapter 2 for an extensive narrative of city's history from its creation until 1940.

the city or in the country before the 1950s.[17] However, after a period of recession in the Greek economy in the period 1929-1932 as a result of the Great Depression, both Fragkiades and Petmezas suggested that the agricultural productivity grew rapidly in the 1930s. Petmezas, nonetheless, questioned this increase by arguing that it "caused the regression of regional specialization and the exhaustion of the development potentialities for Greek agriculture".[18] However, Fragkiades pointed out that the decline in food imports was lower than the growth of agricultural output, resulting in improvements of nutritional sufficiency of the country. He also linked these improvements with the decline in mortality in the early 1930s.[19]

Increasing nutritional intake or changes in food consumption have been linked to the mortality decline in the European literature; yet, it has been a rather controversial issue. Different authors have made assumptions regarding several aspects including the amount of available land under cultivation, seed ratios and what proportion of different crops were used to feed the animals, or during the production or lost.[20] McKeown argued that improvements in nutrition increased resistance to infection and therefore had a major role in the mortality decline.[21] Floud et al. also found that average amount of calories consumed increased gradually over the eighteenth and nineteenth century in England and Wales, while Harris et al. pointed out that such changes may have contributed to mortality change.[22] On the other hand, it has been suggested that food availability declined dramatically in England and Wales during the nineteenth century, the time also of the mortality decline.[23] Whether food intake or agricultural production in Greece changed during the first half of the twentieth century is an intriguing issue which could be usefully explored in further research, although such changes do not seem to have taken place in in the city during that time.

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[17] Babanases, 'E diamorfose tes ftoheias', p.114; Gutenschwager, *E politike tes ygeias*, p.68.

[18] S. Petmezas, 'E Ellenike agrotike oikonomia sto Mesopolemo: e ekselikse ton perifereiakon anisoteton' (The Greek agricultural economy in the interwar period: the evolution of regional divergences), in D. Panayiotopoulos & D.P. Sotiropoulos (eds), *E Ellenike agrotike oikonomia kai koinonia kata te Venizelike periodo* (*The Greek agricultural economy and society during the Venizelos era*) (Athens: National Research Foundation 'Eleftherios K. Venizelos', 2007), p.88.

[19] Fragkiades, *Ellenike oikonomia*, p.140.

[20] B. Harris & J. Helgertz, 'Urban sanitation and the decline of mortality', *The History of the Family*, 24,2 (2019), p.210.

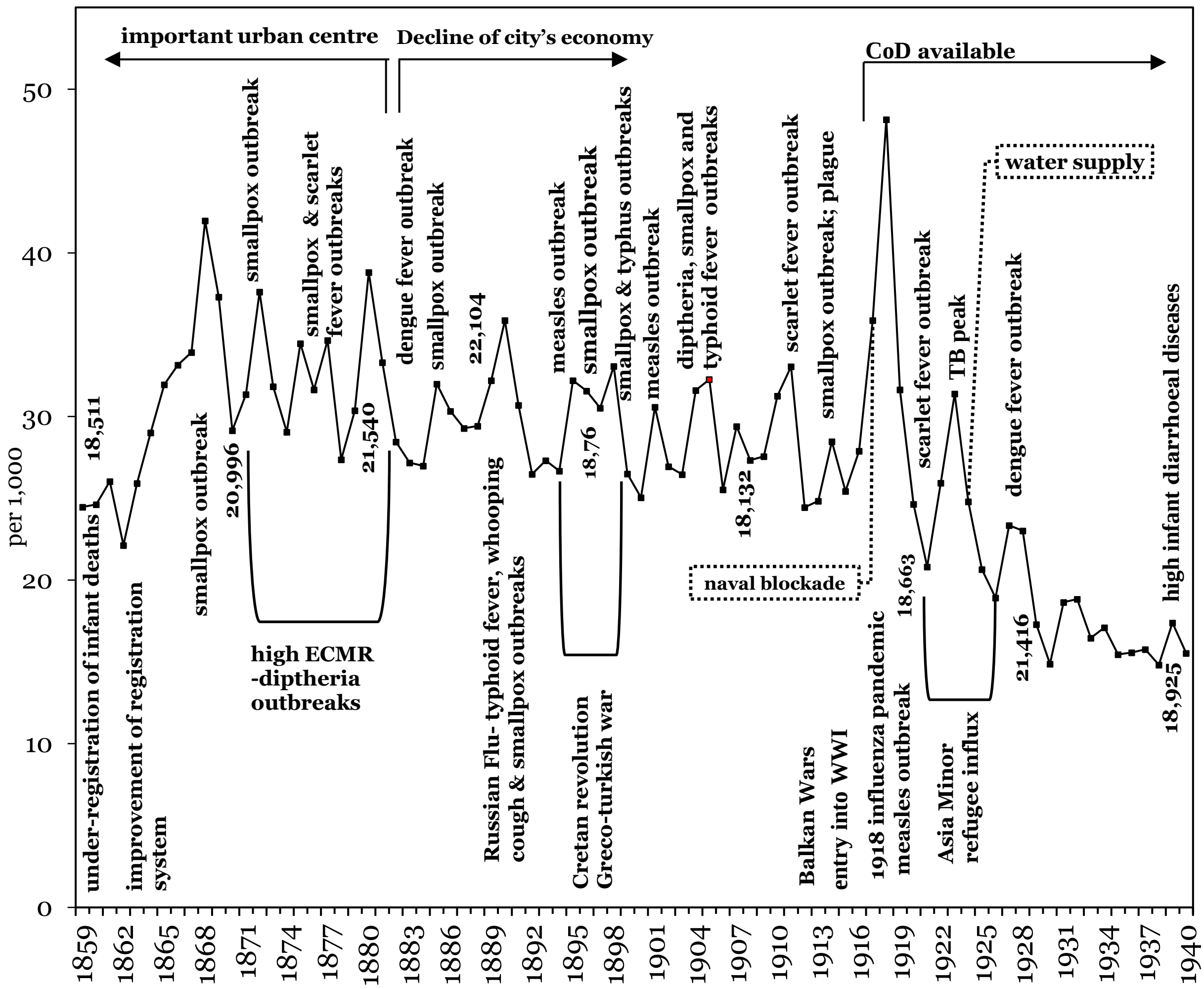
[21] McKeown, *The modern rise*, p.153.

[22] Floud *et al.*, *The changing body*, pp.151-64; B. Harris *et al.*, 'How many calories? Food availability in England and Wales in the eighteenth and nineteenth centuries', *Research in Economic History*, 31 (2015); Harris & Helgertz, 'Urban sanitation', p.210.

[23] D. Meredith & D. Oxley, 'Food and Fodder: Feeding England, 1700-1900', 222 (2014), p.212.

In addition, evidence from Hermoupolis showed that when mortality was declining, the lack of food seems to have interrupted that decline. In 1917, for instance, the increase in mortality was almost certainly the result of the naval blockade of part of the country which led to a food crisis, with Hermoupolis being particularly vulnerable due to the lack of extensive rural hinterland.[24] Finally, the significantly lower mortality in the rural parts of the island compared with those in Hermoupolis and Ano Syros before and during the 1941-43 famine was attributed, among other reasons, to the greater availability of food due to access to land.[25]

Figure 10. 1 Annual CDR in Hermoupolis including the main disease outbreaks and principal political events, 1859-1940



Sources: HMD; Newspapers: *Ermoupolis*; *Helios*; *Tharros*; *Panope*; *To Vema Ermoupoleos*; GSAS, YPA, *Etesia Ekthese* (1929-1940); *Minutes of the Municipal Council* (1859-1940).

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[24] Gallant, *Modern Greece*, p.137.

[25] Hionidou, *Famine and death*, pp.206-07, 164-65.

Other studies have attributed the decline in mortality in Greece especially after the 1920s to improvements in public health or medical care.[26] Nonetheless, very few studies have connected medical progress with mortality decline. Poppel et al. showed that even direct access to medical knowledge by medical practitioners before the twentieth century did not guarantee better health, as other factors such as living and working conditions may have influenced their survival prospects.[27] Easterlin pointed out that only quarantining, inoculation initially and then vaccination against infectious diseases had some effect on mortality decline.[28] Razzell has also argued the positive effect of inoculation against smallpox in the eighteenth and nineteenth century along with Mercer, who emphasized the impact of vaccination in the decline of infectious diseases.[29] Besides, even until the 1930s, physicians had relatively limited means of combating infectious diseases, which suggests the need for caution in attributing a positive effect of medical care on any decline in mortality. A report issued by the League of Nations in 1929 indicated that physicians' education and training in Greece were inadequate, especially regarding preventive medicine; that nurses were untrained; and, midwives were not supervised after their training. Most hospitals also lacked sufficient equipment and were overcrowded. The medical care system in Greece was said to be insufficient and dangerous.[30] But even if the hospitals in Greece did function properly, medicine was largely ineffective before the 1940s, so it could be expected that medical care had contributed only in a very limited way to any possible decline in mortality.[31] However, the fact that Hermoupolis had rather advanced medical services by Greek standards, including a hospital since the late 1820s, a dispensary and a sanatorium since 1921, a municipal health centre, a disinfection area and a very active medical association, should not be underestimated. Physicians had a very active role either by publishing reports in the local press regarding public hygiene and personal sanitation or by collaborating with the local authorities concerning

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[26] Bournova, *Oi katoikoi ton Athenon*, pp.76-78; S. Petmezas, 'Demographia' (Demography), in C. Hatziiosif (ed.), *Istoria tes Elladas tou 20ou aiona* (*The history of Greece in the 20th century*), vol. A (Athens: Vivliorama, 1999), p.43.

[27] F. van Poppel *et al.*, 'The life expectancy of medical professionals in the Netherland, sixteenth to twentieth centuries', *Population*, 71, 4 (2016), pp.634-35.

[28] Easterlin, Easterlin, 'How beneficent is the market?', pp.263-64.

[29] P.E. Razzell, 'An interpretation of the Modern Rise of Population in Europe, a critique', *Populastion Studies*, 28, 1(1974), p.11; A. Mercer, *Infections, chronic disease and the epidemiological transition* (Rochester: University of Rochester Press, 2014).

[30] Kapanides, *E kleiste perithalpse*, pp.201-02; Liakos, *Ergasia kai politike*, p.329; Theodorou & Karakatsani, 'Health policy', pp.63, 65.

[31] Riley, *Rising life expectancy*, p.96

improvements both in medical care and sanitation. The most effective achievement was the implementation of mass vaccinations, which more likely led to the onset of the mortality decline in Hermoupolis.

The largest body of the literature has attributed mortality decline to sanitary reforms. Particularly, a few studies have linked increases in expenditures on water supply and sanitary infrastructure with changes in mortality.[32] Improvements in both water supply and sewerage systems have also been associated with mortality decline in various countries.[33] Others studied the impact of specific measures such as filtration and chlorination of water on mortality.[34] Whether public health initiatives have been responsible for the mortality decline in Greece from the 1920s onwards has not been answered yet. Evidence from Hermoupolis indicates that such reforms did not initiate the mortality decline, which had already started by the beginning of the twentieth century. They might, however, have contributed to the stabilization of the rates or possible further declines.

In Hermoupolis, a water supply system was constructed in the mid-1920s, although oral histories have suggested that water was a 'luxury' commodity as it was not accessible by everybody even by the mid-1930s and they had to rely on public springs.[35] Similarly, in Athens, only by 1931 did 90 per cent of all the city's inhabitants had access to water (and then only for a few hours) on a daily basis.[36] Nonetheless, access to a water supply did not mean that the water was suitable for drinking. As found elsewhere, the very early stages of piped water often suffered from quality issues, making the water ineffective or even harmful.[37] In Hermoupolis, in addition to the water from the underground supply system or artesian wells, the residents stored rainwater in the private water cisterns which most houses had since the creation of the city.[38] All types of water were found to be contaminated in 1933 according to a contemporary report which examined the quality of both the available water supply

[32] Szreter, 'The importance of social', p.26; Cain & Rotella, 'Death and spending', p.147; Beach *et al.*, 'Typhoid fever, water quality', p.72; Chapman, 'The contribution of infrastructure', p.233; Harris & Hinde, 'Sanitary investment', p.28.
[33] Kesztenbaum & Rosenthal, 'Sewers' diffusion', p.182; Gallardo, 'Sanitary infrustractures', pp.27-28.
[34] Cutler & Miller, 'The role of public health', p.3.
[35] No.10.
[36] Maurogonatou, *E ydrodotese tes Athenas*, p.614.
[37] R.J. Evans, *Death in Hamburg: society and politics in the Cholera Years 1830-1910* (London: Penguin Books, 1990), pp.190-91; J. Peltola & S. Saaritsa, 'Later, smaller, better? Water infrastructure and infant mortality in Finnish cities and towns, 1870-1938', *The History of the Family*, 24, 2 (2019), pp.278, 292.
[38] GSAS, YPA, YP113, Alivizatos, *Ekthesis epi tes ydreuseos*.

and sewage disposal in Hermoupolis. The positive effect of chlorination of water on mortality decline in particular among infants and against water-borne diseases (especially typhus) has almost been widely established.[39] Even though it would be expected that a water chlorination system could potentially cause a rapid improvement in water also in Hermoupolis, such application was not introduced until 1940.

However, from the mid-1920s onwards, a very significant decline in CDR is clearly seen in Figure 10.1 but also in infant mortality (Figures 5.4 and 5.5), leading to even further falls during the following decade. The introduction of a water supply, therefore, in Hermoupolis, despite being contaminated, appears to have had a positive effect on the decline in mortality. Recent studies, however, showed that prevention of diarrhoeal diseases in childhood could result from a combination of water and sanitation intervention, as improved sanitation was found to have had greater effect on diarrhoeal diseases than improvements in water supply.[40] The limited sanitary intervention in the city may, therefore, explain the relatively high infant diarrhoeal mortality even until the late 1930s. Whether the decline in Hermoupolis was an immediate response to the direct and easier availability of water remains a topic for further exploration. Various studies have shown that mortality declined most rapidly in those areas that were the first to be connected to a water supply.[41] Evidence from Tartu in Estonia showed that lower IMR was experienced by families which had direct access to a water supply rather than those who acquired water from elsewhere, including surface water.[42] Further associations between parish information, available in the death registers and the expansion of the water supply in the city might establish stronger links and shed more light onto this significant finding.

Despite the positive impact of the introduction of a sewage disposal system on declining mortality rates found in various studies, such links were not identified in the case of Hermoupolis; on the contrary, it might actually have been one of the main factors which contributed to the high mortality patterns in the city throughout the

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[39] Cutler & Miller, 'The role of public health', p.3; Ferrie & Troesken, 'Water and Chicago's mortality transition', p.16; Peltola & Saaritsa, 'Later, smaller, better?', pp.289,298.

[40] J. Fuller *et al.*, 'The joint effect of water and sanitation on diarrhoeal diseases: a multicountry analysis of the Demographic and Health Surveys', *Tropical Medicine and International Health*, 20, 3 (2015), pp.284, 288; G. Fink *et al.*, 'The effect of water and sanitation on child health: evidence from Demographic and Health Surveys, 1986-2007', *International Journal of Epidemiology*, 40 (2011), p.1201.

[41] Cutler & Miller, 'The role of public health', p.3.

[42] Jaadla & Poor, 'The impact of water', p.176.

study period.[43] Hermoupolis had acquired a sewage disposal system by the mid-nineteenth century, although very limited improvements took place until the late 1930s. According to a contemporary physician in 1895, the complete lack of sewers in the city would be more beneficial than the ineffective current sewerage system, which was a foci of germs and infections.[44] Public open holes, situated on the main streets of the city were used by most inhabitants according to oral evidence, except for the upper-class households, which had obtained privately available water closets by the mid-1930s.[45]

Literature has shown that water supply and sewerage system were complementary to each other rather than substitutes.[46] In contemporary India, for example, interventions to provide toilets in the rural areas of the country failed mainly due to incomplete coverage, low usage of toilets but also lack of water supply.[47] Evidence from the US between 1880 and 1920 suggests that each intervention separately had only little effect, but in combination had a positive impact in the improvement of health and mortality decline.[48] The lack of water supply in Hermoupolis prior to the 1920s, therefore, might have been responsible for the ineffectiveness of the sewerage system there.

Increasing charitable activities by affluent inhabitants in Hermoupolis is of special importance as it played a very important role in local society by counterbalancing the ineffectiveness of the state and the local authorities. Philanthropic activity could actually be more beneficial for a medium-sized population such as that of Hermoupolis than for a larger society – such as Athens – where it could be expected to have had only a limited impact. According to a contemporary physician, Hermoupolis had a significant number of philanthropic foundations which played an important role in the protection and the care of young children.[49] The positive effect of the foundation of the organisation for the Welfare of Children (*Perithalpsis tou*

[43] Kesztenbaum & Rosenthal, 'Sewers' diffusion', p.182; Gallardo, 'Sanitary infrustractures', pp.27-28.
[44] *Praktika Iatrikes Etaireias Syrou*, p.46.
[45] No. 2, 4, 5 and 12.
[46] J. Helgertz & M. Onnerfors, 'Public water and sewerage investments and the urban mortality decline in Sweden, 1875-1930', *The History of the Family*, 24,2 (2019), pp.316-17.
[47] E. Duflo *et al.*, 'Toilets can work: Short and medium run health impacts of addressing complementary and externalities in water and sanitation', Working Paper no.21521 (Cambridge, MA: NBER, 2015), p.12.
[48] M. Alsan & C. Goldin, 'Watersheds in child mortality: the role of effective water and sewerage infrastructure, 1880 to 1920', Working Paper no.21263 (Cambridge, MA: NBER, 2015), p.4.
[49] Arfanes, 'E fymatiosis en Syro', pp.4-5.

Paidos) in 1914 and the Hermoupolis foundling hospital in 1920 on the decline in infant mortality seems to be a very significant indication of the association between the local philanthropy and the evolution of mortality in a relatively medium-sized population. The positive impact of charitable provision in young children, often overlooked in the literature, has been also found elsewhere. More specifically, day nurseries of charitable origin were proved to be beneficial for working class children in West London at the turn of the twentieth century, by allowing mothers of those children to work outside their home, fulfilling therefore a need that the local state was unwilling to meet.[50]

I therefore suggest that a combination of these factors may have increased awareness of the importance of personal sanitation among the citizens. Even though this is a factor which is very difficult to explore, it seems that the inhabitants of Hermoupolis started to take care of their personal hygiene in order to overcome the bad housing and the ineffectiveness of the local authorities. The availability of water seems to have increased sensitivity towards personal hygiene. Evidence from Hermoupolis seems to be in line with Floris and Staub, who, by examining the impact of sanitary interventions in seven Swiss cities between 1876 and 1901, found also that such reforms increased attention on hygienic practices, among other.[51] People in Hermoupolis were aware that the groundwater was contaminated, and for this reason they had to rely on the public springs on the island or water cisterns for potable water, as mentioned in oral histories.[52] Nonetheless, due to frequent droughts in the Cyclades during the summer months, it is expected that inhabitants of Hermoupolis acquired water from other sources, which in most cases were contaminated.[53] Research from Sub-Saharan Africa has shown that lack of water during the dry seasons led to higher prevalence of diarrhoea resulted from higher consumption of contaminated water but also it has been related to reduced hygiene practices.[54] Therefore, this is more likely to

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[50] G. Mooney & A. Tanner, 'Infant mortality, a spatial problem: Notting Dale Special Area in George Newman's London', in E. Garrett, C. Galley, N. Shelton & R. Woods (eds), *Infant mortality: A continuing social problem* (Aldershot: Ashgate, 2006), pp.170,171,187.

[51] J. Floris & K. Staub, 'Water, sanitation and mortality in Swiss town in the context of urban renewal in the late nineteenth century', *The History of the Family*, 24, 2 (2019), p.267.

[52] No. 11.

[53] According to a recent study, which employed historical data series for the period 1955-2002 to study the frequency of droughts in various places in Greece, Cyclades experienced frequent drought events that lasted up to 5 years and also severe drought events up to 2 years: D. Tigkas, 'Drought characterisation and monitoring in regions of Greece', *European Water*, 23/24 (2008), p.34.

[54] S. Bandyopadhyay, S. Kanji & L. Wang, 'The impact of rainfall and temperature variation on diarrheal prevalence in Sub-Saharan Africa', *Applied Geography*, 33 (2012), pp.70-71.

be one of the reasons for the high incidence of infant diarrhoeal diseases over the summer months.

The local press had been reporting on the filthiness of the streets and districts in Hermoupolis since the mid-nineteenth century, but these reports had disappeared or at least reduced significantly by the end of the study period. For all these reasons, I argue that improved cleanliness resulted from the introduction of a central water supply in the city. According to oral histories, working-class residential areas were exceptionally clean in the 1930s:

> *Q*. Right. Do you remember the city? Back then in the 1930s how was it [the city]? ... Was it clean?
>
> *A*. Here the city?
>
> *Q*. Yes.
>
> *A*. Whatever I tell you, you might think [that it is] an exaggeration. I tell you this attribute [fact] that in 1945, '46, after the liberation in other words ... an inspector came ... and we went to the neighbourhoods [around the city]. He was stunned by the cleanliness ... here in Vrontado [area]. Because these were the poor [social] classes. The cleanliness was inside [part of the idiosyncrasy of] the inhabitants of Syros. It made him [he was impressed], he said 'I have been, because of my status [profession], around the whole of Greece', he said, 'I haven't seen this [level of cleanliness]' ... In simple [poor] houses. To see the whitewash. Up here in Ano Syros, in Vrontados [area] where the Anastase [area/church] is, where you see that, they were indeed poor but clean people.[55]

Even though that interview referred to the mid-1940s, I expect that the same applied to the previous decade. Another informant said that the city back then was found to be even cleaner than nowadays [the date of the interview, 2000]:

> *Q*. Will you tell me, was the city clean back then? How was it [the city]? Was it clean?
>
> *A*. The city was [then] cleaner than now.
>
> *Q*. Yes?
>
> *A*. Cleaner than now.[56]

[55] No. 1.

