Chapter 13
Long-term Mortality Changes in East Asia: Levels, Age Patterns, and Causes of Death

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Abstract One of the most significant events in recent history has been the worldwide demographic transition. This transition started with mortality decline in some European countries around the beginning of the nineteenth century. While mortality reduction started late in most East Asian populations, their life expectancies have increased faster than those observed in Europe. In recent years, Japan and Hong Kong have achieved the highest life expectancy and led the mortality decline in the world. These changes raise many important research questions and have significant implications. This chapter examines long-term mortality changes in East Asia and compares them with those observed in England and Wales, France and Sweden. Its discussion particularly concentrates on changes in age-specific mortality rates and their contribution to the increase of life expectancies in recent history. To explain these changes and their patterns, the chapter also analyses changes in major causes of death and their impacts on mortality decline across different age groups. On the basis of its major research findings, the chapter concludes with a brief discussion of several factors and their contribution to the rapid mortality transition in East Asia in recent decades.

Keywords East Asia · Mortality trends · Epidemiologic transition · Cause of death · Age-specific mortality

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13.1 Introduction

One of the most significant events in recent history has been the worldwide demographic transition. This change has been so important to 'the creation of the modern world' that some scholars argue that the modern process of development cannot be understood unless the demographic transition is put on the centre-stage (Dyson 2010, p. viii). The demographic transition started with mortality decline in some European countries around 1800. In England and Wales, France and Sweden, life expectancies at birth rose from around 35 years in 1800–1809 to about 50 years at the end of the nineteenth century, and further increased to approximately 70 years in 1950 (Livi-Bacci 2007). Similar changes were also recorded in most western countries in the second half of the nineteenth century and the first half of the twentieth century. It is largely based on these experiences that the classic demographic transition and epidemiological transition theories were developed (Notestein 1945; Omran 1971).

Mortality decline in most East Asian populations began in the early or mid-twentieth century, but their life expectancies have increased faster than those in Europe. Japan and Hong Kong have led the mortality decline in recent years, with the highest life expectancy in the world (United Nations 2011). Mortality in South Korea and Taiwan has also reached a very low level. Rapid mortality transition in East Asia raises a number of questions. What is the route of mortality decline in East Asian populations? To what extent has mortality decline, especially its decline in major age groups, in these populations differed from that observed in North and West Europe in the past? Why could many of these populations improve their mortality so rapidly in comparison with other parts of the world in recent decades? Have changes in major causes of death in East Asia conformed to the patterns observed previously in western industrial countries? What are their contributions to the rapid increase in longevity? Finally, in what ways could East Asia's experience of lowering mortality enrich our knowledge of epidemiological transition and contribute to the theoretical advancement in the study of mortality? Despite their potential theoretical implications and the great significance of mortality decline in East Asia, many of these questions have not been systematically studied from a global perspective.

This chapter examines some of these questions. Following this introduction, section two compares long-term mortality changes in East Asia with those observed in England and Wales, France and Sweden. The selection of these European populations is largely due to the fact that they all possess reliable mortality data for a very long period and that their mortality decline has in many ways exemplified the major characteristics of the classic epidemiological transition described by Omran (1971). After that, section three describes changes in age-specific mortality rates over the past half century and their contribution to the overall mortality decline. In section four, we examine changes in major causes of death and their impact on the increase of life expectancies. Finally, we discuss our major research findings and make some concluding remarks in the last section.

Data used in this study are drawn primarily from the following sources: the Human Mortality Database constructed at the Max Planck Institute for Demographic

Research and University of California at Berkeley; World Population Prospects: 2010 Revision published by the United Nations, and mortality data collected by the World Health Organization. In addition, death records and demographic data collected from Hong Kong and Taiwan are used. The death records are provided by the governments of Hong Kong and Taiwan, and the population data are largely taken from official publications such as *Taiwan-Fukien Demographic Fact Book*.

In the discussion of long-term mortality changes, we include all East Asian populations, but only some of them are included in more detailed investigations of changes in age-specific mortality rates and changes in major causes of death due to data availability. We use conventional demographic methods to analyse and compare long-term mortality changes in study populations. Decomposition techniques developed by Arriaga (1984) are used to examine the contribution of changes in both age-specific mortality rates and major causes of death to the improvement in life expectancies in these populations.

13.2 Mortality Decline in East Asia and Selected European Populations

Available evidence suggests that the worldwide mortality transition started in North and West Europe about 200 years ago. As shown in Fig. 13.1, mortality fluctuated notably in England and Wales, France and Sweden in the second half of the eighteenth century, although their life expectancies at birth were different. This began to change around 1800 when the trend of mortality decline became clearer. This change continued and the improvement in mortality was particularly notable between 1870 and the mid-twentieth century. By the end of this period, life expectancies were already around 70 years in these populations. Similar changes, though slightly later in general, also took place in other parts of North and West Europe, North America, and some countries in Oceania, where life expectancies were also close to 70 years in the mid-twentieth century. According to the United Nations, mortality in these countries decreased to an even lower level during the last six decades. Their life expectancies increased to about 80 years in 2005–2010 (United Nations 2011).

