Unequal pathways to the grave?

Summary

This dissertation is concerned with the changes in health and mortality that have occurred over the past two centuries in modern societies known as the health transition. Whereas in the pre-transitional eras infectious diseases were the dominant cause of death for the majority of the population, causing high premature mortality rates, in post-transitional societies most people live into old age and eventually die of degenerative and man-made diseases. This change was not only a result of medical innovations and increasing wealth, but also a consequence of cultural changes. However, the transition was not evenly dispersed throughout society and inequalities in health and mortality could exist, arise or recede due to differences in age, gender and socioeconomic status. Although the health transition has been broadly theorised based on mainly aggregated mortality data, the underlying changes in particular diseases or among distinct subpopulations are still not fully understood.

The aim of this study is to further expand our understanding of the health transition by looking beyond the aggregated mortality data. The individual-level cause-of-death data that are available for the industrial Dutch city of Maastricht allows for a more detailed analysis of the changes in mortality that occurred between 1864 and 1955. The data not only include the exact cause of death, as written down by a physician, but it also contains information on the age, religion, gender and occupation of the deceased. The richness of the dataset therefore enables the analysis of the combined effects of these characteristics on cause-specific mortality. The specific causes of death are furthermore very informative of the determinants leading to the health transition. When certain diseases recede, the aetiology of the disease can offer a clearer sense of the related factors transforming health.

The central research question for this study is threefold: First, how did the health transition in the industrialising city of Maastricht take shape; second, did the transition lead to new inequalities in cause-specific mortality in terms of socioeconomic status, age and gender; and, third, which determinants were at the root of these changes in health? In order to answer these questions, different methods are used. A common denominator of these methods, however, is the focus on changing epidemiological patterns, i.e. the study of informative changes in the dominant pattern of circulating diseases. The unique data available for Maastricht allow for a focus on cause-specific mortality, despite a population at risk not being available according to all the specific individual characteristics, such as social group. Nevertheless, by analysing changing epidemiological patterns for these particular groups instead of the changes in cause-specific mortality *rates* for these groups, it becomes possible to approximate emerging inequalities and health advantages and disadvantages. The epidemiological patterns thus help to locate changes in mortality regimes for distinct groups in society.

The reasoning behind the methodological approach that focuses on changing epidemiological patterns is derived from Omran's epidemiological transition theory, which can be viewed as one of the crucial elements of the wider health transition theory. To understand the analysis of changing epidemiological patterns in order to identify possible inequalities, two main characteristics of the epidemiological transition theory are needed. The epidemiological transition theory postulates that during the transition the dominant causes of death changed from being infectious diseases to man-made and degenerative causes of death. Moreover, when infectious diseases are rampant, there is a high mortality regime in which many young children and adults find an early death. A low mortality regime is reached when not only the dominant causes of death have changed to non-infectious diseases, but death also predominantly occurs in old age. When cause-specific mortality rates according to socioeconomic group are lacking, it may seem impossible to establish whether the specific group was experiencing a high or low mortality regime. However, the epidemiological patterns for

specific groups can provide an indication of the reigning mortality regimes. When the majority of causes of death is due to infectious diseases, a high mortality regime is most likely to have been in place. A comparison of the changes in epidemiological patterns for specific groups within society over time could therefore indicate whether one or more groups gained an advantage or were disadvantaged compared to the other groups. An advantageous position would be one in which the proportion of infectious diseases in that group has decreased earlier compared to the rest of society. The expectation would be that mortality has declined at that moment as well. On the other hand, a disadvantageous position would mean the lingering of infectious diseases compared to other groups in society, and the continuation of a high mortality regime.

Central to the first analytical chapter, chapter 4, are the changes in health in the late nineteenth and early twentieth century among infants. Infant mortality remained extremely high in Maastricht for a longer period of time compared to the northern and western provinces of the country. Although boys had a slightly higher mortality rate compared to girls, most likely stemming from a biological disadvantage, these differences did not affect the start of the mortality decline, nor did they interact with socioeconomic inequalities. The main focus of the chapter is the emerging socioeconomic inequalities once the decline in mortality had started. The dominant causes of death in this age category were water and foodborne diseases, more precisely gastroenteritis and diarrhoea. By deploying a multinomial logistic regression analysis, it became clear that in the initial phase of the decline of these causes of death specifically, the upper-class infants gained an advantage. The proportion of water and foodborne causes of death of the total of water and foodborne and non-infectious causes of death was lower among upper-class infants in the initial phase of the decline compared to the proportional mortality of infants from working-class families. However, once the decline sped up and infant mortality declined immensely during the early years of World War I, the socioeconomic inequalities receded once more. The inequalities emerging during the early phase can be explained by an earlier awareness of the high infant mortality rates as problematic, yet resolvable. Most likely by adopting hygienic practices and/or breastfeeding, upper-class mothers were able to shield their infants earlier than mothers from the working classes. Working-class mothers adopted hygienic practices and/or breastfeeding *en masse* once aid at a community level offered by the *Green Cross* became available, for which they may have felt an increased need due to the hardship caused by high unemployment during WWI.

