

Chapter 1

Introduction

Since reunification, great efforts have been made in Germany to achieve comparable social and economic conditions in the two parts of the country, including in the area of health. By the 2000s, the East-West life expectancy gap had closed among women, though it persisted among men. Amid these ambitious campaigns to equalize social and economic conditions at the macro level, the small-scale differences that remained attracted less attention. Although Germany is a country with a federal system, attempts were nonetheless made to create comparable living conditions (*gleichwertige Lebensverhältnisse*) throughout the country, as is prescribed in the German Constitution (Barlösius 2006).

The variation in regional mortality in Germany is the subject of this book. From a broader European perspective, regional mortality differences in Germany are at a medium level, but discrepancies of several years in life expectancy at birth can still be found between the regions (European Communities 2009; Valkonen 2001). Studying Germany's regional mortality patterns is particularly interesting given the German divide, which provides researchers with the opportunity to study the short- and long-term effects of different regimes. Spatial patterns and temporal trends at different regional levels are investigated for a period of time before and after German reunification. While the analyses go beyond East-West differences, given the “natural social experiment” of the German divide, these differences are incorporated into the analyses. Together with the study of patterns and trends, mortality determinants at the individual and at the contextual level are investigated.

Demographic change—as determined by processes in fertility, migration, and mortality—across Germany's regions and the societal and political implications of these changes are topics that have sparked considerable debate. However, very little research has been devoted to the component of regional mortality differences. This section will first discuss how regional mortality differences are embedded into research on health inequalities. The aim of the study is then described, and the approach used in this study to address these objectives is outlined.

Health is a key human right, and health equity is a central principle in social justice (Sen 2002; World Health Organization Europe 1998). Equity in health is stated as a general goal of the World Health Organization (WHO), and is especially important in their framework “health for all in the twenty-first century,” which has been adopted by all of the WHO member states (Zöllner 2002). Furthermore, the reduction of health inequities is considered a cost-efficient way to improve general population health (Dahlgren and Whitehead 2007). By contrast, the costs associated with bad health—including, for example, high treatment costs and absences from work—are high. As a result, health equity triggers population wealth and well-being, and vice versa (Anand 2002; Leon and Walt 2001; Zöllner 2002).

A distinction should be made between health equity and health inequality. The latter refers to the existence of unequal conditions in health. Unequal conditions in health will always exist due to differences in the population that cannot be altered (age, sex, genetics; Dahlgren and Whitehead 2007). Health equity judges whether these inequalities are fair or not. Inequity presents the part of inequality that is “avoidable by reasonable action” (Marmot et al. 2008, p. 1661).

Measuring health inequalities is an important step toward assessing health equity. The assessment of health inequalities is usually based on comparisons between geographical areas (countries or subnational entities), or on comparisons between groups of people, such as between different socioeconomic classes within geographical areas (Leon 2001; Marmot 2005; WHO Commission on Social Determinants of Health 2008; Zöllner 2002).

A few examples highlight the issue of mortality differences between and within countries. Between countries, differences in life expectancy at birth can be more than 30 years worldwide, and up to 10 years across OECD countries (Human Mortality Database 2008b; WHO Commission on Social Determinants of Health 2008). Between the regions of one country, large differences may also exist. Life expectancy differences in 1999 across 2,068 county units in the USA constituted 11 years among men and 7.5 years among women. These values refer to the 2.5% of the US population with the highest life expectancy, and the same percentage of the population with the lowest life expectancy. While life expectancy in the USA rose by several years in the second half of the twentieth century, this life expectancy increase was unevenly spread across the county units. Most strikingly, almost 10% of the county units experienced a decline in female life expectancy toward the end of the twentieth century (Ezzati et al. 2008).

These results illustrate that there are not only great mortality differentials between regions, but also that trends observed at the population level can be counteracted by trends in certain population groups that are moving in the opposite direction.

Within each region, mortality is further differentiated by the socioeconomic status of the population. It has long been known that people with lower socioeconomic status tend to have higher mortality risks than those with higher status (Antonovsky 1967). The Black Report on inequalities in health in the UK, which was commissioned by the Department of Health and Social Security, attracted considerable attention when it was published in 1980 (Townsend and Davidson 1992). Subsequently, social gradients in health and mortality were established for many other countries.

While there is no consensus regarding absolute mortality inequalities, it is generally acknowledged that relative mortality inequalities by socioeconomic status have been widening over the last few decades (Kunst et al. 2004; Valkonen 2001).

Parallels between the mortality differentials within and between countries are visible. Several causes of death with a strong mortality gradient across socioeconomic groups have also been found to have a similar gradient across countries and regions (Leon 2001).

Combining the dimensions of inequalities between regions and population sub-groups yields the greatest differentials. For example, Murray et al. (2006) divided the US population by county and race (and a few other county-level indicators) into eight distinct groups. They are called the “Eight Americas,” because the groups differ considerably with respect to race, several socioeconomic characteristics, and location, as well as in their mortality levels and structures. Life expectancy between the best- and worst-performing “Americas” (Asian versus high-risk urban black) constituted 15.4 years among men and 12.8 years among women in 2001.