In comparison with these countries, the mortality transition started later in East Asia. Available studies suggest that in Japan mortality decline did not begin until perhaps the last quarter of the nineteenth century. Figure 13.2 shows that in the first half of the twentieth century, Japan's life expectancy rose notably, although this was shattered by the Second World War (Jannetta and Preston 1991; Tsuya and Kurosu 2004; Zhao and Kinfu 2005). Mortality remained high in other parts of East Asia at the end of the nineteenth century. In Korea, Taiwan, and some cities in Mainland China, a long-term mortality decline started in the early twentieth century and this change was also affected strongly by wars and social upheavals during this period (Banister 1987; Barclay et al. 1976; Campbell 2001; Chen 1946; Engelen et al. 2011; Kim 1986; Kwon 1977; Mirzaee 1983; Zhao 1997, 2007a). By the early 1950s, life expectancy for the East Asian population as a whole was only around 46 years, lower

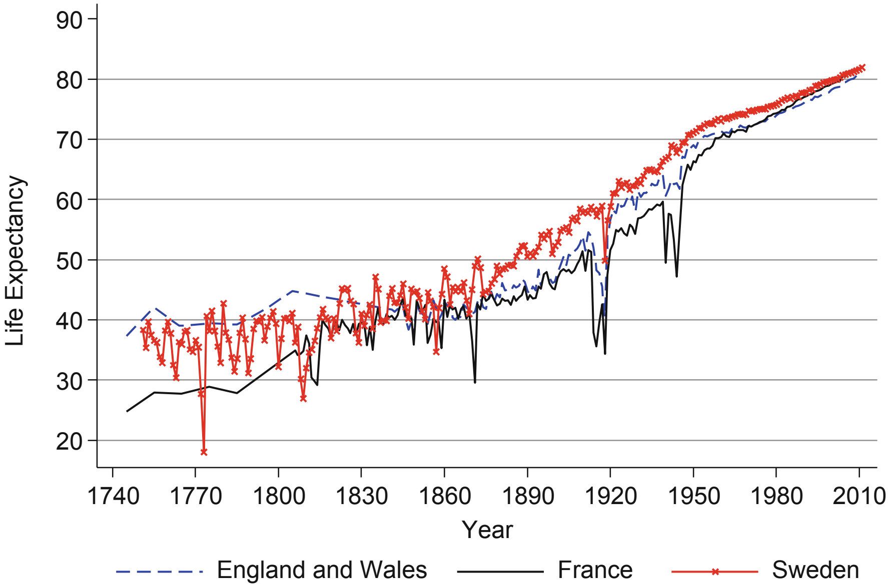

Fig. 13.1 Changes in life expectancies in England and Wales, France and Sweden since the mid-eighteenth century. (England and Wales: 1745–1805 from Wrigley et al. 1997, 1841–2009 from Human Mortality Database; France: 1745–1785 from Blayo 1975, 1806–1815 from Vallin and Mesle 2001, 1816–2010 from Human Mortality Database; Sweden: 1751–2010 from Human Mortality Database)

than the world average. Even in Japan where the lowest mortality in East Asia was recorded, the life expectancy was 62 years and markedly lower than the average for the European population, which was 66 years (United Nations 2011).

Since the early 1950s, East Asia has experienced the most rapid mortality decline observed in major regions of the world. According to estimates made by the United Nations, life expectancy increased 28 years in East Asia in the past six decades and reached 74 years in 2005–2010. In contrast, the average life expectancy for the world population rose only 20 years over the same period. By the 1970s, life expectancies in Japan and Hong Kong had already caught up with that in North and West Europe. In recent years, mortality in Japan and Hong Kong has been among the lowest in the world. Mortality in Macau has been largely similar to that in Hong Kong in the past 30 years. Rapid mortality reduction has also been observed in South Korea and Taiwan. Their life expectancies are now around 80 years, very close to the average recorded in North and West Europe. The life expectancy in Mainland China has been lower than the five East Asian populations mentioned above, but its mortality also went through an extraordinary decline, especially during the third quarter of the twentieth century. At present, life expectancy in Mainland China is close to 75 years. As far as their mortality levels are concerned, Mongolia and North Korea have been falling behind

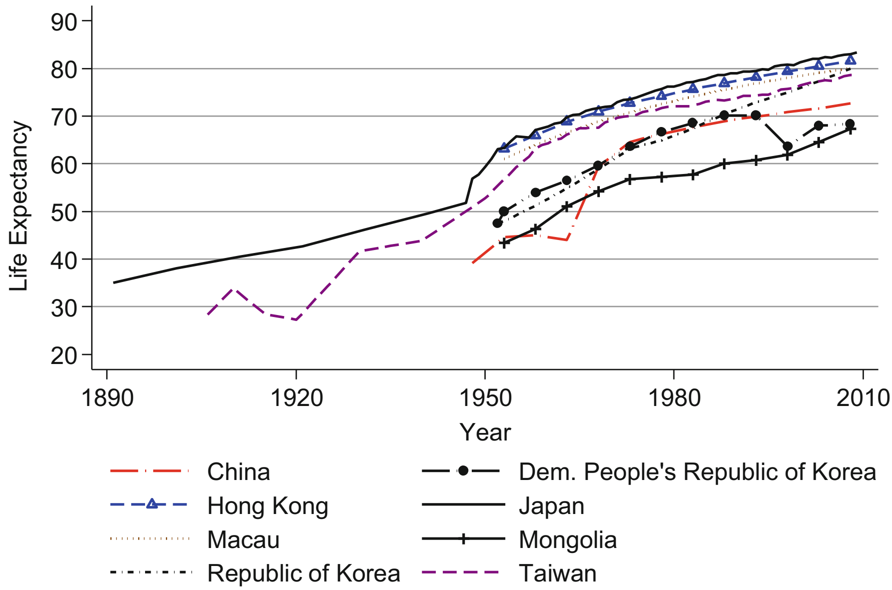

Fig. 13.2 Changes in life expectancies in East Asian populations in recent history. (China:1946–1949 from Zhao and Kinfu 2005, 1950–2010 from United Nations; Dem. People's Republic of Korea: 1950–2010 from United Nations; Hong Kong: 1950–2010 from United Nations; Japan: 1891–1941 from Zhao and Kinfu 2005; 1947–2009 from Human Mortality Database; Macau: 1950–2010 from United Nations; Mongolia:1950–2010 from United Nations; Republic of Korea: 1925–1949 from Zhao and Kinfu 2005, 1950–2010 from United Nations; Taiwan: 1895–1955 from Mirzaee 1986; Taiwan 1957–2009 from Ministry of the Interior, Taiwan)

other East Asian populations. Their current life expectancies are around 69 years, according to the *World Population Prospects: 2010 Revision* (United Nations 2011).