In chapter 5, the attention shifts towards a slightly older age category, the young children from age one through four. Once children had survived their first year, new hazards emerged. Mortality among young children was still high, due to the many typical childhood diseases they were exposed to. The composition of the very particular disease environment for young children was highly important in determining the risks of death for young ones. The analysis of per cent changes in disease categories and individual diseases demonstrated that different disease mechanisms occurred. Driving the decline in early childhood mortality were two disease groups, namely gastrointestinal infectious diseases and airborne infectious diseases. During the first period of substantial decline from the 1870s to the 1880s, mortality of both disease categories declined. The categories acted either indifferently or in symbiosis. Thereafter, the two disease categories declined individually, although the decline in airborne infectious diseases in the period from the 1910s to the 1920s may have been a side effect of the decline in gastrointestinal infections for both young children and infants in the same period, causing more children to be increasingly robust and able to fight airborne diseases. At the level of individual diseases, a different mechanism of the disease environment appears. Here it seems some diseases did increase in lethality after the receding of another disease, for example when mortality

from scarlet fever declined, mortality from tuberculosis and pneumonia actually increased, and later on measles became increasingly lethal.

Socioeconomic inequalities among young children seem to have appeared in the first stages of mortality decline as well, mainly when mortality from gastrointestinal infectious diseases declined. Gender differences seemed to be absent at first, there being no clear excess mortality prior or during the health transition for either of the sexes. However, at the level of individual diseases, it was found that there were a number of differences. Girls may have suffered a more structural disadvantage after all, since they experienced excess mortality regarding endemic diseases. Only for the occasional epidemic diseases did boys have higher mortality levels. Apparently, when an epidemic occurred, the biological disadvantage of boys kicked in, while in other, more normal years, girls were affected disproportionally.

Among adults, men were clearly in the worst position. Chapter 6 focuses on adult mortality and its decline. Until the health transition started, the main disease category causing a premature death among adults was that of airborne infectious diseases. In particular tuberculosis was the disease wearying the already tired bodies of industry workers, with an early death as its result. Although women had to endure the dangers of many pregnancies and births, men experienced the highest mortality rates, mainly due to these airborne infectious diseases. Mortality also declined earlier for women than it did for men. Women's mortality already declined from the late mid-century onwards, while men had to wait until the end of the nineteenth century. Once mortality declined, inequalities in socioeconomic status again emerged for both genders. However, other factors were important in determining the epidemiological patterns as well. Among men, migrants showed an advantageous disease pattern compared to native-born Maastricht men, even across the entire socioeconomic spectrum. An effect of migration status was absent for women – for women, however, it mattered whether they were married or not. Unmarried women were in the worst position, which is most likely explained by a selection effect positively selecting the most healthy women for marriage.

Several overarching conclusions emerge when combining the three analytical chapters. All three included factors – age, gender and socioeconomic status – that contributed to unequal pathways to the grave in Maastricht. However, these three factors did not always exert their influence on health inequalities in a similar fashion. Age dictated in large part the degree to which individuals were exposed to disease hazards. Some causes of death occurred in all age categories discussed here (infancy, early childhood and adulthood), although the predominance of certain infectious diseases differed between ages. The factors influencing the decline in mortality could also differ between age groups, in particular when these factors were targeted at specific age groups. Age therefore determined when the pathways to death started to change, and thus when the mortality decline started. The influence of socioeconomic status on the shift towards a low mortality regime was fairly consistent. Socioeconomic inequalities emerged in the initial phase of the health transition. As such, socioeconomic status created fast tracks and congestions early on *en route* to a low mortality regime. Whereas socioeconomic status caused the emergence of disparities in the initial phase of the health transition and age category mainly dictated the start of the health transition, gender was a more long-lasting discriminatory factor, still creating higher levels of mortality among males after a low mortality regime had been reached. The influence of gender on the health transition was however quite complex. Depending on the age group, it could affect only different levels of mortality, yet without causing different routes towards a low mortality regime. In other age groups, gender could be as important as age in determining the start of the health transition or the predominance of certain diseases.

This case study on Maastricht has contributed substantially to our understanding of the more detailed working of the health transition and its ensuing inequalities. Socioeconomic inequalities are not a static phenomenon, they are dynamic and develop when remedies start to become available. Socioeconomic inequalities are not only connected to the availability of resources, but also the individual's receptiveness – as at least partially determined by socioeconomic status – towards new ideas on hygiene or treatment mattered. Gender inequalities have been shown to have been fairly present as well, not only stemming from biological factors, on which we have the least influence. We may feel that gender inequalities in health are nowadays only reminiscent of the past, but this is far from the case. By prioritising the inclusion of women in historical demographical studies, we can aid the understanding of the singular female health experience as well, whether this may be rooted in biological, social, or cultural influences. Using individual-level data, which allows for a highly detailed analysis of all these factors and their potential interactions, contributes to our understanding of the health transition in major ways.