[56] No. 11.

Finally, an oral account has suggested that these areas remained clean thanks to the initiative of individual housewives:

> *Q*. How was the city at that time? Was it clean …?
>
> *A*. It was clean, certainly. Here the following was prevalent [it was very common]. Because as you have seen Hermoupolis has [is] about 80 per cent steps and slopes, there neither cars were passing nor … Even today the local authority collects the rubbish from these neighbourhoods with a donkey … Well, all the cleaning was done by the housewives. That is to say, they [housewives] went outside their houses and one next to each other were cleaning the whole area, it was very clean. Not just clean. Later on, when 'civilization' [modernity] arrived, dirt also started.
>
> *Q*. Was it the same in Ano Syros or are you not aware?
>
> *A*. Certainly, certainly. The same also in Ano Syros, it was a model of cleanliness, as it is also today. The same is also today, that is the housewives in Ano Syros were real role models. [57]

The current study has therefore shown that cultural factors may have played a crucial role in the changes in mortality in Hermoupolis during the period under study. This aspect seems to have been under-examined or underestimated in previous demographic studies, but it seems to be of very special importance in Greece. The significance of cultural factors was also emphasized by Schofield and Reher, who concluded that:

> In the long run, cultural factors were essential for the breakthrough in the fight against high mortality. Once people, and local and national authorities, became aware of the importance of health and sanitation, numerous obstacles to the decline of mortality were removed. Education and culture may not have been the only elements in the mortality transition, but their importance was far from negligible.[58]

Finally, in addition to the factors discussed above, fertility may also have been responsible for the decline in infant mortality in the 1930s, while fertility seems to have been the product of the fall in early childhood mortality in the late nineteenth century.

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[57] No. 13.

[58] Schofield & Reher, 'The decline of mortality', p.17.

To sum up, evidence from Hermoupolis suggests that a combination of reasons contributed to the significant decline in mortality in the early twentieth century, a shift in mortality that had started in the last decade of the nineteenth century most likely as a result of the vaccination of young children.

The next two sections summarise the main findings of this study and pose further questions for future research.

10.4 Main Findings

The demographic history of urban mortality in nineteenth and early-twentieth-century Greece has rarely been explored. The results from the current study indicate that mortality decline in Hermoupolis had started by the end of the nineteenth century: young children benefited initially, adults and infants followed. This study is the first attempt to apply demographic methods to study the patterns of mortality in a Greek urban centre for such a long period of time using individual-level civil registration data. This thesis challenges the existing view in the Greek literature regarding the reasons which initiated the decline in mortality in Greek cities and introduces the urban-rural debate into the Modern Greek literature.

Hermoupolis enjoyed the prosperity of an important nineteenth-century centre in the Eastern Mediterranean basin. Hermoupolis from its creation in 1821 to the late 1820s experienced a significant increase in its population through migration, transforming it into the first urban centre of the country. By the mid-nineteenth century, Hermoupolis had developed into the second most populated city in Greece, only second to Athens. It was also by far the most important port and one of the biggest industrial centres in modern Greece. By the late nineteenth century and as a result of the rise of other ports and industrial centres in the Greek mainland, the city started to lose its importance and in the early twentieth century it had been relegated to a provincial, rather insignificant Greek city and port, albeit with extensive administrative responsibilities as the capital of the Cyclades islands. Hermoupolis, however, developed a significant textile manufacturing industry in the first decades of the twentieth century, which reduced partly the recession of the previous decades.

Hermoupolis was chosen for this study not only because it was one of the most important nineteenth-century Greek cities experiencing very high mortality but also because of the unique civil registration sources which it possesses. The availability of individual civil registration data in an urban centre is very rare not only in Greece but also in other Mediterranean European communities and even in nineteenth-century Northern Europe, where data is usually available but not accessible.[59] Nonetheless, the use of individual civil registration records has been recently a growing trend in historical demographic studies. This study, therefore, underscores the great importance of employing individual-level civil registration data in historical demographic analysis. All individual-level death records in Hermoupolis from 1859 to 1940 were transcribed into a database, making it the largest and one of the longest time-series ever constructed for the study of mortality patterns in Greece. The technique of nominal record linkage was employed in order to examine the quality of the Hermoupolis sources, to detect the extent of under-registration and to correct the IMR for every census year. A series of abridged life-tables was also constructed for the first time for a Greek urban settlement, enabling the calculation of age- and sex-specific mortality rates and life expectancies.

Hermoupolis's CDR was found to have been much higher than the national average and the highest yet calculated rate in Greece in almost every census year from the mid-nineteenth century until 1940, although similar levels were found in unhealthy urban centres in England and Wales and in Germany in the nineteenth century. Comparisons of Hermoupolis with semi-urban (Mykonos) and rural (Paros) populations suggest that an urban penalty was clearly operating in Greece even during the first decades of the twentieth century, most likely as a result of insufficient sanitary infrastructure, low living standards, unhealthy working conditions and in-migration. Life expectancy at birth in Hermoupolis was significantly lower than any other available rate that has been calculated for Greek populations. Confirming the assumptions made by Valaoras and Siampos about the timing of the mortality decline, Hermoupolis's time-series show that a declining trend was underway by the beginning of the twentieth century or even the late nineteenth century as a result of falls in early-childhood mortality. The mortality of young children was found to have been high, just as it was in nineteenth-century Italy, Spain and neighbouring Mykonos, until the 1920s, accounting for a very high proportion of the general mortality in the second half of the nineteenth century

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[59] Notable exceptions in the Mediterranean basin are *Mykonos*: continuous individual civil registration records are available since 1859, Hionidou, *The demography of a Greek island*; *Alghero, Sardinia*: Individual life histories for infants and young children were recently constructed from civil registration and a combination of other data, Breschi *et al.*, 'A slow transition', p.120; and, *Palma de Mallorca*: parish, burial and civil registers were employed to study infant and childhood mortality, Pujadas, *L'evolució de la mortalitat*.

and confirming the Mediterranean model as has been introduced in the literature.[60] A very strong correlation was found between ECMR and both e_0 and e_{20} (Figures 4.18 and 4.19). The decline of ECMR was probably a result of the mass immunization of the young children in Hermoupolis, although outbreaks continued to occur in the city until the end of the study period as a consequence of the lack of public hygiene (Figure 10.1). Another reason for the decline in early childhood mortality may lie with changes in the virulence of some childhood diseases, as suggested by Woods for England and Wales in the second half of the nineteenth century.[61]

Despite the importance of the early-childhood mortality in Hermoupolis, infant mortality also played a significant role in the evolution of mortality during the study period. IMR was found to be at exceptionally high levels – reaching 250 per thousand in 1896 and 1907. Fluctuations in post-neonatal mortality were responsible for the variations in the levels of IMR throughout the period under study. The evolution of infant mortality seems to have been consistent with the fluctuations in living standards: when the economy of the city declined, IMR increased dramatically. However, Hermoupolis experienced an early decline in 1920, which seems to be a rather unexpected occurrence if one considers that the period 1912-1922 was one of the most turbulent in the history of modern Greece. The calculation of the Linked IMR around the census year does not capture all the fluctuations in infant mortality that may have occurred throughout the study period. Yet, the five-year moving average Reported IMR showed that the decline had started already in the 1910s (Figure 5.5). A similar trend occurred in the rural community of Naousa on the neighbouring island of Paros at the same time and this probably reflects that fluctuations in infant mortality depended to a significant degree on local factors. Two possible explanations for the early decline in infant mortality have been proposed: first, the change in the registration of stillbirths in 1912 seems to have contributed partly to the lower levels of infant mortality. Second, it seems that infants especially in the lower classes received better care as a result of an increased interest of local philanthropy. Loukos also suggested that the establishment of a local foundling hospital in 1920 was the main reason for the decline in foundling mortality, as those infants received better care and nourishment. Evidence from the HMD confirms that in the period 1920-1940, the number of foundlings dying in Hermoupolis was much lower than that in the pre-

[60] Pozzi, 'The determinants of infant', pp.77-86; Ramiro & Sanz, 'Childhood mortality', pp.235-67.
[61] Woods, 'On the historical relationship', p.215.

1920 period. Therefore, it is believed that such changes may have led to significant declines in infant mortality. A further study, however, of the illegitimate mortality in Hermoupolis may expose the links with the evolution of infant and childhood mortality in the city.

A further decline in IMR in Hermoupolis occurred in the 1930s, confirming other studies of Greek populations which have found similar patterns. After examining the different factors which might have contributed to the decline in IMR, including sanitary reforms, female literacy and breastfeeding practices, this study confirmed Hionidou's findings for Mykonos that following the earlier fall in early childhood mortality, fertility declined and in turn triggered the decline in IMR.

Concerning the mortality among other age-groups, when age-specific death rates were plotted, the generally expected U-shaped curve was clearly visible in every census year for which life-tables were constructed. Mortality among men was also found to be consistently higher than that of women, as greater gains in life expectancy occurred among women.

Mortality levels were found to be high throughout the period under study, partly as a result of the lack of public hygiene in the city. For the first time, a study has explored in depth public health in a Greek urban settlement outside Athens. Greek governments rarely undertook initiatives to improve public health in the country. Instead, local authorities had to take care of sanitary reforms and health-care. Hermoupolis had a hospital as early as 1827, the largest quarantine area in Greece by 1842 and a strong association of physicians from the mid-nineteenth century. Even though the local government attempted to improve public hygiene in the city, the lack of a water supply system, the inefficient sewage disposal, bad housing and the very poor living standards among the working classes resulted in frequent outbreaks of infectious diseases and the prevalence of diarrhoeal diseases, especially among children. The only significant public health measures were quarantines imposed on ships arriving from countries that had been affected by plague or cholera and also the systematic vaccination programmes from the late-1880s onwards, primarily among young children. Although Hermoupolis had one of the oldest sewerage systems in modern Greece, it seems that no improvements in sewage management took place in the city until 1940. Based on evidence from the local press, various reports on public health and oral accounts, this study found that the existing sewerage system in Hermoupolis was partly responsible for the high mortality due to infectious and diarrhoeal diseases among all ages but especially among young children, unlike other studies which have found a positive link between the introduction of sewerage system and declining mortality.[62] The non-existence of a piped water supply in the city prior to the 1920s is more likely to be responsible for ineffectiveness of the sewerage system, as there is enough evidence to suggest that they were complimentary to each other, confirming other studies.[63] Residents of Hermoupolis got their water mainly from artesian wells and private water cisterns which collected rainwater. Many inhabitants also relied on public springs for potable water. Furthermore, an underground water supply system was constructed in the city in the mid-1920s. Oral accounts refer to restricted access to the water supply even until the mid-1930s. However, a significant decline in mortality followed the introduction of the underground system. No further links have been established due to the lack of further evidence. Nevertheless, the findings of this study suggest that wider access to water, irrespective of its quality, may have enabled improvements in personal hygiene among the residents of Hermoupolis and consequently to have had a significant effect on levels of mortality. Hermoupolis's findings, therefore, are in accordance with many studies regarding the positive impact of the introduction of underground water supply system; yet, exploring further links between the parish information and the underground system will enhance our understanding of the actual effect of the water sypply to Hermoupolis's inhabitants.[64] Finally, the rather active philanthropy – mainly by affluent citizens – played a crucial role in the improvement of living standards among poor families, especially in terms of taking care of young children, but primarily infants, whose mothers worked outside their home.

Using a variety of demographic measures including cause-specific mortality analysis by age-group and sex, the disease panorama in Hermoupolis from 1916 to 1940 – when cause of death data is available – was established. The high prevalence of infectious diseases as well as the relatively low e_0 suggest that the second stage of Omran's epidemiologic transition 'age of receding pandemics' was still ongoing. However, the significant decline of infectious diseases by the final years of the study period may indicate that the second stage was in its final phase. Analysis by age-group showed that mortality due to diarrhoeal diseases was very high among young children and infants, high rates of infectious mortality were found among adults, while the elderly

[62] Kesztenbaum & Rosenthal, 'Sewers' diffusion', p.182; Gallardo, 'Sanitary infrustractures', pp.27-28.
[63] Helgertz & Onnerfors, 'Public water and sewerage investments', p.330; Duflo *et al.*, 'Toilets can work', p.12; Alsan & Goldin, 'Watersheds in child mortality', p.4.
[64] Meckel, 'Immigration, mortality and population', p.404; Cutler & Miller, 'The role of public health improvements', p.3; Macassa *et al.*, 'The impact of water supply', p.532

died primarily from unspecified causes of death such as 'old age' and from circulatory diseases.

Diarrhoeal diseases were found to have caused almost half of the infant deaths in Hermoupolis from 1916 to 1940 and about 40 per cent of young children aged 0-4 years. Hermoupolis's results, therefore, confirm findings from other studies regarding the high infant and childhood mortality due to diarrhoeal diseases.[65] Evidence from the local press also showed that diarrhoeal mortality among infants was very common throughout the study period. After the implementation of mass immunizations in the city, leading to less frequent outbreaks of the typical childhood infectious diseases, diarrhoeal diseases were found to be the main killer among young children. Seasonality analysis showed that hot and dry summers in combination with poor hygiene killed a large number of infants. Similar results have been found on the neighbouring islands of Mykonos and Paros but also in other Mediterranean communities.[66] Most young children seem to have survived the hot summers and then died in September. Most infants in Hermoupolis were breastfed for at least 8 to 12 months as indicated in the oral histories. However, most infants dying from diarrhoeal diseases were less than 8 months old, so they died while they were still breastfed. The most possible explanation for this rather unexpected phenomenon is the lack of clean water because when supplementary nourishment – either animal milk or powdered milk – was given to infants, it was mixed with mostly contaminated water. The frequent summer droughts in Hermoupolis, as in most Greek islands, forced inhabitants of Hermoupolis to use whatever water was available.

Tuberculosis was the main killer among young adults in Hermoupolis, confirming contemporary studies regarding the exceptionally high levels of tuberculosis mortality in Hermoupolis when compared with the levels of other Greek populations. Other age-groups which were also affected were infants and the elderly. The peak in tuberculosis mortality was reached in 1923, after the arrival of destitute refugees on the island. High levels, still prevalent in the late 1920s must have resulted from the insufficient sanitary reforms, low living standards, poor nutrition, overcrowding and poor housing. Unhealthy working conditions in the local textile factories in the first decades of the twentieth century may have also contributed significantly to the high levels of

[65] Rollet, 'Childhood mortality in high-risk groups'.
[66] Caselli, 'Long-term trends', p.19; Hionidou, *The demography of a Greek island*, p.48; Gavalas, *Demographic reconstruction*, p.219.

tuberculosis in the city. Possible improvements in working conditions in those factories, as part of a national state attempt to enforce hygiene regulations in the industrial workplace, may have led to significant declines in tuberculosis mortality in the 1930s. Nonetheless, further research and links with occupations provided in the civil registration are needed to shed more light in the patterns of tuberculosis mortality in Hermoupolis.

Exceptionally high mortality levels were found during the 1918 influenza pandemic, for which very limited work is available in Greece. Hermoupolis's time-series demonstrated that a prolonged and intense wave took place in late November/early December 1918 – four weeks later that on the Greek mainland – following a similar trend to the rest of the Aegean islands. Mortality increased within every age-group during the pandemic and the W-shaped curve was also confirmed when age-specific excess mortality due to pneumonia and influenza was plotted. Finally, the limited references to the pandemic in the Athenian press – no qualitative sources are available in Hermoupolis – suggest that the Greek government censored the news because of the turbulent situation in the country at the time.

10.5 Further questions

Before concluding this thesis, it is important to discuss which aspects of this subject have not been discussed yet and the future research questions that arose after the discussion of the main findings. Information available in the HMD but not utilised in this study includes occupations and parishes, although neither is consistently available. For instance, continuous reports of parish information are more systematically available from 1916 onwards. Mortality rates by parish should reveal more secure findings concerning the impact of the water supply; in other words, it might be possible to link the availability of water in specific areas and therefore ascertain whether mortality first declined within those neighbourhoods. Furthermore, information on occupation will provide evidence to examine whether differences in employment affected mortality in Hermoupolis. Such links will contribute to our knowledge and will shed more light on mortality attributed to specific causes of death, for instance tuberculosis, which is closely associated with the working environment.

In addition, the unique Hermoupolis hospital patients' nominal registers will be employed in the future to understand more fully the mechanisms of mortality decline by looking at the extent and types of diseases suffered by the population of the city and for which the population sought help from the hospital, producing therefore even better insights into the public health levels of the city. Information on the origin and residence of the patients from the available hospital records will also enable an investigation into whether patients from other parts of the island or from other islands used the hospital and also an understanding of the actual contribution of the hospital deaths to the mortality levels in Hermoupolis. This is a very rich source which, in combination with the results of the current study, is expected to improve our understanding not only of the mortality but also the morbidity levels of the city's population.

This has been the first study of urban mortality in Greece using historical demographical methods. Up to now, the lack of similar studies has constrained the examination of the mortality patterns in Greece as a whole. Consequently, additional long-term studies should provide supplementary evidence regarding the mortality transition and the epidemiologic panorama and contribute to the Greek urban-rural debate, which has been developed and studied thoroughly in this study.

Appendix

Table 1a Male life table in 1861, Hermoupolis

x	$_nM_x$	$_nq_x$	$_np_x$	$_nl_x$	$_nd_x$	$_nL_x$	$_nT_x$	$_ne_x$
0	0.61736	0.19080	0.80920	100000	19080	82828	3504929	35.0
1-4	0.05813	0.20407	0.79593	80920	16512.99	284048.8	3422101	42.3
5-9	0.00850	0.04161	0.95839	64407.01	2679.882	315335.4	3138053	48.7
10-14	0.00394	0.01953	0.98047	61727.13	1205.431	305622.1	2822717	45.7
15-19	0.01146	0.05572	0.94428	60521.7	3372.274	294177.8	2517095	41.6
20-24	0.01923	0.09176	0.90824	57149.42	5243.873	272637.4	2222917	38.9
25-29	0.00570	0.02811	0.97189	51905.55	1459.25	255879.6	1950280	37.6
30-34	0.00975	0.04758	0.95242	50446.3	2400.205	246231	1694400	33.6
35-39	0.00802	0.03929	0.96071	48046.1	1887.738	235511.1	1448169	30.1
40-44	0.01261	0.06111	0.93889	46158.36	2820.553	223740.4	1212658	26.3
45-49	0.01660	0.07968	0.92032	43337.81	3453.223	208056	988917.8	22.8
50-54	0.02693	0.12618	0.87382	39884.58	5032.513	186841.6	780861.8	19.6
55-59	0.02593	0.12175	0.87825	34852.07	4243.347	163652	594020.2	17.0
60-64	0.03271	0.15119	0.84881	30608.72	4627.675	141474.4	430368.2	14.1
65-69	0.03551	0.16307	0.83693	25981.05	4236.786	119313.3	288893.8	11.1
70-74	0.04493	0.20198	0.79802	21744.26	4391.994	97741.33	169580.5	7.8
75+	0.24154	1.00000	0.00000	17352.27	17352.27	71839.14	71839.14	4.1

Table 1b Female life table in 1861, Hermoupolis

x	${}_nM_x$	${}_nq_x$	${}_np_x$	${}_nl_x$	${}_nd_x$	${}_nL_x$	${}_nT_x$	${}_ne_x$
0	0.54487	0.19080	0.80920	100000	19080	82828	3767940	37.7
1-4	0.04798	0.17211	0.82789	80920	13927.21	290254.7	3685112	45.5
5-9	0.00690	0.03393	0.96607	66992.79	2273.35	329280.6	3394857	50.7
10-14	0.00688	0.03381	0.96619	64719.44	2188.225	318126.6	3065577	47.4
15-19	0.00805	0.03945	0.96055	62531.21	2466.815	306489	2747450	43.9
20-24	0.01431	0.06908	0.93092	60064.4	4148.991	289949.5	2440961	40.6
25-29	0.01308	0.06331	0.93669	55915.41	3539.964	270727.1	2151011	38.5
30-34	0.01017	0.04958	0.95042	52375.44	2596.604	255385.7	1880284	35.9
35-39	0.01068	0.05201	0.94799	49778.84	2589.103	242421.4	1624899	32.6
40-44	0.01156	0.05616	0.94384	47189.74	2650.025	229323.6	1382477	29.3
45-49	0.01626	0.07813	0.92187	44539.71	3479.935	213998.7	1153154	25.9
50-54	0.00825	0.04044	0.95956	41059.77	1660.31	201148.1	939154.9	22.9
55-59	0.02924	0.13626	0.86374	39399.46	5368.384	183576.4	738006.8	18.7
60-64	0.01669	0.08010	0.91990	34031.08	2725.796	163340.9	554430.4	16.3
65-69	0.02856	0.13330	0.86670	31305.28	4172.923	146094.1	391089.5	12.5
70-74	0.07096	0.30136	0.69864	27132.36	8176.492	115220.6	244995.4	9.0
75+	0.14607	1.00000	0.00000	18955.87	18955.87	129774.8	129774.8	6.8

