

# Chapter 1

## Introduction

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The present volume contributes to life course research with a specific emphasis on health trajectories as they unfold along individual lives in specific socio-historical contexts. It brings together a range of contributions from different disciplines to shed light on the complex social and biological processes which influence people's health. The Introduction addresses the goals of life course epidemiology and the contribution which insights from the life course perspective can bring to the study of health. Theoretical, methodological and policy considerations associated with life course epidemiology are presented to discuss the current state of the field and expected developments to come. The Introduction finally presents the different contributions of this volume.

### **The Ambitions of Life Course Epidemiology**

Health has been traditionally envisioned as a state, encompassing different dimensions along the lines of the World Health Organization's long-established definition: "[health is] a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity" (WHO 1946). A recent discussion of the

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concept, raising the limitations of this definition, highlighted the dynamic nature of health by suggesting that it reflects “the ability to adapt and to self manage” (Huber et al. 2011, p. 1). This conception is fully in line with the life course perspective which is interested in understanding how the past influences the present. The dynamic component of health is further emphasized by the idea, promoted by epidemiological thinking, that it results from individual exposure to a range of risks. The combination of physiological and social resources that individuals can count on is expected to influence their ability to adapt, with responses ranging between vulnerability and resilience.

Examining health over time involves considering how individual trajectories unfold along different pathways. These trajectories can be stable, at different levels since some individuals remain in good health while others remain in poor health as years go by. Health trajectories can reflect a decline, as can be expected among the elderly who progressively lose functional and cognitive capacities, or alternatively indicate an improvement, for example among those who recover from a specific disease and its associated disability. Last but not least, these trajectories can fluctuate in an unclear trend among individuals who experience successive episodes of good and poor health. Health trajectories reflect continuous developments, informing on individual histories of health (Colerick Clipp et al. 1992). The notion of trajectories is therefore implying a long-term approach, in contrast with the idea of transition which is focused on short-term events or changes (Kuh et al. 2003). While trajectories are estimated from a succession of health measures, reported at more or less short intervals over time (a few days to several years), transitions measure changes between health states. Since these transitions can occur at the physiological level or in social circumstances, “life course epidemiology attempts to integrate biological and social risk processes” (Kuh et al. 2003, p. 778).

Interest in a life course perspective emerged in the 1980s in relation to chronic diseases (Aboderin et al. 2001; Kuh and Ben-Shlomo 2004; Wilkinson 1996). Converging research interests helped consolidate life course epidemiology over the last decade of the twentieth century, as an interdisciplinary field fostering collaborations between the natural and social sciences (Blane et al. 2007; Graham 2002). Expanding Elder’s proposition that the individual life course is shaped by multiple trajectories (Elder 1998), it emphasizes the importance of understanding the interactions between biological change and social change at the individual level. This research studies human beings as both social and biological entities: social in the sense of their plasticity to material and cultural context; biological in the sense of development from a single newly-fertilised cell to the estimated 27.2 trillion cells of an adult who subsequently loses functional capacity, develops disease(s) and dies.

The integration of social and biological components in the study of health is a long-standing issue that has recently gained considerable attention (Anderson 1998; Blane et al. 2013; Glass and McAtee 2006). However life course epidemiology is truly innovative in that it addresses the complex interactions developing over time between a range of determinants and outcomes. Typical questions focus on the influence of social factors on health: How does social class get into the molecules, cells and tissues of the body to produce social class differences in life expectancy

and cause of death? How does social participation enhance resilience at older ages? How does childhood experience of parental separation contribute to the later onset of anxiety and depression? However, reverse influences are also of interest: How does poor health during childhood restrict education opportunities and consequently professional paths? How does depression affect marital life? Considering that these contrasted influences interact, they are likely to produce distinct patterns of disadvantage or privilege. Therefore this research is not only interested in how the social “gets under the skin” to affect biology but also how health affects the way we interact with our social world. In this volume, the contribution of Heilmann et al. emphasizes how oral health is shaped by social factors, especially the conditions children experience when they grow up; while the chapter by Taylor-Robinson et al. looks at how the social background of people with cystic fibrosis affects the care they receive and also how the severity of the disease reduces their chances of employment.