More recently, different sources of information on geographical, as well as on individual health variation, have been combined in order to assess whether there is an independent effect of geographical context on health apart from individual risk factors. This line of research reveals that regional context effects are present, and that people with lower socioeconomic status tend to exert greater detrimental regional effects on health (Pickett and Pearl 2001; Riva et al. 2007).

In line with the international situation, Germany exhibits both regional mortality differences and mortality differences between population groups. Both perspectives are increasingly gaining scientific and political recognition (e.g., Cromm and Scholz 2002; Gans 2008; Luy 2006; Mielck 2008; Razum et al. 2008; Shkolnikov et al. 2008).

When the performance of German regions is compared, the roughest division is usually the one between eastern and western Germany. Considered a natural social experiment, the division of Germany produced different structures, which, at least in part, persist 20 years after reunification. The division of Germany was also reflected in mortality differences between East and West. The differing economic, social, medical, and environmental conditions in the two parts of Germany were therefore thought to explain East German excess mortality (Diehl 2008; Dinkel 2000; Gjonça et al. 2000; Luy 2004). Large small-area mortality differentials both within East and within West Germany were thereby disregarded (Razum et al. 2008). However, these differences often exceeded East-West differences. This study provides empirical evidence on mortality trends in small regional units, the German districts. These trends are then connected to East-West differentials.

There are even greater mortality differentials between population groups than between regions in Germany (Geyer and Peter 1999; Helmert 2005; Lampert and Kroll 2006; Luy 2006; Mielck 2005; Reil-Held 2000; Shkolnikov et al. 2008). Life expectancy differences between population groups—according to occupational status, education, or income level—amount to several years. Regional populations in Germany differ, however, with regard to their socioeconomic structures, which are often imposed by the predominant economic branches (Statistisches Bundesamt 2006; Voigtländer et al. 2010). These differing population compositions imply that at least

part of the regional mortality differences can be traced to such compositional differences. It is, however, unclear to what extent this is the case, and whether or how the individual mortality risks are related to the regional context. This study is the first to explore these relationships for Germany.

The observation of regional mortality differences in Germany is not only interesting from the perspective of health equity. These differences are also part of demographic change in Germany, which affects the regions to varying degrees. Demographic change and its consequences for the population size and population composition of Germany's regions have been fixtures of the political debate in Germany over the past decade. Among the major demographic issues raised in this debate are the challenges and even threats posed by aging and population changes due to migration and fertility trends (Bertelsmann Stiftung 2006; Bundesministerium für Familie, Senioren, Frauen und Jugend et al. 2007; Kröhnert et al. 2006; Neu 2006; Swiaczny et al. 2009; Weber and Klingholz 2009). Longevity is yet another factor in the aging of the population. However, because having a longer lifespan often means more time spent in better health (Christensen et al. 2009), longevity is regarded more positively than the other factors underlying demographic change. Among the demographic factors driving regional population changes in Germany, longevity has been the least-studied in the regional context, and thus deserves additional attention (Mielck 2007; Razum et al. 2008).

Earlier regional mortality research in Germany was missing some important features. Previous research mainly focused on either the federal states or on the districts; and, in the latter case, most studies looked at districts only within a particular federal state. So far, almost all regional mortality analyses in Germany have neglected longitudinal considerations, both in the investigation of mortality patterns as well as in the explanation of these patterns.

Previous research on regional mortality differences in Germany sought to explain these differentials at the regional level only. However, it is known that substantial mortality differences exist between population groups, such as socioeconomic groups, and that the population composition differs regionally. How these regional and compositional differences interact with each other is not known.

This study seeks to fill this research gap. More specifically, the study investigates regional mortality differences within Germany at different spatial levels over time. It attempts to identify mortality determinants over space *and* time. Underlying age- and cause-specific patterns are investigated. The role of the East-West differentials in the mortality variation across space and time are assessed. This study further takes into account the knowledge about regionally varying population composition and differential mortality between population groups. It seeks to demonstrate whether regional mortality differences are attributable to regional differences in population composition, to regional context, or to an interplay between the two factors.

In the following, this study's approach to the research topic will be described. The study begins with an analysis of the differences between East and West. This is followed by a comparison of the mortality structures in the German federal states, and then in the districts at the small-area level. The traditional approach of looking at mortality differences based on life expectancy is complemented by an examination of lifespan disparity, which provides new insights into inequalities in age at death.

Life expectancy trends are not identical to trends in lifespan disparity, which makes it possible to identify which ages determine the lifetime losses. For the first time, cause-specific mortality in the German federal states is not only compared in the cross-section, but also in the longitudinal perspective from 1991 to 2006. Different regional cause-specific patterns are derived, and the changes over time are examined.

The underlying trends in the smaller areas are invisible at the level of the federal states, and therefore deserve special attention. Previous analyses by other researchers are enhanced through the application of exploratory spatial data analysis techniques that provide objective measures of spatial clustering trends. Special attention is paid to changes in the spatial patterns related to the steep life expectancy increases in the East German regions in the 1990s, immediately following reunification. This sharp rise led to a regional mortality convergence, and to a decrease in regional dispersion.

