The Life Course Approach to Health: A Rapid Review of the Literature
(focusing on conceptual and operational considerations)

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1. Introduction

A growing recognition of the global burden of noncommunicable diseases (NCDs) has led to a renewed interest by clinicians, public policy experts and public health researchers and practitioners in improving both the applicability and implementation of the life course approach to health. The life course approach has its roots in the early years of the 20th century, when it became increasingly clear to social reformers in a number of rapidly industrializing European countries that childhood deprivation had serious long-term health consequences for those countries’ poorest citizens (Davey Smith, 2007; Bengtsson et al., 2009). The approach has become progressively more developed as contributions from medical research, epidemiology, history and sociology have sought to describe the complex and intersecting roles of genetics, biology, behaviour and environment in shaping individual and societal risk for, and protection against, ill health.

The World Health Organization (WHO) has long recognized that promoting good health across the life course is a critical component of improving a population’s health, which requires an integrated, multisectoral response with particular attention to gender, equity and human rights (WHO, 2012). In 2008, WHO introduced its own Department of Ageing and Life Course. The life course approach, however, has not been integrated across all WHO’s departments, as many of these departments have been necessarily structured to target disease or health-problem objectives and to prioritize appropriate packages of projects or interventions (WHO, 2012).

Organizational integration of the life course approach is challenging due to several difficulties with existing approaches. First, a number of frameworks of the life course approach have been conceived as tools for analysis, as opposed to a scaffold upon which organizations might operationalize their programmes. The very best of these frameworks are necessarily complex, as they take into account how genetics, intrauterine environment, early childhood experiences and health status, behaviour, environmental exposures and psychosocial, social, economic and political factors continuously intersect, interact, cumulate, cluster and transform health outcomes — and, in turn, affect other health outcomes — across the entire life course. Such frameworks may, thus, be difficult to operationalize.

Additionally, for those frameworks that do focus specifically on implementation, many do so from the perspective of high-income countries, as such countries have the benefit of data resulting from long-running longitudinal, cohort studies (e.g. the United Kingdom 1946 Birth Cohort study; the United States Nurses Health Study; and the Northern Finland Birth Cohort). Victora et al. (2003) outline the challenges of both implementing and financing such longitudinal cohort studies in low- and middle-income countries (LMICs). The result is that, with the exception of a few benchmark studies (e.g. Pelotas Birth Cohort Study in Brazil; Cebu Longitudinal Health and Nutrition Survey in the Philippines; the Birth to Ten Study in South Africa; and the smaller INCAP Nutrition...
Supplementation Trial in Guatemala), life course epidemiology of most populations outside of Europe, North America and Australia/New Zealand is poorly understood. Therefore, the question remains as to how to make a general life course framework applicable to populations worldwide.

In order to begin the development of a framework that can serve as an organizational blueprint for the integration of the life course approach into policies, programmes and processes aimed at LMICs, it is useful to review the scope of existing life course approaches, the range of health problems they cover, the audiences they address and their application in real world settings. To address these questions, we carried out a rapid evidence review of published and grey literature on the life course approach to health. The review began with a search of published articles in PubMed using search terms “Life Course Approach AND Health” (n=199 articles). We then identified additional published literature, as well as grey literature, through bibliographies of articles retrieved. A purposive search of grey literature using Google Search was also conducted.

2. Populations and health issues studied in the literature

Of the papers identified in this rapid review, some focus on specific health problems, while others examine the life course approach to health more broadly. Among those papers that look at specific health problems, the types of health issues studied are detailed in Table 1. The most commonly covered issues are NCDs; malnutrition; later life functionality; maternal and child health (MCH); dental and oral health; and mental health. The majority of papers focused on MCH are related to the implementation of the life course approach in community-based organizations in the US (see section 5.3) and thus do not examine MCH life course issues globally. Few papers studied infectious diseases, which are more prevalent in LMICs than in high-income countries. In fact, the large majority of papers examined health issues in high-income countries, with many of these focused on health issues in disadvantaged communities. Only 15 papers in the review studied health issues with data from low- or middle-income countries.

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<th>Health issue</th>
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<tr>
<td>NCDs (i.e. papers that cover &gt;1 NCDs: e.g. cardiovascular disease, chronic pulmonary disease, diabetes, cancers)</td>
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<tr>
<td>Malnutrition (including obesity, body fat, weight gain, poor diet)</td>
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<td>Later life physical and cognitive functionality (frailty, mobility, dementia, incontinence, etc.)</td>
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3. Conceptual approaches to the life course in health

Most papers looking at conceptual approaches to understanding the role of the life course in health discuss categories or “models” described by Ben-Shlomo and Kuh (2002) (see Box 1). These approaches should not be seen as either definitive or mutually exclusive, as the literature makes clear that their applicability depends both on the problem being examined and the purpose for which the life course approach is intended. Indeed, many papers look at and/or synthesize multiple approaches, either because they use a narrative literature review methodology or because they address health problems that are affected by such a broad range of genetic, biological and socioeconomic factors across the life course that a single approach is insufficient to capture all potential risks, exposures or protective factors.

