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Urban mortality in Greece: Hermoupolis (1859–1940)

Michail Raftakis

Department of Economics and Business, University of Sassari, Sassari

Correspondence
Michail Raftakis
Email: michailraftakis@gmail.com

Abstract

The paper examines mortality patterns in the city of Hermoupolis, on the Greek island of Syros, from 1859 to 1940. It produces important new insights into Mediterranean urban historical demography and is the first comprehensive study of urban mortality in Greece, utilising the largest and one of the longest time series at the individual level yet calculated from civil registration and census data. Abridged life tables were constructed for the first time for a Greek urban settlement, enabling the calculation of age-specific mortality rates and life expectancies. Hermoupolis experienced much higher mortality levels than the national average. The findings suggest that early childhood mortality started to decline rapidly from the late nineteenth century onwards, with declines in early adulthood and infancy following. The paper 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 early twentieth century. Finally, this paper 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, nevertheless enabled improvements in personal hygiene among the residents of the city.

KEYWORDS
age-specific mortality, Greece, Hermoupolis, mortality transition, urban penalty

Mortality started to decline among some populations in northern Europe as early as the eighteenth century. 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] A main characteristic of the mortality regime in the nineteenth century were the great discrepancies between rural and urban populations. Rapid urbanisation in the nineteenth century transformed cities into 'urban graveyards'.[2] 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. 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, especially the lack of adequate water and sewage disposal; and the great number of migrants arriving in the cities. This brought both new foci of infection and new victims.[3] Another significant reason for the urban–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.[4]

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.[5] 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.[6]

Although scholars have examined and proposed different determinants which might have contributed to this remarkable transition over the past centuries, there remain conflicting views regarding the importance of each factor. 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.[7] His results generated considerable controversy and stimulated further work on the possible relationships between public health measures and medical intervention. Harris attempted to re-evaluate McKeown's thesis, by arguing that improving wages, expenditure,

[1] Schofield and Reher, 'Decline', p. 6.

[2] Weber, *Growth*. See also Szreter and Mooney, 'Urbanization'; de Vries, *European*; Sharlin, 'Natural decrease'; Dyson, 'Role'.

[3] Cain and Hong, 'Survival'; Kearns, 'Urban penalty', pp. 222–3; Preston and van de Walle, 'Urban French mortality', p. 279; Ramiro-Fariñas and Oris, *New approaches*, pp. 5–6; Reher, 'Search', pp. 105–6; Szreter and Mooney, 'Urbanization', p. 92; Woods, 'Urban-rural mortality', p. 43; Williamson, 'Urban disamenities'.

[4] Mooney, Luckin and Tanner, 'Patient pathways', p. 247; Ramiro-Fariñas, 'Mortality', p. 405; Revuelta-Eugercios and Ramiro-Fariñas, 'Understanding'.

[5] Ramiro-Fariñas and Oris, *New approaches*, p. 6; Vögele, *Urban mortality change*, p. 7.

[6] Riley, *Rising*, p. 120.

[7] McKeown, *Modern*, p. 153.

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.[8] More recent studies have also linked the role of increasing incomes, better nutritional status, and more effective resistance to a disease environment to prolongation of life expectancy and increases in height.[9]

Others have drawn special attention to improvements in health care, medicine, and/or personal/public hygiene. Initially, it was posited that medical advances had a very limited effect on the decline of mortality until the late nineteenth century (or even later).[10] Easterlin, on the other hand, claimed that preventive measures to control infectious diseases (i.e. quarantines, inoculation, and smallpox vaccination) were responsible for the initial phase of the epidemiologic transition (as described by Omran).[11] Razzell also emphasised the role of smallpox vaccination in reducing mortality, particularly in eighteenth-century English rural villages and small towns.[12] More recently, the importance of improvements in domestic and personal hygiene in mid-nineteenth century England and Wales were re-examined and re-emphasised by Mercer and Mooney.[13] Through a narrative of public health interventions, implemented by local governments to restrict the spread of disease in urban and rural areas, Mooney investigated the expanding use of disease notification, isolation of the sick, and disinfection of homes and belongings.

The largest body of the literature, however, has suggested that the amelioration of 'urban penalty' and the high levels of mortality were due to the success of sanitary reforms rather than simply a general improvement in living standards and diet.[14] Szreter argued that the mortality decline in England and Wales in the 1870s was mainly a result of a successful public health movement (e.g. implementation of preventive measures of municipal sanitation and regulation of the urban environment and food market), although he found that improving nutrition and living standards did play an important role in this decline.[15] Recent studies suggested that public investments in sanitation infrastructures (water supply, sewerage system, street paving, and cleaning) were responsible for a significant share of the reduction in urban mortality in nineteenth-century urban environments in England and Wales, in nineteenth-century France, and in early twentieth-century Germany.[16] Various studies have also investigated the impact of individual sanitary innovations – mainly water supply and sewerage system – on the decline in mortality. For instance, it has widely been found that the introduction of water filtration, chlorination systems, and the expansion of sewer infrastructure contributed to significant declines in mortality and increases in life

[8] Harris, 'Public health', pp. 396–7.

[9] Floud et al., *Changing body*, p. 137; Fogel, *Escape*, pp. 40–2.

[10] McKeown, Brown and Record, 'An interpretation', p. 349; McKeown and Record, 'Reasons', pp. 97–8.

[11] Easterlin, 'How beneficent', pp. 263–4, 273; Omran, 'Epidemiologic transition'.

[12] Razzell, 'Interpretation', p. 11. Although Razzell claimed that such practices reduced smallpox mortality also in late eighteenth century London, this has been challenged by Davenport et al.; Razzell, 'Decline'; Davenport, Boulton and Schwarz, 'Urban inoculation'.

[13] Mercer, *Infections*, pp. 13–4; chap. 5–6; Mooney, *Intrusive interventions*, chap. 5.

[14] Hardy, *Epidemic*, p. 3; Mooney, 'Professionalization', p. 54; Szreter and Mooney, 'Urbanization', pp. 2–3.

[15] Szreter, 'Importance', pp. 26, 36.

[16] Chapman, 'Contribution', p. 233; Harris and Hinde, 'Sanitary investment', p. 28; Hinde and Harris, 'Mortality', p. 394; Vögele, *Urban mortality change*, p. 188; Preston and van de Walle, 'Urban French mortality', pp. 290–1.

expectancy during the late nineteenth and early twentieth century in several European and US populations.[17]

Mortality patterns in Mediterranean Europe, on the other hand, exhibited different trends from those in most north-western European countries. Evidence from Italy and Spain has shown that mortality declined later than in the rest of Europe, as a result of the very high infant and/or early childhood mortality and the high prevalence of infectious diseases until the beginning of the twentieth century.[18] Little evidence, however, is available about changes in mortality in modern Greece prior to the 1960s. Apart from a few studies which have attempted to estimate national mortality levels (though on the basis of indirect techniques and extensive assumptions) and several studies that refer to non-urban populations, cover short periods of time, or employ rather superficial demographic methods, there remains a significant lack of studies focusing solely on urban mortality patterns with a long-term perspective.[19]

Thus, the aim of this article is to quantify the patterns of mortality decline in a Greek urban population and particularly in the city of Hermoupolis on the Greek island of Syros, but also to better comprehend the pathways that facilitated this decline. Hermoupolis, in particular, was chosen 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 at the individual level. Finally, the 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.

I | SETTING

Hermoupolis is the capital city of the island of Syros and of the Cycladic group of islands. The city was created during the Greek revolution against the Ottoman Empire (1821–7). Waves of Greek refugees fleeing from areas where the revolution was suppressed or from the main war zones sought refuge on Syros, which enjoyed the protection of the French government owing to its Catholic population.[20] The settlement grew at an alarming rate. From just 150 people in 1821, the city 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 and along the coastal area. 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.[21] Hermoupolis was also the most significant Greek port and the largest

[17] Meeker, 'Improving', p. 371; Meckel, 'Immigration', p. 404; Cain and Rotella, 'Death', p. 147; Cutler and Miller, 'Role', p. 3; Ferrie and Troesken, 'Water', p. 16; Beach et al., 'Typhoid', p. 72; Kesztenbaum and Rosenthal, 'Sewers'diffusion', p. 182; Gallardo-Albarrán, 'Sanitary infrastructures', pp. 27–8.

[18] Caselli, 'Health transition'; Pérez Moreda, Reher and Sanz Gimeno, *Conquista*, pp. 40–60.

[19] Siampos, *Demographike*; Valaoras, 'Reconstruction'; Hionidou, 'Demography'; Gavalas, 'Demographic reconstruction'; Gavalas, 'Island'; Eliopoulos, 'Oikonomikes'; Bournova, *Katoikoi*.

[20] Ampelas, *Istoria*, p. 87; Drakakis, *Istoria*, p. 3.