It is noteworthy that the reduction in mortality or the increase in life expectancy has not been constant in either the three selected European countries or East Asia. To further examine this change, mortality statistics computed annually or for a relatively short period are often needed. Such data, however, are difficult to find, especially for the early period of our investigation. In addition, there were considerable fluctuations in mortality before life expectancies reaching 50 years. For these reasons, there are some difficulties in determining how long it took for the life expectancy to increase from 30 to 40 years or from 40 to 50 years. After life expectancies reached 50 years, mortality decline generally became steadier, and measuring the speed of mortality changes became easier. To reduce the uncertainty mentioned above, we computed the five-year smoothed life expectancy for the study population, which is used to indicate the time when the population achieved a life expectancy of a certain level. These results, especially changes after life expectancies reached 50 years, are largely consistent with those recorded annually. In the case where available data could not show the year in which the life expectancy in the population reached exactly 40 or

50 years, the year when the life expectancy was closest to 40 or 50 years is selected as a proxy.

In most of the study populations, there were long-term and notable fluctuations in mortality before life expectancies reached 40 years. The increase in life expectancy from 40 to 50 years took a relatively long time (around four decades) in the three European populations, though it was completed in two to three decades in Japan, South Korea and Taiwan. In contrast, the increase of life expectancy from 50 to 60 years and from 60 to 70 years was faster. In the three European countries, the 20-year increase of life expectancies took about five decades to accomplish, which occurred largely in the first half of the twentieth century. In most East Asian populations, life expectancies reached 50 years after the Second World War, and it took less than three decades for them to rise to 70 years. The increase in life expectancy from 70 to 80 years has been more difficult to achieve in comparison with its increase from 50 to 60 years or from 60 to 70 years. This increase took around half a century to complete in the three European countries. While it was faster, a similar increase still took some 30 years to achieve in Hong Kong and Japan.

13.3 Changes in Age-Specific Mortality Rates and Their Contributions to the Increase in Life Expectancy

The previous section showed that mortality decline in several East Asian populations has been faster in comparison with that in the three European countries. This raises a number of questions. Did mortality decline in these populations exhibit similar patterns? For example, when life expectancy in these eastern and western populations rose by the same number of years, did their age patterns of mortality change in a similar way? If not, how did contributions to life expectancy from mortality reductions in major age groups vary across populations or at different stages of their mortality decline? These questions are examined in this section.

13.3.1 Variations in Mortality Decline in Major Age Groups

Mortality decline did not take place simultaneously in all age groups during the process of mortality transition. Generally, mortality fell first among children aged 1−14, who experienced the most significant mortality reduction in the early stage of mortality transition, as observed in England and Wales, France, Hong Kong, and Taiwan. But in Sweden and Japan, a rapid decline in infant mortality was also recorded at the same time when mortality was falling among children aged 1−14. In other sub-population groups, mortality reduction was closely related to people's age. Population aged 15−44 generally experienced an earlier and faster mortality decline, followed by those aged 45−64, and then those aged 65−84 and over. This is largely because infectious diseases were gradually eradicated or controlled during the earlier stages of the epidemiological transition. This change had a stronger impact on mortality decline among children and young adults than among infants or older people, who were more likely to be affected by congenital or degenerative conditions. Because of what has been said above, a significant shift in the distribution of deaths has taken place in the process of mortality transition.

While the decline in age-specific mortality in East Asian populations generally followed the patterns observed in North and West Europe in the past, they differed notably in two respects. First, in almost all age groups, mortality declined faster in the selected East Asian populations. In the three European populations, for example, it took more than 75 years for the probability of death to fall from around 300 per thousand to around 100 per thousand in the population aged 15−44, but the reduction of a similar magnitude took around 30 years to complete in Taiwan. Second, in comparison with those recorded in the three European populations, the time lag or the interval between the times when mortality started falling at younger ages and that at older ages were also notably shorter in the East Asian populations, where simultaneous mortality reductions were increasingly observed in different age groups. For example, in the three European populations, after mortality decline started among people aged 1−14, it generally took a century or even longer for a notable mortality reduction (about a 10 % reduction from its previous level) to be recorded among people aged 65−84. But in Japan and Taiwan, this lag was shorter and around 50 years.

Variations in the speed of mortality decline across different ages can be further examined from Table 13.1, which shows mortality changes in five major age groups over four phases of mortality decline. The four phases are divided according to changes in life expectancy at birth, which has been calculated using the methods discussed in Sect. 13.2.

It is noteworthy that when life expectancy increased from 40 to 80 years, changes in age-specific mortality have followed a rather similar pattern in most of the populations. When life expectancy increased from 40 to 50 years and from 50 to 60 years, the most rapid mortality decline was observed among children aged 1–14, with a few exceptions. The probability of death in this age group fell by 25–54 % and 50–61 % in these two phases of mortality changes, respectively. However, in Japan the decline of infant mortality was faster than that of children aged 1−14 when its life expectancy at birth increasing from 40 to 50 years. In England and Wales the decline of infant mortality was also slightly faster than child mortality when its life expectancy at birth increased from 50 to 60 years. During these phases of mortality transition, mortality decline among those aged 45 and above was generally slow. When the life expectancy increased from 60 to 70 years, the most rapid mortality reduction was still recorded among children aged 1−14. During this period, mortality also fell by 58–70 % and 41–64 % among infants and people aged 15−44. In contrast, the probability of death declined by 21–37 % among those aged 45−64, and the reduction was even smaller among those aged 65–84.