Regions with similar socioeconomic features usually display similar mortality patterns. In order to present a consolidated overview of mortality trends and cause-of-death structures, two different region classifications are adopted. The analysis shows that the more deprived areas have excess mortality, especially in behavior-related causes. This study further provides enhanced evidence that general prosperity in the regions is not only reflected in the spatial life expectancy pattern, but that greater prosperity gains lead to greater life expectancy increases.

The most innovative part of the study is its combination of individual- with regional-level data in a multilevel approach. This approach takes account of the fact that the regional population composition cannot only be captured by aggregate-level characteristics (such an approach has also been put forward by Mielck 2007; Razum et al. 2008). Individual-level data are drawn from the German Federal Pension Fund, a data source that has been available to the scientific community since 2004. The analysis confirms that mortality differentials between people belonging to different socioeconomic groups are large, and persist into old age. In the German context, this is the first study that shows that differential population composition in the districts cannot explain all existing regional mortality variation. This implies that the regional environment significantly affects the mortality risk of individuals. The study vividly illustrates that people with the same risk profile have different mortality risks depending on the region in which they live. People with lower socioeconomic status are even more vulnerable if they live in a deprived area.

In sum, the different parts of the study show that large-scale spatial mortality differences persist over time, while changes occur at the small-area scale.

The book consists of six chapters. A literature review follows this introductory chapter. The next three chapters deal with the empirical analyses of regional mortality differentials. All of the chapters can be read separately, but each chapter builds upon the previous chapter in terms of geographical and methodological detail. The synthesis of the chapters provides the most meaningful conclusions. The research questions cannot always be answered by one analysis alone. Instead, some of the questions are addressed by several analyses, and the results of these analyses taken together provide full responses to these questions.

Each chapter with empirical results describes the specific data used and the methods applied. The specific results are summarized and discussed at the end of each chapter.

Chapter 2 consists of a literature review on regional mortality differentials and their determinants in Germany. First, data sources used by researchers on regional mortality differences are discussed in brief. Second, the East-West mortality differences and their possible determinants during the division of Germany are outlined. Third, regional mortality structures in Germany and their trends are summarized. Finally, the possible determinants of regional mortality differences are discussed. They are divided into regional- and individual-level factors. The research questions for this study are presented at the end of Chap. 2.

Chapter 3 deals with general mortality trends in Germany. This chapter enhances previous work through the inclusion of all of the German federal states in a longitudinal perspective and through the application of innovative methods. Life expectancy trends in East and West Germany (reaching back to 1956), as well as in the federal states (starting in 1980), are complemented by the examination of lifespan disparity. Regional dispersion of life expectancy across the federal states is assessed in the time lapse. The presentation of a model that relates general mortality trends to underlying causes of death completes this chapter.

Chapter 4 looks at mortality patterns and trends from a small-area perspective. The analyses of both all-cause and cause-specific mortality across 438 German districts present fresh perspectives on regional mortality differentials in Germany. Most importantly, this approach makes it possible to determine which regions are changing. Two distinct functional region structures are created to relate mortality trends to specific regional features, such as an urban-rural division. Finally, the regional life expectancy patterns and their temporal changes are related to regional context factors to assess regional mortality determinants.

Chapter 5 takes into account the importance of the individual mortality risk factors. A multilevel model combines individual-level data of the population aged 65 years and older in 438 districts, with contextual data of the districts. The extent of regional mortality variation is assessed following the inclusion of the first individual-level characteristics, and then of the contextual factors. In particular, the interplay between the two levels is addressed.

Chapter 6 completes the work by providing a general summary and discussion of the findings. The research questions are assessed in light of the empirical results from different regional levels outlined in the three preceding chapters.

Several territorial units in Germany are dealt with throughout this book. The crudest differentiation is made between East and West Germany (often referred to simply as the East or the West). West Germany refers to the territory of the Federal Republic of Germany (FRG) as it was before 1990 (federal states Baden-Württemberg, Bavaria, Hesse, Saarland, Rhineland-Palatinate, North Rhine-Westphalia, Hamburg, Bremen, Schleswig-Holstein, West Berlin). East Germany refers to the territory of the former German Democratic Republic (GDR; federal states Mecklenburg-Western Pomerania, Brandenburg, Saxony-Anhalt, Saxony, Thuringia, East Berlin), as well as the former West Berlin for the period after reunification. Meanwhile, the term eastern Germany refers to the territories of the former GDR and Berlin after 1990; while western Germany refers to the other federal states. The 16 federal states

are sometimes referred to as area-states and city-states. City-states are the federal states of (the cities of) Berlin, Hamburg, and Bremen. All other federal states are area-states. The small-area analyses are based on the NUTS-3 level of districts. Other territorial units, such as a group of districts, are generally referred to as regions (Fig. 4.1 shows a map of Germany's regional division).