[21] Kolodny, 'Hermoupolis-syros', pp. 253–4; Kardasis, *Syros*, p. 29; Hionidou, 'Nineteenth-century urban', pp. 404–5; Loukos, 'Families', pp. 317–8.

centre of transit trade in the Eastern Mediterranean.[22] During the following decades, 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.[23] 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.[24] Thereafter, the population of the city has stabilised at around 18 000 inhabitants, apart from a short break in the 1920s owing to the arrival of Greek Orthodox refugees from Asia Minor.[25]

The town of Ano Syros is situated on the hill beside Hermoupolis. While Hermoupolis was inhabited almost exclusively by the Greek Orthodox population, Ano Syros and the entire hinterland of the island were inhabited predominantly by Catholics.[26] Despite the proximity between the two settlements, Hermoupolis and Ano Syros kept separate registration records, each set of records housed in the corresponding locality. When inhabitants of Ano Syros died, their deaths 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 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.[27]

II | SANITARY REFORMS IN HERMOUPOLIS

Most studies have argued that no special improvements in public health took place in Greece in the second half of the nineteenth century, with water supplies and sewerage systems remaining inadequate and in a poor condition even up to the mid-twentieth century. In a study focusing on public health in Greece, Copanares 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.[28] Thus, the local authorities had to take the initiative to deal with the serious problems of the country's bigger urban centres.[29]

Despite actions taken by the Hermoupolis municipal authorities, the levels of public hygiene remained consistently low throughout the study period owing to the dearth of financial resources, the lack of state support, and the absence of a clean water supply and sewerage systems. After its creation, the city was built very rapidly without any town planning, as it had very limited space to expand between the sea front and the hills and, therefore, was cramped around the

[22] Delis, 'Mediterranean', p. 229; Kardasis, *Syros*; Agriantone, *Aparches*, pp. 84–97.

[23] Travlos and Kokkou, *Ermoupole*, p. 40; Kolodny, *Population*, p. 327.

[24] Papastefanaki, '"Patriko Endiaferon"', pp. 159–60.

[25] After the failure of the Greek military campaign in Asia Minor (1920–2) 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. Almost 7 000 refugees arrived on the island; however, most of them left soon after. For more information, see Kolodny, 'Hermoupolis-syros', p. 193.

[26] Hionidou, *Famine*, p. 20.

[27] Raftakis, 'Mortality', pp. 30–1.

[28] Copanares, *Demosia Ygeia*, p. 345.

[29] Kooij and Sapounaki-Dracaki, 'Health', p. 191.

port.[30] Most working-class inhabitants also lived in unhealthy, badly ventilated, damp, dark dwellings.[31]

At every opportunity, the local press inveighed against the local authorities concerning their indifference to the fact that no hygiene measures were being implemented. Most reports focused on the unhealthy sewage disposal system, the inadequate water supply in the city and the use of communal water tanks for obtaining drinking water, deficient public hygiene, and high population density.[32] As a result, outbreaks of various epidemics occurred almost annually in Hermoupolis during most of the nineteenth century.[33]

Since 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* in 1840.[34] Quarantines were imposed throughout the second half of the nineteenth century on ships arriving from countries which had been infected by plague or cholera.[35] Even though the Hermoupolis *lazaretto* did not cease to serve as a quarantine area, it was also used for other purposes (as a prison in the 1890s and lunatic asylum from 1908 onwards).[36] 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.[37]

In order to deal with the high incidence of infectious diseases (mainly smallpox and diphtheria), especially among young children, mass immunisation was implemented by the local authorities. Evidence from the local press suggested that regular smallpox vaccinations and diphtheria antitoxin [*antidiftheritikos oros*] were given from the 1880s, even though vaccination was made compulsory as early as 1835.[38] However, evidence from public hygiene reports showed that such a measure was the only systematic public health action implemented by the local authorities, even until the 1930s.[39]

Water supply was a fundamental issue for the local authorities, who had attempted to deal with the lack of water in the city since the 1870s. Newspaper articles reported that the available water was not sufficient to cover the needs of the city, especially over the summer months, owing to regular droughts.[40] Fragkides suggested that Syros had excellent water resources, and chemical

[30] Fenerle, 'Kallopismos', p. 173.

[31] Fragkides, *Istoria*, pp. 51–2; idem, *Nesos*, p. 62; Tsakalotos, *Demosias*, p. 20; General State Archives of Syros (hereafter GSAS)/Ygeia kai Pronoia Archeio [Health and Welfare Archive] (hereafter YPA)/YP917/'Etesia ekthese ygieinomikes katastaseos Kykladon [Annual report on public hygiene in Cyclades]' (hereafter 'Etesia'), 1931.

[32] For instance, see *Panope:* Δ/174, 6 June 1874; I/677, 14 Oct. 1880, pp. 2–3; and IA/795, 5 Jan. 1882, p. 1; *Helios,* 7 July 1896; *Patris:* 528, 29 May 1876; and 792, 8 Aug. 1881; *To Vema Ermoupoleos:* Γ/132 20, July 1913, p. 2 and Γ/141 21, Sept. 1913, pp. 1–2; *Tharros:* Γ/222, 13 May 1927, p. 1 and Z/454, 11 Oct. 1931, p. 1.

[33] Fragkides, *Istoria*, p. 175; Iatrike Etaireia Syrou, *Praktika*. Regarding how Hermoupolis dealt with the severe 1854 cholera outbreak, see Loukos, 'Epidemia'.

[34] Travlos and Kokkou, *Ermoupole*, p. 110; Slatter, 'Illustrations', p. 73.

[35] *Ermoupolis*: A/19, 26 Dec. 1864; A/45, 26 June 1865; and Θ/353, 18 Sept. 1871; *Patris*, 1428, 11 Sept. 1893, pp. 1–3.

[36] *Patris*, ΣΤ/ 285, 4 Sept, 1871; Travlos and Kokkou, *Ermoupole*, pp. 109–11.

[37] *To Vema Ermoupoleos*, Δ/216, 19 Feb., 1915, pp. 1–2.

[38] For instance, *Patris:* 828, 17 Apr. 1882; 1347, 4 Apr. 1892; and 1396, 6 Mar. 1893; *Helios:* B/83, 6 Mar. 1888, p. 2 and KB/624, 11 Feb. 1898, p. 2.

[39] GSAS/YPA/YP917; GSAS/YPA/YP1308/1932; GSAS/YPA/YP1310/1930–37; and Pagkalos, 'Mikroviologike eksetasis ydatos Syrou [Microbiological examination of the water of Syros]' (1933), GSAS/YPA/YP113 (hereafter Pagkalos, 'Mikroviologike'). See also Raftakis, 'Mortality', pp. 62–4.

[40] *Ermoupolis:* ΣΤ/279, 21 Feb. 1870, p. 2 and Z/350, 28 Aug. 1871, p. 2.

examinations proved that water from the natural springs on the island was safe for consumption in the late nineteenth century.[41] The water was transferred to the city on donkeys and sold by water sellers in various areas. Contemporary physicians, on the other hand, stated that the available water in certain areas of the island was contaminated and, in combination with the inadequate sewerage system, could increase the incidence of typhoid fever in the city.[42] In addition to water from public springs or artesian wells, the residents stored rainwater in private water cisterns which most houses had since the creation of the city in the 1820s. Until the 1930s, water was said to be a 'luxury commodity', and most inhabitants of Hermoupolis obtained water from their cisterns.[43]

In Hermoupolis, a contract for a central water supply was signed with the Swiss Water Supply Company in 1923. The company installed a water supply system a few years later using mainly water from the natural springs in neighbouring Ano Syros. It was estimated that the water supply provided 150 m^3 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 tanks, the water from which was mixed with natural spring water and stored in a water storage tank situated between the two settlements, 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.[44] However, the underground water supply system was not expanded in the working-class areas of the city until the mid-1930s, and therefore, many households still had to acquire water from artesian wells or rainwater collected in water cisterns.[45] The expansion of the underground water supply was delayed significantly owing to the lack of financial resources but especially because of the disagreements between the municipal council and the water company regarding the poor quality of the water and the company's monopoly over the water supply in the city.[46]

According to a contemporary report by two Athenian medical officers in 1933, water from the underground water supply system was found to be contaminated and inadequate for the needs of the city.[47] Despite the initiatives of the local authorities to install a chlorination system, this was rejected by the water company owing to its high cost, and therefore, it was not introduced in the city until 1940.[48] Although of better quality than the underground water, the rainwater collected in private water cisterns, was also found to be contaminated, given that most water cisterns had never been cleaned.[49]

Even though Hermoupolis had one of the oldest sewerage 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 be more beneficial for the

[41] Fragkides, *Istoria*, p. 112.

[42] For instance, *To Vema Ermoupoleos,* Γ/149, 16 Nov. 1913, pp. 1–2; *Tharros:* B/1, 11 Nov. 1925, 129, p. 1 and I/626, 9 Nov. 1934, p. 1.