Table 1c Both sexes life table in 1861, Hermoupolis

x	$_nM_x$	$_nq_x$	$_np_x$	$_nl_x$	$_nd_x$	$_nL_x$	$_nT_x$	$_ne_x$
0	0.57973	0.19080	0.80920	100000	19080	82828	3642533	36.4
1-4	0.05301	0.18810	0.81190	80920	15220.86	287149.9	3559705	44.0
5-9	0.00767	0.03765	0.96235	65699.14	2473.469	322312	3272555	49.8
10-14	0.00567	0.02797	0.97203	63225.67	1768.224	311707.8	2950243	46.7
15-19	0.00940	0.04592	0.95408	61457.45	2822.317	300231.5	2638535	42.9
20-24	0.01660	0.07968	0.92032	58635.13	4672.137	281495.3	2338304	39.9
25-29	0.00865	0.04233	0.95767	53963	2284.352	264104.1	2056809	38.1
30-34	0.00990	0.04833	0.95167	51678.64	2497.539	252149.4	1792704	34.7
35-39	0.00911	0.04452	0.95548	49181.11	2189.379	240432.1	1540555	31.3
40-44	0.01182	0.05739	0.94261	46991.73	2696.722	228216.8	1300123	27.7
45-49	0.01601	0.07698	0.92302	44295	3409.915	212950.2	1071906	24.2
50-54	0.01720	0.08246	0.91754	40885.09	3371.526	195996.6	858955.9	21.0
55-59	0.02740	0.12820	0.87180	37513.56	4809.099	175545.1	662959.3	17.7
60-64	0.02491	0.11725	0.88275	32704.46	3834.688	153935.6	487414.2	14.9
65-69	0.03226	0.14927	0.85073	28869.78	4309.535	133575	333478.6	11.6
70-74	0.05737	0.25087	0.74913	24560.24	6161.32	107397.9	199903.6	8.1
75+	0.19890	1.00000	0.00000	18398.92	18398.92	92505.69	92505.69	5.0

Table 2a Male life table in 1870, Hermoupolis

x	${}_nM_x$	${}_nq_x$	${}_np_x$	${}_nl_x$	${}_nd_x$	${}_nL_x$	${}_nT_x$	${}_ne_x$
0	0.23299	0.18700	0.81300	100000	18700	83170	2746276	27.463
1-4	0.08882	0.29286	0.70714	81300	23809.61	268056.9	2663106	32.757
5-9	0.01571	0.07560	0.92440	57490.39	4346.114	276586.7	2395049	41.660
10-14	0.00843	0.04126	0.95874	53144.28	2192.887	260239.2	2118462	39.862
15-19	0.01056	0.05144	0.94856	50951.39	2621.151	248204.1	1858223	36.471
20-24	0.01675	0.08036	0.91964	48330.24	3883.9	231941.5	1610019	33.313
25-29	0.01086	0.05287	0.94713	44446.34	2349.904	216357	1378078	31.005
30-34	0.01203	0.05841	0.94159	42096.44	2459.037	204334.6	1161721	27.597
35-39	0.01884	0.08995	0.91005	39637.4	3565.459	189273.4	957386.1	24.154
40-44	0.01618	0.07776	0.92224	36071.94	2804.798	173347.7	768112.8	21.294
45-49	0.01691	0.08111	0.91889	33267.15	2698.153	159590.3	594765.1	17.878
50-54	0.05524	0.24270	0.75730	30568.99	7419.159	134297.1	435174.7	14.236
55-59	0.03935	0.17911	0.82089	23149.83	4146.338	105383.3	300877.7	12.997
60-64	0.06075	0.26370	0.73630	19003.5	5011.151	82489.6	195494.3	10.287
65-69	0.04361	0.19662	0.80338	13992.35	2751.193	63083.74	113004.7	8.076
70-74	0.17042	0.59754	0.40246	11241.15	6716.997	39413.27	49920.99	4.441
75+	0.43056	1.00000	0.00000	4524.156	4524.156	10507.72	10507.72	2.323

Table 2b Female life table in 1870, Hermoupolis

x	${}_nM_x$	${}_nq_x$	${}_np_x$	${}_nl_x$	${}_nd_x$	${}_nL_x$	${}_nT_x$	${}_ne_x$
0	0.164425	0.187	0.813	100000	18700	83170	2974665	29.74665
1-4	0.100697	0.32439	0.67561	81300	26372.94	261904.9	2891495	35.56574
5-9	0.009526	0.04652	0.95348	54927.06	2555.21	268247.3	2629590	47.87422
10-14	0.005799	0.028578	0.971422	52371.85	1496.705	258117.5	2361343	45.08801
15-19	0.006795	0.033406	0.966594	50875.15	1699.556	250126.8	2103225	41.34092
20-24	0.008414	0.041203	0.958797	49175.59	2026.175	240812.5	1853098	37.6833
25-29	0.010346	0.050424	0.949576	47149.42	2377.459	229803.4	1612286	34.19525
30-34	0.012924	0.0626	0.9374	44771.96	2802.712	216853	1382482	30.87831
35-39	0.010954	0.05331	0.94669	41969.24	2237.397	204252.7	1165629	27.77342
40-44	0.019169	0.09146	0.90854	39731.85	3633.869	189574.6	961376.7	24.19663
45-49	0.014471	0.069829	0.930171	36097.98	2520.701	174188.1	771802.2	21.38076
50-54	0.033958	0.156504	0.843496	33577.28	5254.989	154748.9	597614	17.79817
55-59	0.007887	0.038671	0.961329	28322.29	1095.243	138873.3	442865.1	15.63663
60-64	0.046524	0.208382	0.791618	27227.05	5673.625	121951.2	303991.8	11.16507
65-69	0.04023	0.182768	0.817232	21553.42	3939.268	97918.94	182040.6	8.446019
70-74	0.169282	0.594721	0.405279	17614.15	10475.5	61882.02	84121.68	4.7758
75+	0.320988	1.000000	0.000000	7138.655	7138.655	22239.66	22239.66	3.115385

Table 2c Both sexes life table in 1870, Hermoupolis

x	$_nM_x$	$_nq_x$	$_np_x$	$_nl_x$	$_nd_x$	$_nL_x$	$_nT_x$	$_ne_x$
0	0.1965	0.187	0.813	100000	18700	83170	2889420	28.8942
1-4	0.094882	0.309133	0.690867	81300	25132.55	264881.9	2806250	34.51722
5-9	0.012342	0.059865	0.940135	56167.45	3362.442	272431.2	2541368	45.24628
10-14	0.006982	0.034311	0.965689	52805.01	1811.775	259495.6	2268937	42.96822
15-19	0.00824	0.040367	0.959633	50993.24	2058.462	249820	2009442	39.40604
20-24	0.012195	0.059171	0.940829	48934.78	2895.537	237435	1759622	35.95851
25-29	0.010638	0.051812	0.948188	46039.24	2385.388	224232.7	1522187	33.06281
30-34	0.012391	0.060093	0.939907	43653.85	2623.31	211711	1297954	29.73286
35-39	0.00926	0.045252	0.954748	41030.54	1856.731	200510.9	1086243	26.47401
40-44	0.017414	0.083439	0.916561	39173.81	3268.605	187697.5	885731.9	22.61031
45-49	0.015804	0.076016	0.923984	35905.21	2729.367	172702.6	698034.4	19.44104
50-54	0.045187	0.203004	0.796996	33175.84	6734.816	149042.2	525331.8	15.83477
55-59	0.022449	0.106282	0.893718	26441.02	2810.217	125179.6	376289.6	14.23128
60-64	0.053968	0.23776	0.76224	23630.81	5618.451	104107.9	251110.1	10.62639
65-69	0.042	0.190045	0.809955	18012.35	3423.157	81503.88	147002.2	8.161185
70-74	0.169935	0.596332	0.403668	14589.2	8700.008	51195.97	65498.28	4.489506
75+	0.411765	1.000000	0.000000	5889.189	5889.189	14302.32	14302.32	2.428571

Table 3a Male life table in 1879, Hermoupolis

x	$_nM_x$	$_nq_x$	$_np_x$	$_nl_x$	$_nd_x$	$_nL_x$	$_nT_x$	$_ne_x$
0	0.60207	0.17940	0.82060	100000	17940	83854	3049892	30.499
1-4	0.06599	0.22787	0.77213	82060	18699.42	283361.4	2966038	36.145
5-9	0.01944	0.09268	0.90732	63360.58	5872.158	302122.5	2682676	42.340
10-14	0.00520	0.02568	0.97432	57488.43	1476.586	283750.7	2380554	41.409
15-19	0.00816	0.03998	0.96002	56011.84	2239.194	274461.2	2096803	37.435
20-24	0.02076	0.09867	0.90133	53772.64	5306.012	255598.2	1822342	33.890
25-29	0.01857	0.08871	0.91129	48466.63	4299.459	231584.5	1566744	32.326
30-34	0.00876	0.04284	0.95716	44167.17	1892.226	216105.3	1335159	30.230
35-39	0.01577	0.07587	0.92413	42274.95	3207.507	203356	1119054	26.471
40-44	0.01401	0.06766	0.93234	39067.44	2643.264	188729	915698	23.439
45-49	0.01417	0.06844	0.93156	36424.18	2492.909	175888.6	726969	19.958
50-54	0.03818	0.17425	0.82575	33931.27	5912.375	154875.4	551080.4	16.241
55-59	0.02480	0.11677	0.88323	28018.89	3271.706	131915.2	396205	14.141
60-64	0.05090	0.22578	0.77422	24747.18	5587.493	109767.2	264289.8	10.680
65-69	0.05687	0.24896	0.75104	19159.69	4770.048	83873.34	154522.6	8.065
70-74	0.17193	0.60123	0.39877	14389.64	8651.443	50319.62	70649.24	4.910
75+	0.28226	1.00000	0.00000	5738.202	5738.202	20329.63	20329.63	3.543

Table 3b Female life table in 1879, Hermoupolis

x	$_nM_x$	$_nq_x$	$_np_x$	$_nl_x$	$_nd_x$	$_nL_x$	$_nT_x$	$_ne_x$
0	0.90208	0.17940	0.82060	100000	17940	83854	3408257	34.083
1-4	0.06707	0.23107	0.76893	82060	18961.59	282732.2	3324403	40.512
5-9	0.01451	0.07002	0.92998	63098.41	4417.879	304447.3	3041671	48.205
10-14	0.00526	0.02597	0.97403	58680.53	1523.873	289593	2737223	46.646
15-19	0.00865	0.04234	0.95766	57156.66	2419.994	279733.3	2447630	42.823
20-24	0.01157	0.05622	0.94378	54736.66	3077.146	265990.5	2167897	39.606
25-29	0.01013	0.04942	0.95058	51659.52	2553.022	251915	1901907	36.816
30-34	0.00900	0.04400	0.95600	49106.5	2160.751	240130.6	1649992	33.600
35-39	0.01140	0.05543	0.94457	46945.74	2602.039	228223.6	1409861	30.032
40-44	0.01069	0.05208	0.94792	44343.71	2309.317	215945.2	1181637	26.647
45-49	0.02025	0.09635	0.90365	42034.39	4049.976	200047	965692.1	22.974
50-54	0.01299	0.06289	0.93711	37984.41	2388.699	183950.3	765645.1	20.157
55-59	0.02176	0.10318	0.89682	35595.71	3672.938	168796.2	581694.7	16.342
60-64	0.03321	0.15333	0.84667	31922.78	4894.811	147376.8	412898.5	12.934
65-69	0.03599	0.16511	0.83489	27027.96	4462.53	123983.5	265521.7	9.824
70-74	0.09709	0.39062	0.60938	22565.43	8814.537	90790.83	141538.2	6.272
75+	0.27097	1.00000	0.00000	13750.9	13750.9	50747.36	50747.36	3.690

Table 3c Both sexes life table in 1879, Hermoupolis

x	${}_nM_x$	${}_nq_x$	${}_np_x$	${}_nl_x$	${}_nd_x$	${}_nL_x$	${}_nT_x$	${}_ne_x$
0	0.71134	0.17940	0.82060	100000	17940	83854	3267682	32.677
1-4	0.06652	0.22945	0.77055	82060	18828.37	283051.9	3183828	38.799
5-9	0.01494	0.07202	0.92798	63231.63	4554.059	304773	2900776	45.875
10-14	0.00524	0.02584	0.97416	58677.57	1516.059	289597.7	2596003	44.242
15-19	0.00847	0.04148	0.95852	57161.52	2371.156	279879.7	2306405	40.349
20-24	0.01505	0.07252	0.92748	54790.36	3973.239	264018.7	2026526	36.987
25-29	0.01418	0.06849	0.93151	50817.12	3480.282	245384.9	1762507	34.683
30-34	0.00982	0.04794	0.95206	47336.84	2269.228	231011.1	1517122	32.050
35-39	0.01392	0.06726	0.93274	45067.61	3031.223	217760	1286111	28.537
40-44	0.01225	0.05941	0.94059	42036.39	2497.554	203938	1068351	25.415
45-49	0.01605	0.07717	0.92283	39538.83	3051.345	190065.8	864412.9	21.862
50-54	0.02301	0.10881	0.89119	36487.49	3970.183	172512	674347.1	18.482
55-59	0.02341	0.11059	0.88941	32517.3	3595.97	153596.6	501835.1	15.433
60-64	0.03887	0.17714	0.82286	28921.33	5123.231	131798.6	348238.5	12.041
65-69	0.04740	0.21188	0.78812	23798.1	5042.354	106384.6	216439.9	9.095
70-74	0.11613	0.45001	0.54999	18755.75	8440.213	72678.21	110055.3	5.868
75+	0.27599	1.00000	0.00000	10315.54	10315.54	37377.07	37377.07	3.623

Table 4a Male life table in 1907, Hermoupolis

x	$_nM_x$	$_nq_x$	$_np_x$	$_nl_x$	$_nd_x$	$_nL_x$	$_nT_x$	$_ne_x$
0	0.49744	0.25480	0.74520	100000	25480	77068	3466195	34.66
1-4	0.03735	0.13711	0.86289	74520	10217.3	273558.5	3389127	45.48
5-9	0.00484	0.02392	0.97608	64302.7	1538.059	317668.3	3115569	48.45
10-14	0.00601	0.02960	0.97040	62764.64	1857.912	309178.4	2797901	44.58
15-19	0.00479	0.02366	0.97634	60906.73	1440.923	300931.3	2488722	40.86
20-24	0.01228	0.05957	0.94043	59465.8	3542.644	288472.4	2187791	36.79
25-29	0.00716	0.03516	0.96484	55923.16	1966.158	274700.4	1899319	33.96
30-34	0.01084	0.05277	0.94723	53957	2847.335	262666.7	1624618	30.11
35-39	0.01407	0.06797	0.93203	51109.67	3473.917	246863.5	1361951	26.65
40-44	0.01483	0.07151	0.92849	47635.75	3406.447	229662.6	1115088	23.41
45-49	0.01321	0.06396	0.93604	44229.3	2828.8	214074.5	885425.3	20.02
50-54	0.03452	0.15887	0.84113	41400.5	6577.215	190559.5	671350.8	16.22
55-59	0.02787	0.13028	0.86972	34823.29	4536.645	162774.8	480791.4	13.81
60-64	0.05175	0.22910	0.77090	30286.64	6938.617	134086.7	318016.5	10.50
65-69	0.08088	0.33640	0.66360	23348.02	7854.185	97104.66	183929.9	7.88
70-74	0.10904	0.42841	0.57159	15493.84	6637.751	60874.82	86825.21	5.60
75+	0.34127	1.00000	0.00000	8856.088	8856.088	25950.4	25950.4	2.93

Table 4b Female life table in 1907, Hermoupolis

x	$_nM_x$	$_nq_x$	$_np_x$	$_nl_x$	$_nd_x$	$_nL_x$	$_nT_x$	$_ne_x$
0	0.54131	0.25480	0.74520	100000	25480	77068	3618578	36.2
1-4	0.03736	0.13715	0.86285	74520	10220.25	273551.4	3541510	47.5
5-9	0.01013	0.04942	0.95058	64299.75	3177.538	313554.9	3267958	50.8
10-14	0.00373	0.01850	0.98150	61122.21	1130.846	302783.9	2954404	48.3
15-19	0.00710	0.03490	0.96510	59991.37	2093.534	294723	2651620	44.2
20-24	0.00847	0.04145	0.95855	57897.83	2399.91	283489.4	2356897	40.7
25-29	0.01032	0.05031	0.94969	55497.92	2792.348	270508.7	2073407	37.4
30-34	0.00727	0.03572	0.96428	52705.57	1882.737	258821	1802899	34.2
35-39	0.01073	0.05223	0.94777	50822.84	2654.673	247477.5	1544077	30.4
40-44	0.01146	0.05569	0.94431	48168.16	2682.246	234135.2	1296600	26.9
45-49	0.01109	0.05394	0.94606	45485.92	2453.478	221295.9	1062465	23.4
50-54	0.01186	0.05758	0.94242	43032.44	2477.986	208967.2	841168.9	19.5
55-59	0.01384	0.06690	0.93310	40554.45	2713.093	195989.5	632201.7	15.6
60-64	0.03649	0.16718	0.83282	37841.36	6326.294	173391.1	436212.1	11.5
65-69	0.06067	0.26339	0.73661	31515.07	8300.612	136823.8	262821.1	8.3
70-74	0.11485	0.44614	0.55386	23214.45	10356.94	90179.92	125997.3	5.4
75+	0.35897	1.00000	0.00000	12857.52	12857.52	35817.37	35817.37	2.8

Table 4c Both sexes life table in 1907, Hermoupolis

x	$_nM_x$	$_nq_x$	$_np_x$	$_nl_x$	$_nd_x$	$_nL_x$	$_nT_x$	$_ne_x$
0	0.51822	0.25480	0.74520	100000	25480	77068	3537723	35.4
1-4	0.03736	0.13713	0.86287	74520	10218.8	273554.9	3460655	46.4
5-9	0.00753	0.03693	0.96307	64301.2	2374.876	315568.8	3187100	49.6
10-14	0.00480	0.02371	0.97629	61926.33	1468.529	305960.3	2871531	46.4
15-19	0.00614	0.03023	0.96977	60457.8	1827.624	297719.9	2565571	42.4
20-24	0.00990	0.04831	0.95169	58630.18	2832.376	286069.9	2267851	38.7
25-29	0.00888	0.04342	0.95658	55797.8	2422.665	272932.3	1981781	35.5
30-34	0.00885	0.04328	0.95672	53375.14	2310.071	261100.5	1708848	32.0
35-39	0.01217	0.05907	0.94093	51065.06	3016.508	247784.1	1447748	28.4
40-44	0.01297	0.06282	0.93718	48048.56	3018.624	232696.2	1199964	25.0
45-49	0.01206	0.05852	0.94148	45029.93	2635.277	218561.5	967267.6	21.5
50-54	0.02385	0.11254	0.88746	42394.65	4771.109	200045.5	748706.1	17.7
55-59	0.02147	0.10189	0.89811	37623.55	3833.376	178534.3	548660.6	14.6
60-64	0.04496	0.20207	0.79793	33790.17	6828.044	151880.7	370126.3	11.0
65-69	0.07128	0.30250	0.69750	26962.13	8155.996	114420.6	218245.6	8.1
70-74	0.11160	0.43629	0.56371	18806.13	8204.987	73518.18	103825	5.5
75+	0.34979	1.00000	0.00000	10601.14	10601.14	30306.79	30306.79	2.9

Table 5a Male life table in 1920, Hermoupolis

x	$_nM_x$	$_nq_x$	$_np_x$	$_nl_x$	$_nd_x$	$_nL_x$	$_nT_x$	$_ne_x$
0	0.22426	0.14580	0.85420	100000	14580	86878	3686079	36.86
1-4	0.05152	0.18339	0.81661	85420	15664.94	304084.1	3599201	42.14
5-9	0.01078	0.05247	0.94753	69755.06	3659.762	339625.9	3295117	47.24
10-14	0.00393	0.01946	0.98054	66095.3	1285.901	327261.7	2955491	44.72
15-19	0.00569	0.02804	0.97196	64809.4	1817.426	319503.4	2628229	40.55
20-24	0.01724	0.08264	0.91736	62991.97	5205.948	301945	2308726	36.65
25-29	0.01229	0.05961	0.94039	57786.02	3444.77	280318.2	2006781	34.73
30-34	0.00988	0.04822	0.95178	54341.25	2620.118	265156	1726462	31.77
35-39	0.01416	0.06838	0.93162	51721.13	3536.488	249764.5	1461306	28.25
40-44	0.01487	0.07168	0.92832	48184.65	3454.097	232288	1211542	25.14
45-49	0.01642	0.07888	0.92112	44730.55	3528.264	214832.1	979253.9	21.89
50-54	0.02494	0.11740	0.88260	41202.29	4836.981	193919	764421.8	18.55
55-59	0.02655	0.12448	0.87552	36365.3	4526.801	170509.5	570502.8	15.69
60-64	0.03947	0.17964	0.82036	31838.5	5719.492	144893.8	399993.3	12.56
65-69	0.06422	0.27668	0.72332	26119.01	7226.604	112528.5	255099.5	9.77
70-74	0.08054	0.33520	0.66480	18892.41	6332.651	78630.41	142571	7.55
75+	0.19643	1.00000	0.00000	12559.76	12559.76	63940.58	63940.58	5.09

Table 5b Female life table in 1920, Hermoupolis

x	$_nM_x$	$_nq_x$	$_np_x$	$_nl_x$	$_nd_x$	$_nL_x$	$_nT_x$	$_ne_x$
0	0.23936	0.14580	0.85420	100000	14580	86878	3988387	39.9
1-4	0.04726	0.16977	0.83023	85420	14501.8	306876	3901509	45.7
5-9	0.00852	0.04171	0.95829	70918.2	2958.01	347196	3594633	50.7
10-14	0.00522	0.02577	0.97423	67960.2	1751.55	335422	3247437	47.8
15-19	0.00818	0.04010	0.95990	66208.7	2654.72	324407	2912015	44.0
20-24	0.00931	0.04548	0.95452	63554	2890.28	310544	2587608	40.7
25-29	0.00528	0.02604	0.97396	60663.7	1579.78	299369	2277064	37.5
30-34	0.01053	0.05128	0.94872	59083.9	3029.94	287845	1977695	33.5
35-39	0.01153	0.05604	0.94396	56054	3141.54	272416	1689850	30.1
40-44	0.01029	0.05017	0.94983	52912.4	2654.47	257926	1417434	26.8
45-49	0.01559	0.07503	0.92497	50258	3770.69	241863	1159508	23.1
50-54	0.02755	0.12887	0.87113	46487.3	5990.63	217460	917645	19.7
55-59	0.02679	0.12552	0.87448	40496.6	5083.26	189775	700186	17.3
60-64	0.01754	0.08403	0.91597	35413.4	2975.91	169627	510411	14.4
65-69	0.04785	0.21368	0.78632	32437.5	6931.08	144860	340783	10.5
70-74	0.07576	0.31847	0.68153	25506.4	8123.05	107224	195924	7.7
75+	0.19598	1.00000	0.00000	17383.3	17383.3	88699.6	88699.6	5.1

