Introduction

Early-life effects on socio-economic performance and mortality in later life: A full life-course approach using contemporary and historical sources

Evidence has shown that conditions early in life can influence the development of cardiovascular diseases, respiratory and allergic diseases, diabetes, hypertension and obesity, breast and testicular cancers, neuropsychiatric and some other disorders (Ben-Shlomo & Kuh, 2004). Three specific diseases, respiratory tuberculosis, haemorrhagic stroke, and bronchitis, which have accounted for two-thirds of the total decline in mortality in ages 15–64 years from the mid-nineteenth century to the first decade of the 20th century in Britain, reflect demonstrable responses from conditions in infancy and childhood (Lindström & Davey Smith, 2007). This is not to deny the influence of adult factors, such as life style, education and income, but merely to state that factors over the entire life course need to be taken into account when analyzing adult mortality. A fundamental question that arises is “what is the importance of early risk factors over the entire life course and to what extent do later life factors mitigate or intervene?”

The overall aim of this Special Issue is to contribute to our understanding of the importance of early-life factors for health deficits or resilience and address whether early-life factors affect mortality at older ages directly or indirectly through education and attained socio-economic position. This aim includes the need to identify certain life-course factors that potentially mitigate the influence of early-life factors and health in later life.

Contemporary prospective studies that have been developed to address these questions include the Medical Research Council’s National Survey of Health and Development which sampled all births that took place in England, Scotland and Wales during the week 3–9 March 1946 (Wadsworth et al., 2003) and the National Child Development Study (Ferri, 1993) which includes nearly all births in England, Wales, Scotland and during the week 3–9 March 1958 in Great Britain. The age-depth in these studies is presently 50–60 years, which means that they do not cover older ages in which most deaths today occur. Prospective studies based on register data, generally available from around 1970 onwards, include all age-spans but here the age-depth is even shorter, only about 40 years. Studies of old-age mortality in contemporary populations are therefore, partly or entirely, retrospective. This is problematic regarding the exclusion of details about socio-economic and other factors at individual and family level early in life. It is also problematic regarding selectivity since studies also lack information about those migrating or dying before they enter into the sample. Taken together, it makes it difficult to use a full life-course approach in analyzing old-age mortality in contemporary populations. Studies based on historical data bases often contain full life courses and thus are more useful for analyzing conditions over the entire life course. One important goal of this Special Issue has been to include studies that follow recent cohorts of individuals as they age as well as historic cohorts that allow us to observe full life spans of individuals.

Background

The significance of conditions in early childhood for health in later life has been long known. Barker (1994: 155) cites Mary McCracken, secretary of the ladies committee of the Belfast Poorhouse, who in the 1830s wrote about the importance of proper nourishment and treatment during infancy for future life. Hellstenius (1871), in an analysis of the relationship between harvests during the foetal stage and health of recruits to the Swedish army, cites a former secretary of the state, Hans Järta, who in a pamphlet in the 1830s wrote about the notion of the importance of nourishment during the first years of life for future well-being. The importance of early-life factors for health in later life can, however, be traced even further back in time, at least to 1633 and Francis Bacon (see Spedding, Ellis, & Heath, 1858: 259–260). Epidemiologists and demographers, who in the 1920s and 1930s studied the great mortality decline, were also aware of the importance of early-life factors (Derrick, 1927; Kermack, McKendrick, & McKinley, 1934). Based on analysis of changes in age-specific mortality rates for England, Wales, Scotland, and Sweden, Kermack et al. found that each generation continued to exhibit the same relative mortality they had in childhood throughout the life and into old age (Kermack et al., 1934: 699).

As modern Western society developed and with it public health interventions and medical technology, mortality at all age spans was simultaneously affected and the focus shifted away from early-life factors. In 1953, when the United Nations summarized the causes behind the great mortality decline such factors were not included. The decline was instead attributed to improvements in living standards, diet and personal hygiene, public health interventions to improve water quality and sanitation, and medical advancement (United Nations, 1953).