[43] The Syros interviewees, #10, 13. For full extracts, see Raftakis, 'Mortality', pp. 64–65, 67–68.

[44] GSAS/YPA/YP1311/1929.

[45] Ibid.; GSAS/Demotiko Archeio [Municipal Archive] (hereafter DA)/Praktika Demotikou Symvouliou [Minutes of the Municipal Council] (PDS hereafter): 693/60, 14 July 1932; 730/11, 17 Aug. 1934; 781/46, 14 Aug. 1936; 812/75, 13 Apr. 1937; and 815/77, 20 May 1937.

[46] Ibid.: 563/301, 7 Oct. 1924; 583/321, 10 July 1925; 622/31, 21 Dec. 1926; 653/20, 4 June 1930; and 680/47, 27 Nov. 1931.

[47] Alivizatos, 'Ekthesis epi tes ydreuseos kai apochetefseos tes poleos' ['Report on the water supply and sewerage system of the city'], (1933), GSAS/YPA/YP113 (hereafter Alivizatos, 'Ekthesis'); Pagkalos, 'Mikroviologike'.

[48] GSAS/YPA/YP1310/1930–7,1936; GSAS/DA/DY/5b, 21/11/1939.

[49] Alivizatos, 'Ekthesis'; Pagkalos, 'Mikroviologike'.

city.[50] In the nineteenth century, the lack of sewers in most of the city was addressed by digging local or individual cesspits.[51]

The sewerage 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, flowed directly into the sea.[52] However, the 1933 report pointed out that Hermoupolis' sewerage system, a combined sewer system (*pantorroiko*), worked only partially and would require significant expenditures for its improvement.[53] Public open holes, situated in most streets and only cleaned by pouring water in, were used instead by most inhabitants, according to oral evidence, except for upper-middle class households, which had obtained privately available water closets by the mid-1930s.[54] Thus, it seems that no significant improvements in sewage disposal took place in Hermoupolis after its creation in the mid-nineteenth century; instead, there were only open public holes in the streets, which were found to be foci for germs and infections.

Medical services in Hermoupolis were advanced in comparison to other parts of the country. Hermoupolis had the country's first-ever hospital in 1825–7.[55] In addition to the hospital, Hermoupolis had a very strong community of physicians since the mid-nineteenth century. Physicians maintained a continuous prominent presence in the city and in the local press by collaborating with the local authorities concerning public health improvements and by informing Hermoupolis inhabitants regarding public hygiene and personal sanitation.[56]

By the early twentieth century, the city also had a municipal disinfection service (from 1904), a municipal health centre, a private French Catholic hospital (from 1886), a hospital for infectious diseases, a smallpox hospital, and a sanatorium and a dispensary (both from 1921 onwards). Hermoupolis also had an exceptional number of philanthropic foundations, including two orphanages, a foundling hospital (1920–9), a poorhouse, and a lunatic asylum (from 1908).[57] 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. Under this initiative, a group of women – using financial aid from the state, the city council, or philanthropists – contributed to the childcare, medical care, and protection of children of lower social classes.[58]

III | DATA AND METHODS

Two sets of data were used to reconstruct the mortality patterns in Hermoupolis: death certificates at the individual level, which have constituted part of the civil registration sources available

[50] Iatrike Etaireia Syrou, *Praktika*, p. 46.

[51] Fragkides, *Istoria*, p. 52.

[52] GSAS/YPA/YP917/'Etesia', 1931.

[53] Alivizatos, 'Ekthesis'.

[54] The Syros interviews, #2, 5, 13. For full extracts, Raftakis, 'Mortality', pp. 69–71.

[55] Travlos and Kokkou, *Ermoupole*, pp. 102–3.

[56] For instance, *Panope*: IB/911, 05 Mar. 1883, p. 2 and IΓ/949, 23 July 1883, pp. 1–2; Iatrike Etaireia Syrou, 'Praktika'.

[57] Not all institutions operated continuously or simultaneously throughout the study period: Iatrike Etaireia Syrou, 'Praktika'; GSAS/YPA/YP112/'Etesia', 1934.

[58] Loukos, 'Ethelontikes', pp. 67, 72–3.

continuously since 1859,[59] and census sources. Although censuses do exist, there is a lack of uniformity in relation to the data that were published on each occasion; for instance, age–sex data do not exist for the 1889, 1896, and 1940 censuses, while such information is also not available for the female population at the municipal level in the 1879 census. Therefore, robust abridged life table data have been constructed for 1861, 1879, 1879, 1907, 1920, and 1928.

The availability of individual-level death records, however, is extremely rare prior to 1925 by Greek standards. Each death certificate includes information about the person declaring the death (the informant; full name, age, place of origin, and occupation) as well as about the deceased person (full name, age, marital status, place of origin, occupation, relationship to the informant, date of death, and date of reporting). 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 Hermoupolis Mortality Database (approximately 45 000 individual-level death records), which was created for the purposes of this study.[60] 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. Registration of deaths was always higher than that of births owing to legislation which dictated that every death must be reported within 24 hours of the event.[61] If there was not a death record, the funeral could not be carried out. There were no serious indications of under-registration of deaths, except perhaps for those deaths that occurred immediately after birth.[62]

For the purposes of this study, abridged life tables were constructed around the census years for the very first time for a Greek urban population.[63] Ages were grouped at 0, 1–4, 5–9, 10–14, and so on until the final 75-plus age group was reached. Two sets of data were used to calculate conventional life tables: first, the mid-year published age structure of the population at risk (by the age groups defined above) in a census year; and second, the three-year average number of deaths in each of these age groups around the census year. The main problems to overcome in using 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. For the years 1870, 1879, and 1907, the age structures underwent graduation by employing the quadratic reorientation of age group method.[64] 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 nominal age structure, which is available for part of the population.[65] As the 1879 female life table is based on multiple assumptions, care needs to be taken in its interpretation.[66] Finally, it should be noted that it was not possible to calculate life

[59] GSAS/Leksiarcheio [Registry Office]/DA/'Leksiarchika Vivlia Apovioseon [Civil death registration manuscript books] 1859–1924'; Municipality of Syros-Hermoupolis (hereafter MSH')/Leksiarcheio[Registry Office]//'Leksiarchika Vivlia Apovioseon [Civil death registration manuscript books] 1925–1940'.

[60] The database is available by request to the author. See also Raftakis, 'Mortality', pp. 39–43.

[61] Stephanos, *Grèce*, p. 450.

[62] Raftakis, 'Why were infants dying', pp. 411–2.

[63] For a detailed description of the life table exercise, see Raftakis, 'Mortality', pp. 88–92.

[64] Carrier and Hobcraft, *Demographic estimation*, pp. 16–7, 55–7, and table D, p. 204.

[65] The original manuscript books of the 1861, 1870 and 1879 censuses have survived in Hermoupolis (nominal censuses). The surviving manuscript census books provide a wealth of information. GSAS/DA/ 'Vivlia Apographes (Census Manuscript Books)'. For a detailed description of the nominal censuses, see Hionidou, 'Nineteenth-century urban', p. 406; Loukos, 'Families', pp. 318–20.

[66] See Raftakis, 'Mortality', pp. 91–2.

tables for each census year owing 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.[67] The 1940 census material was never analysed because the country was occupied in 1941.[68]

To estimate early childhood mortality rate (ECMR) in the absence of population at risk for certain census years, an indirect method for capturing the trend was employed since it was not possible to calculate the actual rates. The probability of dying between the ages of one and four years was estimated as ${}_4q_1 = d_{1-4}/\mathrm{B}(1 - q_0)$, where d_{1-4} refers to the deaths occurring between the first and the fifth birthdays, B to live births, and q_0 to infant mortality rate (IMR). According to Ramiro and Sanz, this procedure does not take into account the exact population in those ages nor the actual deaths, since it cannot control the effects of migration in that age group.[69] However, migration did not involve young children, especially in late-nineteenth-century Hermoupolis (or even until the end of the study period); instead, young single males were more likely to migrate in and out of the city.[70] Given that the actual number of child deaths is employed in combination with the fact that the population at risk in this age group was relatively stable, it seems that, in this way, we are capturing the actual trend of ECMR around these years.

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. The Minutes of the Municipal Council were used extensively to investigate the initiatives or the reactions of the local authorities in dealing with public health issues.[71] This study has also employed the archive of the Prefecture of Cyclades on Health and Welfare, which includes various reports on public health in Hermoupolis starting from 1920.[72] Moreover, local press coverage during the study period has been used to explore public health problems and to obtain qualitative information about the population. Finally, oral interviews were employed in this study when examining the evolution of public health on the island, mainly during the 1920s and 1930s.[73]

IV | RESULTS

The crude death rate (CDR) in Hermoupolis 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, the CDR started to decline gradually, as it fell by almost five points in 1907 (figure 1). The gradual improvement of civil registration along with the decline of the economy

[67] National Statistical Service of Greece (hereafter NSSG), '1907 Census', p. *ιβ*–*ιγ*.