3.1 Critical and/or sensitive period

Critical and/or sensitive period approaches assume that health outcomes are influenced by exposure to a risk or protective factor at “critical” and/or “sensitive” developmental
periods of the life course (Quaranta et al., 2014; Steegers-Theunissen and Steegers, 2015; Abreu et al., 2015; Mitchell et al., 2015; Zhang et al., 2015). These exposures may lead to irreversible changes to an individual’s biological structure that remain unaffected by later experiences. For example, the difference in total body fat (fat mass) of newborns of different ethnic groups can be correlated with similar differences in adults of those ethnic groups (Hull et al., 2015).

Exposure during a critical period can be structurally determinative (e.g. intrauterine exposure to thalidomide prior to 42 weeks’ gestation), but may not necessarily impact biological function as the body may compensate or adapt for structural deficits (Ben-Shlomo and Kuh, 2002). Exposure during critical or sensitive periods may also be modified or triggered by exposures later on along the life course. For example, intrauterine growth restriction’s association with coronary heart disease or insulin resistance is often modified by childhood or adult obesity (Ben-Shlomo and Kuh, 2002).

Critical or sensitive period approaches are not only limited to risks encountered during intrauterine or early childhood development. Zhang et al. (2015) look at longitudinal data on the effect of parental migration on the health and nutritional intake of Chinese children under the age of six, finding that “being left behind” is correlated with long-term growth (height and weight) outcomes. In addition, Halmdienst and Winter-Ebmer (2014) assess the long-run impact of childhood shocks on health using SHARE data from 11 European countries and find that having lived in a children’s home or in a foster family, or having suffered a period of hunger during childhood, are negatively correlated with health even after the age of 50 years.

In this model, the emphasis tends to be on intrauterine environment or early childhood, as these stages often represent the most critical or sensitive periods in which exposure takes place. While the intent of a critical or sensitive period approach would be to prevent adverse health conditions further along the life course, the relevant life stages targeted either for intervention, or for screening-related information gathering, would thus often be the periods of fetal development and early childhood. Prepregnancy and pregnancy would be understood as the context to these stages, but not necessarily as stages in themselves. The emphasis of a framework employing a critical period approach would be on the reduction of risk during these critical periods. For example, in a study of exposure to disease in early life on mortality over the entire life course using Swedish longitudinal data, Quaranta et al. (2014) emphasize the need to establish preventive measures to reduce disease exposure during the second and third trimesters of gestation and the first months of life, as well as the need to conduct medical screening

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1 A critical period refers to “the limited time window in which an exposure can have adverse or protective effects on development and subsequent disease outcome” while a sensitive period refers to “the time period when an exposure has a stronger effect on development and hence disease risk than it would at other times” (Ben-Shlomo and Kuh, 2002).
of people who are adversely exposed in early life. The critical or sensitive period approach is most applicable for activities such as:

- designing policies and interventions for health conditions across the life course that have their direct or indirect origins in exposures encountered prior or just after birth;
- making an investment case for reproductive, maternal, newborn and child health (RMNCH) as not only a programmatic focus in itself, but as a key component of any overall policy agenda directed at the prevention of both noncommunicable disease and future susceptibility to infectious disease; and
- ensuring adequate development and integration of pre-pregnancy, antenatal, and neonatal interventions into initiatives targeting general population health, as opposed to specialized silos.

3.2 Accumulation of risk

Another conceptual approach looks at health outcomes as the result of the accumulation of risks along the life course, with the understanding that the number or exposures incurred, and the duration of exposure, will ultimately affect the damage individuals experience and the likelihood of developing health conditions in the future (Ben-Shlomo and Kuh, 2002; Kuh et al., 2013; Lindström and Rosvall, 2014; Evans-Polce et al., 2014; Fink and Galea, 2015; Searle and Rockwood, 2015). Searle and Rockwood (2015), for instance, describe frailty and cognitive impairment among the elderly as a result of the intersection and accumulation of the natural biological and neurological changes that come with ageing (declining subcellular pathophysiology and systems mechanisms, impaired repair) and key environmental, medical and social exposures. Such exposures can be protective (physical activity, for example), or debilitating (onset of disease).