Early-life factors, however, were once more to receive regained interest within both medicine and demography. With respect to medical research, the work by Barker has been of major importance. In Mothers, babies, and disease in later life (Barker, 1994), he summarises the medical evidence for the significant importance of the nutrition of the foetus and the newborn infant for the health of the adult. While Barker’s work to a large extent focuses on a critical period in the very beginning of life, Forsdahl argues that a detrimental experience early in life often leads to an accumulation of risks over the life course (Forsdahl, 1977). Within demography,
work by Preston and van de Walle (1978) for urban France and Fri-dilizius (1989) for Sweden emphasised the importance of early-life factors for the mortality decline using methods similar to those of Kermack et al. (1934). The scholar who probably has advocated these ideas in historical research more than any other is Fogel (1993, 2004), who used final heights as a measure of net nutrition and health during childhood. Individuals, who were well nourished during the foetal stage, have well nourished and healthy mothers, are less exposed to infectious diseases, have lower risk of dying during infancy, have better development of their cells and organs, reach higher heights, and enjoy a longer life.

Age, cohort and period factors

Demographers often wish to distinguish between period and cohort factors in addition to age. Early-life factors that have long lasting effects on health are called cohort factors while factors affecting all (or almost all) age groups at the same time are called period factors. The issue at hand is their relative importance. Finch and Crimmins (2004) examined age-specific mortality rates for various countries and argued that cohort factors were important for the great mortality decline. A response by Barbi and Vaupel (2005) suggests that such effects are modest and that period effects have been more important. Some demographers have concluded that cohort factors have played only a minor role in the mortality decline associated with the demographic transition (Kannisto, 1994; Wilmuth, 1988).

Contemporary studies based on longitudinal data for individuals using a life-course approach show repeatedly the importance of specific early-life factors for overall mortality at older ages, as well as for mortality in specified diseases (Kuh & Ben-Shlomo, 2004). Historical studies using longitudinal individual-level data emphasize the exposure of infectious diseases in the first year of life as a determinant of adult mortality in respiratory and other diseases (Bengtsson & Lindström, 2000, 2003). The major differences between these studies and the ones by some demographers are the level of aggregation and the use of causal models. While studies based on population totals certainly can provide a large overview, studies at the individual level give specificity and make it possible to test causal models. Life-course models using longitudinal individual-level data for analyzing adult mortality include such factors as mother's condition during the foetal stage, birth weight, height, prevalence of diseases, and sometimes information from blood tests.

Explanatory factors, pathways and mechanisms

Contemporary studies can include social and economic information such as parental socio-economic status at birth, and own socio-economic status at certain ages in adulthood, education, and income. Environmental factors, such as prevalence of infectious diseases or Gross Domestic Product per capita, are sometimes also used. Genetically informed measures, such as longevity of parents or grandparents have, however, only rarely been included (see Bengtsson & Mineau, 2008).

Models often try to identify critical periods during which individuals are more than normally vulnerable to external factors. The work by Barker (1994) and his colleagues, focusing on the foetal stage, falls into this category, as do studies focusing on inflammation in first year(s) of life (see Finch & Crimmins, 2004). The underlying idea is that the speed of the development of cells and organs very early in life causes an individual to become more or less vulnerable to subsequent threats and exposures. A different approach focuses on accumulated risks, for example smoking over the life course. Accumulated risks models do not exclude, but neither do they require, critical periods from early life (Ben-Shlomo & Kuh, 2004).

Insults during a critical period early in life could either have a permanent negative or positive effect on health in later life. Surviving certain infectious diseases, such as smallpox or measles, might result in lifelong immunity but could also cause permanent health damage, what Preston et al. call scarring (Preston, Hill, & Drevenstedt, 1998). The effect could be mediated by various factors throughout the life course. Having access to economic resources and medical treatment may, for example, dampen or even eliminate the scarring effect. On the other hand, scarring may make it more difficult to acquire and accumulate resources. Persons having damaging insults to their health status early in life may therefore end up having less favourable socio-economic situations as adults.

Adverse health in childhood and adolescence may influence educational and labour market performance. Negative impacts very early in life could therefore both directly affect adult health through permanent damage of cells and organs, and indirectly through abilities to accumulate wealth. Access to resources and/or medical technologies either during infancy and childhood or later in life could also mediate the negative impact of insults early in life. Thus one has not only to take into account the different pathways but also interactions between different negative and positive factors over the life course when analyzing adult health and mortality.