[68] Valaoras, 'National', p. 345.

[69] For a detailed analysis of the method, see also Ramiro-Fariñas and Sanz-Gimeno, 'Structural changes', pp. 63–64; Sanz-Gimeno and Ramiro-Fariñas, 'Estructuras', p. 129.

[70] Hionidou, 'Nineteenth-century urban', p. 407.

[71] PDS, GSAS/DA/PDS/X.

[72] Ygeia kai Pronoia [Prefecture of Cyclades on Health and Welfare], GSAS/YPA/X.

[73] The Syros interviews were conducted by Hionidou as part of the Wellcome Trust for the History of Medicine post-doctoral Fellowship (no. 056211) on the 1941–2 Greek famine in 2000, but included also questions on public health and living standards. The interviews were translated into English by the current author. For a full description, see Hionidou, *Famine*, pp. 29–30. For reasons of anonymity, all interviews are denoted by a number (interviewee #X).

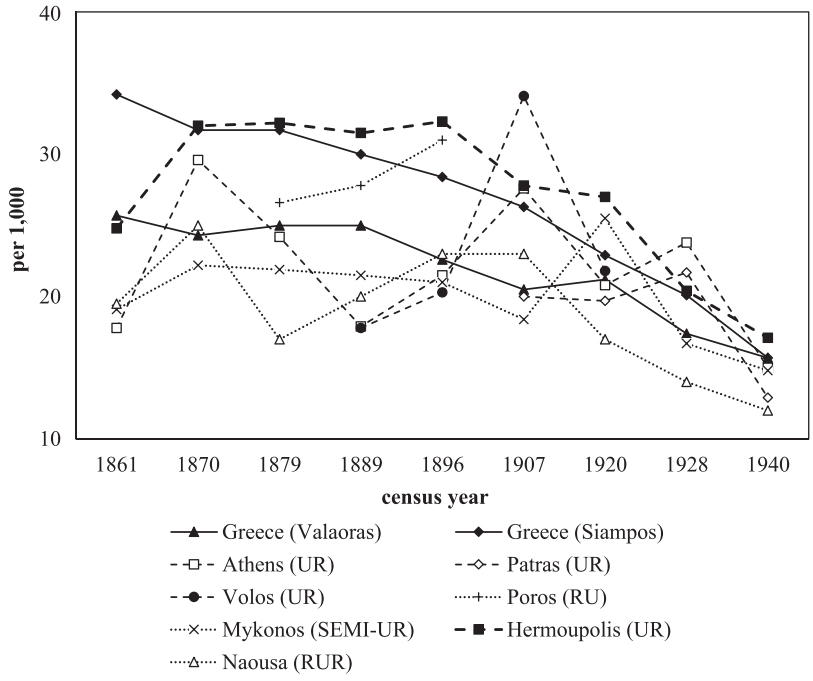

FIGURE 1 CDR in several Greek populations, 1861–1940 (census years). *Notes:* Continuous lines represent national rates, dashed lines urban rates, and dotted lines rural/semi-urban rates. UR, urban; SEMI-UR, semi-urban; RUR, rural. *Sources:* Greece: Valaoras, 'Reconstruction', p. 132; Siampos, *Demographike*, p. 20; Athens: Dimitropoulou, *Athènes*, p. 104; Bournova, *Katoikoi*, p. 77; Patras: Eliopoulos, 'Oikonomikes', p. 103; Volos: Moustane, 'Demographikes', pp. 206–7; Poros: Tolis, 'Demographikes', pp. 164–7; Mykonos: Hionidou, 'Demography', p. 50; Paros/Naousa: Gavalas, 'Demographic reconstruction', pp. 223—4; Hermoupolis: Hermoupolis Mortality Database; Raftakis, 'Mortality', p. 86

in the city (which resulted in deterioration of working conditions and living standards among the working-class population)[74] towards the end of the nineteenth century might have contributed to some of the fluctuations of the CDR. In 1920, the CDR seems to have stabilised at levels around 27 per thousand. If 1919 is excluded and, instead, the two-year average number of deaths is used for the calculation of the 1920 rate, the declining trend appears to be continuous. Hermoupolis, as with most populations around the world, experienced heavy increases in 1918–9 owing to the influenza pandemic.[75] In 1928, the CDR fell by seven points, the steepest-ever decline to take place in Hermoupolis. Finally, by 1940, the death rate fell significantly, reaching 17 per thousand.

Hermoupolis mortality levels were higher than the national average for most of the study period, as has been estimated by Valaoras and Siampos (figure 1). They have published the only existing continuous national estimations of demographic trends for the nineteenth and twentieth centuries. In 1960, Valaoras attempted to reconstruct Greek demographic history by employing a series of survival ratios in order to link all successive censuses and estimated the age composition of the population for each sex independently from 1860 to 1965, a period when Greece experienced sharp population changes owing to annexation of areas, migration, wars, and refugee

[74] Kolodny, 'Hermoupolis-syros', pp. 274–5.

[75] Raftakis, 'A "silent" pandemic?'.

influxes.[76] Hionidou has drawn attention to the fact that these estimates were based on extensive assumptions rather than on actual data and that indirect techniques were employed in the calculations.[77] In addition, by employing the technique of retrospective projection, Siampos attempted to reconstruct the demographic history of Greece, made predictions about the development of the Greek population, and estimated the levels of age and sex misreporting in all censuses from 1861 until 1961.[78] Even though Valaoras and Siampos's rates present wide disparities for most of the study period, the gap between the two rates had become minimal in the 1930s owing to improvements in the quality of the published mortality statistics, whereas earlier, each author had to make assumptions to fill missing data.

The CDR in Hermoupolis seems also to have been consistently higher than any other rate that has been calculated in Greece.[79] 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 the arrival of refugees, which resulted in population increases, and that of Athens was the result of the Asia Minor refugee influx, which affected the population of the capital extensively.[80] Furthermore, if the mortality pattern in Hermoupolis is compared with that of Athens, it is observable that, at the turn of the twentieth century, the 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. Internal migrants, mostly males, made up a large part of the Athenian population at the time, whilst in Hermoupolis in-migration was rather low.

The much higher rates which were found in all urban centres in Greece compared with the rates in Mykonos, Paros, 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. Increasingly unhealthy urban conditions along with low public health at least prior to the 1930s in the Greek urban centres most likely contributed to the existence of high mortality levels there. The urban–rural differences were also the result of high under-registration in most rural areas (the only exception is Mykonos, which has continuous data of high quality).[81] 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 to have access to health care. This phenomenon is expected to have affected mostly Athens from the early twentieth century onwards owing to very rapid urbanisation, but for Hermoupolis, it is not known yet whether this factor affected 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 were not residents of Hermoupolis, although such information is missing in 41 per cent of all registered deaths. Using evidence from death registration, it is not possible to show

[76] Valaoras, 'Reconstruction', pp. 119–20.

[77] Hionidou, 'Demography', p. 51; eadem, 'Istorike', pp. 40–4.

[78] Siampos, *Demographike*, pp. 50–6.

[79] Hionidou, 'Demography', p. 50; Gavalas, 'Demographic reconstruction', pp. 223–4; Dimitropoulou, *Athènes*, p. 104; Eliopoulos, 'Oikonomikes', p. 103; Tolis, 'Demographikes', pp. 164–7; Moustane, 'Demographikes', pp. 206–7; Bournova, *Katoikoi*, p. 77.

[80] Moustane, 'Demographikes', pp. 206–7; Bournova, *Katoikoi*, pp. 65–6.

[81] Valaoras, 'Adynamies', p. 428.