Ben-Shlomo and Kuh (2002) describe four varying ways by which accumulation of risk occurs. First, risks might be separate and independent of one another. For example, an individual encounters disconnected exposures – a work-related accident and subsequent disability; the death of a child; bankruptcy – that, taken together, increase the likelihood of health problems developing (Ben-Shlomo and Kuh, 2002).

Alternatively, risks might cluster in socially predictable patterns. For example, economically disadvantaged women are more likely to give birth to low birth weight children and depend on food assistance. This may lead to their children having poorer quality diets, experiencing more negative environmental exposures such as passive smoking or lead contamination, and having less access to education (Ben-Shlomo and Kuh, 2002). Similarly, in a prospective cohort study looking at African Americans from the age of six, Evans-Polce et al. (2014) describe the way in which childhood and adolescent experiences, family environment, expectations of academic achievement,
and socioeconomic status coalesce to influence both risk of drug and alcohol abuse and treatment seeking in adulthood.

Risks also might accumulate differentially depending on the birth cohort into which an individual is born, with health outcomes appearing in certain generations of people and not in others. Risks associated with birth cohort can be either event-based (e.g. children affected by the Dutch famine of 1944 and eventual health outcomes in adulthood) or related to rapid social or economic change (e.g. the long-term effects of the post-war “baby boom” on population health across the life course) (Kuh et al., 2003; Darnton-Hill, 2007; Davey Smith, 2007; Bengtsson and Mineau, 2009).

Finally, risks might link sequentially in what is interchangeably described as chains or pathways. In this accumulation of risk approach, one risk is seen as leading to another and then to another, eventually leading to a key risk that triggers the health problem (Ben-Shlomo and Kuh 2002; Kuh et al., 2003; Séguin et al., 2014; Lu et al., 2011; Lindström and Rosvall, 2014). For example, unemployment might lead to financial insecurity, which in turn might lead to the loss of home, then to family conflict and then to abuse. Abuse leads to emotional distress, then to destructive behaviour such as overeating, smoking or alcohol abuse, culminating in a noncommunicable disease (Ben-Shlomo and Kuh 2002). In a cohort study of young adults’ oral health in Hong Kong, Lu et al. (2011) tested an oral health chain of risk model and found that the economic circumstances of subjects were positively related to utilization of dental services, and this in turn affected their experience of tooth decay. Séguin et al. (2014) apply path analysis modelling to a study of suicide cases in Quebec so as to assess trajectories of factors that feed into increased risk of suicide across the life course. Lindström and Rosvall (2014) found that in Sweden the lack of internal health locus of control (a person’s belief in the possibility of influencing one’s own health) was due to higher levels of accumulated economic stress over time.

The accumulation of risk approach emphasizes the life course as a whole, from genetic inheritance, to intrauterine development, to health and social exposures unfolding across early childhood, middle childhood, adolescence, adulthood, and old age. Pregnancy, in this model, can be treated simultaneously as: a) the earliest stage of the life course (intrauterine development), and b) a contributing factor that both impacts and is impacted by clusters or chains of risk encountered in adolescence or adulthood. Genetics can also be accounted for in this model, as genetic inheritance is the first factor to consider when looking at individuals’ chains of risk. A framework that operationalizes an accumulation of risk model would focus on the entire life course, with particular emphasis on the stages of life during which clusters or chains of risk are likely to have the most long-term impact in relation to a particular health problem. The accumulation of risk approach, then, is useful for:

- clinically identifying potential future health problems in younger patients in order to begin screening processes and promote preventative measures;
• designing policies and interventions for health conditions by identifying and targeting populations of people exposed to clusters or chains of risks; and
• improving integrated health and social welfare programmes with the recognition that health conditions and socioeconomic deprivation often are mutually constitutive.

3.3 Social/ecological determinants

Another body of literature examines health problems that have their foundations in individuals’ socioeconomic circumstances (their “health ecology”) at different stages of their life course (Van Leeuwen et al., 2012; Hargrove and Brown, 2015; Mojola et al., 2015; Woodhead et al., 2015; Hawkins et al., 2006; Willows et al., 2012). The social/ecological determinants of disease model often takes a more sociological, ethnographic or ecological approach to health behaviour and health outcomes, understanding that the nonbiological factors influencing the life course are often not easily reduced to simple bi- or multivariate analyses of indicators. This approach looks at the life course within the context of families, neighbourhoods, communities and broader environments, and examines the ways in which history, politics, economics, social relationships and cultural perceptions inform expectations, choices, possibilities and opportunities (or lack thereof) for individuals and populations. For example, Willows et al. (2012) propose a socioecological life course model for better contextualizing the reasons for obesity in Aboriginal children and youth. The model demonstrates the reciprocity among levels that influence active living, the consumption of healthy foods and weight status, and recognizes that historical factors encompass and influence all levels. Van Leeuwen et al. (2012) investigate whether, independent of needs, the socioeconomic characteristics of the mother's country of birth are associated with psychotropic medication use in Swedish-born adolescents. The authors call for further research to clarify whether patients of different ethnicities whose parents have different life histories receive similar diagnoses and adequate treatment.