Parents’ socio-economic situation, however, may have an impact on the health of their children later in life either directly, by providing better conditions for their children while they are young, or indirectly through education or economic transfers later in life. Children born under favourable economic circumstances often end up as well off adults themselves. Thus, there exist social, as well as biological, pathways between childhood and adult health (Kuh, Power, Blane, & Bartley, 1997:169). The correlation of environments throughout the life course makes it impossible to identify critical periods or accumulation effects (Elford & Ben-Shlomo, 1997; Strachan & Perry, 1997). Thus the number of factors, possible pathways, and interactions that exist makes the modelling of adult mortality extremely complex and the issue of causality problematic. Not only is this theoretically and methodologically demanding; but the identifying and developing of appropriate data sets is also challenging.

The Mölle meeting and organisation of the special issue

To explore this topic we organized an international meeting in June 2006 in Mölle, Sweden. The meeting, jointly organized by the Research Group in Economic Demography at Lund University (now the Centre for Economic Demography) and the International Union for the Scientific Study of Populations Committee on Historical Demography, brought together a multi-disciplinary group of investigators with interests in historical demography and epidemiology. For this Special Issue we have chosen eleven papers that focus on early-life conditions, social mobility and other factors that influence mortality and survival to old age. The majority of these studies use individual-level or micro data and have access to longitudinal information on these individuals. Rather than summarize conclusions from these papers, we provide the reader with an introduction of the general themes that the authors address. First is a set of papers that analyze the pathways or the causal processes. Next is a set of papers that continue this theme and narrow their focus to identify critical factors and periods, such as exposure to infection or exposure to contagious diseases in the first year of life. The last set of papers concentrate on aspects of the fertility experience and family structure and include factors
across the life course in their analyses, factors that might mitigate adverse impact of early-life factors.

The first paper by Kuh et al. uses data from the British cohort study to investigate risk factors related to childhood and early adulthood experience to determine if there are possible pathways to adult survival (Kuh, Shah, Richards, Mishra et al., 2009). These risk factors include poor childhood and adult socio-economic conditions, lower childhood cognitive ability and cigarette smoking. They study differences in cardiovascular and cancer mortality as well as general mortality. Palloni and associates explain the possible mediating process of the health selection mechanism on the well known adult socio-economic gradient in health (Palloni, Milesi, White, & Turner, 2009). They use data from the 1958 British Cohort to estimate the influence of early health conditions on adult social class position and the contribution of the individuals’ early health status to observed adult health differentials. Using data from rural 19th century Sweden, Bengtsson and Broström also address whether conditions in early life directly and indirectly affects mortality in older ages (Bengtsson & Broström, 2009). While the direct effect is due to permanent damage, indirect effects are due to effects of these conditions on ability to accumulate wealth over the life course, which in turn affects mortality in older ages. In their analyses they combine micro and macro measures of early-life and life-course conditions over the entire life span. The paper by van den Berg et al. also combines micro and macro level data to address how economic conditions in the first years after birth affect the mortality rates later in life (van den Berg, Dobhammer, & Christensen, 2009). They analyze macro data, such as time-series data on food price deviations, combined with individuals in the Danish Twin Registry to indicate potential causal effects on individual mortality rates controlling for family shared factors. Lastly, the paper by Noymer tests whether having tuberculosis was a risk factor for death due to influenza (Noymer, 2009). While previous work by Noymer and Garenne (2000) analyzed aggregate data on the 1918 influenza pandemic and raised the question of influenza–tuberculosis selective morality, Noymer here uses data on Union Army veterans to study whether individuals with tuberculosis were at greater risk of influenza death.

In order to address early-life exposure to infectious diseases, the next papers study how disease load prevalent during the individual’s birth year affects old age mortality. Drawing from French-Canadian, individual-level data from the 17th and 18th centuries, Gagnon and Mazan study whether an increasing infant mortality rate translated into a decrease in survival prospects in later life after introducing factors related to demographic and biological characteristics within families (Gagnon & Mazan, 2009). Bruckner and Catalano use time trends and aggregate data to study whether birth cohorts that experience virulent environmental insults early in life experience increased mortality in older ages (Bruckner & Catalano, 2009). They test the “diminished entelechy” hypothesis by measuring the association between infant mortality and life expectancy by age in three populations: Sweden, Denmark, and England and Wales.