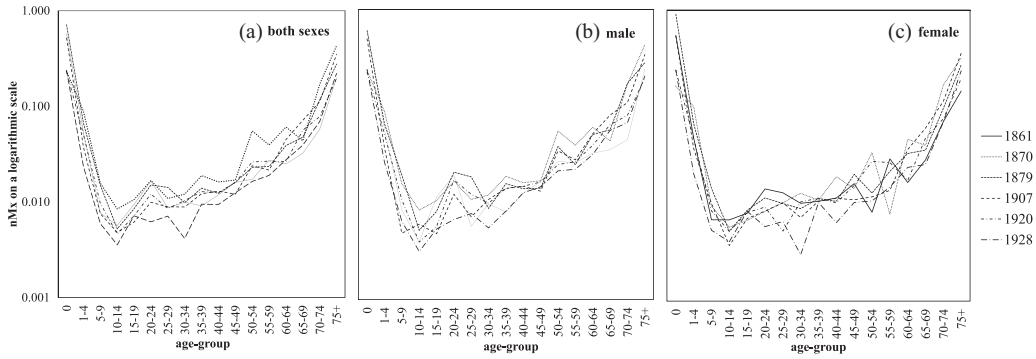

FIGURE 2 (a–c) Age-specific death rates ($_nM_x$) by sex, Hermoupolis, 1861–1928 (census years). *Sources*: Hermoupolis Mortality Database; Greek censuses 1861, 1870, 1879, 1907, 1920, and 1928

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] Catholic hospital situated in Ano Syros and then to the Hermoupolis hospital.[82] 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.[83]

In figures 2a–c, age-specific death rates ($_nM_x$) 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 higher male mortality in the age group 20–24 years in the nineteenth-century censuses is almost certainly the result of age misreporting. Even though the real age was reported in death registers, males avoided reporting ages between 18 and 24, because these were the ages at which they were eligible for military service.[84] 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 owing to the high prevalence of infectious diseases over the past centuries have been suggested as main reasons for the high levels of male mortality.[85] In addition, the curve of the probability of dying ($_nq_x$) in figure 3 takes on the shape of a 'tick' when plotted on the graph, although a number of remarkable patterns are evident. 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 years, and then a constant increase until $_\infty q_{75}$ is observed.

A closer examination of figures 3 and 4 indicates that mortality among young children aged from one to four years was far more prevalent than for infants in 1870 and 1879 (see also note in figure 4). A similar trend of increasing childhood mortality is observed in neighbouring Mykonos during the same period.[86] Following the Mediterranean model, this trend of a higher rate of early

[82] The Syros interviews, #22.

[83] Hionidou, 'Hospitals', p. 365.

[84] Siampos, *Demographike*, pp. 57–8; Hionidou, 'Demography', p. 144.

[85] Gage, 'Population', p. 273; Weden and Brown, 'Life course', p. 76; Wisser and Vaupel, 'Sex differential', p. 2.

[86] Hionidou, 'Demography', pp. 139–40.

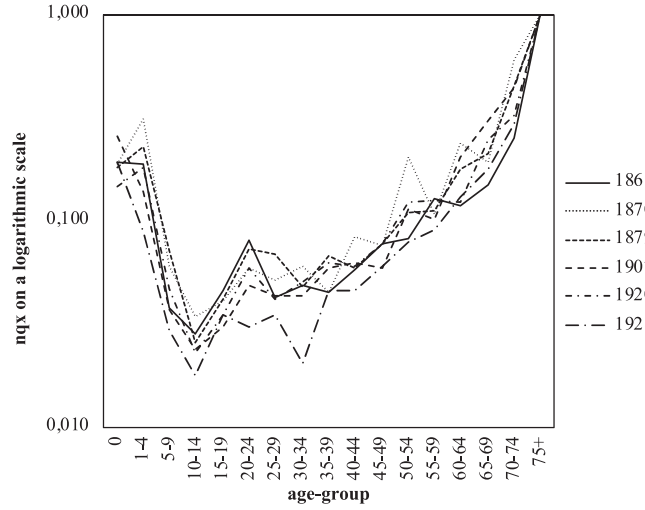

FIGURE 3 Probability of dying for both sexes (${}_nq_x$), Hermoupolis, 1861–1928 (census years). *Sources*: Hermoupolis Mortality Database; Greek censuses 1861, 1870, 1879, 1907, 1920, and 1928

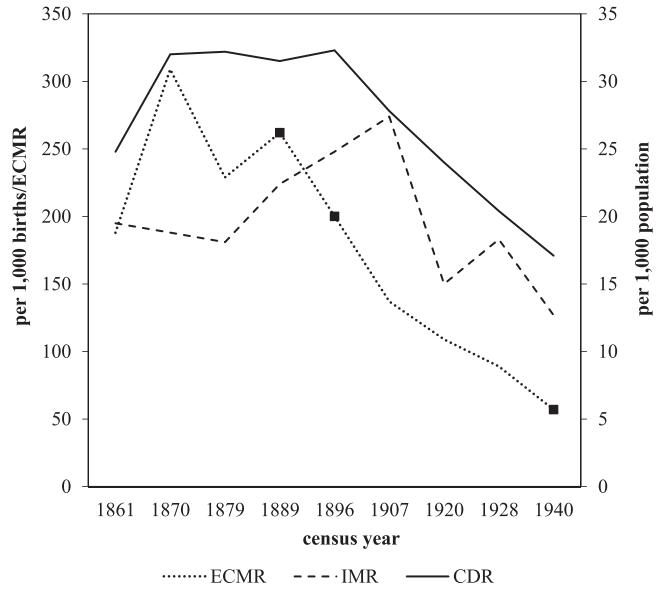

FIGURE 4 ECMR, IMR, and CDR, Hermoupolis, 1861–1940 (census years). *Notes*: ECMR in 1889, 1896, and 1940 has been estimated owing to the lack of population at risk for the age group 1–4 years. *Sources*: Hermoupolis Mortality Database; Greek censuses 1861, 1870, 1879, 1907, 1920, 1928; Raftakis, 'Why were infants dying', p. 86. See also Ramiro-Fariñas and Sanz-Gimeno, 'Structural changes', pp. 63–4; Sanz-Gimeno and Ramiro-Fariñas, 'Estructuras', p. 129

childhood mortality than infant mortality was also observed in Spain and Italy at that time.[87] Yet, this pattern was typical of large urban populations in the nineteenth century.[88] A possible reason for the great increase of ${}_4q_1$ from 1861 to 1870 is the outbreaks of typical childhood diseases such as scarlet fever, whooping cough, measles, and diphtheria.[89] Subsequently, figure 4 shows a drop in mortality among young children. Although this decline has not been associated with a specific

[87] Pozzi, *Lotta*; Ramiro-Fariñas and Sanz-Gimeno, 'Structural changes'; isdem, 'Childhood'; Sanz-Gimeno and Ramiro–Fariñas, 'Estructuras'.

[88] Woods, 'Historical relationship'; Wolleswinkel-van den Bosch et al., 'Determinants'; Jaadla and Reid, 'Geography'.

[89] Foustanos, 'Syzetesis'.

reason, it might have resulted from fluctuations in diphtheria-related mortality, as was discussed extensively in a contemporary medical report.[90]

The ECMR in Hermoupolis exhibits a significant decline which started in the late 1880s, approximately two decades before that of infants, as a recent study has shown.[91] This trend is in line with other European experiences.[92] The timing of the ECMR decline in Hermoupolis coincided with the timing of mass immunisation practices which started in the 1880s and possibly contributed to increasing the survival of those in the age group. Another reason for the decline in ECMR may lie with changes in the virulence of some childhood diseases, as suggested by Woods for nineteenth-century England and Wales.[93] Finally, improvements in registration coverage might have also affected the decline in ECMR, as age reporting was more accurate by the late nineteenth century. Since rounding the age of infants to one year was rather common, many infants who were close to one year old were previously reported as being one year old. An improvement in the accuracy of the age at death would have resulted in these infants being reported of dying at the age of zero, thus decreasing ECMR and increasing the infant mortality rate (IMR). To test the accuracy of the Hermoupolis dataset and to reduce the net error of age misreporting, the exact age at death (in days) of all infants was re-calculated around all census years by linking their death records with their respective birth ones.[94]

In 1870, apart from the high ECMR, the age groups between 40 and 64 years had a relatively greater possibility of dying in comparison with either the younger ages or the same age groups in other census years (figure 3). 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 20–40 years is observed, which may have resulted from the 1918–9 influenza pandemic.

Figures 5a–c depict the main trends of life expectancy at every age group for both sexes separately in Hermoupolis for every census year, and table 1 shows life expectancy at birth (e_0) in various places in Greece, which has 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. What is notable is that the life expectancy at birth in 1861 was not subsequently reached again until 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 (at least for the male population). In the early twentieth century, the pace of change did begin to accelerate, especially after the decline of IMR and ECMR, reaching almost 46 years of age in 1928. In addition, life expectancy for the age groups 1–14 years seems to have followed similar trends to that of e_0, although life expectancy of adult age groups improved only very slowly, remaining relatively steady throughout the whole period under study.

[90] Ibid. Although causes of death are not available in civil registers prior to 1916, draft [*proheira*] death registers, which are available for sporadic runs of years (including 1876–9), have been linked to civil registers. Such material has not yet been employed; however, it is expected to generate useful results. For a first elaboration of the draft registers regarding infant causes of death, see Raftakis, 'What was killing babies'.

[91] Raftakis, 'Why were infants dying', p. 415.

[92] Vögele, *Urban mortality change*, p. 56; Ramiro-Fariñas and Sanz-Gimeno, 'Structural changes', p. 62; Woods, *Demography*, p. 247.

[93] Woods, 'Historical relationship', p. 215.

[94] For a more detailed overview of the linkage techniques that were employed to analyse infant mortality in Hermoupolis, see Raftakis, 'Why were infants dying', pp. 409–12.