This sort of approach also has implications for research methodologies, with many articles focusing on qualitative methodologies, in particular ethnography and life history. Muirhead et al. (2013), for instance, look at child dental care decision-making by focusing on 10 families in Montreal and using a detailed life-history approach to explore and analyse the themes within parents’ lives that contributed to their decisions regarding their children’s dental health. They found that “parents described a process of ‘lay diagnosis’ that consisted of examining their children's teeth and interpreting their children’s oral signs and symptoms based on their observations. These lay diagnoses were also shaped by their own dental crises, care experiences and oral health knowledge gained across a life course of poverty and dental disadvantage”. Bristow et al. (2011) focused on children in six preschools in Liverpool, looking closely at cultural and social influences in childhood in order to understand better the factors that impact early childhood nutrition and how these factors might contribute to poor nutrition and health outcomes in adulthood. They argue that cohort studies that treat early childhood
socioeconomic status, inequality, social status, psychological stress and access to service retrogressively, and/or as simple variables, fail to capture adequately the how and why of exposure and risk.

The literature looking at the social determinants of disease seeks to delineate at which points along the life course socioeconomic factors cluster and why. For example, Mojola et al. (2015), describes how living in a resource-poor rural environment may encourage young men to migrate away for wage labour. This provides them with disposable income and facilitates their ability to marry in their home communities. However, it also creates a risk of practising unhealthy sexual behaviour in their place of work, leading to the spread of HIV and long-term, often intergenerational, health problems for themselves and their wives and children. The consequences of these may differ and change across stages of life.

In this model, the overwhelming focus is on social aspects of deprivation. Genetic inheritance or intrauterine environment, then, is of less importance than adversity encountered in early and middle childhood, adolescence and various sub-stages of adulthood. Pregnancy, in this model, is an element taken into account when considering the life stages of female adolescence and adulthood. A framework operationalizing a model based on the social/ecological determinants of health would begin with a focus on socioeconomic and ecological risk factors and their relation to the life course. This model, thus, is useful for:

- uncovering factors that feed into later life health outcomes that may not be otherwise elucidated by survey methodologies or analyses of empirical data;
- applying and integrating the life course approach across a far wider range of health problems, including those not specific to noncommunicable disease; and
- understanding the concept of “clusters” or “chains” of risk in a way that takes into account the complexity and messiness of social worlds, and that promotes community engagement in health interventions.

3.4 Health stock/potential

Alternatively, the life course might be conceptualized as the process by which initial genetic or intrauterine potential either receives inputs or depletes across individual life spans. This model, based on the idea of health capital, sees individuals receiving an initial stock of potential based on their genetic inheritance and the intrauterine conditions supporting prenatal development (Ben-Shlomo and Kuh, 2002; Guimaraes, 2007; Cinar et al., 2008; Bircher and Kuruvilla, 2014). The health capital approach borrows from the Meikirch model of health, which states that health is a state of well-being emergent from conducive interactions between individuals’ potentials, life’s demands, and social and environmental determinants. After birth, initial stock/potential is added to throughout the life course with inputs of mutually reinforcing “assets” or
“personally acquired potential”. These derive from such factors as an individual’s physiological or biological status, psychological state, behavioural choices and childhood and adult socioeconomic status, and from various broader environmental factors. At any given time, an individual holding higher health stock or potential can be assessed as ageing more healthily than an individual holding lower stock. For example, an individual may start with higher health stock, having been born to a healthy mother at a normal birth weight, and having received adequate nutrition in the womb. This stock then accumulates over time via inputs in early childhood from an improved material status of the family or community, higher levels of education and cognitive stimulation, provision of a sense of autonomy and affection, healthy behaviour and strong physiological biomarkers – all of which contribute to a healthier adulthood and old age (Guimaraes 2007).

The health stock/potential approach looks at the life course across all life stages, starting from genetic inheritance. As the model places emphasis on increasing well-being so that individuals enter old age with the greatest health stock/potential possible, the life stages targeted for intervention are those in which stock can be most accumulated (intrauterine environment; early childhood; middle childhood; adolescence). Pregnancy in this model is considered a contributor to intrauterine environment and a key stage in which “health capital” is first built. Depending on the health problem, it may also be considered an independent contributor to later life health stock (e.g. with the timing of pregnancy, birth parity, pregnancy-related weight gain and other pregnancy-related factors feeding into later life health conditions such as obesity or cancers). Health stock/health potential approaches contribute to:

- creating plans and policies focused not simply on the aversion of disease but also on the enhancement of well-being and the maximization of individual and societal potential for good health;
- developing targeted interventions aimed at either introducing protective health inputs into the life course, or removing negative ones; and
- analysing long-term cost-benefit analyses of health problems and interventions.