Table 5c Both sexes life table in 1920, Hermoupolis

x	${}_nM_x$	${}_nq_x$	${}_np_x$	${}_nl_x$	${}_nd_x$	${}_nL_x$	${}_nT_x$	${}_ne_x$
0	0.23043	0.14580	0.85420	100000	14580	86878	3832504	38.3
1-4	0.05054	0.18031	0.81969	85420	15401.7	304716	3745626	43.8
5-9	0.00964	0.04707	0.95293	70018.3	3295.84	341852	3440910	49.1
10-14	0.00461	0.02281	0.97719	66722.5	1521.95	329808	3099058	46.4
15-19	0.00714	0.03507	0.96493	65200.5	2286.67	320286	2769251	42.5
20-24	0.01209	0.05867	0.94133	62913.9	3691.17	305341	2448965	38.9
25-29	0.00852	0.04170	0.95830	59222.7	2469.33	289940	2143623	36.2
30-34	0.01034	0.05038	0.94962	56753.4	2859.11	276619	1853683	32.7
35-39	0.01280	0.06201	0.93799	53894.3	3341.93	261116	1577064	29.3
40-44	0.01249	0.06055	0.93945	50552.3	3061.13	245109	1315948	26.0
45-49	0.01605	0.07715	0.92285	47491.2	3663.74	228297	1070839	22.5
50-54	0.02612	0.12259	0.87741	43827.5	5372.89	205705	842542	19.2
55-59	0.02667	0.12500	0.87500	38454.6	4806.82	180256	636837	16.6
60-64	0.02632	0.12346	0.87654	33647.7	4154.04	157854	456581	13.6
65-69	0.05621	0.24641	0.75359	29493.7	7267.44	129300	298728	10.1
70-74	0.07781	0.32569	0.67431	22226.3	7238.95	93033.9	169428	7.6
75+	0.19619	1.00000	0.00000	14987.3	14987.3	76393.7	76393.7	5.1

Table 6a Male life table in 1920 (excluding 1919), Hermoupolis

x	$_nM_x$	$_nq_x$	$_np_x$	$_nl_x$	$_nd_x$	$_nL_x$	$_nT_x$	$_ne_x$
0	0.20588	0.14580	0.85420	100000	14580	86878	4008039	40.08
1-4	0.03182	0.11824	0.88176	85420	10100.3	317439	3921161	45.90
5-9	0.00808	0.03961	0.96039	75319.7	2983.35	369140	3603722	47.85
10-14	0.00246	0.01220	0.98780	72336.3	882.796	359475	3234582	44.72
15-19	0.00569	0.02804	0.97196	71453.5	2003.74	352258	2875108	40.24
20-24	0.01916	0.09141	0.90859	69449.8	6348.24	331378	2522849	36.33
25-29	0.01382	0.06682	0.93318	63101.5	4216.14	304967	2191471	34.73
30-34	0.00988	0.04822	0.95178	58885.4	2839.22	287329	1886504	32.04
35-39	0.00973	0.04752	0.95248	56046.2	2663.1	273573	1599175	28.53
40-44	0.01580	0.07599	0.92401	53383.1	4056.83	256773	1325602	24.83
45-49	0.01642	0.07888	0.92112	49326.2	3890.76	236904	1068829	21.67
50-54	0.02154	0.10221	0.89779	45435.5	4643.76	215568	831924	18.31
55-59	0.03245	0.15007	0.84993	40791.7	6121.54	188655	616356	15.11
60-64	0.04441	0.19985	0.80015	34670.2	6928.9	156029	427701	12.34
65-69	0.06651	0.28515	0.71485	27741.3	7910.49	118930	271673	9.79
70-74	0.06711	0.28736	0.71264	19830.8	5698.5	84907.7	152743	7.70
75+	0.20833	1.00000	0.00000	14132.3	14132.3	67835	67835	4.80

Table 6b Female life table in 1920 (excluding 1919), Hermoupolis

x	$_nM_x$	$_nq_x$	$_np_x$	$_nl_x$	$_nd_x$	$_nL_x$	$_nT_x$	$_ne_x$
0	0.22074	0.14580	0.85420	100000	14580	86878	4441062	44.4
1-4	0.02515	0.09488	0.90512	85420	8104.83	322228.4	4354184	51.0
5-9	0.00479	0.02368	0.97632	77315.17	1830.667	381999.2	4031956	52.1
10-14	0.00435	0.02152	0.97848	75484.5	1624.72	373360.7	3649957	48.4
15-19	0.00818	0.04010	0.95990	73859.78	2961.499	361895.2	3276596	44.4
20-24	0.01034	0.05040	0.94960	70898.28	3573.502	345557.7	2914701	41.1
25-29	0.00396	0.01960	0.98040	67324.78	1319.232	333325.8	2569143	38.2
30-34	0.00827	0.04052	0.95948	66005.55	2674.258	323342.1	2235817	33.9
35-39	0.00988	0.04823	0.95177	63331.29	3054.564	309020	1912475	30.2
40-44	0.01201	0.05828	0.94172	60276.73	3513.215	292600.6	1603455	26.6
45-49	0.01670	0.08017	0.91983	56763.51	4550.789	272440.6	1310855	23.1
50-54	0.03030	0.14085	0.85915	52212.72	7353.905	242678.9	1038414	19.9
55-59	0.02232	0.10571	0.89429	44858.82	4741.947	212439.2	795735.1	17.7
60-64	0.01535	0.07392	0.92608	40116.87	2965.344	193171	583295.9	14.5
65-69	0.05024	0.22317	0.77683	37151.53	8290.989	165030.2	390124.9	10.5
70-74	0.07828	0.32735	0.67265	28860.54	9447.484	120684	225094.7	7.8
75+	0.18593	1.00000	0.00000	19413.05	19413.05	104410.8	104410.8	5.4

Table 6c Both sexes life table in 1920 (excluding 1919), Hermoupolis

x	${}_nM_x$	${}_nq_x$	${}_np_x$	${}_nl_x$	${}_nd_x$	${}_nL_x$	${}_nT_x$	${}_ne_x$
0	0.21196	0.14580	0.85420	100000	14580	86878	4229146	42.3
1-4	0.02916	0.10901	0.89099	85420	9311.773	319331.7	4142268	48.5
5-9	0.00643	0.03163	0.96837	76108.23	2407.219	374523.1	3822936	50.2
10-14	0.00346	0.01716	0.98284	73701.01	1264.457	365343.9	3448413	46.8
15-19	0.00714	0.03507	0.96493	72436.55	2540.445	355831.6	3083069	42.6
20-24	0.01343	0.06498	0.93502	69896.11	4541.657	338126.4	2727238	39.0
25-29	0.00852	0.04170	0.95830	65354.45	2724.994	319959.8	2389111	36.6
30-34	0.00904	0.04422	0.95578	62629.45	2769.464	306223.6	2069151	33.0
35-39	0.00981	0.04789	0.95211	59859.99	2866.5	292133.7	1762928	29.5
40-44	0.01383	0.06682	0.93318	56993.49	3808.576	275446	1470794	25.8
45-49	0.01655	0.07946	0.92054	53184.91	4226.107	255359.3	1195348	22.5
50-54	0.02550	0.11985	0.88015	48958.81	5867.615	230125	939988.7	19.2
55-59	0.02741	0.12825	0.87175	43091.19	5526.427	201639.9	709863.7	16.5
60-64	0.02697	0.12635	0.87365	37564.77	4746.242	175958.2	508223.8	13.5
65-69	0.05855	0.25536	0.74464	32818.52	8380.624	143141.1	332265.6	10.1
70-74	0.07349	0.31041	0.68959	24437.9	7585.715	103225.2	189124.5	7.7
75+	0.19619	1.00000	0.00000	16852.19	16852.19	85899.33	85899.33	5.1

Table 7a Male life table in 1928, Hermoupolis

x	$_nM_x$	$_nq_x$	$_np_x$	$_nl_x$	$_nd_x$	$_nL_x$	$_nT_x$	$_ne_x$
0	0.23984	0.19020	0.80980	100000	19020	82882	4266038	42.7
1-4	0.02642	0.09936	0.90064	80980	8046.274	304608.9	4183156	51.7
5-9	0.00648	0.03189	0.96811	72933.73	2325.905	358853.9	3878547	53.2
10-14	0.00314	0.01556	0.98444	70607.82	1098.783	350292.1	3519693	49.8
15-19	0.00536	0.02643	0.97357	69509.04	1837.243	342952.1	3169401	45.6
20-24	0.00673	0.03311	0.96689	67671.79	2240.788	332757	2826449	41.8
25-29	0.00775	0.03802	0.96198	65431.01	2487.871	320935.4	2493692	38.1
30-34	0.00550	0.02715	0.97285	62943.14	1708.863	310443.5	2172756	34.5
35-39	0.00821	0.04024	0.95976	61234.27	2464.156	300011	1862313	30.4
40-44	0.01270	0.06157	0.93843	58770.12	3618.213	284805.1	1562302	26.6
45-49	0.01468	0.07080	0.92920	55151.9	3904.56	265998.1	1277497	23.2
50-54	0.02144	0.10176	0.89824	51247.34	5214.808	243199.7	1011499	19.7
55-59	0.02222	0.10526	0.89474	46032.54	4845.53	218048.9	768299	16.7
60-64	0.03161	0.14647	0.85353	41187.01	6032.717	190853.2	550250.1	13.4
65-69	0.05622	0.24648	0.75352	35154.29	8664.789	154109.5	359396.9	10.2
70-74	0.06742	0.28846	0.71154	26489.5	7641.202	113344.5	205287.4	7.7
75+	0.20500	1.00000	0.00000	18848.3	18848.3	91942.91	91942.91	4.9

Table 7b Female life table in 1928, Hermoupolis

x	$_nM_x$	$_nq_x$	$_np_x$	$_nl_x$	$_nd_x$	$_nL_x$	$_nT_x$	$_ne_x$
0	0.24000	0.19020	0.80980	100000	19020	82882	4557702	45.6
1-4	0.02058	0.07845	0.92155	80980	6352.838	308673.2	4474820	55.3
5-9	0.00537	0.02650	0.97350	74627.16	1977.752	368191.4	4166147	55.8
10-14	0.00411	0.02035	0.97965	72649.41	1478.417	359551	3797955	52.3
15-19	0.00844	0.04131	0.95869	71170.99	2940.016	348504.9	3438404	48.3
20-24	0.00586	0.02887	0.97113	68230.98	1970.096	336229.6	3089899	45.3
25-29	0.00662	0.03257	0.96743	66260.88	2158.335	325908.6	2753670	41.6
30-34	0.00301	0.01495	0.98505	64102.55	958.1846	318117.3	2427761	37.9
35-39	0.01036	0.05047	0.94953	63144.36	3186.81	307754.8	2109644	33.4
40-44	0.00644	0.03170	0.96830	59957.55	1900.398	295036.8	1801889	30.1
45-49	0.01040	0.05068	0.94932	58057.15	2942.086	282930.6	1506852	26.0
50-54	0.01078	0.05247	0.94753	55115.07	2891.662	268346.2	1223922	22.2
55-59	0.01497	0.07215	0.92785	52223.41	3767.923	251697.2	955575.4	18.3
60-64	0.02387	0.11264	0.88736	48455.49	5458.065	228632.3	703878.2	14.5
65-69	0.02556	0.12012	0.87988	42997.42	5164.855	202075	475245.9	11.1
70-74	0.07048	0.29963	0.70037	37832.57	11335.6	160823.8	273171	7.2
75+	0.23585	1.00000	0.00000	26496.97	26496.97	112347.1	112347.1	4.2

Table 7c Both sexes life table in 1928, Hermoupolis

x	$_nM_x$	$_nq_x$	$_np_x$	$_nl_x$	$_nd_x$	$_nL_x$	$_nT_x$	$_ne_x$
0	0.23767	0.19020	0.80980	100000	19020	82882	4408218	44.1
1-4	0.02344	0.08877	0.91123	80980	7188.973	306666.5	4325336	53.4
5-9	0.00592	0.02915	0.97085	73791.03	2151.342	363576.8	4018670	54.5
10-14	0.00356	0.01764	0.98236	71639.68	1263.487	355039.7	3655093	51.0
15-19	0.00714	0.03507	0.96493	70376.2	2468.429	345709.9	3300053	46.9
20-24	0.00618	0.03043	0.96957	67907.77	2066.579	334372.4	2954344	43.5
25-29	0.00709	0.03484	0.96516	65841.19	2294.118	323470.7	2619971	39.8
30-34	0.00414	0.02047	0.97953	63547.07	1300.595	314483.9	2296500	36.1
35-39	0.00946	0.04620	0.95380	62246.48	2875.73	304043.1	1982017	31.8
40-44	0.00939	0.04585	0.95415	59370.75	2722.294	290048	1677974	28.3
45-49	0.01248	0.06050	0.93950	56648.45	3427.305	274674	1387926	24.5
50-54	0.01638	0.07866	0.92134	53221.15	4186.521	255639.4	1113252	20.9
55-59	0.01894	0.09044	0.90956	49034.63	4434.656	234086.5	857612.1	17.5
60-64	0.02759	0.12903	0.87097	44599.97	5754.835	208612.8	623525.6	14.0
65-69	0.03915	0.17828	0.82172	38845.14	6925.389	176912.2	414912.8	10.7
70-74	0.06914	0.29474	0.70526	31919.75	9407.926	136078.9	238000.6	7.5
75+	0.22087	1.00000	0.00000	22511.82	22511.82	101921.7	101921.7	4.5

Bibliography

Aggelopoulou A., & S. Loumide, *Nestlé 100 hronia sten Ellada* (*Nestlé 100 years in Greece*) (Athens: Elleniko Logotehniko kai Istoriko Arheio, 2001)

Agriantoni C., & A. Fenerli, *Ermoupole-Syros. A historical tour* (Athens: Olkos, 1999)

Alsan M., & C. Goldin, 'Watersheds in child mortality: the role of effective water and sewerage infrastructure, 1880 to 1920', Working Paper no.21263 (Cambridge, MA: NBER, 2015), 1-52

Alter, G., & A.G. Carmichael, 'Studying causes of death in the past', *Historical Methods: A Journal of Quantitative and Interdisciplinary History*, 29 (1996), 44-48

Alter, G., & A.G. Carmichael, 'Reflections on the classification of causes of death', *Continuity and Change*, 12 (1998), 169-173

Alter, G., & A.G. Carmichael, 'Classifying the dead: towards history of the registration of causes of death', *Journal of the History of Medicine*, 54(1999), 114-132

Alter, G., & M. Oris, 'Childhood conditions, migration and mortality: Migrants and natives in 19th-century cities', *Social Biology*, 52, 3/4(2005), 178-191

Ampelas, T., *Istoria tes nesou Syrou apo ton arhaiotaton hronon mehri kath'emas* (*The history of the island of Syros from the ancient times to the present day*) (Hermoupolis, 1874)

Anagnostake, K., 'Demiourgia, anaptykse, akme kai parakme tes Ermoupoles mesa apo ten epeksergasia ton epaggelmaton ton demotologion' (Creation, development, prosperity and decline of Hermoupolis through the elaboration of the citizens' professions cited in the municipal rolls), *The City in Modern Times*: http://cities.ims.forth.gr/docs/Municipal.Hermoupolis.Anagnostaki.pdf (access in March 2018)

Anagnostopoulos, G., *E episteme kai e koinonia eis ton agona kata tes fymatiosis* (*Science and society in the anti-tuberculosis campaign*) (Piraeus, 1928)

Anderson, M., 'The social implications of demographic change', in F.M.L. Thompson (ed.), *The Cambridge social history of Britain, 1750-1950: People and their environment*, vol.2 (Cambridge: Cambridge University Press, 1990), 1-70

Anon., 'To protiston kathekon tes metros' (The primary responsibility of mothers), *Pandora* (1858)

Anon., 'Syzetesis peri grippes' (Discussion on influenza), *Iatrike Proodos* (November 1917)

Anon., 'Greece', *Bulletin de l'Academie de Medecine* (21 January 1919)

Anon., Egkyklios me thema 'Odegiai dia ten delosin aition thanatou' (Circular Letter entitled 'Guidelines for the cause of death reporting'), *Arheia Ygieines*, B, 1, 1 (April 1937)

Ansart, S., C. Pelat, P. Boelle, F. Carrat, A. Flahault & A. Valleron, 'Mortality burden of the 1918-1919 influenza pandemic in Europe', *Influenza and Other Respiratory Diseases*, 3 (2009), 99-106

Arfanes, E., *Ypomnema peri ton ektheton* (*Statement concerning the foundlings*) (Hermoupolis, 1900)

Arfanes, E., ‘E fymatiosis en Syro kai o kat’ aytes agon’ (Tuberculosis in Syros and its anti-tuberculosis fight), *Syllogos Ygieines Syrou*, 1 (1918)

Atkins, P.J., ‘White Poison? The social consequences of milk consumption, 1850-1930’, *Social History of Medicine*, 5, 2 (1992), 207-227

Babanases, S., ‘E diamorfose tes ftoheias sten Ellada tou 20ou aiona’ (The formation of poverty in Greece in the 20th century), *The Greek Review of Social Research*, 42-43 (1981), 110-144

Bandyopadhyay, S., S. Kanji & L. Wang, ‘The impact of rainfall and temperature variation on diarrheal prevalence in Sub-Saharan Africa’, *Applied Geography*, 33 (2012), 63-72

Beach, B., J. Ferrie, M. Saavedra & W. Troesken, ‘Typhoid fever, water quality and human capital formation’, *The Journal of Economic History*, 76, 1 (2016), 41-75

Beaver, M.W., ‘Population, infant mortality and milk’, *Population Studies,* 27, 2 (1973), 243-254

Becker, G.S., ‘An economic analysis of fertility’, in Universities-National Bureau (ed.), *Demographic and economic change in developed countries* (New York: Columbia University Press, 1960), 209-240

Bell, F., & R. Millward, ‘Public health expenditures and mortality in England and Wales, 1870-1914’, *Continuity and Change*, 13, 2 (1998), 222-249

Bent, J.T., The Cyclades, or life among the insular (London, 1885)

Bernabeu-Mestre, J., D. Ramiro Farinas, A. Sanz Gimeno & E. Robles Gonzalez, ‘El analisis historico de la mortalidad por causas. Problemas y soluciones’, *Revista de Demographia Historica*, XXI, I (2003), 167-192

Bideau, A., J. Dupaquier & J-N. Biraben, ‘La mortalité de 1800 a 1914’, in J. Dupaquier (ed.), *Histoire de la population francaise: De 1789 a 1914* (Paris: Presses Universitaires de France, 1988), 286-298

Bongaarts, J., ‘A method for the estimation of fecundability’, *Demography*, 12, 4 (1975), 645-660

Bootsma, M., & N. Ferguson, ‘The effect of public health measures on the 1918 influenza pandemic in U.S. cities’, *PNAS*, 104, 18 (2007), 7588-7593

Borowy, I., ‘Counting death and disease: classification of death and disease in the interwar years, 1919-1939’, *Continuity and Change,* 18, 3 (2003), 457-481

Boulton, J., & R.J. Davenport, ‘Few deaths before baptism: clerical policy, private baptism and the registration of births in Georgian Westminster: a paradox resolved’, *Local Population Studies*, 94 (2015), 28-47

Bournett, J., ‘Housing and the decline of mortality’, in R. Schofield, D. Reher & A. Bideau (eds), *The decline of mortality in Europe* (Oxford: Clarendon Press, 1991), 158-76

Bournova, E., *Oi katoikoi ton Athenon, 1900-1960* (*The inhabitants of Athens, 1900-1960*) (Athens: Department of Economics/ National and Kapodistrian University of Athens, 2016)

Brändström, A., ‘The impact of female labour conditions on infant mortality: a case study of the parishes of Nedertomea and Jokkmokk, 1800-96’, *Journal of the Society for the Social History of Medicine,* 1 (1988), 329-358

Brändström, A., 'Infant mortality in Sweden, 1750-1950: past and present research into its decline', in C.A. Corsini & P.P. Viazzo (eds), *The decline of infant mortality in Europe, 1800-1950, Four national case studies* (Florence: UNICEF, 1993), 19-34

Brändström, A., S. Edvinsson & J. Rogers, 'Illegitimacy, infant feeding practices and infant survival in Sweden 1750-1950. A regional analysis', *Hygiea Internationalis*, 3 (2002), 13-52

Breschi, M., A. Fornasin, M. Manfredini, S. Mazzoni & L. Pozzi, 'Socioeconomic conditions, health and mortality from birth to adulthood, Alghero 1865-1925', *Explorations in Economic History*, 48, 3 (2011), 366-375

Breschi, M., M. Esposito, S. Mazzoni & L. Pozzi, 'The Sardinian experience of the lowest Italian infant mortality at the turn of the twentieth century. True or false empirical evidence?', *Annales de démographie historique*, 123, 1 (2012), 63-94

Breschi, M., M. Esposito, S. Mazzoni & L. Pozzi, 'A slow transition. Infant and child mortality decline in a Sardinian community: Alghero (1866-1935)', in D. Ramiro Farinas and M. Oris (eds), *New approaches to death in cities during the health transition* (New York: Springer, 2016), 115-136

Brown, J.C., 'Public health reform and the decline in urban mortality: the case of Germany, 1876-1912', in G. Kearns, R. Lee, M. Nelson & J. Rogers (eds), *Improving the public health: Essays in medical history* (Liverpool: Liverpool University Press, 1991), 89-103

Bryder, L., *Below the magic mountain: A social history of tuberculosis in twentieth-century Britain* (Oxford: Clarendon Press, 1988)

Cain, L., & S.C. Hong, 'Survival in 19th century cites: the larger the city, the smaller your chances', *Explorations in Economic History*, 46, 4 (2009), 450-463

Cain, L., & E. Rotella, 'Death and spending: urban mortality and municipal expenditure on sanitation', *Annales de démographie historique*, 101, 1 (2001), 139-154

Carrier, N., & J. Hobcraft, *Demographic estimation for developing societies* (London: Population Investigation Committee, 1971)

Carlsson, G., 'The decline of fertility: innovation or adjustment process', *Population Studies*, 20, 2 (1966), 149-174

Caselli, G., 'Long-term trends in European mortality', *Studies on Medical and Population Subjects,* 56 (London: HMSO, 1991)

Caselli, G., 'National differences in the health transition in Europe', *Historical Methods*, 29, 3 (1996), 107-125

Caselli, G., & R. Capocaccia, 'Age, period, cohort and early mortality: An analysis of adult mortality in Italy', *Population Studies*, 43, 1 (1989), 133-153

Chapman, J., 'The contribution of infrastructure investment to Britain's urban mortality decline 1861-1900', *Economic History Review*, 72, 1 (2018), 233-259

Charitakis, A.K., *To vivlio tes meteras* (*The mother's book)* (Athens: Ekdotikos oikos Petrou Demetrake, 1948)

Chatzikonstantinou, K., & L. Sapounaki-Dracaki, 'Two sanatorium cases in the greater Athens area: ideal curative environments or perfect social exiles?', *Histoire Urbaine*, 39 (2014), 142-51

Chowell, G., L.M.A. Betterncourt, N. Johnson, W.J. Alonso & C. Viboud, 'The 1918-1919 influenza pandemic in England and Wales: spatial patterns in transmissibility and mortality impact', *Proceedings of the Royal Society*, 275 (2008), 501-509

Chowell, G., A. Erkoreka, C. Viboud & B. Echeverri-Dávila, 'Spatial-temporal excess mortality patterns of the 1918-1919 influenza pandemic in Spain', *BMC Infectious Diseases*, 14, 371 (2014), 1-12

Chowell, G., & C. Viboud, 'Pandemic influenza and socioeconomic disparities: Lessons from 1918 Chicago', *PNAS*, 113, 48 (2016), 13557-9

Chrysake, M., *Ta dyo prota hronia tou paidiou* (*The first two years of the child*) (Athens: Typografeio SK Vlastou,1930)

Clogg, R., *A concise history of Greece* (Cambridge: Cambridge University Press, 2013).