The final set of papers looks at specific life-course experiences for later-life mortality. They raise questions related to the persistence of reproductive events when analyzed with other life-course factors. To study the timing of first birth and post-reproductive mortality, Spence and Eberstein compare black and white mothers in the U.S. using data from the National Longitudinal Survey of Mature Women (Spence & Eberstein, 2009). After analyzing social, economic, and health related factors across the life course, they introduce a “weathering hypothesis” to explain the experience of black mothers. Modin et al. study the persistent social disadvantage of illegitimacy in early twentieth-century Sweden by highlighting a set of plausible mechanisms linked to this event and identify health disadvantages and longevity across three generations (Modin, Koupil, & Vågerö, 2009). Using household register data for a rural population in northeast China from the 18th and 19th centuries, Campbell and Lee study childhood living arrangements, such as loss of mother, short birth interval and older-age mother, to analyze adult and old-age mortality (Campbell & Lee, 2009). Lastly, Smith and associates also examine how early family circumstances, such as number of siblings and age of parents, affect mortality risks decades later (Smith, Mineau, Garibotti, & Kerber, 2009). Studying individuals born in Utah in the last half of the 19th century, they include a genetic component related to the mortality experience of their parents and other ancestors as well as intervening factors related to the individuals’ life course.

Conclusions

The papers in this Special Issue illustrate the contribution of both prospective studies and retrospective studies to the growing body of work on the health effects of early-life conditions. Contemporary prospective studies are valuable because they include a large amount of detailed, individual-level information that is necessary to study causal pathways for well-defined cohorts, an advantage that will only increase as subjects approach their later years. These studies may allow more direct observations of the factors that can mitigate the influence of early-life factors and thus have the potential to shape health policies. While studies based on historical data may offer less detail, they contain information on individuals and families over a larger portion of their life span. A number of the studies represented in this issue cover the entire life course and sometimes several generations thereby allowing for intergenerational analyses (see Bengtsson & Mineau, 2008). Historical data sets vary in size; however, some are very large and offer opportunities for examining entire populations with unparalleled statistical power. In addition many have collected data from multiple points over the life course and can study both the direct and indirect effects of early-life events. Thus historical studies can allow an insight into the life course of individuals from different periods and settings. They can provide insights regarding critical periods and pathways, also relevant today. Less appreciated is the fact that findings from historical cohort studies can inform contemporary policy debates because more distant exposures in childhood (e.g., the 1918 Influenza Pandemic, the Great Depression) have had time to propagate effects in the lives of older individuals; some of these historical events occur again in the present in somewhat different form (e.g., SARS, the recession of 2008) and insights from historical studies can be used to help understand the potential consequences of tumultuous contemporary events and the interventions needed to attenuate their pernicious effects.

Looking to the future, we encourage investigators to continue addressing key questions that are motivated by a life-course orientation. What specific early-life conditions promote these later-life health and longevity differentials, at what ages do their influences begin, and how are they mediated by mid- and later-life circumstances? Specifically what are the linkages and mechanisms connecting adverse/advantageous conditions early in life to health and survival during older adult ages? Results from such studies will allow us to further understand the health significance of early-life factors.

We recommend that the ideal course of action is the use of full models, including early-life and broader life-course factors into the analyses of adult health and mortality, as well as factors transferred across generations. Factors at the individual, family and environmental levels need to be taken into account whenever feasible. The issue of causality when using factors at the individual and family level need to be carefully considered since causality between
such factors and health may run either way. When it comes to environmental variables the issue is not reversed causality but the fact that environmental variables are often correlated with each other, in particular if they contain trends. Analytical approaches close to a natural experiment situation can sometimes be used to solve this problem. One could analyze the effects of changes in environmental conditions, for example, such as exposure to infectious diseases in first year of life. Another issue involves the restriction of samples to persons surviving to adulthood; investigators need to address the issue of potential mortality selection bias and ways to assess its influence. Lastly, when the outcome of analysis is mortality, we need to focus our attention on causal mechanisms linking specific life-history factors to specific causes of death.

References