3.5 Synthesized approaches

The approaches described above suggest mutually exclusive models or theoretical paradigms. In reality, however, much of the literature on the life course examined in this review utilizes or advocates for a broad approach that takes into account critical periods, sensitive periods, social determinants and the accumulation of risks – whether along pathways or in social clusters – as well as potential (Halfon and Hochstein, 2002; Lu and Halfon, 2003; Darnton-Hill et al., 2004; Victora et al., 2003; Caspi et al., 2006; Pies et al., 2009; Mishra et al, 2010; Seo et al 2010; Power et al, 2013; Perez-Escamilla and Kac, 2013; Kuh et al., 2014; Umberson et al., 2014; Callahan et al., 2015; Fink and Galea, 2015; Hardy et al., 2015; Barakat-Haddad et al., 2012).
Halfon and Hochstein (2002) and Lu and Halfon (2003) refer to the integration of the critical/sensitive periods approach and the accumulation of risk approach as the *life-course health development model* to explain how different health trajectories develop. Lu and Halfon (2003) apply this model to the study of racial-ethnic disparities in birth outcomes in the US and argue that the black-white gap in reproductive potential widens in utero and early life, and possibly during puberty, pregnancy and other sensitive periods. The gap continues to widen due to differential cumulative exposures to risks and protective factors. Other authors refer to Bronfenbrenner’s *social ecological model (SEM)*, which looks at the life course as a complex relationship between interconnected systems (Perez-Escamilla and Kac, 2013).

These synthesized approaches attempt to integrate life course models within a unified framework and share in common certain characteristics in that they:

- understand that one’s health, at any given stage, is the result of intersecting and mutually influencing experiences, exposures and influences from prior stages;
- take into consideration *all* the factors that might influence health outcomes, whether genetic, intrauterine, biological, behavioural, psychological, familial, environmental, economic or social;
- look at the impact of such factors across *all* stages of life – preconception, infancy, childhood, adolescence, adulthood, old age – and recognize that these stages are connected;
- account for exposures experienced during critical or sensitive periods in fetal/early childhood development that may influence health later on;
- account for how these exposures influence, and are influenced by, other exposures across the life span that, taken together, have a cumulative effect on health outcomes and status later on;
- recognize that exposures or experiences can be deleterious and thus constitute risk, or be protective and thus constitute benefit; and
- target, integrate and coordinate prevention and promotion interventions across all stages of the life course, recognizing that these interventions will likely be multidisciplinary and multisectoral (adapted from Callahan et al., 2015).

For example, in a narrative review of diet, nutrition and chronic disease, Darnton-Hill et al. (2004) emphasize the interplay of genetic predisposition, fetal development and diet, nutrition and health-related behaviour across the life course – all of which are informed by economic, social, cultural and political environments encountered at different life stages. The authors emphasize that all these factors contribute in various ways to changes, often irreparable, to key biological processes which, in turn, may limit behavioural choices. Intrauterine growth retardation, premature delivery, overnutrition in utero, as well as family genetics, all have implications for long-term biological function in children, adolescents and adults, and are all associated with diabetes and
cardiovascular disease in adults. However, such biological functions are also impacted by diet, level of physical activity, and other health-related behaviours, which take place within the context of an individual’s family and peer relationships, socioeconomic status and culture. A life course approach to the role of nutrition in chronic disease, thus, must look at people more holistically and develop a range of clinical, behavioural, policy, regulatory and social welfare interventions.

Barakat-Haddad et al. (2012) uses the life course health development model to examine the impacts of childhood exposure to air pollution on respiratory health in adulthood. Using data from a cohort of participants who resided in four distinct neighbourhoods in Hamilton, Ontario, the study examined exposure to air pollution, indoor exposures, socio-demographic variables and health outcomes data. The study found that long-term exposure to air pollution did not predict respiratory conditions/symptoms in adults. On the other hand, childhood respiratory health did predict respiratory health in adulthood, suggesting that the exposures that impact respiratory health during critical or sensitive periods in childhood have long-term health impacts.