When the life expectancy increased from 70 to 80 years, a notable mortality decline took place in all major age groups and the magnitude of the decline was generally related to age. During this phase of mortality improvement, while the largest reduction was still recorded among infants except in Taiwan, mortality decline sped up considerably among those aged 45−64 and those aged 65−84. Their reductions

Table 13.1 Percentage decline of probability of death in major age groups at different phases of mortality changes. (Data Sources: See Figs. 13.1 and 13.2)

Changes in e_0 (years)	Population	q_0	q_{1-14}	q_{15-44}	q_{45-64}	q_{65-84}
40–50	England and Wales	12.11	49.09	39.48	8.72	0.72
	France	26.15	53.89	32.29	10.45	1.01
	Sweden	27.63	33.57	26.99	33.62	8.82
	Hong Kong	–	–	–	–	–
	Japan	52.51	32.29	15.81	10.75	1.37
	Taiwan[a]	23.32	25.42	31.73	18.76	–
50–60	England and Wales	51.34	49.64	32.86	24.97	2.73
	France	45.85	54.15	27.87	11.78	4.90
	Sweden	42.20	60.74	17.61	17.61	4.93
	Hong Kong	–	–	–	–	–
	Japan	38.74	55.27	46.38	25.33	8.30
	Taiwan	–	–	46.90	23.38	– 0.65
60–70	England and Wales	60.85	83.45	61.82	23.29	7.29
	France	57.62	74.98	63.66	32.67	11.23
	Sweden	62.52	77.82	63.74	20.51	1.41
	Hong Kong	69.57	82.68	40.69	22.69	23.27
	Japan	60.32	75.62	57.01	26.63	4.41
	Taiwan	–	–	45.69	36.50	10.82
70–80	England and Wales	80.88	76.81	44.49	52.88	34.52
	France	86.76	78.64	45.17	45.45	39.29
	Sweden	85.86	85.80	64.32	50.32	33.19
	Hong Kong	80.81	67.72	59.85	54.00	28.37
	Japan	80.81	72.44	59.09	50.23	36.67
	Taiwan	63.99	75.91	36.22	36.61	31.42

– data unavailable

[a] For Taiwan the last age group is 65 +. This group is used as a proxy for age group 65–84. In the panels where life expectancy increased from 40 to 50 years, from 50 to 60 years, and from 60 to 70 years, for Taiwan, age group 0–4 is used as a proxy for age group 0, and age group 5–14 is used as a proxy for age group 1–14. Data Sources: See Figs. 13.1 and 13.2

varied between 37 and 54 % and between 28 and 39 %, respectively. It is important to keep in mind that in Table 13.1, the statistics are presented by phases of mortality change. When annual mortality changes have been calculated, the decline in the probability of death in most of the East Asian populations was faster than that in the three European countries, because it took a shorter period to gain the same increase in life expectancy in East Asia.

13.3.2 Mortality Changes in Different Age Groups and Their Contributions to the Improvement in Life Expectancies at Birth

While the speed of mortality decline at a given age is a major factor determining its contribution to the increase of life expectancy, the latter is also related to the absolute level of mortality reduction and at which age this reduction takes place.

Table 13.2 Contribution of the decline in age-specific mortality to the increase in life expectancies by phases of mortality improvement. (Data Sources: See Figs. 13.1 and 13.2)

Changes in e_0 (years)	Age group	England and Wales	France	Sweden	Hong Kong	Japan	Taiwan[a]
40–50	0	11.34	24.90	23.66	–	56.90	26.89
	1–14	51.72	43.71	34.90	–	23.88	25.47
	15–44	31.67	26.39	17.50	–	12.44	31.46
	45–64	4.42	4.04	16.50	–	5.34	13.77
	65–84	0.81	0.98	7.32	–	1.38	2.42
	85 +	0.03	– 0.02	0.12	–	0.06	–
50–60	0	42.41	41.25	30.17	–	19.06	58.97
	1–14	26.57	26.38	47.40	–	28.81	4.44
	15–44	14.97	20.80	10.28	–	34.49	23.70
	45–64	12.85	6.35	7.60	–	11.08	11.29
	65–84	3.31	5.05	4.42	–	6.29	1.94
	85 +	– 0.11	0.19	0.15	–	0.27	– 0.33
60–70	0	28.07	25.60	27.11	27.34	24.84	47.85
	1–14	26.29	15.77	24.90	22.30	24.28	6.99
	15–44	25.60	31.78	37.24	10.90	29.74	16.05
	45–64	11.80	16.34	8.69	11.75	13.89	18.32
	65–84	7.88	10.06	2.01	27.35	7.07	10.38
	85 +	0.36	0.45	0.05	0.36	0.19	0.42
70–80	0	17.03	20.19	16.34	12.92	13.68	8.72
	1–14	4.78	5.32	7.35	4.27	5.94	8.74
	15–44	8.79	10.81	16.73	14.64	14.38	12.28
	45–64	27.46	22.46	22.52	30.38	23.86	21.12
	65–84	38.42	37.23	34.10	33.31	38.97	42.81
	85 +	3.53	3.99	2.96	4.48	3.17	6.34