Coale, A.J., & P. Demeny, *Regional model life tables and stable population* (New York: Academic Press, 1983)

Cole, J., '"A sudden and terrible revelation", motherhood and infant mortality in France 1858-1874', *Journal of Family History*, 21 (1996), 419-445

Condran, G.A., 'Declining mortality in the United States in the late nineteenth century and early twentieth centuries', *Annales de démographie historique*, 1 (1987), 119-141

Condran, G.A., & E. Crimmins-Gardner, 'Public health measures and mortality in U.S. cities in the late nineteenth century', *Human Ecology*, 6, 1 (1978), 27-54

Condran, G.A., & H.R. Lentzner, 'Early death: Mortality among young children in New York, Chicago, and New Orleans', *Journal of Interdisciplinary History*, 34, 3 (2004), 315-354

Corsini, C., 'Structural changes in infant mortality in Tuscany from the eighteenth to the nineteenth century', in T. Bengtsson, G. Fridlizius & R. Ohlsson (eds), *Pre-industrial population change. The mortality decline and short-term population movements* (Stockholm: Almquist and Wiksell International, 1985), 127-149

Corsini, C., & P. Viazzo (eds), *The decline of infant and child mortality. The European experience: 1750-1990* (The Hague: Martinis Nijhoff, 1997)

Crosby, A., *America's forgotten pandemic* (Cambridge: Cambridge University Press, 2003)

Cunningham, A.S., 'Breast-feeding and morbidity in industrialized countries: an update', in D. B Jelliffe & E.F.P Jelliffe (eds), *Advances in international maternal and child health* (Oxford: Oxford University Press, 1981), 128-165

Cutler, D., & G. Miller, 'The role of public health improvements in health advances: the twentieth-century United States', *Demography*, 42, 1 (2005), 1-22

Dahal, S., J. Melinda, L. Dinh, K. Mizumoto, C. Viboud & G. Chowell., 'Excess mortality patterns during 1918-1921 influenza pandemic in the state of Arizona, USA', *Annals of Epidemiology*, 28 (2018), 273-280

Dardaveses, T., 'E organose tes kentrikes dioikeses gia ten ygeionomike politike sten periodo tou mesopolemou' (The organization of the central administration for the hygiene policy during the interwar period) in I. Kyriopoulos (ed.), *Demosia ygeia kai koinonike politike: o Eleftherios Venizelos kai e epohe tou* (*Public health and social policy: Eleftherios Venizelos and his time*) (Athens: Papazissi, 2008), 99-112

Davenport, R., 'Year of birth effects in the historical decline of tuberculosis mortality: A reconsideration', *PLOS ONE*, 8, 12 (2013), e81797

Davenport, R.J., 'The relationship between stillbirth and early neonatal mortality: evidence from eighteenth century London', unpublished working paper: http://www.geog.cam.ac.uk/people/davenport/davenport9.pdf (access in March 2018)

Davenport, D., J. Boulton & L. Schwarz, 'Infant and young adult mortality in London's West End, 1750-1824', unpublished working paper: http://research.ncl.ac.uk/pauperlives/infantandchildmortality.pdf (access in March 2018)

Davis, G., 'Stillbirth registration and perceptions of infant death, 1900-60: the Scottish case in national context', *Economic History Review*, 62, 3 (2009), 629-654

Dekigalas, I., *Statistike tes nesou Theras* (*Statistics of the island of Thera*) (Syros, 1850)

Delis, A., 'Modern Greece's first industry? The shipbuilding centre of sailing merchant marine of Syros, 1830-70', *European Review of Economic History*, 19 (2015), 255-274

Delis, A., 'A Mediterranean insular port-city in transition: economic transformations, spatial antagonism and the metamorphosis of landscape in nineteenth-century Hermoupolis on the island of Syros', *Urban History*, 42, 2 (2015), 225-245

Delis, A., *Mediterranean wooden shipbuilding: economy, technology and institutions in Syros in the nineteenth century* (Leiden & Boston: Brill, 2016)

Del Panta, L., 'Infant and child mortality in Italy, eighteenth to twentieth century: long-term trends and territorial differences', in A. Bideau, B. Desjardins & H. Brignoli (eds), *Infant and child mortality in the past* (Oxford: Clarendon, 1997), 7-21

Del Panta, L., & L. Pozzi, 'Age and cause mortality structure in the Italian regions at the beginning of the health transition: a research project', *Statistica*, 1 (2011), 23-49

Delis, A., *Ermoupole-Syros: To naupegiko kentro tes istioforou nautilias, 1830-80* (*Hermoupolis-Syros: the shipbuilding centre of the sailing merchant marine, 1830-80*) (Ionian University: Unpublished PhD thesis, 2010)

Devos, I., 'La régionalisation de la sumortalité de jeunes filles en Belgique entre 1890 et 1910', *Annales de démographie historique* (1996), 375-407

Dimitropoulou, M., *Athènes au XIX^{e} siècle: de la bourgade à la capitale* (Université Lumiere Lyon 2: Unpublished PhD thesis, 2008)

Dimitropoulou, M., '"Enopion emou tou Leksiarchou tes poleos Athenon". Demographikes symperifores sten Athena tou 19ou aiona' ('In front of me, the Registrar of Athens'. Demographic behaviour in Athens during the second half of the nineteenth century), in *International conference of economic and social history: New perspectives in theory and empirical research* (Athens: Publications of the Faculty of Philosophy, University of Crete/Alexandria, 2012), 33-54

Doepke, M., 'Child mortality and fertility decline: Does the Barro-Becker model fits the facts?', *Journal of Population Economics*, 18, 2 (2005), 337-366

Dopico, F., 'Regional mortality tables for Spain in the 1860s', *Historical Methods*, 20, 4 (1998), 173-179

Dopico, F., & D.S. Reher, *El declive de la mortalidad en España, 1860-1930* (Zaragoza: Mongráfias I, Asocoación de Demographía Histórica, 1998)

Doxiadis, A., *Grammata pros meteras* (*Letters to mothers*) (Athens: Ekdoseis Gkreka, 1926)

Drakakis, A., *Istoria tou oikismou tes Ermoupoleos Syras, 1821-1825* (*History of the settlement of Hermoupolis, Syros, 1821-1825*), vol. A (Athens, 1979)

Duflo, E., M. Greenstona, R. Guiteras & T. Clasen, 'Toilets can work: Short and medium run health impacts of addressing complementary and externalities in water and sanitation', Working Paper no.21521 (Cambridge, MA: NBER, 2015), 1-27

Easterlin, R.A., 'How beneficent is the market? A look at the modern history of mortality', *European Review of Economic History*, 3, 3 (1999), 257-294

Edvinsson, S., A. Brändström, J. Rogers & G. Broström, 'High-risk families: The unequal distribution of infant mortality in nineteenth-century Sweden', *Population Studies*, 59, 3 (2005), 321-337

Edvinsson, S., O. Gardarsdottir & G. Thorvaldsen, 'Infant mortality in the Nordic countries, 1780-1930', *Continuity and Change*, 22, 3 (2008), 457-485

Eliopoulos, P.G., 'Matters of life and death in a Mediterranean port city. Infrastructure, housing and infectious disease in Patras, 1901-1940', *Hygiea Internationalis*, 9, 1 (2010), 247-277

Eliopoulos, P.G, *Oikonomikes kai koinonikes domes mias periphereiakes metropoles: Patra sto 10 miso tou 20ou aiona* (*Economic and social structures of a peripheral metropolis: Patras in the second part of the 20th century*) (National and Kapodistrian University of Athens: Unpublished PhD thesis, 2011)

Evans, R.J., *Death in Hamburg: society and politics in the Cholera Years 1830-1910* (London: Penguin Books, 1990),

Exner, F., G. Walker, G.C. Simpson, H.H. Clayton & R. Mossman, *World Weather Collections,* 79 (Smithsonian Miscellaneous Collections, 1929)

Exner, F., G. Walker, G.C. Simpson, H.H. Clayton & R. Mossman, *World Weather Collections,* 90 (Smithsonian Miscellaneous Collections, 1934)

Fenerle, A., 'O kallopismos tes poles- Ermoupole, 19os ai.' (The beautification of the city- Hermoupolis, 19th c.), *E pole stous neoterous hronous: Mesogeiakes kai Valkanikes opseis, 19os-20os ai..* (*The city in modern times: Mediterranean and Balkan aspects, 19th-20th c.*) (Rethymno: EMNE, 2000), 173-182

Ferrie, J.P., & W. Troesken, 'Water and Chicago's mortality transition, 1850-1925', *Explorations in Economic History*, 45 (2008), 1-16

Ferrie, J.P., & W. Troesken, 'Death and the city: Chicago's mortality transition, 1850-1925', *National Bureau of Economic Research*, Working Paper 11427 (2005), 1-62

Fildes, V., 'Breast-feeding in London, 1905-19', *Journal of Biosocial Sciences*, 24 (1992), 53-70

Fildes, V., 'Infant feeding practices and infant mortality in England', *Continuity and Change*, 13, 2 (1998), 251-80

Filtzos, T.G., 'Epidemic influenza in Greece'¸ *Public Health Reports*, 34 (1919), 507

Fink, G., I. Gunther & K. Hill, 'The effect of water and sanitation on child health: evidence from Demographic and Health Surveys, 1986-2007', *International Journal of Epidemiology*, 40 (2011), 1196-1204

Finlay, R., 'Distance to church and registration experience', *Local Population Studies*, 24 (1980), 26-40

Floris, J., & K. Staub, 'Water, sanitation and mortality in Swiss town in the context of urban renewal in the late nineteenth century', *The History of the Family*, 24, 2 (2019), 249-276

Floud, R., R.W. Fogel, B. Harris & S.C. Hong, *The changing body: health, nutrition and human development in the western world since 1700* (Cambridge: Cambridge University Press, 2011)

Fogel, R.W., *The escape from hunger and premature death, 1700-2100* (Cambridge: Cambridge University Press, 2004)

Foustanos, I., 'Syzetesis peri diphteritidos. Statistike thnesimotetos en Ermoupolei ton eton 1848-1894' (Discussion on diphtheria. Statistics of mortality in Hermoupolis for the years 1848-1894), *Iatrike Etaireia Syrou* (*Syros Medical Association*) (Syros: Patris, 1894)

Foustanos, I., 'E demosia ygeia. Ti den egeneto mehri semeron en te hora emon, ti tha ginei eis to mellon, ti yposhetai h neosystatheisa etaireia tes ygieines' (Public health: What has not happened in our country until today, what will happen in the future, what does the new established hygiene association promise), *Iatrike Proodos*, 11-2, K (1915)

Foustanos, I., 'E alethes noserotes kai thnesimotes ek fymatioseos en Elladi' (The real morbidity and mortality due to tuberculosis in Greece), *Iatrike Proodos* (1917)

Fragkiades, A. (ed.), *Ellenike Oikonomia, 19os -20os aionas* (*Greek Economy, 19th-20th century*) (Athens: Nefele, 2007)

Fragkides, A., *Nesos Syros ypo topographiken, klimatologiken kai iatriken epopsin* (*The island of Syros through topographic, climatological and medical perspective*) (Hermoupolis, 1894)

Fragkides, A., *Istoria tes nesou Syrou* (*History of the island of Syros*) (Syllogos ton en Athenais & Peiraiei Syrianon, 1975)

Fuller, J.A., J.A., Westphal, B. Kenney & J.N.S. Eisenberg, 'The joint effect of water and sanitation on diarrhoeal diseases: a multicountry analysis of the Demographic and Health Surveys', *Tropical Medicine and International Health*, 20, 3 (2015), 284-292

Gabriel, K.R., & I. Ronen, 'Estimates of mortality from infant mortality rates', *Population Studies*, 12, 2 (1958), 164-169

Gage, T., 'Population variation in cause of death: level, gender, and period effects', *Demography*, 31, 2 (1994), 271-296

Gallant, T.W., 'Agency, structure and explanation in social history: the case of the foundling home on Kephallenia, Greece, during the 1830s', *Social Science History*, 15, 4 (1991), 479-508

Gallant, T.W., *Modern Greece* (London: Arnold, 2001)

Gallardo Albarrán, D., 'Sanitary infrastructures and the decline of mortality in Germany, 1877-1913', *GGDC Research Memoranda*, 176 (2018), 1-38

Galley, C., *The demography of early modern towns. York in the sixteenth and seventeenth centuries* (Liverpool: Liverpool University Press, 1998)

Galley, C., 'The stillbirth rate in early modern England', *Local Population Studies*, 81 (2008), 75-83

Garden, M., & E. Bournova, 'O plethysmos tes Athenas kai tes gyro periohes kata to 20 miso tou 19ou aiona' (Population of Athens and the region around during the second half of the 19th century), *Istorika*, 43 (December 2005), 373-396

Gavalas, V.S., *Demographic reconstruction of a Greek island community: Naousa and Kostos, on Paros, 1894-1998* (University of London, LSE: Unpublished PhD thesis, 2001)

Gavalas, V.S., Fertility transition on a Greek island', *Continuity and Change*, 17, 1 (2002), 133-160

Gavalas, V.S., 'Island mortality in the past: some evidence from Greece', *Journal of Biosocial Science*, 40, 2 (2008), 203-222

Gavalas, V.S., 'E ptose tes gennetikotetas stis Kyklades' (Fertility decline in the Cyclades islands), *Epeteris Etairias Kykladikon Spoudon*, 21 (2014), 121-140

Gerasimides, K., *To panorama tes Syrou* (*The panorama of Syros*) (Syros: Keryks ton Kykladon, 1933)

Giagkakes, G., *Demografika Kykladon, 1821-1971* (*The demographics of the Cyclades, 1821-1971*) (Athens: Vivliopoleio ton vivliofilon, 1978)

Giannuli, D., '"Repeated Disappointment": The Rockefeller Foundation and the reform of the Greek public health system, 1929-1940', *Bulletin of the History of Medicine*, 72, 1 (1998), 47-72

Glezen, W., 'Emerging infections: pandemic influenza', *Epidemiologic Reviews*, 18, 1(1996), 64-76

Goff, R., 'Factors in the drop in United States infant mortality: 1900-1940', *Carnegie Mellon University Research Showcase*, 5 (2010)

Goldblum¸ R.M., S. Ahlstedt, B. Carlsson, L.A. Hanson, U. Jodal, G. Lidin-Janson & A. Sohlakerlund, 'Antibody-forming cells in human colostrum after social immunisation', *Nature*, 30 (1975), 797-799

G. Gonatidis, *Afrodisia nosemata sten Ermoupole ton 19o aiona* (*Venereal diseases in Hermoupolis in the 19th century*) (University of Ioannina, MA dissertation, 2014)

Goulandres, N., 'E fymatiosis para to lao, therapeuterion kai iatreion en Syro' (Tuberculosis of the people, sanatorium and dispensary in Syros), *Syllogos Ygieines Syrou* (1921)

Gourbin, C., & G. Masuy-Stroobant, 'Registration of vital data: are live births and stillbirths comparable all over Europe?', *Bulletin of the World Health*, 73, 4 (1995), 449-460

Gourbon, V., & C. Rollet, 'Stillbirths in nineteenth-century Paris: social, legal and medical implication of a statistical category', *Population*, 64, 4 (2009), 601-634

Gourgoulianos, K.(ed.), *Giati fovomaste te gripe? Apo ten eksaplose ton loimokseon sten pandemia tes gripes* (*Why are we afraid of the flu? From the spread of infectious diseases to the influenza pandemic*) (Athens: Metaihmio, 2009)

Grantz, K.H., M.S. Rane, H. Salje, G.E. Glass, S.E. Scharchtele & D.A.T. Cumming, 'Disparities in influenza mortality and transmission related to sociodemographic factors within Chicago in the pandemic of 1918', *PNAS*, 113, 48 (2016), 13839-13844

Gronjé, G., 'Tuberculosis and mortality decline in England and Wales, 1851-1910', in R. Woods & J. Woodward (eds), *Urban disease and mortality* (London: Batsford Academic and Educational, 1984), 79-101

Guillot, M., P. Gerland, F. Pelletier & A. Saabneh, 'Child mortality estimation: A global overview of infant and child mortality age patterns in light of empirical data', *PLoS Med*, 9, 8 (2012), 1-15

Gutenschwager, G., *E politike tes ygeias ste neotere Ellada* (*The political economy of health in Modern Greece*) (Athens: EKKE, 1989)

Haines, M.R., 'Conditions of work and decline of mortality', in R. Schofield, D. Reher & A. Bideau (eds), *The decline of mortality in Europe* (Oxford: Clarendon Press, 1991), 177-195

Haines, M.R., 'Socio-economic differentials in infant and child mortality during mortality decline: England and Wales, 1890-1911', *Population Studies*, 49, 2 (1995), 297-315

Haines, M.R., 'The urban mortality transition in the United States, 1800-1940', *Annales de démographie historique*, 101, 1 (2000), 33-64

Hardy, A., *The Epidemic Streets: Infectious disease and the rise of preventive medicine, 1856-1900* (Oxford: Clarendon Press, 1993)

Hardy, A., ''Death is the cure of all diseases': Using the general register office cause of death statistics for 1837-1920', *Social History of Medicine*, 7 (1994), 472-492

Harris, B., 'Public health, nutrition, and the decline of mortality: the McKeown thesis revisited', *Social History of Medicine*, 17, 3 (2004), 379-407

Harris, B., R. Floud & S. Hong, 'How many calories? Food availability in England and Wales in the eighteenth and nineteenth centuries', *Research in Economic History*, 31 (2015), 111-191

Harris, B., & J. Helgertz, 'Urban sanitation and the decline of mortality', *The History of the Family*, 24,2 (2019), 207-226

Harris, B., & A. Hinde, 'Sanitary investment and the decline of urban mortality in England and Wales, 1817-1914', *The History of the Family*, 24,2 (2019), 377-403

Hart, N., 'Beyond infant mortality: Gender and stillbirth in reproductive mortality before the twentieth century', *Population Studies*¸ 52, 2 (1998), 215-229

Hassiotis, L., 'Greece', *International Encyclopaedia of the First World War*: https://encyclopedia.1914-1918-online.net/article/greece (access in April 2018)

Hastaoglou-Martinidis, V., 'The cartography of harbour construction in eastern Mediterranean cities: technical and urban modernization in the late nineteenth century', in B. Kolluoglou & M. Toksoz (eds), *Cities of the Mediterranean. From the Ottomans to the present day* (London and New York: I.B. Tauris, 2010), 78-99

Hatzianastasiou, S., A. Pavli & H. Maltezou, 'Legal aspects of public health: How law frames communicable disease control in Greece', *Journal of Public Health Policy*, 32, 4 (2011), 445-457

Helgertz, J., & M. Onnerfors, 'Public water and sewerage investments and the urban mortality decline in Sweden, 1875-1930', *The History of the Family*, 24,2 (2019), 307-338

Hietala, T., 'Proheira vivlia apovioseon demou Ermoupolis' (Rough registers of death certificates of the Municipality of Hermoupolis), *The City in Modern Times*, http://cities.ims.forth.gr/docs/Death.Hermoupolis.pdf (access in April 2018)

Hietala, T., 'Prosfygia sten Ermoupole: Ksefyllizontas to metroo prosfygon Syrou' (Refugees in Hermoupolis: browsing the Syros refugees' registers), *The City in Modern Times*, http://cities.ims.forth.gr/docs/RefugeeArrivals.Hermoupolis.pdf (access in April 2018)

Hinde, A., *England's population: a history since the Domesday Survey* (London: Hodder Arnold, 2003)

Hinde, A., 'Sex differentials in phthisis mortality in England and Wales, 1861-1870', *The History of the Family*, 20, 3 (2015), 366-390

Hinde, A., & B. Harris, 'Mortality decline by cause in urban and rural England and Wales, 1851-1910', *The History of the* Family, 24,2 (2019), 377-403

Hionidou, V., *The demography of a Greek island, Mykonos, 1859-1959: A family reconstitution study* (University of Liverpool: Unpublished PhD thesis, 1993)

Hionidou, V., 'Istorike kritike anadrome tes gennetikotitas sten Ellada. E periptose tes Mykonou, 1859-1959' (A critical historical review of fertility in Greece: the case of Mykonos, 1859-1959), *Greek Review of Social Research*, 92-93 (1997), 31-62

Hionidou, V., 'Infant mortality in Greece, 1859-1959: problems and research perspectives', in C.A. Corsini and P.P. Viazzo (eds), *The decline of infant and child mortality: the European experience: 1750-1990* (The Hague: Martinis Nijhoff ,1997), 155-172

Hionidou, V., 'The adoption of fertility control on Mykonos 1879-1959: Stopping, spacing or both?', *Population Studies*, 52, 1 (1998), 67-83

Hionidou, V., 'Nineteenth-century Greek households: The case of Hermoupolis, 1861-1879', *Continuity and Change*, 14, 3 (1999), 403-427

Hionidou, V., 'Domestic service on three Greek islands in the later 19th and early 20th centuries', *The History of the Family*, 10 (2005), 473-489

Hionidou, V., 'Demographia' (Demography), in K. Petmezas (ed.), *E anaptykse tes ellenikes oikonomias ton 19o aiona* (*The Greek economy in the 19th century*) (Athens: Alexandreia, 2006), 81-102.