In one of the rare papers examining the life course in a LMIC, Victora et al. (2003) describe the Pelotas Birth Cohort Study, in which all 5914 hospital births taking place in maternity hospitals in Pelotas, Brazil, in 1982 were studied longitudinally through 2001. This was one of the first, and the longest, longitudinal studies carried out in a non-European or North American country. The research began as a study of perinatal health, collecting data on babies’ birth weight and length, and on mothers’ maternal weight and height, and demographic, socioeconomic and health, pregnancy and delivery characteristics. The birth cohort was followed up in 1983, 1984, 1986, 1995, 1997–2001, 2000 and 2001, with some follow-up phases focused on specific themes (i.e. overnutrition; army recruitment in 2000; household visits in 2001; children born to cohort women). Additionally, ethnographic (1997–2001) and dental studies were undertaken. Overall, 2000 variables were examined, including maternal health post pregnancy; childhood nutrition; growth and physical and psychological development; adolescent behaviour and mental health; and family and community influences. The authors take pains to describe the barriers to conducting longitudinal studies in a country like Brazil, including their difficulty in finding consistent funding sources and high loss to follow-up.

Synthesized approaches are an all-inclusive means of conceptualizing the life course. A framework based on an all-inclusive model requires articulating a very wide range of multisectoral factors in a way that can be readily operationalized by the end user to achieve their goals and objectives. Like with the accumulation of risk studies, synthesized approaches view pregnancy as: a) the earliest stage of the life course (intrauterine development), and b) a contributing factor that both impacts and is impacted by risks and exposures encountered in adolescence or adulthood.
For example, Callahan et al. (2015) conceive of life span stages as circular, with pregnancy sitting as a factor at the juncture between adolescent/young adult/adult and perinatal/infancy (see Figure).

### Box 1: Conceptual approaches to understanding the role of the life course in health

| 1. critical/sensitive period | • Determinative with or without later life risk factors  
Exposure during critical or sensitive period determines later health outcome.  
• Later life exposures modify outcomes  
Exposure during critical period leads to a health outcome only if another exposure happens later on. |
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Exposure to risk during a critical/sensitive period has irreversible life-long effects on individual biological structure, which remain regardless of later experience. |
| 2. Accumulation of risk | • Risks are separate and independent of one another.  
• Risks cluster in socially predictable patterns.  
• Risks depend on the birth cohort into which an individual is born.  
Risks link sequentially in chains or pathways. |
| Number and duration of exposures increase over an individual’s life course, leading to increasing cumulative damage. |
| 3. Social/ ecological determinants of disease | • The life course takes place within the context of families,  
neighbourhoods, communities and broader environments.  
Risks, exposures, and protective factors are partly determined by the choices, possibilities, perceptions and opportunities (or lack thereof) for individuals and populations that inform early life development, behaviour and socioeconomic status. |
| History, politics, economics, social relationships and cultural perspectives can be correlated with, and play a determining role in, health outcomes along the life course. |
| 4. Health stock /potential | • Most models start with initial input of “genetics/intrauterine conditions” as set, finite and depreciating from birth.  
• Other “stock” or “potential” inputs might be physiological/biological; psychological; behavioral; socioeconomic; and environmental at various levels (micro-, meso-, macro-environmental).  
Well-being is as much a focus as ill health. |
| Genetics and intrauterine development form initial capital, modified later on by the input of assets (socioeconomic, psychological, physiological) from which health stock/potential is derived; risk factors lead to depreciation of stock/potential. |
| 5. Synthesized approaches | • Health at any given stage, is the result of intersecting and mutually influencing experiences, exposures and influences from prior stages.  
• It is necessary to look at all possible factors: genetic; intrauterine; biological; behavioral; psychological; familial; environmental; economic; and social. |
| Critical periods, sensitive periods, social determinants and the accumulation of risks and potential – whether along pathways or in social clusters – are all interdependent and interconnect, and together play a role in health outcomes along the life course. |
It is necessary to address all stages of life: preconceptation; infancy; childhood; adolescence; adulthood; old age – recognizing that stages are connected. Both critical or sensitive periods and accumulation of risk are looked at simultaneously. Exposures or experiences can be deleterious and thus constitute risk, or be protective and thus constitute benefit. Prevention and promotion interventions should be multidisciplinary and multisectoral and target all stages of the life course.

Note: Adapted from Ben-Shlomo and Kuh (2002), Guimaraes (2007), and Bircher and Kuruvilla (2014)

4. Audiences in the life course approach to health literature

The literature review found not only different models for conceptualizing the life course approach but also that the approach was understood and utilized differently depending on the audience. This finding is important as it confirms the need to define carefully the audience for any life course framework or application. The audiences identified in the literature include clinicians, epidemiological researchers and health and public policy-makers and practitioners. Audiences, like approaches, are not mutually exclusive, and often intersect and overlap. Nevertheless, these different groups are often utilizing the life course approach toward slightly different ends. Here we discuss these audiences, with the recognition that sometimes papers address several audiences at once.