– data unavailable

[a] In the panel where life expectancy increased from 40 to 50 years, for Taiwan the last age group is 65 +. This group is used as a proxy for age group 65–84. In the panels where life expectancy increased from 50 to 60 years, and from 60 to 70 years, for Taiwan, age group 0–4 is used as a proxy for age group 0, and age group 5–14 is used as a proxy for age group 1–14

It is for this reason that we have decomposed the contribution to increasing life expectancy made by falling mortality in major age groups at different phases of mortality transition. According to the results presented in Table 13.2, the increase in life expectancy was generally accompanied by a shift in its major contributors: from being driven predominately by the mortality reduction at younger ages to being driven largely by falling mortality in adult and old populations. When the life expectancy in these populations rose from 40 to 50 years and from 50 to 60 years, the largest contribution (varying between 48 and 81 %) to these improvements was made by mortality reduction among children under age 15. The relatively small contribution (48 %) recorded in Japan when life expectancy rose from 50 to 60 years was closely related to its large contribution of 81 % made when the life expectancy improved from 40 to 50 years. Because a significant mortality improvement was made mainly at younger ages during this phase of the mortality transition, life expectancy at age 65 showed only a small increase (1 or 2 years in general), although life expectancy at birth rose by 20 years.

When the life expectancies improved from 60 to 70 years, the contribution made by the mortality reduction among people aged 15−44 increased. In most of the listed populations, mortality reduction among people under age 45 made more than 70 % contribution to the increase in life expectancy. In contrast, when their life expectancies rose from 70 to 80 years, most of the contribution was made by the mortality reduction among people aged 45−84 years, those aged 65−84 years in particular. The mortality decline in these two age groups contributed 57−66 % of the increase in their life expectancies. For this reason, a more notable increase (4.5–5.7 years) in life expectancy at age 65 was also recorded at the phase when the life expectancy at birth rose from approximately 70 to about 80 years. This was attributable to the fact that while mortality at younger ages continued to fall significantly, it had already reached a very low level. Such a reduction could not make a large contribution to the increase in life expectancy in this and future times.

13.4 Recent Changes in Major Causes of Death

The previous section showed marked variations in the time and speed of mortality decline at different ages and in their contributions to the increase in life expectancy at birth. These results raise a further question about the mortality transition: what are the major factors that led to these variations? To answer this question, it is important to examine changes in major causes of death and their contributions to mortality improvement.

Omran developed the theory of epidemiological transition in 1971. According to him, the process of epidemiological transition and mortality decline can be divided into three phases: ‘the Age of Pestilence and Famine’, ‘the Age of Receding Pandemics’, and ‘the Age of Degenerative and Man-Made Disease’. In the first phase mortality was high and was caused largely by infectious and parasitic diseases. In the second phase the impact of these diseases lessened gradually. As a result, mortality fell. In the third phase degenerative diseases became the primary killer. Mortality further declined and then stabilised at a relatively low level (Omran 1971, pp. 737–738). Since Omran published his theory, notable epidemiological changes have taken place in the world. Based on the examination of these new developments, several scholars, including Omran himself, further developed or revised the classic epidemiological transition theory. Olshansky and Ault pointed out that mortality decline did not stop at ‘the Age of Degenerative and Man-Made Diseases’. There was a fourth stage of the epidemiological transition: ‘the Age of Delayed Degenerative Diseases’. During this phase, mortality caused by degenerative diseases continued to fall and life expectancy further increased (Olshansky and Ault 1986). Countries with low mortality are now experiencing these changes. We would very much like to systematically examine changes in causes of death over the entire period when mortality fell from a high to a low level. But, because of data availability, our discussion has to concentrate on major changes in causes of death since the mid-twentieth century.

Before 1950, infectious diseases remained a major killer in many parts of the world and led to high or relatively high mortality. This was also the case in East Asia. In Japan and some other East Asian populations, although mortality had started to fall, infectious diseases still caused a significant number of deaths in the first half of the twentieth century. Eradicating these diseases played a crucial part in the early mortality decline in the selected populations (Campbell 2001; Engelen et al. 2011; Omran 1971; Zhao 2007a). By the early 1950s, life expectancies were between 50 and 60 years in Hong Kong, Japan and Taiwan, and they further increased to around 80 years in 2010. During the past six decades, changes in major causes of death in these and the three European populations showed notable similarities.

As shown in Tables 13.3 and 13.4, age standardised death rates for infectious diseases were already lower than 0.5 per thousand in the three European populations in the 1950s. In contrast, they were still relatively high and close to 2 per thousand in the three East Asian populations. By 2005 they were all below 1 per thousand and accounted for 1–3 % of the overall mortality. These results indicate that the classic epidemiological transition was completed many decades ago in all these populations, and the mortality impact of infectious diseases was rather small in the past half century.

During this period, cardiovascular diseases (CVD) were the major killer in most of the study populations and for most of the time. In the 1950s, standardised death rates attributable to CVD were 2.5–5.0 per thousand in the six populations. In the late 1970s, their contribution to the overall mortality seemed to have reached, or been close to, the peak, which was followed by a notable decline. Their levels fell to 1.0–1.6 per thousand in 2005, with relatively high mortality rates recorded in England and Wales and Sweden, where CVD mortality contributed 33–37 % of the overall mortality. In the four other populations, they constituted 21–28 % of the total.

Standardised mortality rates of respiratory diseases were relatively high in England and Wales, Hong Kong, Japan and Taiwan in the 1950s, while they had already dropped to less than 1 per thousand in France and Sweden. During the next half century, they all declined notably and varied between 0.3 and 0.6 per thousand in 2005. Their contributions to overall mortality were relatively high in England and Wales, Hong Kong and Japan, ranging from 12 to 17 %. In the other three populations, they were lower and ranged between 5 and 9 %.