## **The Added Value of the Life Course Perspective to the Analysis of Health**

Developed in the social sciences in the 1960s, life course research represents a major shift in the study of human life. It aims at analysing human development throughout the lifespan, considering together processes originally examined separately (Elder 1998; Featherman and Lerner 1985; Sapin et al. 2014). The comprehensive approach of the life course perspective offers important insights with specific relevance for the study of health trajectories, as will be described in this section.

The notion of time is central to the life course perspective. As human development and ageing are life-long processes, research in this domain extends across the successive segments of life or life stages: “different periods across the life course influence phases of biological development, stability or decline” (Ben-Shlomo and Kuh 2002, p. 286). Contrasting but interwoven aspects of time can influence health trajectories, in particular individual ageing and social change. Individual ageing is associated with biological development and decline and with successive social life stages. Research documents ‘standard’ trajectories and identifies factors associated with deviations from normal paths (non-normative trajectories). In parallel, social change determines specific life conditions since exposure to different risks is time-associated (Wadsworth 1997). Behaviours change over historical time, as for example with smoking patterns: “it is possible to be born into a period of high prevalence of parental smoking and to have lived middle life in a time of much reduced likelihood of smoking” (Wadsworth 1997, p. 864). Patterns of infectious illnesses vary over historical periods of time, as a result of contagion or vaccination. Transformations in medical care and efficacy of treatment also intervene, including the growing capacity to detect diseases earlier in life than before. Changes in policy for example regarding education and in social norms such as those illustrated by the increasing rate of divorce are also time-dependent (Wadsworth 1997). The chapter

by Wilmoth et al. in this volume, examining the body mass index trajectories of men who served in the military, offers important insights on the importance of comparing cohorts who lived in distinct historical periods. Therefore the life course perspective promotes analyses that take into account both social and biological opportunities at a specific historical time.

Both structure and agency contribute to an understanding of health inequalities (Abel and Frohlich 2012). The life course perspective also emphasizes the important role that social structures and individual resources play in the development of different trajectories (Elder 1998). It has been noted that, along with structural factors, agency associated with health behaviours account for a part of inequalities in the incidence of diabetes (Kumari et al. 2004; Wikström et al. 2011), obesity (Giskes et al. 2009), functional impairment (Lantz et al. 2001) and poor self-rated health (Joung et al. 1995; Lantz et al. 2001). Life course epidemiology is then interested in how health behaviours and psychosocial resources constitute domains of agency through which individuals influence, positively or negatively, their health over time. In the open debate regarding the origins of disease, studies keep estimating how much individuals influence the development of their own health through their personal resources and behaviours. Modelling trajectories of health behaviours with British cohort data suggested that health behaviours and body mass index could account for almost half of the socioeconomic inequalities in the incidence of type 2 diabetes (Stringhini et al. 2012). Similarly, analyses among young adults concluded that change in psychological resources moderates the evolution of inequalities in distress symptoms: socioeconomic differences increased among respondents having low psychological resources, while these differences remained similar among those with stable or increasing resources (Kiviruusu et al. 2012). Therefore examining the longitudinal influence of agency is likely to contribute to disentangling the effects of different determinants of health. As an illustration, Missinne in this volume analyses the development of health lifestyles, specifically mammogram behaviours, in relationship with respondents' social mobility.