Hionidou, V., *Famine and death in occupied Greece, 1941-1944* (Cambridge: Cambridge University Press, 2006)

Hionidou, V., '"It was a bridge from life to death": Hospitals during the Food Crisis, Greece 1941-1944', *Social History of Medicine*, 22, 2 (2009), 361-385

Hionidou, V., 'Popular medicine and empirics in Greece, 1900-1950: An oral history approach', *Medical History*, 60, 4 (2016), 492-513

Hionidou, V., 'Adjusting to crisis on Greek islands: a micro-historical approach', unpublished paper presented at the C*rises, gender and adaptive family economies in Mediterranean Europe (late XVIIIth-20th centuries). Concepts, definitions and methods*, (Athens: École Française d'Athènes, May 2017)

Hionidou, V., '"Etote den etan opos tora pou mathainoun ta koritsia grammata kai pane sta grapheia kai douleuoune. Tote pegainame yperetries": Yperetries sten Ellada, 1860-1960' ("Then it was not as it is now with girls being educated and working in offices. Then we became servants": Domestic servants in Greece, 1860-1960), in P. Mene, A. Stavrakopoulou, K. Georgiade & I. Pipinia (eds), *To yperetiko prosopiko sten ellenike tehne, ten koinonia kai ten istoria. Mythoi kai pragmatikoteta* (*Servants in Greek art, society and history. Myths and reality*) (Rethymno: University of Crete Press, in press)

Hugh, P., 'Shifts in the seasonality of infant deaths in nine English towns during the 19th century: a case for reduced breast feeding?', *Explorations in Economic History*, 34, 4 (1997), 368-386

Ioakeimoglou, I., P. Papamarkou & K. Kinna, 'To gala ton Athinon' (Milk in Athens), *Asklepios*, B, 11 (1931)

Ithakisios, D., & A. Vozikis, 'Quarantine and lazarettos in the 19th Century Greece: an economic perspective', *SPOUDAI Journal of Economics and Business*, 64, 1 (2014), 42-52

Jaadla, H., & M. Klesment, 'Infant mortality in the Lutheran population of Tartu at the end of the nineteenth century', *Ajalooline Ajakiri*, 2, 3 (2014),

Jaadla, H., & A. Puur, 'The impact of water supply and sanitation on infant mortality: individual level evidence from Tartu, Estonia, 1897-1900', *Population Studies*, 70, 2 (2016), 163-179

Jaadla, H., & A. Reid, 'The geography of early childhood mortality in England and Wales, 1881 and 1911', *Demographic Research*, 37, 58 (2017), 1863-1890

Jackson, M.R., 'Comparing the Balkan demographic experience, 1860 to 1870', *The Journal of European Economic History*, 14 (1985), 223-272

Johnson, N., *Britain and the 1918-19 influenza pandemic: A dark epilogue* (London: Routledge, 2006)

Johnson, N., & J. Mueller, 'Updating the accounts: Global mortality of the 1918-1920 'Spanish' influenza pandemic', *Bulletin of the History of Medicine*, 76, 1 (2002), 105-115

Kaires, M., *To egkolpion tes maias* (*The midwife's handbook*) (Athens, 1927)

Kanellakes, A., *Symvole eis ten melete tes vrefikes thnesimotitos en Elladi* (*A contribution to the study of infant mortality in Greece*) (University of Athens: PhD thesis, 1955)

Kapanides, N., *E kleiste perithalpse sto elleniko kratos, 1909-1940* (*Healthcare system in Greece 1909-1940*) (Aristotle University of Thessaloniki: Unpublished Ph.D. thesis, 1988)

Karachaliou, F., 'To hroniko tes ispanikes gripes' (The chronicle of the Spanish flu), in K. Gourgoulianos (ed.), *Giati fovomaste te gripe? Apo ten eksaplose ton loimoxeon sten pandemia tes gripes* (*Why are we afraid of the flu? From the spread of infections to the influenza pandemic*) (Athens: Metaihmio, 2009), 35-78

Karamanes, E. & A. Mpakole, ‘Metriko gala kai thelasmos: e proseggise ton laografikon katagrafon’ (Maternal lactation and breastfeeding: a folkloric approach), *Epeteris tou kentrou Ellenikes Laografias*, 33 (2009-10), 1-19

Kardamates, I.P., ‘E para to paidio epidemike dysenteria kai ai par’ emin dysenteroeideis nosoi’ (Infant epidemic dysentery and adult dysenteric diseases), *Iatrike Proodos* (1905)

Kardamates, I., ‘H ek fymatioseos noserotes kai thnesimotes en Elladi’ (Tuberculosis morbidity and mortality in Greece), *Iatrike Proodos* (1917)

Kardasis, V., ‘Ermoupole: Astikes leitourgies kai symperifores’ (Hermoupolis: Urban services and performances), *Praktika tou diethnous symposiou istorias- Neollenikes poles, Othomanikes kleronomies kai Elleniko kratos* (Proceedings of the International Symposium of History, Neo-Hellenic cities, Ottoman Heritages and Greek State) (Athens: Etaireia Meletes Neou Ellenismou, 1985), 585-589

Kardasis, V., *Syros: stavrodromi tes Anatolikes Mesogeiou, 1832-1857* (*Syros: crossroads of the Eastern Mediterranean*) (Athens: MIET, 1987)

Kates, K., *Nosokomeio nosematon thorakos Athenon ‘E SOTERIA’: istorike melete* (*Hospital of chest diseases ‘SOTERIA’: an historical study*) (Athens: National and Kapodistrian University of Athens, 1984)

Kearns, G., ‘The urban penalty and the population history of England’, in A. Brandström & L.-G. Tedebrand (eds), *Society, health and population during the demographic transition* (Stockholm: Amlqvist and Wisksell International, 1988), 213-236

Kesztenbaum, L., & J. Rosenthal, ‘The health cost of living in a city: The case of France at the end of the 19th century’, *Explorations in Economic History*, 48 (2011), 207-225

Kesztenbaum, L., & J. Rosenthal, ‘Sewers’ diffusion and the decline of mortality: The case of Paris, 1880-1914’, *Journal of Urban Economics*, 98 (2017), 174-186

Kintner, H., ‘Classifying causes of death during the late nineteenth and twentieth centuries: The case of German infant mortality’, *Historical Methods: A Journal of Quantitative and Interdisciplinary History*, 19, 2, (1986), 45-54

Kirby, R.S., ‘Neonatal and post-neonatal mortality: useful constructs or outdated concepts?’, *Journal of Perinatology*, 13,6 (1993), 433-441

Knodel, J., ‘Seasonal variations in infant mortality: an approach with applications’, *Annales de démographie historique* (1984), 208-230

Knodel, J., & H. Kitner, ‘The impact of breast feeding patterns on the biometric analysis of infant mortality’, *Demography*, 14, 4 (1977), 391-409

Kokkou, A., ‘To loimokatharterio tes Syrou- Istoria kai peripeteies tou mnemeiou’ (Syros’s lazaretto- history and adventures of the site), unpublished paper in *Ta Seminaria tes Ermoupoles* (*Hermoupolis’s Seminars*) (Hermoupolis, 2012).

Kolodny, E., ‘Hermoupolis-Syros, Gennesis kai ekselikses mias ellenikes nesiotikes poleos’ (Hermoupolis-Syros, the birth and evolution of a Greek island city), *Epeteris Etaireias Kykladikon Meleton*, 8 (1969), 249-286

Kolodny, E., *Population des îles de la Grèce* (Aix-en-Provence: Edisud, 1974)

Komis, K., *Istorike demographia tou Neoellenikou horou, 19os aionas* (*Historical demography of the Neohellenic area, 19th century*) (Ioannina: Panepistemio Ioanninon, 2002)

Kontogiorgi, E., *Population Exchange in Greek Macedonia: The rural settlement of refugees 1922-1930* (Oxford: Oxford University Press)

Kooij, P., & L. Sapounaki- Dracaki, 'Health care in Greece and the Netherlands in the nineteenth century. A tale of two cities', *Gesnerus*, 60, 3-4 (2003), 188-219

Kopanares, F., *E demosia ygeia en Elladi* (*Public health in Greece*) (Athens, 1933)

Korasidou, M., *Otan e arrostia apeilei. Epiterese kai eleghos tes ygeias tou plethysmou sten Ellada tou 19ou aiona* (*When disease threatens. Surveillance and control of the health of the population in 19th century Greece*) (Athens: Typothyto, 2002)

Korasidou, M., *Oi Athlioi ton Athenon kai oi therapeutes tous. Ftocheia kai filanthropia sten Ellenike protevousa to 19o aiona* (*The Athens miserable and their therapists. Poverty and charity in the Greek capital of the 19th century*) (Athens: Typothyto, 2004)

Kosmatou, E., *La population de lles Ioniennes: XXVIIeme- XIXeme siècle*, (University de Paris 1 Pantheon Sorbonne: Unpublished PhD thesis, 2000)

Kotzamanis, B., *Dictionary in Demography*: http://www.demography-lab.prd.uth.gr/DDAoG/edu/Lexiko/LEXIKO_GR.pdf (access in March 2018)

Kotzamanis, B. & E. Androulaki, 'Oi demografikes ekselikseis ste neotere Ellada' (The demography of modern Greece), in B. Kotzamanis (ed.), *E demografike proklese, gegonota kai diakyveumata* (*Demographic challenge, facts and risks*) (Volos: University of Thessaly, 2009), 87-120

Kunitz, R., 'Premises, premises: Comments on the comparability of classifications', *Journal of the History of Medicine*, 54 (1999), 226-240

Kyriazides, K., *Ta pepragmena tes Ygeionomikes yperesias tou Ypourgeiou ton Esoterikon kata ten dekaetia 1911-1921* (*The activities of the Sanitary Service of the Ministry of Interior Affairs*) (Athens, 1929)

Landers, J., *Death and the metropolis. Studies in the demographic history of London 1670-1830* (Cambridge: Cambridge University Press, 1993)

Langford, C., 'The age pattern of mortality in the 1918-19 influenza pandemic: an attempted explanation based on data for England and Wales', *Medical History*, 46 (2002), 1-20.

Lecoeur, S., *Mussolini's Greek island: Fascism and the Italian Occupation of Syros in World War II* (London: Tauris, 2009)

Lee, K., 'Infant mortality decline in the late 19th and early 20th centuries: the role of market milk', *Perspectives in Biology and Medicine,* 50, 4 (2007), 585-602

Leivadaras, N., *To proto nosokomeio tes epanastatemenes kai eleftheres Elladas sten Ermoupole Syrou 1825* (*The first hospital of revolutionary and independent Greece in Hermoupolis of Syros 1825*), (Aristotle University of Thessaloniki: Unpublished PhD thesis, 2012)

Leon, G.B., *Greece and the Great Powers, 1914-1917* (Thessaloniki, 1974)

Leontidou, L., *The Mediterranean city in transition: social change and urban environment* (Cambridge: Cambridge University Press, 1990)

Levene, A., *Childcare, health and mortality at the London Foundling Hospital 1741-1800: 'left to the mercy of the world'* (Manchester: Manchester University Press, 2007)

Lewis, J., 'The social history of social policy: infant welfare in Edwardian England', *Journal of Social Policy*, 9, 4 (1980), 463-486

Liakos, A., *Ergasia kai politike sten Ellada tou mesopolemou: to Diethnes Grafeio Ergasias kai e anadyse ton koinonikon thesmon* (*Labour and politics in interwar Greece: the International Labour Office and the emergence of social institutions*), (Athens: EKT, 1993)

Longini, I., J. Koopman, A. Monto & J. Fox., 'Estimating household and community transmission parameters for influenza', *American Journal of Epidemiology*, 115, 5 (1982), 736-751

Louis, C., 'Daily newspaper view of dengue fever epidemic, Athens, Greece, 1927-1931', *Emerging Infectious Diseases*¸ 18, 1 (2012), 78-82

Loukos, C., 'Epidemia kai koinonia. E cholera sten Ermoupole tes Syrou, 1854 (Epidemic and society. The cholera in Hermoupolis of Syros, 1854), *Mnimon*, 14 (1992), 49-69

Loukos, C., 'Ta ektheta vrefe tes Ermoupoles: Ta prota thymata tes pathologias mias koinonias;' (Foundling infants of Hermoupolis: First victims of a society's pathology?)', *Volume in Honour of the Professor Vasileios VI Sfyroeras* (Athens: Lychnos, 1994), 247-264

Loukos, C., *Pethainontas ste Syro ton 19o aiona* (*Dying in Hermoupolis in the 19th century*) (Iraklio: Crete University Press, 2000)

Loukos, C., 'Katholikoi kai orthodoksoi ste Syro, 1821-1974: Mia dyskole sygkatoikese' (Catholics and Orthodox in Syros, 1821-1974: A difficult cohabitation), *Epistemoniko symposio Meionotites sten Ellada* (*Scientific symposium Minorities in Greece*) (Athens: Etaireia Spoudon Neoellenikou Politismou kai Genikes Paideias, 2002)

Loukos C., 'Families and family structure in a Neo-Hellenic city: Hermoupolis in the mid-19th century', *The History of the Family*, 9 (2004), 317-324

Loukos, C., 'Merikes episemanseis gia tous katoikous tes Ermoupoles to 19o aiona: geografike proeleuse, kinetikoteta, egkatastase sto horo, epaggelmata, koinonikes sheseis' (A few points on the inhabitants of Hermoupolis in the 19th century: geographical origin, mobility, settlement, occupations and social relationships), in C. Agriantoni & D. Dimitropoulos (eds), *Syros kai Ermoupolis: Symvoles sten istoria tou nesiou: 15os- 20os ai.* (*Syros and Hermoupolis: Contributions to the history of the island: 15th-20th c.*) (Athens: EIE, 2008), 105-126

Loukos, C., Ethelontikes syssomatoseis gia neous kai apo neous ste Syro kata to proto miso tou eikostou aiona' (Voluntary organisations for the youth and from the youth on Syros during the first half of the twentieth century), in E. Avdela, C. Eksertzoglou & C. Lyrintzes (eds), *Morphes demosias koinonikotetas sten astike Ellada tou eikostou aiona* (*Forms of public sociality in twentieth century urban Greece*) (Rethymno: Crete University Press, 2015), 62-81

Loukos, C., 'Oi demotikes apographes' (The municipal censuses), *The City in Modern Times* http://cities.ims.forth.gr/docs/Census.Hermoupolis.1861.1870.1879.pdf (access in April 2018)

Loukos, C., 'To demotologio tes Ermoupoles' (Municipal rolls of Hermoupolis), *The City in Modern Times*, http://cities.ims.forth.gr/docs/Municipal.Hermoupolis.pdf (access in April 2018)

Loukos, C., & P. Poleme, *Odegos demotikou arheiou Ermoupoles, 1821-1949* (*A guide to the municipal archives of Hermoupolis, 1821-1949*) (Athens: EMNE, 1987)

Luckin, B., *Pollution and control: a social history of the Thames in the nineteenth century* (Bristol: Adam Hilger, 1986)

Luk, J., P. Gross & W.W. Thompson, 'Observations on mortality during the 1918 influenza pandemic', *Clinical Infectious Diseases,* 33 (2001), 1375-1378

Lunn, P.G., 'Nutrition, immunity and infection', in R. Schofield, D. Reher & A. Bideau (eds), *The decline of mortality in Europe* (Oxford: Clarendon Press, 1991), 131-145

Lussier, M., R. Bourdeau & R. Choinière, 'Does the recent evolution of Canadian mortality agree with the epidemiologic transition theory?', *Demographic Research*, 18, 19 (2008), 532-568

Macassa, G., A.P. De Leon & B. Burström, 'The impact of water supply and sanitation on area differentials in the decline of diarrhoeal disease mortality among infants in Stockholm 1878-1925', *Scandinavian Journal of Public Health*, 34, 5 (2006), 526-533

Makkas, G.N., *E thnesimotis tes paidikes elikias en Elladi: Aitiai kai mesa pros peristolin* (*Childhood mortality in Greece: causes and means for its reduction*) (Athens, 1911)

Makkas, G., *E prostasia tou paidiou* (*The protection of the child*) (Athens, 1921)

Makrides, N., *Ai yperesies ygieines sten Ellada* (*The sanitary services in Greece*) (Athens, 1934)

Mamelund, S-E., 'A socially neutral disease? Individual social class, household wealth and mortality from Spanish influenza in two socially contrasting parishes in Kristiania 1918-19', *Social Science and Medicine*, 62 (2006), 923-940

Mamelund, S-E., 'Geography may explain adult mortality from the 1918-20 influenza pandemic', *Epidemics*, 3 (2011), 46-60

Mamelund, S-E., '1918 pandemic morbidity: The first wave hits the poor, the second wave hits the rich' *Influenza and Other Respiratory Viruses* (2018), 1-7

Mamelund, S-E., L. Sattenspiel & J. Dimka., 'Influenza-associated mortality during the 1918-1919 influenza pandemic in Alaska and Labrador', *Social Science History*, 37, 2 (2013), 177-229

Mansolas, A., *Politeiografikai pleroforiai peri Ellados* (*Statistical information concerning Greece*) (Athens: National Press, 1867)

Margarites, G., 'Polemoi' (Wars), in C. Hatziiosif (ed.) *Istoria tes Elladas tou 20ou aiona (The history of Greece in the 20th century)*, vol. A (Athens: Vivliorama, 1999), 150-187

Mastrogiannes, I., *E istoria tes koinonikes pronoias tes Neoteras Ellados* (*History of social welfare in Modern Greece*) (Athens, 1960)

Masuy Stroobant, G., 'Infant health and infant mortality in Europe: lessons from the past and challenges for the future', in C.A. Corsini, P. Viazzo (eds), *The decline of infant and child mortality. The European experience: 1750-1990* (The Hague: Martinis Nijhoff, 1997), 1-34

Maurogonatou, S.G., *E ydrodotese tes Athenas. Apo ta diktya sto diktyo: 1880-1930. Technologia, koinonia, politike* (*Water supply in Athens. From the networks to the network: 1880-1930. Technology, society, politics*) (National and Kapodistrian University of Athens & National Technical School of Athens: Unpublished PhD Thesis, 2009)

Mauroeide, M., 'Eisagomene kai eghoria technologia ste viomehania tes Ermoupoles ten periodo tou Mesopolemou' (Imported and domestic technology in the industry of Hermoupolis during the interwar period), in C. Agriantoni & D. Dimitropoulos (eds), *Syros kai Ermoupolis: Symvoles sten istoria tou nesiou: 15os- 20os ai.* (*Syros and Hermoupolis: Contributions to the history of the island: 15th-20th c.*) (Athens: EIE, 2008), 187-200

Mazower, M., *Greece and the Inter-war economic crisis* (Oxford: Oxford University Press, 1991)

McFarlane, N., 'Hospitals, housing, and tuberculosis mortality in Glasgow, 1911-51', *The Society for the History of Medicine*, 2 (1989), 59-85

McGehee, M.A., 'Mortality', in J.S. Siegel & D.A. Swanson (eds), *The methods and materials of demography* (Elsevier Academic Press, 2004), 265-300

McKeown, T.R., *The modern rise of population* (London: Edward Arnold Ltd, 1976)

McKeown, T.R., & R.G. Record, 'Reasons for the decline of mortality in England and Wales during the nineteenth century', *Population Studies*, 16 (1962), 94-122

McKeown, T.R., R.G. Brown & R.G. Record, 'An interpretation of the modern rise of population in Europe', *Population Studies*, 26 (1972), 345-382