In the 1950s, standardised mortality rates of neoplasms were higher than 1 per thousand in all study populations except Taiwan. They all exhibited some increases in the next three or four decades and only showed some decrease since the mid-1980s, though a similar reduction has not yet been witnessed in Taiwan. In the first decade of the twenty-first century, deaths caused by various types of neoplasms accounted for 27–34 % of the overall mortality in these populations.

Injuries and poisoning were also among the major causes of deaths. During most of the period under investigation, their standardised mortality rates were 0.3–0.9 per thousand. But, they have shown some decreases during the last 10–20 years. Despite that, they still accounted for 5–11 % of the overall mortality in these populations in 2005.

Table 13.3 Age-standardised mortality rates by major causes of death in six populations. (Data Sources: England and Wales, France, Sweden, Hong Kong, Japan: (WHO Mortality Database); Taiwan: 1955–1970 (WHO Mortality Database), 1971–2005 (Ministry of the Interior))

	1950	1960	1970	1980	1990	2000	2005
Infectious diseases							
England and Wales	0.44	0.10	0.06	0.04	0.03	0.04	0.06
France	0.69	0.25	0.12	0.09	0.07	0.10	0.08
Sweden	–	0.09	0.07	0.04	0.04	0.05	0.06
Hong Kong	–	1.11	0.56	0.20	0.19	0.09	0.10
Japan	2.08	0.53	0.27	0.10	0.07	0.08	0.08
Taiwan	–	1.02	0.58	0.34	0.25	0.14	0.10
Neoplasms							
England and Wales	1.60	1.62	1.69	1.71	1.70	1.45	1.39
France	1.44	1.57	1.55	1.64	1.59	1.49	1.40
Sweden	–	1.43	1.40	1.44	1.31	1.24	1.21
Hong Kong	–	1.10	1.39	1.54	1.52	1.38	1.28
Japan	1.15	1.34	1.35	1.33	1.29	1.26	1.17
Taiwan	–	0.83	1.05	1.21	1.27	1.47	1.46
CVD							
England and Wales	4.81	4.42	4.09	3.54	2.66	1.87	1.54
France	3.20	2.89	2.58	2.20	1.53	1.23	1.05
Sweden	–	3.97	3.42	3.22	2.52	1.88	1.55
Hong Kong	–	2.45	2.27	1.99	1.50	1.12	0.94
Japan	3.04	3.68	3.61	2.62	1.68	1.09	0.99
Taiwan	–	2.71	2.77	2.76	2.15	1.23	1.09
Respiratory diseases							
England and Wales	1.06	0.94	1.23	1.01	0.60	0.77	0.58
France	0.90	0.73	0.48	0.36	0.32	0.26	0.24
Sweden	–	0.50	0.40	0.34	0.36	0.29	0.25
Hong Kong	–	1.57	1.24	1.09	0.92	0.65	0.63
Japan	1.22	0.82	0.70	0.49	0.55	0.46	0.45
Taiwan	–	1.00	0.88	0.77	0.61	0.47	0.49
Injuries and poisoning							
England and Wales	0.40	0.45	0.40	0.35	0.30	0.25	0.25
France	0.60	0.69	0.80	0.76	0.64	0.49	0.41
Sweden	–	0.58	0.60	0.55	0.44	0.32	0.34
Hong Kong	–	0.42	0.51	0.44	0.30	0.25	0.25
Japan	0.66	0.71	0.62	0.44	0.38	0.40	0.38
Taiwan	–	0.64	0.72	0.88	0.85	0.62	0.54
Taiwan	–	0.64	0.72	0.88	0.85	0.62	0.54
Other diseases							
England and Wales	1.61	1.23	0.89	0.82	0.91	0.80	0.90
France	3.88	2.80	2.04	1.55	1.21	1.14	1.11
Sweden	–	1.31	0.93	0.79	0.82	0.80	0.81
Hong Kong	–	3.16	2.05	1.33	0.82	0.60	0.56
Japan	6.25	3.39	1.88	1.10	0.74	0.54	0.51
Taiwan	–	5.77	3.48	2.21	1.85	1.80	1.65

Standardized mortality rates are calculated using the five-year-age-sex structure of the WHO standard population (Ahmad 2001)
– data unavailable

Table 13.4 Percentage distribution of age-standardised mortality by major causes of death in six populations. (Data Sources: See Table 13.3)