Individuals live in interdependence or in situated networks of relationships. Significant others share similar environmental influences, such as household income, division of domestic tasks, eating patterns or holidays. These elements, referring to the linked lives principle in the life course perspective, are also shaping health behaviours and chronic disease management through mutual influences within the couple, the household or among close friends. Evidence exists that diagnosis of a serious illness and its associated distress impact on both the patients and their spouse (Berg and Upchurch 2007; Booker and Sacker 2012), depression affects one's partner's cognitive functioning (Hinton et al. 2009) and cognitive decline over time is influenced by the spouse (Gerstorff et al. 2009; Gruber-Baldini et al. 1995). The influence of these connections between significant others and individual trajectories remains neglected in empirical research (Bird and Krüger 2005): according to recent reviews, family and health research still focuses on individuals rather than on couples or households as units of analysis (Carr and Springer 2010; Hoppmann and Gerstorff 2009; Pietromonaco et al. 2013). Taking into account individuals' social

circumstances needs consideration of their close relationships over time, adding another level of complexity in life course epidemiology analyses.

Family studies and occupational health have contributed to the study of inequalities in health. However, life course epidemiology only recently integrated the family and work lives spheres (Cullati et al. 2014a; Worts et al. 2013). Individuals spend most of their lifetime in these spheres, which (clearly) influence health trajectories. In regard to the work sphere, longitudinal studies show that having secure employment with good working conditions reduces the risks of developing a limiting illness (Bartley et al. 2004); unemployment is associated with higher mortality and morbidity and lower quality of life (Bartley 1994; Booker and Sacker 2013; Flint et al. 2013; McKee-Ryan et al. 2005; Roelfs et al. 2011); and poor psychosocial work environment is a cause of mental disorders (Stansfeld and Candy 2006) and heart disease (Sacker et al. 2001). With regard to the family sphere, it was shown that the family environment not only shapes the life course of individuals but also deeply influences their wellbeing (Uhlenberg and Mueller 2003). Recent research examining the increasing diversity in family structures emphasizes that parenthood and parenting experiences influence wellbeing over life (Umberson et al. 2010). Growing evidence suggests that the accumulation of social roles affects both men's and women's health (Bartley et al. 1999; Bianchi and Milkie 2010). It is known that work-family conflict affects individuals' health (Allen et al. 2000; Eby et al. 2005) and their use of medical drugs (Lallukka et al. 2013), however most of the evidence is based on cross-sectional studies. There is clearly a need to understand better how the intersection of work and family lives imprints into the health trajectories of individuals (Cullati 2014). Indeed individuals experience changing levels of work-family conflict during specific life stages, such as when having young children at home or providing care to older parents (Bianchi and Milkie 2010; Rantanen et al. 2012). Life course epidemiology may thus help identify vulnerable subgroups at specific life stages and inform public policies accordingly.

Research developing at the intersection of social epidemiology and the life course perspective suggests new hypotheses that can help understand how health trajectories are shaped. Looking at social factors (socioeconomic resources, gender roles, changing risks and opportunities), psychological resources (coping mechanisms, resilience and vulnerability), and physiological transformations (ageing, emergence of symptoms, disease, frailty and disability) in a dynamic way clearly opens up promising research questions.

## **Theoretical Models in Life Course Epidemiology**

To formulate hypotheses associating trajectories and transitions, different theoretical models have been discussed in the life course epidemiology literature: the critical (sensitive) period model, the pathway model and the accumulation model (Blane

et al. 2007; Graham 2002; Kuh et al. 2003). These models anticipate different patterns and therefore help clarify the mechanisms through which individuals' multiple trajectories interact.