First, there is a body of life course literature that seeks, in part, to inform the clinical practice of health-care workers (Gans, 2006; Pretty, 2014; Daniels and Hassink, 2015; Searle and Rockwood, 2015; Hardy et al., 2015; Offidani et al., 2013; Jones et al., 2014). These authors advocate and/or provide evidence for physicians and other providers to integrate the life course approach into the development of personalized health care for their patients, identifying each individual’s risk and creating patient-relevant plans for prevention. Paediatricians, for example, might start by gathering information about their patients’ fetal and early childhood development, nutrition, family dynamics and activity-level. This would capture risks and exposures from the very beginning and help to build complete and accurate records on the life course of their patients (Daniels and Hassink, 2015). Physicians working with older patients can use the life course approach to assess which patients are most at risk for future cognitive impairment and tailor prevention and treatment programmes accordingly (Searle and Rockwood, 2015). In these papers, the life course approach represents the creation of holistic clinical pathways for individual patients. It encourages doctors to move away from reactively treating health problems as they emerge and instead to develop an overall projection of a patient’s future health based on his or her life experiences and exposures.

Alternatively, a number of articles target epidemiological researchers. In these articles, the life course approach is an analytical framework used to collect data for, report on
and advocate for health issues based primarily on longitudinal cohort studies, but also through other research designs such as cross-sectional studies that include some sort of time-based comparison (Victora et al., 2003; Callahan Caspi et al., 2006; Chittleborough et al., 2006; Bengtsson and Mineau, 2009; Popham and Boyle, 2012; Cable et al., 2014; Kuh et al., 2014; Umberson et al., 2014; Moscati and Mezuk, 2014; Frilander et al., 2015; Zhang et al., 2015; McCrory et al., 2015; Koike et al., 2016). Cable et al. (2014), for instance, argue in a narrative review of literature on life course epidemiology that longitudinal data is essential prior to any policy recommendations on reducing health inequalities, and recommends multidisciplinary collaboration in the collection of such data. Callahan et al. (2015) review the process of coming up with shared indicators on the role of the life course in maternal, newborn and child health in the United States. They assert that the choice of indicators and measures was restricted by the lack of consistent quality cohort and longitudinal data across all 50 states, with the result that many of the final set of agreed indicators rely on cross-sectional information.

Chittleborough et al. (2006) make a case for longitudinality to be built into population surveillance systems, especially with regard to linking data on early life socioeconomic indicators to health inequalities over time.

Others discuss the context of longitudinal data in LMICs, describing how only a handful of LMICs have the longitudinal birth cohort studies required to integrate the life course approach into public health efforts (Victora et al., 2003; Darnton-Hill et al., 2004). In a review of the longitudinal study from Pelotas, Brazil, Victora et al. (2003) emphasize why more longitudinal studies are needed in LMICs: “Findings from developed country cohorts cannot be automatically extrapolated to populations where the prevalence of intrauterine growth retardation and pre-term deliveries is considerably higher, where childhood infections are highly prevalent, and where malnutrition takes a heavy toll”.

The majority of life course epidemiology studies provide few details about the policy or programme relevance of their findings. A few, however, do provide a discussion of the public health implications of life course findings and the translation of findings into public health policy and interventions (Gary-Webb et al., 2013; Mitchell et al., 2015; Mosquera et al., 2015; Shoemaker et al., 2015). While papers often have overlapping audiences, this small subset of the literature thus targets a public health and public policy audience. Their intent is to use the life course approach to demonstrate that population health outcomes are due to a series of factors in individuals and communities that collectively develop over time. A life course approach, in this instance, might propose specific health promotion and prevention activities and/or social welfare interventions, or packages of activities, targeting different age categories across the life course.

Mitchell et al. (2015), for example, advocate for integrating skeletal health into a public health life course approach toward nutrition. Stating that bone health across the life course is tied to a range of factors from genetic potential for peak bone mass, maternal diet, birth weight and nutritional intake across childhood, adolescence and adulthood, the authors argue that public health nutrition programmes should aim health messages
and programmes at specific age groups across the life span. Nutrition programmes should target children aged up to 18 years with diet and exercise programmes aimed at achieving accrual of peak bone mass. Adults aged 19–64, by contrast, should be targeted for messages and programmes aimed at maintaining dietary intake of calcium and vitamin D and undertaking regular exercise, while adults over 65 receive messages and programmes aimed at preserving physical activity, promoting healthy lifestyles and avoiding environmental hazards.