	1950	1960	1970	1980	1990	2000	2005
Infectious Diseases							
England and Wales	4.44	1.12	0.71	0.47	0.54	0.81	1.23
France	6.42	2.79	1.62	1.32	1.25	2.08	1.92
Sweden	–	1.15	0.97	0.67	0.68	1.07	1.45
Hong Kong	–	11.35	7.01	3.02	3.60	2.12	2.69
Japan	14.40	5.07	3.19	1.61	1.49	2.11	2.19
Taiwan		8.55	6.07	4.15	3.55	2.45	1.85
Neoplasms							
England and Wales	16.12	18.47	20.19	22.87	27.40	27.93	29.48
France	13.47	17.55	20.51	24.80	29.67	31.53	32.60
Sweden	–	18.16	20.55	22.53	23.90	27.06	28.68
Hong Kong	–	11.17	17.33	23.40	29.01	33.86	34.02
Japan	8.01	12.81	16.03	21.82	27.31	32.77	32.69
Taiwan	–	6.92	11.11	14.84	18.19	25.70	27.36
CVD							
England and Wales	48.50	50.46	48.88	47.42	42.94	36.11	32.76
France	29.88	32.38	34.06	33.32	28.51	26.13	24.37
Sweden	–	50.35	50.08	50.43	45.94	41.00	36.67
Hong Kong	–	24.98	28.25	30.21	28.55	27.35	24.89
Japan	21.13	35.17	42.83	43.19	35.75	28.52	27.65
Taiwan	–	22.66	29.18	33.84	30.84	21.48	20.51
Respiratory Diseases							
England and Wales	10.70	10.77	14.73	13.53	9.64	14.90	12.26
France	8.40	8.20	6.28	5.50	6.03	5.59	5.56
Sweden	–	6.36	5.91	5.33	6.54	6.31	5.99
Hong Kong	–	16.04	15.46	16.56	17.62	15.98	16.72
Japan	8.47	7.84	8.25	8.10	11.66	12.09	12.53
Taiwan	–	8.34	9.33	9.39	8.80	8.23	9.11
Injuries and poisoning							
England and Wales	4.05	5.13	4.84	4.68	4.77	4.73	5.20
France	5.64	7.71	10.61	11.55	11.86	10.42	9.64
Sweden	–	7.32	8.80	8.68	7.97	7.09	8.01
Hong Kong	–	4.26	6.40	6.72	5.67	6.05	6.65
Japan	4.60	6.76	7.38	7.23	8.07	10.54	10.73
Taiwan	–	5.32	7.64	10.78	12.12	10.75	10.21
Other diseases							
England and Wales	16.19	14.06	10.65	11.02	14.70	15.53	19.08
France	36.19	31.36	26.92	23.50	22.68	24.24	25.91
Sweden	–	16.66	13.68	12.37	14.97	17.47	19.20
Hong Kong	–	32.20	25.55	20.10	15.55	14.63	15.03
Japan	43.38	32.35	22.34	18.06	15.72	13.96	14.21
Taiwan	–	48.22	36.68	26.99	26.51	31.39	30.96

– data unavailable

Table 13.5 Contributions of changes in cause-specific mortality to the improvement in life expectancy at birth, 1955–2005. (Data Sources: See Table 13.3)

Populations	Changes in e_0	Increase in e_0 (years)	Contribution made by					
			Infectious Disease	Neo-plasms	CVD	Injury and poisoning	Respira-tory diseases	Other diseases
England and Wales	70.53–79.45	8.92	0.38	0.69	4.58	0.44	1.06	1.78
France	68.28–80.53	12.25	0.85	0.44	3.58	0.83	1.09	5.45
Sweden	72.40–80.75	8.35	0.23	0.63	4.35	0.64	0.46	2.05
Hong Kong[a]	60.50–81.72	21.23	3.74	0.54	3.91	0.65	4.06	8.33
Japan	64.97–82.44	17.48	2.31	0.74	4.34	1.17	1.20	7.72
Taiwan[b]	62.91–77.68	14.77	2.58	– 0.65	2.88	– 0.29	2.02	8.23

[a] For Hong Kong the starting year is 1956
[b] For Taiwan the starting year is 1958

Mortality due to causes that were not included in the above five groups varied notably among the six populations. This may be caused partly by variations in both the quality of death records and the practice of coding causes of death in these populations. In 2005, standardised mortality rates attributable to these causes varied between 0.5 and 1.7 per thousand, with the highest rate recorded in Taiwan. Deaths attributable to these causes accounted for 15–31 % of the overall mortality, with 26 % for France and 31 % for Taiwan, respectively.

Table 13.5 shows that life expectancies rose by 8.4–12.3 years in the three European populations and 14.8–21.2 years in the three East Asian populations over the period between the mid-1950s and 2005. In the European populations the increases were mainly attributable to the decrease in mortality caused by CVD and diseases included in the group of 'others', which accounted for more than 70 % of the total improvement in life expectancy. In England and Wales and Sweden, the decrease in mortality due to CVD led to an increase of 4.6 or 4.4 years in life expectancy, respectively. In France, the decline of mortality caused by diseases grouped as 'others' resulted in a 5.5-year increase in life expectancy. Less than 30 % of the improvement in life expectancies was attributable to mortality decline in the four other groups of diseases.

In Hong Kong and Taiwan, the decline of mortality attributable to diseases classified as 'others', respiratory diseases, CVD, and infectious diseases all made notable contributions to the remarkable increase in their life expectancies. In Japan, the contribution made by the decline of mortality attributable to respiratory diseases was slightly smaller, and the decrease of mortality caused by diseases classified as 'others', CVD and infectious diseases contributed to more than 70 % in the increase in its life expectancy. During this 50-year period, the decrease in mortality caused by diseases grouped as 'others' played the most important role in improving survival. It led to an increase of 8.3 years, 8.2 years and 7.7 years in life expectancy in Hong Kong, Taiwan and Japan, respectively.

To further examine the impact of changes in cause-specific mortality on the improvement of survival, we have compared their contributions to mortality decline

Table 13.6 Contributions of changes in cause-specific mortality to the improvement of survival when life expectancy rose from around 70 to approximately 80 years. (Data Sources: See Table 13.3)

Populations	Period	Changes in e_0	Contribution made by					
			Infectious Disease	Neo-plasms	CVD	Injury and poisoning	Respira-tory diseases	Other diseases
England and Wales	1954–2007	70.34–79.98	0.45	0.79	5.04	0.44	1.00	1.91
France	1959–2004	70.12–80.22	0.56	0.43	3.18	0.80	0.89	4.23
Sweden	1951–2002	71.41–80.16	0.59	0.60	3.71	0.50	0.50	2.84
Hong Kong	1971–1998	71.18–80.04	0.96	0.56	2.31	0.50	1.66	2.88
Japan	1964–1995	70.05–80.05	0.68	0.50	4.04	0.76	0.27	3.74
Taiwan	1974–2007	70.30–78.23	1.05	– 0.51	3.31	0.82	1.36	1.90

during the time when life expectancies rose from around 70 years to approximately 80 years in these populations. According to the results presented in Table 13.6, the main driving force for rising life expectancies at this phase of the transition was the significant reduction in mortality caused by CVD and diseases classified as ‘others’ in England and Wales, France, Japan and Sweden, while the decline of mortality caused by respiratory diseases also made a notable contribution to the increase in life expectancies in Hong Kong and Taiwan.