McNay, K., J. Humphries & S. Klassen, 'Excess female mortality in nineteenth-century England and Wales: A regional analysis', *Social Science History*, 29, 4 (2005), 649-681

Meckel, A.R., 'Immigration, mortality and population growth in Boston, 1840-1889', *Journal of Interdisciplinary History*, 15, 3 (1985), 393-417

Meeker, E., 'The improving health of the United States, 1850-1915', *Explorations in Economic History*, 9 (1972), 353-373

Mercer, A., *Diseases, mortality and population in transition* (Leicester: Leicester University Press, 1990)

Mercer, A., *Infections, chronic disease and the epidemiological transition* (Rochester: University of Rochester Press, 2014)

Meredith, D., & D. Oxley, 'Food and Fodder: Feeding England, 1700-1900', 222, 1 (2014), 163-214

Meslé, F., & J. Vallin, 'Reconstructing long-term series of causes of death', *Historical Methods: A Journal of Quantitative and Interdisciplinary History*, 29 (1996), 72-87

Millward, R., & F. Bell, 'Infant mortality in Victorian Britain: the mother as medium', *Economic History Review*, LIV, 4 (2001), 699-733

Ministry of Hygiene, *Meteres pos na threfete ta paidia os pou na ginoun dyo hronon* (*Mothers, how to feed your babies until they reach the second year*) (Athens, 1930)

Mitchell, B.R., *European historical statistics 1750-1975* (New York: Macmillian Press, 1981)

Monnier, A., 'L'Italie, l'Espagne et le Portugal: Situation démographique', *Population,* 35, 4/5 (1980), 924-957

Mooney, G., 'Did London pass the 'sanitary test'? Seasonal infant mortality in London, 1870-1914', *Journal of Historical Geography,* 20, 2 (1994), 158-174

Mooney, G., *The geography of mortality decline in Victorian London* (University of Liverpool: Unpublished PhD thesis, 1994)

Mooney, G., 'Professionalization in public health and the measurement of sanitary progress in nineteenth-century England and Wales', *The Social History of Medicine*, 10, 1 (1994), 53-78

Mooney, G., 'Still-births and the measurement of urban infant mortality rates c.1890-1930', *Local Population Studies*, 53 (1994), 42-52

Mooney, G., B. Luckin & A. Tanner, 'Patient pathways: solving the problem of institutional mortality in London during the later nineteenth century', *The Society for the Social History of Medicine*, 12, 2 (1999), 227-269

Mooney, G., & A. Tanner, 'Infant mortality, a spatial problem: Notting Dale Special Area in George Newman's London', in E. Garrett, C. Galley, N. Shelton & R. Woods (eds), *Infant mortality: A continuing social problem* (Aldershot: Ashgate, 2006), 169-188

Morel, M., 'The care of children: the influence of medical innovation and medical institutions on infant mortality 1750-1914', in R. Schofield, D. Reher & A. Bideau (eds), *The decline of mortality in Europe* (Oxford: Clarendon Press, 1991), 196-219

Morens, D., & A. Fauci, 'The 1918 influenza pandemic: insights for the 21st century', *Journal of Infectious Diseases*, 195 (2007), 1018-1028

Morgenthau, H., *I was sent to Athens* (New York, 1929)

Moriyanna, I., R. Loy & A. Robb-Smith, *History of the Statistical Classification of diseases and causes of deaths*, edited and updated by H. Rosenberg & D. Hoyert (CDC, National Centre for Health Statistics, 2001)

Mosley, W.H., & L.C. Chen, 'An analytical framework for the study of child survival in developing countries', *Population and Development Review*, 10 (1984) suppl., 25-45

Moustane, D., *Oi demographikes ekselikseis s'ena viomechaniko kentro: Volos, 1881-1922* (*Demographic evolutions of an industrial centre: Volos 1881-1922*) (University of Thessaly: Unpublished PhD thesis, 2014)

Mpakole, A.S. 'Paidike paradosiake diatrofe' (Traditional child's diet), *Epeteris Kentrou Laografias* (*Yearbook of the Hellenic Folklore Research Centre*), 29/30 (2004), 163-175

Murray, J., *Hand-book for travellers in the Ionian sands, Greece,* Turkey (London, 1840)

Murray, J.F., 'Tuberculosis and World War I', *American Journal of Respiratory and Critical Care Medicine*, 192, 4 (2015), 411-414

Murray, C.J., AD. Lopez, B. Chin, D. Feeham & KH. Hill, 'Estimations of potential global pandemic influenza mortality on the basis of vital registration data from 1918-20 pandemic: a quantitative analysis', *Lancet*, 368 (2006), 2211-2218

Natale, M. & A. Bernassola, *La mortalità per causa nelle regioni italiane: tavole per contemporanei 1965-66 e per generazioni 1790-1964* (Istituto di Demografia, Facoltà di Scienze Statistiche Demografich, Università di Roma, 1973)

Newell, C., *Methods and models in demography* (New York: Guilford Publications, 1988)

Nikolaidis, G., & S. Sakellaropoulos, 'Social policy in Greece in the interwar period: events, conflicts, and the conceptual transformation', *SAGE open* (2012), 1-15

Notestein, F., 'Population: The long view', in T. Schultz (ed.), *Food for the World* (Chicago: University of Chicago Press, 1945)

Noymer, A., 'The 1918 influenza pandemic hastened the decline of tuberculosis in the United States: an age, period, cohort analysis', *Vaccine*, 29, 2 (2011), B38-B41

Oei, W., & H. Nishiura, 'The relationship between tuberculosis and influenza deaths during the influenza (H1N1) pandemic from 1918-19', *Computational and Mathematical Methods in Medicine* (2012), 1-9

Olshansky, S.J., & A.B. Ault, 'The fourth stage of the epidemiologic transition: the age of delayed degenerative diseases', *The Milbank Quarterly,* 64, 3 (1986), 355-391

Omran, A.R., 'The epidemiologic transition: A theory of the epidemiology of population change', *Milbank Memorial Fund, Blackwell Publishing*, 83, 4 (2005), 731-757

Oris, M., R. Derosas & M. Breschi, 'Infant and child mortality', in T. Bengtsson, C. Campbell, J. Lee *et al.* (eds), *Life under pressure: Mortality and living standards in Europe and Asia, 1700-1900* (Cambridge: Massachusetts Institute of Technology Press, 2004), 359-398

Pampoukes, P., *O Agon kata tes fthiseos* (*The fight against phthisis*) (Athens, 1927)

Panellenios Syndesmos kata tes fematiosis (Panhellenic Anti-Tuberculosis Association), *Logodosia 1918* (*Proceedings 1918*) (1919)

Papakostas, G., 'Organosis antifymatikou agona' (Organizing the anti-tuberculosis struggle), *Arheia Ygieines* (December 1937)

Papapanagiotou, A., 'E thnetotis ton paidon en Athinais' (Child mortality in Athens), *Emerologion Efemeridos ton Kyrion tou 1891* (*Calendar of Women's Journal of 1891*)

Papastefanaki, L., 'Demosia ygeia, fymatiose, kai epaggelmatike pathologia stis ellenikes poleis stis arhes tou 20ou aiona: e antifatike diadikasia tou astikou eksychronismou' (Public health, tuberculosis and occupational pathology in the Greek towns in the beginning of the 20th century: the controversial process of the bourgeois modernisation), *Praktika synedriou Eleftherios Venizelos kai ellenike pole* (*Proceedings of the conference Eleftherios Venizelos and the Greek city*) (Athens: National Research Foundation 'Eleftherios K. Venizelos', Technical Chamber of Greece, National Technical University of Athens, 2005), 155-170

Papastefanaki, L., 'Katamerismos ergasias kai fylo stis ellenikes poleis' (Divisions of labour and gender in Greek cities), published paper presented at the *Gynaikes kai andres stous horous tes kathemerinotetas* (*Women and men in everyday places*) (Athens: National Technical School of Athens, 2006), 121-131

Papastefanaki, L., ‘Apo ten “Ygieine ton Epitedeumaton” sten “Eyksemenen noseroteta tes ergatikes takseos”: E eppagelmatike ygeia sten Ellada 1870-1940’ (From the “Hygiene of Trades” to the “Increased morbidity of the working class”: Occupational health in Greece, 1870-1940), in I. Kyriopoulos (ed.), *Demosia ygeia kai koinonike politike: o Eleftherios Venizelos kai e epohe tou* (*Public health and social policy: Eleftherios Venizelos and his time*) (Athens: Papazissi, 2008), 265-288

Papastefanaki, L., ‘To “patriko endiaferon” ton viomehanon kai e diaheirise tes ergasias sten klostoufantourgia Karella’ (Ermoupole, proto miso tou 20ou aiona) (The “paternal interest” of industrialists and the management of labour in Karellas’s textile mill (Hermoupolis, first half of the twentieth century), in C. Agriantoni & D. Dimitropoulos (eds), *Syros kai Ermoupolis: Symvoles sten istoria tou nesiou: 15os- 20os ai.* (*Syros and Hermoupolis: Contributions to the history of the island: 15th-20th c.*) (Athens: EIE, 2008), 155-186

Papastefanaki, L., “Politics, modernization and public health in Greece: the case of occupational health, 1900-1940”, in C. Promitzer, S. Trubeta & M. Turda (eds), *Hygiene and eugenics in Southeastern Europe to 1945* (Central European University Press, 2011), 165-191

Papathanasiou, M., *Megalonontas ston oreino horo, paidia kai paidike elikia sto Krokyleio Doridas tis protes dekaeties tou 20ou aiona* (*Growing up in mountainous areas, children and childhood in Krokyleio Doridos in the first decades of the 20th century*) (Athens: EIE, 2003)

Papavlasopoulou, C., ‘Demotiko Vrefokomeio Athenon’ (Municipal Foundling Hospital of Athens), *Publications of Historical Demography Postgraduate Program*, 9 (2013), 87-104

Pappa, M., *Nosoi kai thnesimoteta: to paradeigma ton Ioanninon* (*Diseases and mortality: the case of Ioannina*) (University of Ioannina: MSc dissertation, 2009)

Patterson, D., & G. Pyle, ‘The geography and mortality of the 1918 influenza pandemic’, *Bulletin of the History of Medicine*, 65, 1 (1991), 4-21

Patrikios, V., *E fthisis en Elladi* (*Phthisis in Greece*) (Athens, 1901)

Patrikios, V., ‘E poreia tes fthises en Elladi kata ten teleytaia dekaetia’ (The course of phthisis in Greece during the last decade), *First Conference Against Tuberculosis* (1909)

Pearce, D.C., P.K. Pallaghy, J.M. McCaw, J. McVernon & JD Matthews., ‘Understanding mortality in the 1918-1919 influenza pandemic in England and Wales’, *Influenza and Other Respiratory Diseases*, 5 (2010), 89-98

Pechlivani, F., A. Matalas & C. Bakoula, ‘Infant feeding and professional advice in the first half of the 20th century in Greece’, *Breastfeeding Review*, 16, 3 (2008), 23-28

Pentzopoulos, D., *The Balkan exchange of minorities and its impact on Greece* (London: Hurst & Company: 2002)

Petmezas, S., ‘Demographia’ (Demography), in C. Hatziiosif (ed.), *Istoria tes Elladas tou 20ou aiona* (*The history of Greece in the 20th century*), vol. A (Athens: Vivliorama, 1999)

Petmezas, S., ‘E Ellenike agrotike oikonomia sto Mesopolemo: e ekselikse ton perifereiakon anisoteton’ (The Greek agricultural economy in the interwar period: the evolution of regional divergences), in D. Panayiotopoulos & D.P. Sotiropoulos (eds), *E Ellenike agrotike oikonomia kai koinonia kata te Venizelike periodo* (*The Greek agricultural economy and society during the Venizelos era*) (Athens: National Research Foundation ‘Eleftherios K. Venizelos’, 2007)

Peltola, J., & S. Saaritsa, 'Later, smaller, better? Water infrastructure and infant mortality in Finnish cities and towns, 1870-1938', *The History of the Family*, 24, 2 (2019), 277-306

Polychronides, I., *Demosia ygeia, koinonike pronoia kai ygeionomike politike sten Kretike Politeia (1898-1913)* (*Public health, welfare and health policy in the Cretan State (1898-1913)*) (Athens: Papazisi, 2010)

Pooley, M.E., & C.G. Pooley, 'Health, society and environment in Victorian Manchester, in R. Woods & J. Woodward (eds), *Urban disease and mortality* (London: Batsford Academic and Educational, 1984), 148-175

Potter, C., 'Chronicle of influenza pandemic', in K. Nicholson, R.G. Webster & A. Hay. (eds), *Textbook of influenza* (London: Blackwell Science, 1998), 3-18

Pozzi, L., 'The determinants of infant and childhood mortality: a complex tangle in the historical research', *Atti della XLI Riunione Scientifica della Società Italiana di Statistica* (2002), 77-86

Pozzi, L., & J.S. Barona, 'Vulnerable babies. Late foetal, neonatal and infant mortality in Europe (18th-20th centuries)', *Annales de démographie historique*, 123, 1 (2012), 139-154

Pozzi, L., & D. Ramiro Farinas, 'Infant and child mortality in the past', *Annales de démographie historique*, 129, 1 (2015), 55-75

Preston, S.H., & E. van de Walle, 'Urban French mortality in the nineteenth century', *Population Studies*, 32, 2 (1978), 275-297

Preston, S.H., & M.R. Haines, *Fatal years, child mortality in late nineteenth-century America* (Princeton: Princeton University Press, 1991)

Prinaris, G.X., 'Peri tes endemouses vrefoktonou nosou' (On the endemic infant-killing disease), *O Neos Asklipios*, Athens 1848

Pujadas Mora, J.M., *L'evolució de la mortalitat infantile i juvenil a la ciutat de Palma (Mallorca, 1838-1960)* (Universitat de les Illes Balears: Unpublished PhD thesis, 2009)

Puranen, B., 'Tuberculosis and the decline of mortality in Sweden', in R. Schofield, D. Reher & A. Bideau (eds), *The decline of mortality in Europe* (Oxford: Clarendon Press, 1991), 97-117

Ramiro Farinas, D., 'Mortality in hospitals and mortality in the city in nineteenth- and twentieth-century Spain: the effect on the measurement of the urban penalty mortality rate of the outsiders in urban health institutions', in J. Henderson, P. Horden & A. Pastore (eds), *The impact of hospitals, 300-2000* (Oxford: Peter Land AG, 2007), 395-416

Ramiro Farinas, D., & M. Oris (eds), 'Introduction', *New approaches to death in cities during the health transition* (New York: Springer, 2016), 1-18

Ramiro Farinas, D., & A. Sanz Gimeno, 'Childhood mortality in Central Spain 1790-1960: changes in the course of demographic modernization', *Continuity and Change*, 15, 2 (2000), 235-267

Ramiro Farinas, D., & A. Sanz Gimeno, 'Structural changes in childhood mortality in Spain, 1860-1990', *International Journal of Population Geography*, 6, 1 (2000), 61-82

Razzell, P.E., 'An interpretation of the Modern Rise of Population in Europe, a critique', *Populastion Studies*, 28, 1(1974), 5-17

Registrar-General's Statistical Review of England and Wales, New Annual Series 7 (1927)

Reher, D.S., *Town and country in pre-industrial Spain. Cuenca, 1550-1870* (Cambridge: Cambridge University Press, 1990)

Reher, D.S., 'Back to the basics: mortality and fertility interactions during the demographic transition', *Continuity and Change*, 14, 1 (1999), 9-31

Reher, D.S., 'In search of the 'Urban penalty': Exploring urban and rural mortality patterns in Spain during the Demographic transition', *International Journal of Population Geography*, 7 (2001), 105-127

Reher, D.S., & G. Sandström, 'Dimensions of rational decision-making during the demographic transition; Aranjuez (Spain) Revisited', *Historical Life Course Studies*, 2 (2015), 20-36

Reher, D.S., & A. Sanz-Gimeno, 'Rethinking historical reproductive change: Insights from longitudinal data for a Spanish town', *Population and Development Review*, 33, 4, (2007), 703-727

Reid, A., 'Neonatal mortality and stillbirths in early twentieth century Derbyshire, England', *Population Studies*, 55, 3 (2001), 213-232

Reid, A., 'Infant feeding practices and post-neonatal mortality in Derbyshire, England in the early twentieth century', *Population Studies*, 56, 2 (2002), 151-166

Reid, A., 'The effects of the 1918-1919 influenza pandemic on infant and child health in Derbyshire', *Medical History*, 49 (2005), 29-54

Reid, A., & E. Garrett, 'Doctors and the causes of neonatal death in nineteenth century Scotland', *Annales de démographie historique*, 123 (2012), 149-179

Reid, A., & E. Garrett, 'Mortality, work and migration. A consideration of age-specific mortality from tuberculosis in Scotland, 1861-1901', *Historical Life Course Studies*, 6, 1 (2018), 111-132

Reid, A., E. Garrett, C. Dibben & L. Williamson, '"A confession of ignorance": deaths from old age and deciphering cause-of-death statistics in Scotland, 1855-1949', *The History of the Family*, 20, 3 (2015), 320-344

Revuelta Eugercios, B.A., 'Abandoned and illegitimate, a double mortality penalty? Mortality of illegitimate infants in the foundling hospital of Madrid, La Inclusa (1890-1935)', *History of the Family*, 18, 1 (2013), 44-67

Revuelta Eugercios, B.A., & D. Ramiro Farinas, 'Understanding infant mortality in the city: exploring registration and compositional effects. Madrid, 1905-1906', in D. Ramiro Farinas & M. Oris (eds), *New approaches to death in cities during the health transition* (New York: Springer, 2016), 19-42

Riley, J.C., *Rising life expectancy, a global history* (Cambridge: Cambridge University Press, 2001)

Rollet, C., 'Childhood mortality in high-risk groups: some methodological reflections based on French experience', C.A. Corsini and P.P. Viazzo (eds), *The decline of infant and child mortality: the European experience:1750-1990*, (The Hague: Martinis Nijhoff, 1997), 213-225

Rollet, C., & P. Bourdelais, 'Infant mortality in France, 1750-1950: evaluation and perspectives', in C.A. Corsini & P.P. Viazzo (eds), *The decline of infant mortality in Europe, 1800-1950, Four national case studies* (Florence: UNICEF, 1993), 51-70

Rondopoulos, P.,'E en Elladi fthiseos thnetotes kath' elikian, fylon kai epaggelma en 12 polesin kata ten teleutaia dekaetia 1899-1908' (Phthisis mortality in Greece per age, sex and occupation in 12 cities during the last decade 1899-1908) (1909)

Rondopoulos, P. I., 'Shedio Nomou peri systaseos kai organoses iatrikes statistikes yperesias en Elladi' (Draft Law concerning the foundation and organization of the Service of Medical Statistics in Greece), *Iatrike Proodos* (1916)

Rondopoulos, P., 'H en Elladi ek fthiseos thnesimotes kata ten eikosipentaetian 1890-1914' (Phthisis mortality in Greece during the twenty-five-period 1890-1914), *Iatrike Proodos* (1917)

Rondopoulos, P.J., 'Influenza in Greece', *JAMA*, 72, 26 (1919), 1947

Sanz Gimeno, A., & D. Ramiro Farinas, 'Estructuras internal de la mortalidad de la infancia (0-4 anos) en la Espana de siglo XX', *Politica y Sociedad*, 26 (1997), 125-142

Savvas, K., *Egheiridion ygieines* (*A textbook of hygiene*) (Athens: Estia, 1915)

Sawchuk, L.A., L. Tripp, S. Damouras & M. DeBono, 'Situating mortality: quantifying crisis points in period of stability', *American Journal of Physical Anthropology*, 152 (2013), 459-470

Schofield, R., & D. Reher, 'The decline of mortality in Europe', in R. Schofield, D. Reher & A. Bideau (eds), *The decline of mortality in Europe* (Oxford: Clarendon Press, 1991), 1-17

Scott Smith, D., 'A homeoastic demographic regime: patterns in West European family reconstitution studies', in R.D. Lee (ed.), *Population patterns in the past* (New York: Academic Press, 1977), 19-52

Shanks, G., T. Hussell & J.F. Brundage, 'Epidemiological isolation causing variable mortality in island populations during the 1918-1920 influenza pandemic', *Influenza and Other Respiratory Viruses*, 6, 6 (2012), 417-423

Sharlin, A., 'Natural decrease in early modern cities: a reconsideration', *Past and Present*, 79, 1 (1978), 126-138

Siampos, G.S., *Demographike ekseliksis tes neoteras Ellados 1821-1895* (*Demographic evolution of modern Greece 1821-1985*) (Athens, 1973)

Siampos, G.S., & V.G. Valaoras, 'Long term fertility trends in Greece', *International Population Conference*, 1 (London: IUSSP, 1969), 598-610

Sideres, N., 'Arrosties kai arrostoi ste Leykada ton 19o aiona' (Diseases and patients in Leykada during the 19th century), *Ta Istorika*, 1 (1983), 101-120

Slatter, E.M., 'Illustrations from the Wellcome Institute Library', *Medical History*, 28 (1984), 73-80

Soteriades, D., 'E demosia ygeia en Elladi kai e eklaikeuse tes ygieines' (Public health in Greece and the popularisation of the hygiene), *Athens Hygiene Association* (Athens, 1917)

Soutzoglou- Kottaride, P., *Paidi kai ygeia* (*Child and health*) (Athens: Dodoni Press, 1991)

Spence, D.P.S., J. Hotchkiss, C.S.D. Williams & P.D.O. Davies, 'Tuberculosis and poverty', *British Medical Journal*¸ 307 (1993), 759-761

Stavrakis, G., *1902-2002, Enas aionas 'Soteria'* (*1902-2002, a century of 'Soteria'*) (Athens, 2002)