The critical period model assumes that part of the differences in health observed across social groups is explained by exposures occurring in specific periods of development. Deprivation, illness, divorce, risk behaviours (for example smoking, unbalanced diet) are such exposures. Because of their timing, hitting individuals in those critical periods of their life course, these events might lead to irreversible damages or diseases (Ben-Shlomo and Kuh 2002; Marmot and Wadsworth 1997). At first, critical periods have been chiefly related to the biological, cognitive and psychosocial development during foetal life, infancy and childhood. The biological programming hypothesis formulated by David Barker (1997) suggests that poor nutrition during foetal life is associated with increased risk of diseases in adult life. Consequently, authors have suggested that other critical periods for psychosocial and social development may be important for health. Examples include entry into the labour market, leaving the parental home, establishing one's own residence, the transition to parenthood, job insecurity, or exit from the labour market (Bartley et al. 1997). In this volume, the chapter by Johnson et al. dedicated to body size and cardio-metabolic health examines the influences on trajectories of critical periods and transitions, occurring both at the biological and behavioural level. Since social scientists consider that the term "critical period" primarily resonates with biological determinism, they prefer the notion of "sensitive period" (Ben-Shlomo and Kuh 2002; Bornstein 1989; Halfon and Hochstein 2002), or "time associated vulnerability" (Wadsworth 1999). These propose a less deterministic model, where an exposure in a particular period of the life span increases the risk of but does not necessarily result in irreversible damage.

The pathway model hypothesises that the effect of early disadvantage is indirect (Graham 2002). It highlights the different factors, such as lifestyles, educational achievement, social class, health behaviours that can act as mediators between early life social situations and adult health. For example, childhood adversity might restrict educational opportunities which in turn restrict socioeconomic wealth and resources, which in turn influence health behaviours, resulting in poorer health in late life. This model considers that the effect of early life factors on health later in life can be modified to some extent by circumstances occurring at various life stages (Power and Hertzman 1997). The metaphor of the domino aptly summarises the pathway model, also called the "trigger" model.

The accumulation model suggests that life course exposure to adverse environmental and socioeconomic conditions and to health damaging behaviours accumulate over time. Two main fields can be identified: first, the accumulative risk model examines the sum of adverse exposures and risks in the lives of individuals and how these have an increasing influence on health outcomes over time. Second, the cumulative advantage and disadvantage model considers that those with advantaged origins tend to experience subsequent advantageous life course trajectories (O'Rand 1996, 2009), resulting in increasing differences with underprivileged groups over time (Dannefer 2003). This model emphasizes how advantaging or disadvantaging

characteristics exert accruing positive or negative influences on health; in contrast, the pathway model emphasizes the paths between the early life advantages or disadvantages and later adult health. The cumulative advantage and disadvantage model, “concerned [ . . . ] with questions of fairness in the distribution of opportunities and resources” (Dannefer 2003, p. S327) postulates increasingly diverging patterns in health trajectories.

Variations of these models are also discussed in the present volume. For example Taylor-Robinson et al. make reference to the Diderichsen model identifying four main pathways in the development of health inequalities over the life course, integrating social causation and social selection mechanisms, and Johnson et al. to the developmental origins of health and disease (DOHaD) model. All these models are attractive, but it is also clear that their application is associated with difficulties. One limitation is the absence of theoretical developments addressing the potential reversibility of these processes. Indeed, some life course mechanisms are reversible and should be examined in regard to their negative and positive effects, respectively: for example marriage or divorce can bring either opportunity or adversity in the individual life course (O’Rand 2009); similarly, new employment can bring either better wealth and role enhancement or role overload and life strain. Another problem relates to the fact that even though the empirical testing of these models has increased (Hallqvist et al. 2004; Lynch 2003; Mishra et al. 2009), such findings have rarely been synthesised in systematic reviews (Niedzwiedz et al. 2012; Pollitt et al. 2005). For example we showed that explicit references to the cumulative advantage and disadvantage model remain limited in longitudinal analyses of health trajectories (Cullati et al. 2014b). Different reasons could explain this, including the availability of relevant data (as discussed in the next section) and the difficulty to operationalise in statistical models the assumptions of the theoretical models.