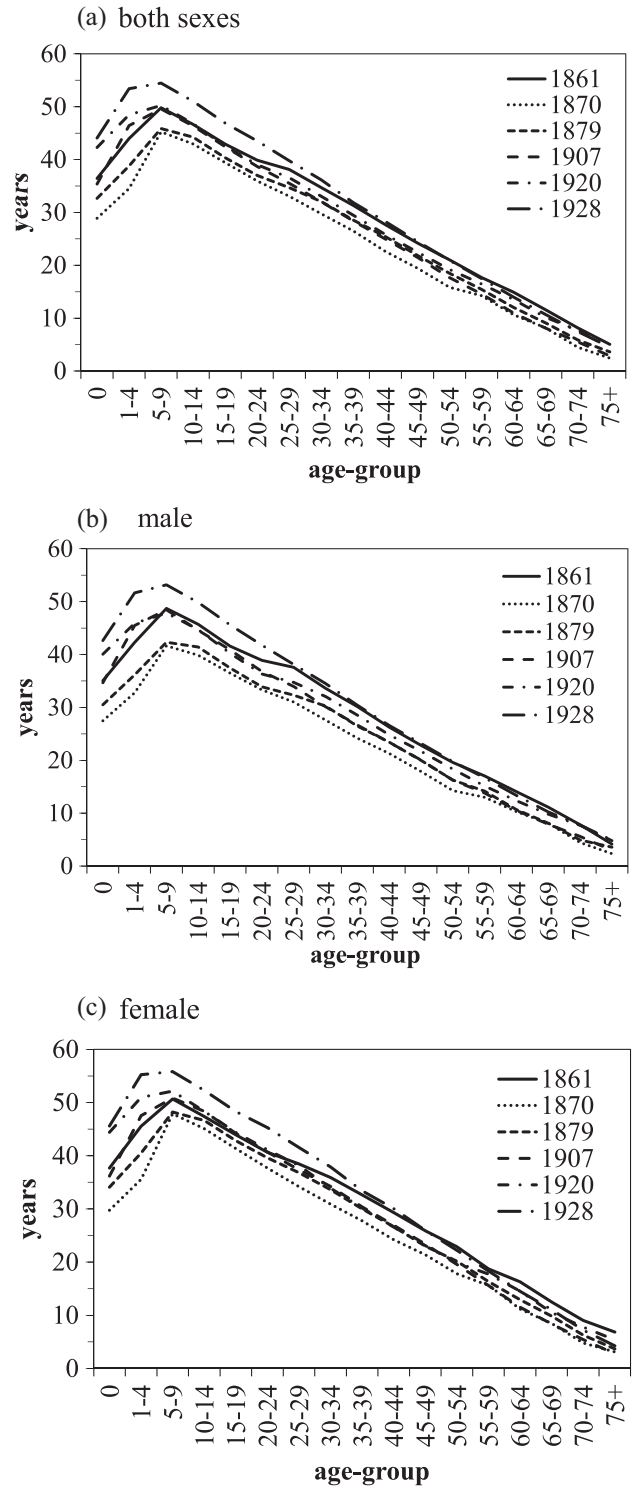

FIGURE 5 (a–c) Life expectancy at all ages by sex, Hermoupolis, 1861–1928 (census years). *Sources*: Hermoupolis Mortality Database; Greek censuses

TABLE 1 Expectancy of life at birth in various places in Greece, 1861–1928

	Greece		Hermoupolis		Mykonos		Cyclades islands		Ionian islands	
	M	F	M	F	M	F	M	F	M	F
1861	–	–	**35.0**	**37.7**	47.4	43.6	–	–	–	–
1870	39.8	41.3	**27.5**	**29.5**	45.3	42.6	43.1	44.6	47.4	47.8
1879	36.0/44.9	37.5/46.3	**30.5**	**34.1**	48.7	–	47.0	49.2	49.1	49.8
1907			**34.7**	**36.2**						
1920			**40.0**	**44.4**						
1930	45.0/49.1	47.5/50.9	**42.7**	**45.6**						

Sources: Greece: Valaoras, 'Comparative study', pp. 560–4; idem, 'Gain', pp. 34–40; NSSG, 'Ellenikoi', pp. 22–3. Mykonos: Hionidou, 'Demography', p. 149. Ionian islands: Kosmatou, 'Population', p. 328. Cyclades islands and Greece: Gavalas, 'Demographic reconstruction', pp. 82–3. Hermoupolis: Hermoupolis Mortality Database.

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 study period. Therefore, comparisons with other Greek populations are limited. Even so, it is argued here that at least the 1861, 1870, and 1879 (for males) 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. 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 20 years higher.[95] In 1879, as table 1 depicts, two rates are available for the whole country. To calculate the national life tables in 1879, Gavalas used the 1870 ${}_1M_0$, owing to the high under-registration of infants in the 1879 census.[96] Valaoras constructed life tables in 1879 as well.[97] The lower levels of e_0 produced in Valaoras study should be attributed to the use of an estimated IMR.[98] 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 IMR but also ECMR found in Hermoupolis.

After a gap of almost 50 years, in 1920 the first national life tables were published. As is evident in table 1, two different national rates of e_0 were produced by the National Statistical Service of Greece (NSSG) and by Valaoras. The NSSG life tables underwent revision to correct the underestimation of infant deaths and the overestimation of old age deaths because of the significant age and sex misreporting.[99] Valaoras, on the other hand, employed the mean population at risk of the 1920 and 1928 census and the five-year average of deaths (1926–30) to minimise the effects of the increased mortality caused by the Asia Minor refugee influx and the 1929 dengue fever epidemic.[100]

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 to four years longer

[95] Kosmatou, 'Population', p. 328.

[96] Gavalas, 'Demographic reconstruction', pp. 82–3.

[97] Valaoras, 'Gain', pp. 34–40.

[98] See Hionidou, 'Demography', p. 149.

[99] NSSG, 'Ellenikoi', pp. 22–3.

[100] Valaoras, 'Comparative study', p. 554.

than males throughout the study period. When the e_0 results for women in Hermoupolis are compared with those of Mykonos, it seems that women in Hermoupolis had better survival chances compared with men whereas that was not the case in Mykonos in 1860 and 1870 (see table 1). However, evidence from other parts of Greece confirms the results found in Hermoupolis in relation to sex.

V | 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 mortality rates with those of semi-urban Mykonos and rural Paros suggest that urban mortality in Hermoupolis was much higher than that of non-urban populations, even until 1940.

For Greece, under-registration of vital events has been said to have been extensive in rural parts of the country.[101] This is partly owing to the interruption of the collection of vital statistics by the Central Statistical Office during the period 1889–1920. 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. Under-registration of vital events was also of great importance in the largest urban centres of the country and, therefore, responsible for inaccurate estimates.[102] Certainly, from 1925 onwards, civil registration in Greece is considered of better quality, since it properly commenced almost everywhere in the country. On the other hand, there are no serious indications of under-registration in Hermoupolis. Thus, 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.

The fact that Hermoupolis had a busy port and noteworthy industrial activity were among the main reasons for the high levels of in-migration and significant increases in its population in the second half of the nineteenth century.[103] In-migration, which generally was linked with increases in mortality in urban centres, might have also 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, but these same migrants were not captured by the censuses, then mortality rates could be heavily overestimated. The increase in CDR in 1923 is such an instance: 7000 refugees from Asia Minor arrived in 1922, whose deaths were captured in Hermoupolis but 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 was the existence of health institutions, including hospitals and foundling hospitals, as often large shares of deaths registered in many urban environments were deaths of rural residents.[104] 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

[101] Valaoras, 'Adynamies', p. 429.

[102] Dimitropoulou, *Athènes*, p. 104; Eliopoulos, 'Oikonomikes', p. 103; Moustane, 'Demographikes', pp. 206–7.

[103] Hionidou, 'Nineteenth-century urban', p. 407.

[104] Mooney, Luckin and Tanner, 'Patient pathways', p. 247; Ramiro-Fariñas, 'Mortality', p. 405; Revuelta-Eugercios and Ramiro-Fariñas, 'Understanding', p. 33.