Stefanos, Clon, 'Greece, Geographie medicale', in A. Dechambre (director), *Dictionnaire Encyclopedique des Sciences Medicales* (Paris: G. Masson & P. Asselin, 1884)

Stoyannides, Y., *Sanatoria kai to koinoniko zetema tes fymatiosis sten Athena, 1890-1940* (*Sanatoria and the social question of tuberculosis in Athens, 1890-1940*) (University of Thessaly: Unpublished PhD thesis, 2016)

Stoyannides, Y., '"Apagoreyetai to ptyein": Politikes diaheirises tes fymatioses stous horous ergasias ("No spitting": Dealing with TB in the workplace)', *O Kosmos tes Ergasias*, 4 (2017), 28-45

Sundin, J., 'Child mortality and causes of death in a Swedish city, 1750-1860', *Historical Methods*, 29, 3 (1996), 93-106

Sutherland, I., *Stillbirths: their epidemiology and social significance*, (Oxford: Oxford University Press, 1949)

Syros Medical Association, *Praktika Iatrikes Etaireias Syrou* (*Minutes of the Syros Medical Association*), v. A (Syros: Patris, 1894)

Szreter, S., 'The importance of social intervention in Britain's mortality decline *c*.1850-1914: a reinterpretation of the role of public health', *Social History of Medicine*, 1, 1 (1988), 1-38

Szreter, S., & G. Mooney, 'Urbanization, mortality and the standard of living debate: new estimates of the expectation of life at birth in nineteenth-century British cities', *Economic History Review*, 51, 1 (1998), 84-112

Taubenberger, J., 'Seeking the 1918 Spanish influenza virus', *ASM News*, 65 (1999), 473-478

Taubenberger, J., & D. Morens, '1918 influenza: the Mother of all pandemics', *Emerging Infectious Diseases*, 12 (2006), 15-22

Theodorou, V., 'Oi giatroi apenanti sto koinoniko zetema, o antifymatikos agonas stis arhes tou 20ou aiona (1901-1926)' (Doctors' attitude towards the social issue, the struggle against tuberculosis in the beginning of the 20th century (1901-1926)), *Mnimon*, 24 (2002), 145-178

Theodorou, V., 'Ypositismos kai fymatiose sto Mesopolemo: ygieine diatrofe kai organose mathetikon syssition (1928-1932)' (Undernourishment and tuberculosis in the interwar period: healthy diet and organisation of student soup-kitchens (1928-1932)), *Mnimon*, 30 (2009), 233-263

Theodorou, V., & D. Karakatsani, 'Health policy in interwar Greece: the intervention by the League of Nations Health organization', *Dynamis*, 28 (2008), 53-75

Theodorou, V., & D. Karakatsani, *"Ygieines Paraggelmata": Iatrike epivlepse kai koinonike pronoia gia to paidi tis protes dekaeties tou 20ou aiona* (*"Hygiene Imperatives": medical control and child welfare in the beginning of the 20th century*) (Athens: Dionikos, 2010)

Thorvaldsen, G., 'Was there a European breastfeeding pattern?', *The History of the Family*, 13, 3 (2008), 76-90

Tigkas, D., 'Drought characterisation and monitoring in regions of Greece', *European Water*, 23/24 (2008), 29-39

Tolis, E., *Demographikes opseis tou Porou, 19th aionas* (*Demographic aspects of Poros, 19th century*) (University of Ioannina: Unpublished PhD thesis, 2012)

Tomara-Sideri, M., 'Oikonomike dynamike kai demografike metavase' (Economic dynamics and demographic transition), *Greek Review of Social Research*, 80 (1991), 70-85.

Tompros, N., 'E epipolazousa nosos einai e grippe: e makavria 'algebra'' (The prevalent disease is the influenza: the morbid 'algebra'), in I. Athanasopoulou (ed.), *Noseroteta kai thnesimoteta sten Ellada ton 20o aiona: Iatrike kai demographike proseggise* (*Mortality and morbidity in Greece during the 20th century: a medical and demographic approach)* (Corfu: Ionio University, 2009), 263-288

Toundassakis, I., *Parenté, marriage et succession dans le village de Vourkoti* (EHESS: Unpublished PhD Thesis, 1995)

Tountas, M., 'Pole kai viomehania, e periptose tes Ermoupoles' (City and industry, the case of Hermoupolis), *Praktika tou diethnous symposiou Istorias- Neollenikes poles, Othomanikes kleronomies kai Elleniko kratos* (*Proceedings of the International Symposium of History, Neo-Hellenic cities, Ottoman Heritages and Greek State*) (Athens: Etaireia Meletes Neou Ellenismou, 1985), 609-634

Travlos, I., & A. Kokkou, *Ermoupole, e demiourgia mias neas poles ste Syro stis arhes tou 19ou aiona* (*Hermoupolis, the creation of a new town on Syros at the beginning of the 19th century*) (Athens: Emporike Trapeza, 1980)

Trilla, A., G. Trilla & C. Daer, 'The 1918 'Spanish flu' in Spain', *Clinical Infectious Diseases*, 47 (2008), 668-673

Tsakalotos, A., *Peri tes demosias ygeias kai idia tes fymatioseos en Syro* (*Concerning the public health and especially the tuberculosis in Syros*) (Athens, 1914)

Tsaouses, D.G., *Morphologia tes Neollenikes koinonias* (*Morphology of the Modern Greek society*) (Athens: Gutenberg, 1971)

Tsoukalas, G., F. Karachaliou, V. Kalogirou, G. Gatos, E. Mavrogiannaki, A. Antoniou & K. Gatos, 'The first announcement about the 1918 "Spanish flu" pandemic in Greece through the writings of the pioneer newspaper "Thessalia" almost a century ago', *Le Infezioni in Medicina*, 1 (2015), 79-82

Valaoras, V.G., 'A comparative study of the mortality of the population of Greece', *Human Biology*, 8, 4 (1936), 553-564

Valaoras, V.G., 'The gain in the expectation of life in Greece during the last fifty years', *Bulletin de l'Institute International de Statistique*, 29, 2 (1937), 34-40

Valaoras, V.G., *To demographiko provlema tes Ellados kai e epidrasis ton prosfugon* (*The demographic problem of Greece and the effect of the refugee population*) (Athens, 1939)

Valaoras, V.G., *Stoiheia viometrias kai statistikes: demographike melete tou plethysmou tes Ellados* (*Biometrics and statistics: a demographic study of Greece*) (Athens, 1943)

Valaoras, V.G., *E Ygieine tou choriou* (*The hygiene of the village*) (Athens: Ypourgeion Anoikodomeseos, 1945)

Valaoras, V.G., ‘A reconstruction of the demographic history of modern Greece’, *Milbank Memorial Fund Quarterly*, 38 (1960), 115-139

Valaoras, V.G., ‘National primary socio-economic data structures. V: Greece’, *International Social Science Journal,* 32, 2 (1980), 343-358

Valaoras, V.G., ‘Adynamies ton leksiarhikon mas katagrafon kai e vrefike thnesimoteta ton Ellenon’ (Weaknesses of the civil registration and infant mortality of the Greeks), *Parnassos*, A (1988)

Vallin, J., ‘Mortality in Europe from 1720 to 1914, long-term trends and changes in patterns by age and sex’, in R. Schofield, D. Reher & A. Bideau (eds), *The decline of mortality in Europe* (Oxford: Clarendon Press, 1991), 38-67

van de Walle, F., ‘Infant mortality and the European demographic transition’, in A.J. Coale and S. Watkin (eds), *The decline of fertility in Europe: the revised proceedings of a conference on the Princeton European fertility project’* (Princeton University Press, 1986), 201-233

van Poppel, F., G. Bijwaard, M. van Lieburg, F. van Lieburg, R. Hoekstra & F. Verkade, ‘The life expectancy of medical professionals in the Netherland, sixteenth to twentieth centuries’, *Population*, 71, 4 (2016), 619-640

van Poppel, F., D. Reher, A. Sanz-Gimeno, M. Sanchez-Dominquez & E. Beekink, ‘Mortality decline and reproductive change during the Dutch demographic transition: Revisiting a traditional debate with new data’, *Demographic Research*, 27, 11 (2012), 299-338

Veras, S., ‘E ygiene tes diatrofes tes deyteres paidikes kai sholikes elikias en Elladi’(The hygiene of childhood and school-age nutrition in Greece), *Iatrika Hronika*, 116, (11/10/1937), 3-10

Viboud, C., J. Eisenstein, AH. Reid, TA. Janczewski, D. Morens & J. Taubenberger, ‘Age- and sex-specific mortality associated with the 1918-1919 influenza pandemic in Kentucky’, *Journal of Infectious Diseases*, 207 (2013), 721-729

Virvilis, A., ‘To loimokatharterio tou Agiou Georgiou Salaminos’ (The lazaretto of St. George in Salamis island), *Philotelia*, 590 (1998), 106-127

Vladimeros, L., & H. Fragkides, ‘To Panellenio iatrikon synedrion tou 1901’ (The first Greek medical congress in 1901), *Archives of Hellenic Medicine,* 19, (2002), 700-709

Vlastos, G., *E antimetopise tes fymatioses sten Ellada kata te diarkeia tou 20ou aiona* (*The therapeutical approach of tuberculosis in Greece during the 20th century*) (University of Ioannina: Unpublished PhD thesis, 2005)

Vögele, J., ‘Urban infant mortality in Imperial Germany’, *Social History of Medicine*, 7, 3 (1994), 41-55

Vögele, J., *Urban mortality change in England and Germany, 1870-1913* (Liverpool: Liverpool University Press, 1998)

Vögele, J., & W. Woelk, ‘Public health and the development of infant mortality in Germany, 1875-1930’, *The History of the Family*, 7 (2002), 585-599

Vynnycky, E., & P.E.M. Fine, ‘Interpreting the decline in tuberculosis: the role of secular trends in effective contact’, *International Epidemiological Association*, 28 (1999), 327-334

Watson-Jones, D., J. Changalucha, B. Gumodoka *et al.*, 'Syphilis in pregnancy in Tanzania. I. Impact of maternal syphilis on outcome of pregnancy', *The Journal of Infectious Diseases*, 186 (2002), 940-947

Weber, A.F., *The growth of cities in the nineteenth century: a study in statistics* (New York: MacMillan, 1899)

Weden, M.M. & R.A. Brown, 'Historical and life course timing of the male mortality disadvantage in Europe: Epidemiologic transitions, evolution and behavior', *Social Biology*, 53, 1/2 (2006), 61-80

WHO, *Neonatal and perinatal mortality: country, regional and global estimates* (Geneva: World Health Organization, 2006)

Williams, N., *Infant and child mortality in urban areas of nineteenth-century England and Wales: A record-linkage study* (University of Liverpool: Unpublished PhD thesis, 1989)

Williams, N., 'Death in its season: class, environment and the mortality of infants in nineteenth-century Sheffield', *Social History of Medicine,* 5, 1 (1992), 71-95

Williams, N., 'The reporting and classification of causes of death in mid-nineteenth century England', *Historical Methods*, 29, 2 (1996), 58-71

Williams, N., & C. Galley, 'Urban-rural differentials in infant mortality in Victorian England', *Population Studies*, 49, 3 (1995), 401-420

Williams, N., & G. Mooney, 'Infant mortality in an 'Age of Great Cities': London and the English provincial cities compared, c.1840-1910', *Continuity and Change*, 9, 2 (1994), 185-212

Williamson, J.G., 'Urban disamenities, dark satanic mills and the British standards of living', *Journal of Economic History*, 41 (1981), 75-83

Wilson, I., 'The historical decline of tuberculosis in Europe and America: its causes and significance', *Journal of the History of Medicine and Allied Sciences*, 45 (1990), 366-396

Winter, J., & J. Robert, *Capital at war: Paris, London, Berlin 1914-1919* (Cambridge: Cambridge University Press, 1997)

Wisser, O., & J.W. Vaupel, 'The sex differential in mortality: a historical comparison of the adult-age pattern of the ratio and the difference', MPIDR Working Paper (Rostock: MPIDR, 2014), 1-15

Wrigley, A., 'Explaining the rise in marital fertility in England in the 'long' eighteenth century', *The Economic History Review*, New Series, 51, 3 (1998), 435-464

Wolleswinkel-van den Bosch, J., F. van Poppel, C. Looman & J.P. Mackenbach, 'Determinants of infant and early childhood mortality levels and their decline in the Netherlands in the late nineteenth century', *International Journal of Epidemiology*, 29, 6 (2000), 1031-1040

Woodward, J., 'Medicine and the city the nineteenth century', in R. Woods & J. Woodward (eds), *Urban disease and mortality* (London: Batsford Academic and Educational, 1984), 65-78

Woods, R., *Population analysis in geography* (New York: Longman, 1979)

Woods, R., 'The effects of population redistribution on the level of mortality in nineteenth-century England and Wales', *Journal of Economic History*, 45 (1985), 645-651

Woods, R., 'On the historical relationship between infant and adult mortality', *Population Studies*, 47, 2 (1993), 195-219

Woods, R., *The demography of Victorian England and Wales* (Cambridge: Cambridge University Press, 2000)

Woods, R., 'Urban-rural mortality differentials: an unresolved debate', *Population and Development Review*, 29, 1 (2003), 29-46

Woods, R., 'The measurement of historical trends in fetal mortality in England and Wales', *Population Studies*, 59, 2 (2005), 147-162

Woods, R., *Deaths before birth. Fetal health and mortality in historical perspective* (New York: Oxford University Press, 2009)

Woods, R., & N. Shelton, *An atlas of Victorian mortality* (Liverpool: Liverpool University Press, 1997)

Woods, R.I., P.A. Watterson & J.H. Woodward, 'The causes of rapid infant mortality decline in England and Wales, 1861-1921', Part I, *Population Studies*, 42 (1988), 343-366

Woods, R.I., P.A. Watterson & J.H. Woodward, 'The causes of rapid infant mortality decline in England and Wales, 1861-1921', Part II, *Population Studies*, 43 (1989), 113-132

Zaharias, K., *E ekselikse tes fymatioses sten Ellada kata ton teleytaio aiona* (*The tuberculosis evolution in Greece during the last century*) (National and Kapodistrian University of Athens: Unpublished PhD thesis, 2007)

Zavitsanos, T., *E thnesimotes tes nepiakes kai prosholikes elikias en Elladi, 1921-1960* (*Childhood mortality and pre-school mortality in Greece, 1921-1960*) (Athens, 1964)

Zelides¸ H., *Aksiologese ton protovathmion yperesion ygeias tou agrotikou plethysmou* (*Evaluation of the primary medical care of the rural population*) (Athens: Agrotike Trapeza Ellados, 1989)

Zinnes, A., *E en Athinais thnetotis ton vrefon* (*Infant mortality in Athens*) (Athens, 1877)

Zinnes, A., *Etude sur les principals causes léthifères chez les enfants au dessous de cinq ans et plus spécialement chez ceux de 0-1 an à Athènes* (Athens, 1880)

Official Publications

National Statistical Service of Greece (All the following publications were published by the National Press):

Kinesis tou plethysmou en Elladi to etos 1861 (*Natural movement of the population in Greece in 1861*) (Athens: Ministry of Interior Affairs)

Statistike tes Ellados, plethysmos tou etous 1861 (*Statistics of Greece, the population of 1861*) (Athens: National Press, 1862)

Statistike tes kineseos tou plethysmou (*Statistics of the natural movement of the population*) (Athens: NSSG, 1869)

Plethysmos tes Ellados kata to etos 1870 (*Population of Greece in the year 1870*) (Athens: Ministry of Interior Affairs, 1871)

Statistike tes Ellados, plethysmos 1879 (*Greek statistics, population 1879*) (Athens: Ministry of Interior Affairs, 1879)

Statistike tes Ellados, plethysmos, apographe 15-16/4/1889 (*Greek statistics, population, census 15-16/4/1889*) (Athens: Ministry of Interior Affairs, 1890)

Statistika apotelesmata tes apographes plethysmou kata ten 5-6/10/1896 (*Statistical results of the population census of 5-6/10/1896*) (Athens: Ministry of Interior Affairs, 1897)

Statistika apotelesmata tes apographes tou plethysmou tes Ellados kata ten 27.10.1907 (*Statistical results of the general population census of 27.10.1907*) (Athens: Ministry of Interior Affairs, 1909)

Arithmeses ton katoikon ton neon eparhion tes Ellados tou etous 1913 (*Enumeration of the inhabitants of the new provinces of Greece in 1913*) (Athens: Ministry of National Finances, 1915)

Apographe tou plethysmou tes Ellados kata ten 19/12/1920 (*Census of the Greek population of 19/12/1920*) (Athens: Ministry of National Finances, 1928)

Statistika apotelesmata tes apographes tou plethysmou tes Ellados tis 15-16/5/1928 (*Statistical results of the census of the Greek population of 15-16/5/1928*) (Athens: Ministry of National Finances, 1929)

Plethysmos tes Ellados kata ten apographe tes 16 Octovriou 1940 (*Population of Greece according to the census of the 16th of October 1940*) (Athens: Ministry of National Finances, 1946)

Statistike tes kineseos tou plethysmou (*Statistics of the natural movement of the population*) (Athens: National Statistical Service of Greece, 1921-1938)

Statistike ton aition thanatou (*Statistics of the causes of death*) (Athens: National Statistical Service of Greece, annually 1921-1938)

Statistike tes kineseos tou plethysmou (*Statistics of the natural movement of the population*) (Athens: National Statistical Service of Greece, 1956)

Ellenikoi pinakes epiviosis (*Greek Life Tables*) (Athens: National Statistical Service of Greece, 1964)

Legislation Acts

'Peri systaseos ton demon' (Law concerning the establishment of municipalities), *FEK* (1834)

V.D. 'Peri systaseos Iatrosynedriou' (Royal Decree concerning the foundation of the Medical Council), *FEK*, 13/05/1834

V.D. 'Peri eisagoges tou emvoliasmou damalidos' (Royal decree concerning the introduction of smallpox serum), *FEK*, 11/05/1835

V.D. 'Peri empodismou tes metadoses ton molysmatikon astheneion (Royal decree concerning the prevention of infectious diseases)', *FEK*, 31/12/1836

'Peri ekteleseos tou Anagkastikou Nomou 171/1936 "peri damalismou" (Concerning the implementation of the compulsory law 171/1936 "concerning smallpox vaccination"', *FEK*, 208, 29/05/1937

V.D. ‘Peri ygeionomikon metron kata tes eulogias’ (Royal decree concerning the hygiene measures against smallpox), *FEK*, 13/06/1848

V.D. ‘Peri ygeionomikon metron kata tou tyfou’ (Royal decree concerning the hygiene measures against typhus), *FEK*, 6/03/1856

‘Astikos Ellenikos Nomos’ (Civil Greek Law), *FEK*, 75, 15/11/1856

Law 4057 ‘Peri systaseos demon kai koinoteton’ (Concerning the establishment of municipalities and communities), *FEK*, 58, 14/02/1912

Law 4063, ‘Peri eksaskiseos tou iatrikou epaggelmatos’ (Concerning the training of the medical profession), *FEK*, 68, 20/02/1912

Royal Decree ‘Peri kanonismou ygieines ton typographeion’ (Concerning the hygiene regulations of printing works), *FEK*, 36, 11/02/1914

Law 346/1914, ‘Peri epivlepseos tes demosias ygeias’ (*Concerning the supervision of public health*), *FEK*, 27/12/1914

‘Peri foiteseos eis to Maieutikon Scholeion’ (Concerning Attendance at the Midwifery School’), *FEK*, 1 69, 13/09/1916, A

V.D. ‘Peri systaseos ypourgeiou perithalpseos’ (Royal Decree concerning the establishment of the Ministry of Healthcare), *FEK*, 14/06/1917

Law 1979, ‘Peri tes idryseos antifymatikon iatreion, nosokomeion, anarroterion kai oreinon theapeuterion’ (Concerning the foundation of dispensaries, tuberculosis hospitals, sanatoria and preventoria), *FEK*, 33, 28/01/1920

‘Law 2436 Peri ton leksiarchikon prakseon’ (Concerning the Civil Registration), *FEK*, 156, 14/07/ 1920

Law 2358, ‘Addendum to Law 1979 Peri tes idryseos antifymatikon iatreion, nosokomeion, anarroterion kai oreinon theapeuterion’ (Concerning the foundation of dispensaries, tuberculosis hospitals, sanatoria and preventoria), *FEK,* 147, 29/07/1929

Law 6008, ‘Peri organoseos peripheriakes Ygeionomikes Yperesias toy Ypourgeiou Kratikes Ygieines kai Antilipseos’ (Concerning the organizing of the regional Hygiene Service of the Ministry of Public Hygiene and Awareness), *FEK*, 27/01/1934

Archival Material

Civil Death Registers, 1859-1924, Municipal Archive, General State Archives of Syros

Civil Death Registers, 1925-1940, Registry Office, Municipality of Syros-Hermoupolis

Civil Birth Registers, 1859-1924, Municipal Archive, General State Archives of Syros

Civil Birth Registers, 1925-1940, Registry Office, Municipality of Syros-Hermoupolis

1861 Census Manuscript Book, Municipal Archive, General State Archives of Syros

1870 Census Manuscript Book, Municipal Archive, General State Archives of Syros

1879 Census Manuscript Book, Municipal Archive, General State Archives of Syros

Foundling List of the Local Hospital, Municipal Archive, General State Archives of Syros

Minutes of the Municipal Council, 1859-1940, Municipal Archive, General State Archives of Syros

Archive of the Prefecture of Cyclades islands *Health and Welfare*, General State Archives of Syros

Newspapers

Hermoupolis (1864-1876)

Helios (1875-1900)

Panope (1874-1886)

Patris (1879-1894)

To Vema Ermoupoleos (1911-1916)

Paliggenesia (1911-1914)

Tharros (1924-1940)