## **Methodological Considerations in the Study of Health Trajectories**

Analysing health trajectories requires repeated measurements. A minimum of two measures is necessary to observe change over time, a minimum of three measures allows description of patterns in trajectories. Longitudinal databases, initiated in the United Kingdom with birth cohorts as early as 1946, are becoming more common. Household panel data available in different countries offer repeated measurements of indicators related to health and social conditions. In a few countries, mostly Scandinavian, unique identification numbers attributed to each citizen allow linkage of data from a range of sources (census, social surveys, medical records . . . ) providing rich information over the individual life span (Blane et al. 2007). Retrospective data, such as collected through life-grid techniques (for example in the SHARE study), also give access to longer periods of time, making possible connections between earlier life events and later health trajectories, but with a risk of information bias.

Investigation of the life course is a progressive research programme that raises new encompassing questions which require the development of new methods, such as large-scale social surveys that include the collection of biomedical data (Blane et al. 2013). However such projects raise ethical issues and public concerns that can impede their developments, as illustrated by the failure of the Swiss Etiological Study of Adjustment and Mental Health (SESAM) (Kummer 2011). Next to challenges associated with work in interdisciplinary teams that bring together social and biological scientists, statistical expertise is required to analyse longitudinal data, adding another layer of complexity. Important questions arise around the empirical analysis of the theoretical models. In this volume, Bell and Jones underline the perils of modelling age, period and cohort effects and propose a theory driven approach to conceptualise these effects. In a chapter combining a methodological discussion and empirical results, Hoekstra and Twisk compare the contributions of latent class growth models and mixed models to the analysis of health trajectories. Ghisletta et al. also examine the advantages and limitations of different statistical models, namely linear mixed-effects models and structural equation models.

While life course epidemiology remains centred on the analysis of quantitative data, we consider that qualitative data are also needed to improve our understanding of health trajectories. Meanings associated with transitions and social hierarchies, expectations of successive cohorts of elderly people ageing in better health conditions are important elements in the complex experience of health. As initiated with work on lay views on health inequalities (Davidson et al. 2006; Popay et al. 1998), data from in-depth individual or collective interviews can inform on mechanisms that relate social and physiological aspects of individual life courses. Qualitative data collected with people suffering from specific conditions are needed to understand their trajectories and their interpretations of biological and social vulnerability.

## **Policy Implications of Knowledge Gained on Health Trajectories and Transitions**

The persistence of health inequalities across contrasting regimes of welfare and health system access is striking (Marmot 2004; Mackenbach 2012). Increasing health inequalities observed in several countries over the last decades (Mackenbach 2012) have been associated with socioeconomic changes but also with the crisis of welfare systems (Bourque and Quesnel-Vallée 2006). This section considers how the life course perspective can contribute to framing public policies that reduce differences in health chances across social categories and generations.

Evidence provided by life course epidemiology can help to identify when measures should intervene in individuals' life span. In the recommendations of the Marmot Review of social determinants and the health divide of the European region (Marmot et al. 2012), adopting a life course perspective is considered as one of



the priority areas of action with a focus on children's health: "the highest priority is for countries to ensure a good start in life for every child" (p. 1012). This is expected to contribute to the reduction of health inequalities today, but also in the future by ensuring more health equity across generations, hence addressing the plea of the WHO commission on social determinants of health 'Closing the gap in one generation' (CSDH 2008). The WHO report on life course perspectives on coronary heart disease, stroke and diabetes (Aboderin et al. 2001) also suggested developing policies focused on early life, monitoring growth trajectories of those born into socially or biologically disadvantaged families. This report identified further areas of intervention for later stages of the life span, such as promoting smoking cessation and alcohol reduction programmes among adolescents and adults, and reducing workplace stress among working age adults. In this book, the review by Howe et al. of the evidence on age transitions into obesity during childhood and the degree to which obesity persists over time also discuss how to identify optimal timing for obesity prevention.