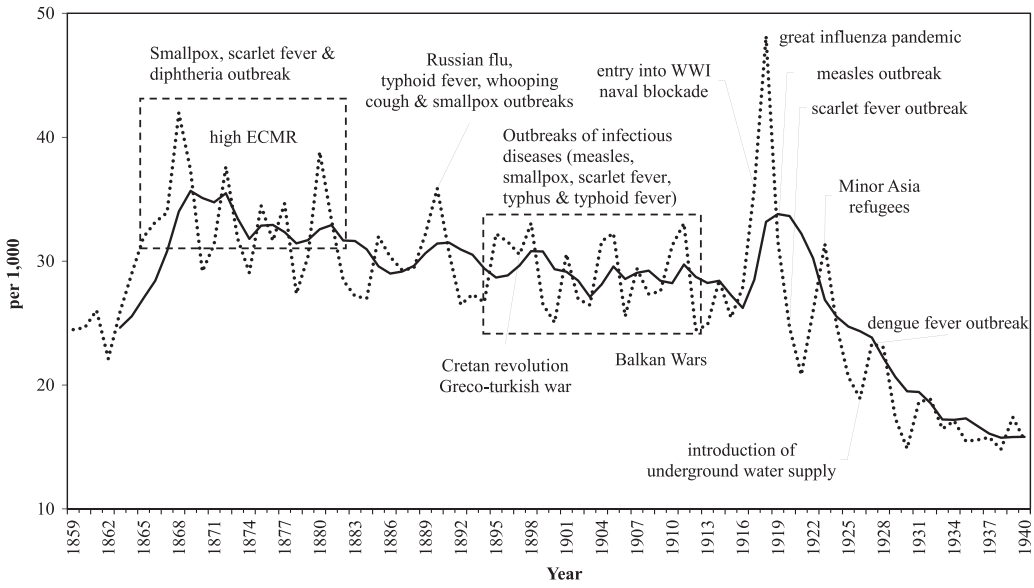

FIGURE 6 Annual and five-year moving average CDR, including the main disease outbreaks and principal political events, Hermoupolis, 1859–1940. *Sources*: Hermoupolis Mortality Database; Greek censuses 1861, 1870, 1879, 1907, 1920, 1928; Newspapers: *Ermoupolis*; *Helios*; *Tharros*; *Panope*; *To Vema Ermoupoleos*; Annual Public Hygiene Reports: GSAS/YPA/ 'Etesia' (1929–40); Minutes of the Municipal Council: GSAS/DA/PDS

to seek medical care is still unknown.[105] In addition, foundling deaths accounted for 10 per cent of all annual infant deaths for most of the period prior to 1920. These infants being of rural origin is highly unlikely since mothers wanted to retain their anonymity and to conceal their association with the illegitimate infants. In particular, oral evidence showed that the Catholics of Ano Syros did not bring unwanted babies to Hermoupolis but instead left them in or near Catholic churches in Ano Syros. However, it is more likely that mothers would travel to bigger urban centres so as to avoid the social stigma.[106]

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 6). The insufficient and filthy sewers and the mostly contaminated available water in the city were responsible to a significant extent for a large number of young children dying from diarrhoeal diseases and the dissemination of infectious diseases among all ages. Despite the widespread practice of breastfeeding in the city, a more in-depth seasonality analysis by cause of death during infancy indicated the early initiation of supplementary food, which was mixed with impure water and, therefore, turned into an important medium for a large share of infant deaths, especially during the hot summer months.[107] However, the introduction of an underground water supply in Hermoupolis in the mid-1920s, although not

[105] 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 in the early 1940s: Hionidou, 'Hospitals', p. 365.

[106] Raftakis, 'Why were infants dying', pp. 410–1.

[107] Raftakis, 'Mortality', p. 187; idem, 'Why were infants dying', pp. 423–4.

expanded across the whole city, may have had an indirect impact on the amelioration of death rates in the city.

In addition, as Hermoupolis declined in significance compared to other Greek cities, the very poor living standards, especially among the working classes, caused the city to experience the highest levels of mortality calculated thus far in the country. Given that Hermoupolis was built very rapidly in the 1820s without town planning and with 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 it was responsible for not only high levels of mortality but also morbidity. High density also seems to have affected workplaces and housing.[108]

The findings of this study may therefore suggest, following European trends, that the unhealthy urban environment in Hermoupolis was responsible for reducing the survival of its inhabitants.[109] 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.

VI | WHY DID MORTALITY DECLINE IN HERMOUPOLIS?

Sharp spikes can be seen when the annual CDR is plotted in figure 6. Such wide fluctuations in mortality have been characterised by Vallin as 'crises' which interrupted the 'normal' trajectory of mortality.[110] In Hermoupolis, these erratic fluctuations were more frequent in the second half of the nineteenth century rather than in the first decades of the twentieth century. When the five-year moving average is examined, it is apparent that the mortality decline, which had started in the late 1890s, was only interrupted in the years around the 1918–9 influenza pandemic and the arrival of refugees from Asia Minor. To explore the reasons for these fluctuations, various qualitative sources, including the local press and public health reports, were employed.[111]

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 the CDR in the second half of the nineteenth century. During the 1890s, however, the decline in the ECMR coincided with the introduction of mass immunisations, implemented by the local medical authorities in collaboration with the local government since the 1880s.[112] At the same time, Hermoupolis experienced a deep financial and social crisis as it lost 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 local society.[113] During the first decades of the twentieth century, investments in the textile industry balanced the

[108] Reher, 'Search', p. 120.

[109] Kearns, 'Urban penalty', pp. 222–3; Szreter and Mooney, 'Urbanization', p. 92; Reher, 'Search', pp. 105–6; Woods, 'Urban-rural mortality', p. 43.

[110] Vallin, 'Mortality', p. 43.

[111] Apart from the Hermoupolis Mortality Database and census material, the newspapers *Ermoupolis*, *Helios*, *Tharros*, *Panope*, *To Vema Ermoupoleos*; the Minutes of the Municipal Council (GSAS/DA/PDS); and annual public hygiene reports for the period 1929–40 (GSAS/YPA/'Etesia') were employed.

[112] For instance, *Patris:* 828, 17 Apr. 1882; 1347, 4 Apr. 1892; and 1396, 6 Mar. 1893; *Helios:* B/83, 6 Mar. 1888, p. 2; and KB/624, 11 Feb. 1898, p. 2; GSAS/DA/PDS 973/ΠΚΘ: 20 Apr. 1887; 1296/MZ, 29 Nov. 1896; 146/52, 31 Oct. 1906; and 690/57, 23 May 1932.

[113] Travlos and Kokkou, *Ermoupole*, p. 40.

shrinkage in the local economy by reducing unemployment and out-migration.[114] Even though evidence from the local press reveals that the lower social classes suffered throughout the interwar period,[115] it is expected that these improvements in the local economy would have contributed to an amelioration of the living standards in the city. Certainly, this factor did not initiate any declines in mortality, but it may have helped to stabilise the rates. Besides, there is little evidence to suggest that nutritional status changed either in the city or in the country before the 1950s.[116] Nonetheless, various scholars suggested that agricultural productivity grew rapidly in the 1930s, perhaps resulting in improvements in nutritional sufficiency of the country.[117] 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.[118] 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. Evidence from Hermoupolis shows 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,[119] with Hermoupolis being particularly vulnerable owing to the lack of an extensive rural hinterland. The much lower mortality in the rural parts of the island compared with those in Hermoupolis and Ano Syros before and during the 1941–3 famine was attributed, among other reasons, to the greater availability of food owing to access to land.[120]

Other studies have attributed the decline in mortality in Greece, especially after the 1920s, to improvements in public health or medical care.[121] Nonetheless, very few studies have connected medical progress (particularly, inoculation and/or vaccination) with mortality decline.[122] Besides, even until the 1930s, physicians had relatively limited means of combatting 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, untrained nurses, and midwives who went unsupervised after their training. Most hospitals also lacked sufficient equipment and were overcrowded. The medical system in Greece was said to be insufficient and dangerous.[123] 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 decline in mortality.[124] However, the fact that Hermoupolis had rather

[114] Papastefanaki, '"Patriko Endiaferon"', pp. 159–60.

[115] For instance, 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. *Tharros:* B/43, 17 Jan. 1925, p. 1; B/70, 22 Apr. 1925, p. 1; E/313, 26 Jan. 1929, p. 1; E/315, 8 Feb. 1929, p. 1; Z/417, 19 Feb. 1932, p. 2; Z/481, 16 Mar. 1932, p. 1; and H/549, 23 June 1933, p. 1.

[116] Babanases, 'Diamorfose', p. 114; Gutenschwager, *Politike*, p. 68.

[117] Fragkiades, *Ellenike*, p. 140; Petmezas, 'Ellenike', p. 88.

[118] McKeown, *Modern*, p. 153; Floud et al., *Changing body*, pp. 151–64; Meredith and Oxley, 'Food', p. 212; Harris, Floud and Hong, 'How many calories?'; Harris and Helgertz, 'Urban sanitation', p. 210.

[119] Raftakis, 'A "silent" pandemic?'.

[120] Hionidou, *Famine*, pp. 164–5.

[121] Bournova, *Katoikoi*, pp. 76–8; Petmezas, 'Demographia', p. 43.

[122] Easterlin, 'How beneficent', pp. 263–4; Razzell, 'Interpretation', p. 11; Mercer, *Infections*.