13.5 Concluding Remarks

On the basis of the analysis presented in previous sections, we now further comment on the major findings of this study and address the following questions: What can we learn from the mortality decline in East Asian populations? In what ways could their experience of lowering mortality enrich our knowledge of the epidemiological transition in the world?

Mortality transition arrived late in East Asia. Long-term mortality decline did not start until the late nineteenth century in Japan and until the early twentieth century in some other populations, and it was also interrupted by the wars and social upheavals taking place in several countries in the first half of the century. Since the 1950s, however, East Asia has experienced a very rapid mortality decline. Its life expectancy increased 28 years between 1950–1955 and 2005–2010. Very low, or the lowest, mortality has been recorded in several East Asian populations in recent years.

The acceleration of mortality transition taking place in most East Asian populations was not a simple compression of the time or the process of mortality decline experienced by many North and West European populations in the past. Such a compression has indeed been observed in many East Asian populations, where a mortality decline of the same magnitude took a shorter period to accomplish in most age groups in comparison with that recorded in selected European populations. However, aside from this compression, the acceleration of the mortality decline in East Asia was also closely related to the fact that simultaneous mortality reductions were increasingly observed in different age groups in East Asian populations.

The increasing simultaneity in mortality decline at different ages and the compression of the mortality decline, or the compression of the time required for the mortality decline, were both related to the changes that took place in the process of the epidemiological transition. In the classic epidemiological transition experienced by the selected European populations, controlling and eradicating major infectious diseases were often achieved gradually and took a long time to complete (Omran 1971, 1983; Riley 2001; Szreter 2003). In this phase, fighting major degenerative diseases was not yet on the agenda and it was also prevented by limited medical knowledge and the lack of effective treatments. It is largely for these reasons that mortality decline was slow during this period and usually showed a long delay at older ages. This changed significantly in the first half of the twentieth century, and especially after the Second World War. In the mid-twentieth century a wide range of effective prevention methods, medicines and treatments were already available and used in conquering various kinds of infectious diseases. Progress in preventing and treating some degenerative diseases was also made at the time and in the decades that followed. Since the late 1950s, medical science and knowledge have advanced significantly. Many new methods, equipments and techniques have been developed and used in preventing, detecting and treating cardiovascular diseases and neoplasms (Beckmann 2006; Ford et al. 2007; Laatikainen et al. 2005; Tunstall-Pedoe et al. 2000). All these led to increasingly simultaneous reductions in mortality that was caused by infectious diseases, degenerative diseases and diseases of other kinds. This contributed to the rapid decline in age-specific mortality and the increasing simultaneity of such changes, which together brought about the 'accelerated model' of epidemiological transition (Omran 1971).

The accelerated epidemiological transition observed in some East Asian populations was of course related to the fact that their transitions took place at a later time or a different stage of development in comparison with that witnessed in the selected European populations. The late starters did have the advantages that they could learn from the experiences of other countries and that they could use the latest knowledge and technologies to prevent and treat various kinds of diseases. But the successful story of lower mortality in Japan, Hong Kong, Macau, South Korea, Taiwan and perhaps Mainland China may also be attributable to the following facts. These populations have all experienced rapid economic growth in recent decades and people have enjoyed high or relatively high standards of living. They have good or reasonably good health care systems and facilities. Many of these countries and areas had and still have relatively egalitarian social policies. They all emphasize the importance of education including health education and disease prevention. Educational levels in these populations have been relatively high. In addition, they are all highly organized societies, where the role of government interventions and policies in promoting public health has been more effective than in many other populations. The importance of some of these factors for improving population health has been discussed by Caldwell (1986) and other scholars (Frenk et al. 1991).

Aside from what was mentioned above, the successful experience of Japan is particularly noteworthy. The country has led the mortality decline in the world in recent decades. This is revealed by the fact that in 2005, age-standardised mortality rates varied between 3.58 and 5.34 per thousand in the six selected populations. Japan had the lowest standardised mortality and its mortality rates for neoplasms, CVD and diseases classified as 'others' were also the lowest or the second lowest among these populations. In Hong Kong, the level of mortality and its causal structure were very similar to those observed in Japan. Successively lowering mortality caused by these diseases, which is closely related to their early detection and effective prevention, has been the main reason why these populations achieved the highest life expectancy in the world (Hamzelou 2012). Examining such experiences could provide very useful lessons for countries that are trying to further improve their life expectancies in the fourth stage of the epidemiological transition.

Another noteworthy lesson learnt from this and other studies (Zhao 2003, 2007b) is that frequent changes in age patterns of mortality have often been observed in the process of the mortality transition. While regional variations in mortality patterns might have existed in the past when many populations lived in isolation and their mortality fluctuated around a high level, recent cross-population variations in age patterns of mortality were often related to the time and phase of the mortality transition. There is hardly any population that has maintained the same age pattern of mortality throughout the period when its life expectancy rose from a low to a high level. The same is also true for changes in sex differentials in mortality, although they are not discussed in this chapter. Understanding the nature and characteristics of these changes is of considerable importance for improving our knowledge about the mortality transition.

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