The life course perspective emphasizes the need to develop policies that can meet people's needs over the lifespan in their different life spheres. Policies that protect families are expected to have a favourable effect on the health of both parents and children (Bourque and Quesnel-Vallée 2006), especially when policies can address the challenges associated with transitions in family life (birth of children, successive unions, care provided to elderly parents). Policies that protect workers are also likely to have an impact on health trajectories. Analyses of the 2008 crisis showed that employment protection policies mitigated the increased risks of job loss for individuals in poor health in the new economic environment (Reeves et al. 2014). Life course epidemiology further helps to identify vulnerable groups whose needs might require specific measures. For example, a comparison between the United Kingdom and Sweden showed that the Swedish welfare system reduced the poverty and work insecurity of single mothers compared to couple mothers, but that single mothers still reported poorer health status (Whitehead et al. 2000). These results highlight the complex social mechanisms that affect single parenthood and call for policy measures addressing this specific situation. Similarly, Reeves et al. concluded that labour protection policies only have a limited impact on the most vulnerable groups (disabled people, individuals suffering from a chronic disease) during severe recessions, suggesting that next to employment protection, anti-discrimination policies are needed to avoid increasing health inequalities (Reeves et al. 2014).

Accumulating evidence in life course epidemiology emphasizes that health trajectories result from interactions between social and biological processes. Promoting medical care and encouraging healthy behaviours are therefore clearly important domains of action (Braveman et al. 2011; Marmot et al. 2012), but they remain focused on individual determinants of health. Policies across all domains of social life are also called for, to promote healthier environments, at community, national and global levels, in order to limit the impact of threats on health such as the economic crisis, but also climate change (Marmot et al. 2012). Taking into account the social determinants of health in a whole-of-society and life course perspective

is expected to contribute to the reduction of health inequalities and to mitigate the intergenerational transmission of risks and disadvantages. On the whole, this will provide economic benefits, but also improve overall quality of life and reinforce social cohesion (Marmot et al. 2012).

## State of the Field and Contributions of the Volume

The intersection of social epidemiology and the life course perspective is fairly recent. This volume shows that the field is expanding, with groups developing in different contexts. Infrastructure and resources required for this effort are also extending. These will help to further establish life course research groups, such as the International Centre For Life Course Studies In Society and Health at University College London, the University of Antwerp's Centre for Longitudinal and Life Course Studies (CELLO), and the National Center for Competence in Research LIVES – Overcoming vulnerability over the life course – at the Universities of Lausanne and Geneva. Developments will also be strengthened through the funding of biomedical data collection as part of large-scale social surveys and the promotion of open academic access to these publically funded data. On the academic side, progressive institutionalisation can be observed with the establishment of learned societies, the organization of scientific conferences, workshops and summer schools. Further efforts should focus on comparisons between countries and international projects. Challenges exist in regard to the integration of interdisciplinary theoretical models and sophisticated statistical analyses, which requires collaborative interdisciplinary work, allowing a mix of skills to pursue the ambitions of life course epidemiology.

This volume brings together nine contributions selected upon propositions received after a wide distribution of the call for papers at the international level. The authors of these contributions represent a range of disciplines and countries, including Switzerland, United States of America, the Netherlands, Belgium, New Zealand and United Kingdom. The chapters combine a mix of reviews, empirical analyses and methodological contributions. They address a range of health topics including obesity, oral health, coronary heart disease, mammogram screening, and cystic fibrosis and take into account different life stages, from childhood to late life. In the absence of clear criteria to structure the presentation of the contributions, we opted for a 'random' order for the first six chapters. The last three contributions have a common focus on methodological and statistical aspects.

The first chapter, *Trajectories and transitions in childhood and adolescent obesity* by Laura Howe, Riz Firestone, Kate Tilling and Debbie Lawlor, offers a review of the evidence regarding trajectories and transitions in childhood and adolescent obesity. The rising prevalence of obesity has turned it into a major public health preoccupation, despite some variations across high-income countries. The chapter shows how adopting a life course perspective improves our understanding of long term consequences of overweight and obesity in early life. Longitudinal

analyses provide important insights, assessing how distinct obesity trajectories unfold over time, taking into account the potential persistence of such situations as people age. The authors also discuss how existing data help evaluate the impact of prevention activities and improve their outcome thanks to a better understanding of changes over time.