[123] Kapanides, 'Kleiste', pp. 201–2; Liakos, *Ergasia*, p. 329; Theodorou and Karakatsani, 'Health policy', pp. 63–5.

[124] Riley, *Rising*, p. 96.

advanced medical services by Greek standards, multiple health institutions, 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 improvements both in medical care and sanitation. The most effective achievement was the implementation of mass vaccinations, which are more likely to have 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.[125] Improvements in both water supply and sewerage systems have also been associated with mortality decline in various countries.[126] Others studied the impact of specific measures such as filtration and chlorination of water on mortality.[127] Whether public health initiatives have been responsible for the mortality decline in Greece from the 1920s onwards remains an unanswered question. 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 stabilisation of the rates or 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 to everybody even by the mid-1930s and many relied on public springs.[128] Similarly in Athens, only by 1931 did 90 per cent of all the city's inhabitants have access to water on a daily basis (and then only for a few hours).[129] Nonetheless, access to a water supply did not necessarily mean that 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.[130] However, the positive effect of chlorination of water on mortality decline among infants and against waterborne diseases (especially typhus) has been widely established.[131] Such application, though, was not introduced in Hermoupolis until 1940.

However, from the mid-1920s onwards, a noteworthy decline in the CDR is clearly seen in figure 6. The introduction of a water supply in Hermoupolis, therefore, despite being contaminated, appears to have had a positive effect on the decline in mortality. Recent studies 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.[132] The limited sanitary intervention in the city may, therefore, explain the relatively high infant diarrhoeal mortality even until the late 1930s.[133] 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, nonetheless, have shown

[125] Szreter, 'Importance', p. 26; Cain and Rotella, 'Death', p. 147; Beach et al., 'Typhoid', p. 72; Chapman, 'Contribution', p. 233; Harris and Hinde, 'Sanitary investment', p. 28.

[126] Kesztenbaum and Rosenthal, 'Sewers' diffusion', p. 182; Gallardo-Albarrán, 'Sanitary infrastructures', pp. 27–8.

[127] Cutler and Miller, 'Role', p. 3.

[128] The Syros interviews, #10. Raftakis, 'Mortality', p. 64.

[129] Mavrogonatou, 'Ydrodotese', p. 614.

[130] Evans, *Death in Hamburg*, pp. 190–1; Peltola and Saaritsa, 'Later', p. 278.

[131] Cutler and Miller, 'Role', p. 3; Ferrie and Troesken, 'Water', p. 16; Peltola and Saaritsa, 'Later', p. 298.

[132] Fink, Günther and Hill, 'Effect', p. 1201; Fuller et al., 'Joint effects', p. 288.

[133] Raftakis, 'Why were infants dying', pp. 423–5.

that mortality declined most rapidly in those areas that were the first to be connected to a water supply.[134]

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 study period.[135] Hermoupolis had acquired a sewage disposal system by the mid-nineteenth century, although very limited improvements took place until the late 1930s. According to contemporary evidence, the ineffective current sewerage system was a foci of germs and infections.[136] Literature has shown that water supply and sewerage systems were complementary to each other rather than substitutes.[137] In contemporary India, for example, interventions to provide toilets in the rural areas of the country failed mainly owing to incomplete coverage and low usage of toilets but also lack of water supply.[138] Evidence from the United States 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.[139] 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 activity by affluent inhabitants to provide childcare, medical care, nourishment, and protection of foundlings and lower strata infants in Hermoupolis is of special importance as it played a very important role by counterbalancing the ineffectiveness of the state and the local authorities. Philanthropic activity could 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. Hermoupolis had a significant number of philanthropic foundations which played an important role in the protection and the care of young children.[140] The positive effect of the foundation of the Organisation for the Welfare of Children (*Perithalpsis tou 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.[141] The positive impact of charitable provision for young children, often overlooked in the literature, has also been found elsewhere (e.g. late-nineteenth-century London).[142]

It is therefore suggested here that a combination of these factors may have increased awareness of the importance of personal sanitation among the Hermoupolis inhabitants. Even though this is a factor which is very difficult to explore, it seems that the Hermoupolis inhabitants started to take care of their personal hygiene to overcome bad housing and the ineffectiveness of the local authorities. The availability of water may have increased sensitivity towards personal hygiene. Evidence from Hermoupolis seems to be in line with other studies, which indicated that sanitary

[134] Cutler and Miller, 'Role', p. 3.

[135] Kesztenbaum and Rosenthal, 'Sewers' diffusion', p. 182; Gallardo-Albarrán, 'Sanitary infrastructures', pp. 27–8.

[136] Iatrike Etaireia Syrou, 'Praktika', p. 46.

[137] Helgertz and Önnerfors, 'Public water', pp. 316–7.

[138] Duflo et al., 'Toilets', p. 12.

[139] Alsan and Goldin, 'Watersheds', p. 590.

[140] Arfanes, *Fymatiosis*, pp. 4–5.

[141] Loukos, 'Ethelontikes', p. 66; Raftakis, 'Why were infants dying', p. 417.

[142] Mooney and Tanner, 'Infant mortality', pp. 170–1.

interventions increased attention on hygienic practices in several Swiss cities.[143] 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 on water cisterns for potable water, as mentioned in oral histories.[144] Nonetheless, owing 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.[145] Research from Sub-Saharan Africa has shown that lack of water during the dry seasons led to higher prevalence of diarrhoea resulting from higher consumption of contaminated water, but it has also been related to reduced hygiene practices.[146]

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, it is argued here 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. An informant specifically indicated that when a public health inspector visited the Syros neighbourhoods:

> [H]e was stunned by the cleanliness [especially in the *Vrontados* 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.[147]

Another informant gave a more detailed description of the hygienic conditions of Hermoupolis and the role of individual housewives:

> 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 [early 2000] the local authority collects the rubbish from these neighbourhoods with a donkey … Well, all the cleaning was done by the housewives…[T]hey [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.[148]

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 has been underexamined, or at least underestimated, in previous demographic studies, but it seems to be of very

[143] Floris and Staub, 'Water', p. 267.

[144] The Syros interviews, #11. Raftakis, 'Mortality', pp. 69–71.

[145] According to a recent study, which employed historical data series for the period 1955–2002 to study the frequency of droughts in various Greek environments, Cyclades experienced frequent drought events that lasted up to five years: Tigkas, 'Drought', p. 34.

[146] Bandyopadhyay, Kanji and Wang, 'Impact', pp. 70–1.

[147] The Syros interviews, #1. For full extract, see Raftakis, 'Mortality', p. 291.

[148] The Syros interviews, #13. For full extract, see Raftakis, 'Mortality', p. 292.

special importance in Greece. The significance of cultural factors was emphasised by Schofield and Reher[149] but also recently by Mooney, who claimed that domestic cleanliness (i.e. disinfection of homes and belongings) was an important intervention in Victorian England.[150]

Finally, in addition to the factors discussed above, the decline in mortality, especially that of infants, in Hermoupolis may also have been to a certain extent the result of the mortality–fertility interaction during the demographic transition, improvements in maternal literacy, and changes in the registration system.[151]

VII | CONCLUSIONS

The demographic history of urban mortality in nineteenth- and early-twentieth-century Greece has rarely been explored. This article 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. 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. The main contributions of this study reinforce, confirm, and expand our limited knowledge regarding the timing and the reasons which initiated the decline in mortality in Greece. Moreover, the study contributes to the urban–rural debate within Europe.

The CDR in Hermoupolis was found to have been much higher than the national average and the highest rate yet calculated in Greece in almost every census year from the mid-nineteenth century until 1940. Comparisons of Hermoupolis with other semi-urban and rural Greek 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, the Hermoupolis time series show that a declining trend was underway by the beginning of the twentieth century or even the late nineteenth century: young children benefitted initially; adults and infants followed. A combination of factors was found to be responsible for the mortality decline in Hermoupolis, including changes in the registration system, mass immunisation, improvements in living standards and nutrition among lower strata infants, improvements in maternal literacy, the mortality–fertility interaction during the demographic transition, and wider access to water. An underground water supply system was introduced in the mid-1920s, and although not expanded across the whole city, it may have enabled improvements in personal hygiene among the residents of the city.

Concerning the mortality among other age groups, when age-specific death rates were plotted, the 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.

This has been the first study of urban mortality in Greece using historical demographic methods and data. Up to now, the lack of similar studies has constrained the examination of the mortality

[149] Schofield and Reher, 'Decline', p. 6.

[150] Mooney, *Intrusive interventions*, chap. 5.

[151] Raftakis, 'Why were infants dying', pp. 418–9.

patterns in Greece as a whole but also in certain important Greek urban centres, such as Athens or Piraeus. Consequently, additional long-term studies should provide supplementary evidence regarding the mortality transition and contribute to the Greek urban–rural debate, which has been developed and studied thoroughly in this study.

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ORCID

Michail Raftakis https://orcid.org/0000-0001-8327-1065

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