The second chapter is dedicated to a less visible issue, but of great public health importance, i.e. health related to conditions of the teeth, gums and mouth. In *Oral health over the life course*, Anja Heilmann, Georgios Tsakos and Richard Watt show how these diseases are socially distributed, such differences being accentuated by the high costs associated with their treatment. Oral health is related to general health and affects individuals' quality of life. However, despite its obvious dynamic nature, only limited work examines oral health in a life course perspective. Reviewing the existing literature, the authors emphasize how oral health in adult life is associated with conditions encountered in childhood and how social mobility contributes to distinct trajectories in that domain. Discussing the relevance of the critical period model and the cumulative (dis)advantage model they make suggestions about how this field should pursue its developments.

In *A life course perspective on body size and cardio-metabolic health*, William Johnson, Diana Kuh and Rebecca Hardy are interested in the relationship between birth weight and coronary heart disease. Moving beyond the developmental origins of health and disease (DOHaD) model, the authors propose a lifelong view of the environmental exposures and biological pathways associating body size and cardio-metabolic health. Reviewing the substantial amount of research that has developed over the last 25 years, they describe evidence regarding specific life stages (from gestation to adulthood) and identify three possible trajectories, emphasizing the many factors that can affect the observed associations. They also assess the role of socio-cultural factors and biological pathways and discuss the interactions between these influences, with a focus on transitions, at the biological and social level, that can influence trajectories. They call for the integration of biological and social research in order to understand how to limit the progress of disease in more vulnerable groups.

David Taylor-Robinson, Peter Diggle, Rosalind Smyth and Margaret Whitehead wrote a chapter entitled *Health trajectories in people with cystic fibrosis in the UK: exploring the effect of social deprivation*. They analyse the influence of social factors on the trajectories of these people. Considering that there are no socioeconomic differences in the incidence of cystic fibrosis since it has a genetic origin, they analyse the trajectories of those affected and identified during childhood to reveal social patterns in the outcomes associated with cystic fibrosis. The contribution brings together results from longitudinal registry studies that examine the impact of social deprivation on clinical outcomes, health care use and employment opportunities. The findings show social deprivation differences in clinical outcomes, with individuals living in more affluent areas having better lung function and less *Pseudomonas aeruginosa* (the most common pathogen causing chronic infection in those with cystic fibrosis) chronic colonisation. Treatments differ across social groups and inequalities grow after the transition to adult care.

Employment chances vary along social resources, disease severity and time spent in hospital. Observing that inequalities start early in the trajectories of those diagnosed with cystic fibrosis, the contribution confirms the importance of action taken at the beginning of life and supports the development of public health policies focused on early life experiences. Implications of the findings for health care systems and for clinicians are also discussed.

The next chapter, *Moving towards a better understanding of socioeconomic inequalities in preventive health care use: a life course perspective* by Sarah Missinne, examines how the life course perspective can also contribute to the study of socioeconomic factors in preventive behaviours. Pursuing different recent theoretical developments in medical sociology that take into account a longer-term view of individual health, she analyses mammography screening in the light of the five principles of the life course perspective. Including the life-span development principle helps to clarify how healthy lifestyles are adopted and maintained. The timing principle allows analyses of regularity and timeliness in preventive health care. Socialization contexts affect health-related lifestyles, illustrating the structure-agency debate. Comparisons across different European countries show the importance of policy contexts. And finally her analyses confirm the importance of the linked lives principle with the role played by significant others in the use of preventive measures.

In *Inter-Cohort Variation in the Consequences of U.S. Military Service on Men's Body Mass Index Trajectories in Mid- to Late-Life*, Janet Wilmoth, Andrew London and Christine Himes are also interested in obesity as a particularly important public health preoccupation in the United States. Their analysis compares trajectories of veterans who served in the army with those of men of mid- to-late life, including different successive cohorts of men born during the first half of the twentieth century. Different mechanisms affecting veterans' health are discussed, including positive factors such as intense physical training and fitness required to be in the army and negative factors such as training accidents or stressors related to separation from family and work. Analyses controlling for birth cohort, early-life factors and mid- to late-life influences indicate that veterans are marginally heavier than their civil counterparts. The study demonstrates a large secular effect in increasing weight among successive cohorts and a small but consistent intra-cohort effect.

The volume then presents three papers addressing methodological issues in the analyses of health trajectories and transitions, in particular specific issues associated with longitudinal data. In *Linear mixed-effects and latent curve models for longitudinal life course analyses*, Paolo Ghisletta, Olivier Renaud, Nadège Jacot and Delphine Courvoisier emphasize how longitudinal data cannot be analysed with standard statistical models since these data, collected with the same individuals, are inherently dependent. They present linear mixed-effects models and structural equation models, more appropriate for quantitative longitudinal data since they explicitly define parameters related to both stability and change processes. Furthermore, these models present the advantage that they allow analysis of the interactions between individuals and their context, considering that these characteristics can be stable

or can vary over time. The authors further discuss the advantages of these models and their recent developments, such as dealing with incomplete data, multivariate specifications, comparisons of groups, and latent class analyses that uncover group membership through statistical analyses. Illustrations for these different arguments are provided with analyses conducted with data of the Swiss Household Panel.

Trynke Hoekstra and Jos Twisk also highlight difficulties associated with repeated observations in longitudinal data. As indicated by its title, *The analysis of individual health trajectories across the life course: Latent class growth models versus mixed models*, their contribution is focused on two types of models that allow the integration of successive stages in the life course trajectory. The authors discuss the specificities of both statistical models, including extensions that allow measuring possible heterogeneity in health trajectories. They illustrate their points by analyses of body mass index trajectories with data of the Amsterdam Growth and Health Study cohort, first started in 1974 with teenagers.

Last but not least, the contribution of Andrew Bell and Kelvyn Jones considers age, period and cohort effects. The chapter *Age, period and cohort processes in longitudinal and life course analysis: a multilevel perspective* envisions these different effects as sources of health-related change, combining biological and social factors. Naïve life course approaches can produce misleading results if these different effects – age, period and cohort (APC) – are not carefully examined to understand if they could be generating mathematical confounding. Using the example of obesity, the authors show the limits of some of the currently used APC models and they offer an extension that aims at modelling these different effects in a robust and explicit way. In their case, illustrations of their arguments are based on analyses of the British Household Panel Survey.

This volume has been made possible by the commitment of the authors to prepare and revise their chapters. In fact, we also want to emphasize the important contribution of the reviewers we have solicited over the preparation of this book. We want to warmly thank: Thomas Abel, Mel Bartley, Patrick Bodenmann, Stefano Cavalli, Paul Clarke, Laurie Corna, Angela Donkin, Jacques-Antoine Gauthier, Francesco Giudici, Anne McMunn, Scott Montgomery, Sam Norton, France Weaver and Dick Wiggins, for their thorough reviews. We are also grateful to the editors of the collection, Laura Bernardi, Dario Spini and Michel Oris, for their support in the preparation of this volume. Generous funding received from the NCCR LIVES – Overcoming vulnerability over the life course – has made this publication possible, especially its open access online edition.

We hope this volume will be of interest for researchers working in different domains, in particular health and social sciences, and reinforce the attention to be paid to the unfolding of individuals' health histories. Considering that these result from complex interactive effects associating transitions within individuals' bodies and lives with changes in the broader social environment, the contributions offer theoretical insights, methodological developments and empirical results whose policy implications should be acknowledged by those who can impact governmental measures.

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