Gary-Webb et al. (2013) look at how the life course approach has been used to create a framework for both research and policy that takes into account all factors that influence diabetes across the life course, beyond the traditional biomedical and behavioural factors. Factors include the role of genetics, intrauterine environment and socioeconomic status over time. The authors explain that “[p]aramount to this conceptual framework is the integration of factors across...inter-connected levels in influencing health outcomes...the framework incorporates a time dimension that extends beyond risk factors and disease processes in adulthood, and suggests that risk factors and development of diabetes are shaped by circumstances throughout the life course, including those encountered in early life.” The framework has fed into US Centers for Disease Control and Prevention (CDC) recommendations for implementing a life course focused diabetes prevention strategy, as well as The Diabetes Prevention Program. The latter sought to identify high-risk people based on a range of life course factors in order to better target anti-diabetes interventions.

Shoemaker et al. (2015) make a similar case for the role of the life course in public health policy and intervention when discussing the development of the Cancer Prevention Across the Lifespan (CPAL) working group at the CDC. The goal of the working group is to assess how risk and protective factors contribute to cancer development at different stages of life, and how can these factors be modified through policy, systems or environmental changes or other social or public health interventions. The working group seeks to define the range of data needed, establish a set of best practices, and spell out the role of public agencies in cancer prevention. They propose a set of multidisciplinary/multisectoral policies and programmes such as: a) reducing exposure to endocrine-disrupting chemicals, pro-tobacco advertisements and radiation from medical imaging; b) messaging on the danger of indoor tanning; c) promoting protective behaviours around factors such as the human papillomavirus vaccine, physical activity and healthy eating.

More recently, a group of women’s health advocates and researchers released a set of recommendations aimed at integrating the life course approach into the post-2015 women’s health agenda, particularly with regard to NCDs (Azenha et al., 2013). The authors point out that NCDs now represent a major health, social and economic burden that affects women around the world, yet it remains unclear how such diseases impact women in LMICs. They call on the post-SDG development agenda to realign its focus toward the creation of equitable health systems oriented toward the life course.
Approach, with a special emphasis on the integration of NCDs into appropriately resourced health frameworks and platforms for women. They argue that the life course approach should embrace the following priorities: a) access to universal health care; b) integration of NCDs into both general health systems and services — specifically those that target women’s health; c) promotion and implementation of innovative multisectoral partnerships and collaboration; d) strengthened investments in women’s health.

Other articles move beyond the focus on public health, toward more general public policy. For example, Mosquera et al. (2015) address both a public health and public policy audience in their study of income-related inequalities in cardiovascular disease (CVD) from mid-life to old age in a cohort of adults in northern Sweden. They point out that income inequalities are not static across the life course. Inequalities increase with age, with elderly people becoming gradually poorer. Whereas socioeconomic status, in particular unemployment, has been seen as an important risk factor for CVD, this factor is often measured with indicators assessing middle-life labour market participation. The authors state that, in fact, the creation of social policies addressing income-related inequality in old age is a critical life course intervention, especially as the older population is expected to increase in the future. In another example, Cullati (2014) addresses the work-life balance in Switzerland and its impact on self-rated health (SRH), using longitudinal data from the Swiss Household Panel measuring the association between exhaustion after work, difficulty in disconnecting from work, and work interference in private family obligations in relation to SRH across the life course. They assert that national policies and strategies to address work-family conflict are critical components of a life course approach to health.

We have thus far presented the various life course approaches and audiences in order to redirect the focus away from a discussion of the relevance (or lack thereof) of different models (and with it the discussion of whether or not there is need for a “new” model) toward a recognition of the validity of different perspectives and needs related to the life course approach. Any new framework should, therefore, carefully and explicitly define its audience and its intended application, with the understanding that it might not be possible to create a framework that does all things for all people. In the next section, we look at some of the applications of the life course approach in policy and programme settings. As will become evident, many of these applications have taken place in high-income country settings.

5. Operationalizing the life course approach

As has been shown, there is a substantial literature on the life course approach. However, the translation of life course theory and research into practice is far less developed. In this section, we present a few examples of how governments,
organizations and communities of practice have tried to operationalize the life course approach in their policy-making, planning, implementation and monitoring and evaluation.

5.1 The life course approach and the National Women’s Health Policy in Australia

In 1985, the women’s health movement in Australia called for a national women’s health policy. They advocated for the policy to be consistent with the WHO Health for All by 2000 strategy, particularly in regards to community involvement and recognition of the social basis for health (Gray, 1998). An extensive consultation process ensued, and in 1989 the National Women’s Health Policy and National Women’s Health Program were launched, making Australia the only country to have a comprehensive policy on women’s health (Department of Health and Ageing, 2010). The amount of Commonwealth funding set aside for the 1989 policy was, however, small and the government did not commit to ongoing funding for the programme. Rather, funding was provided for an initial four-year period (1989–1993) and again for a second period (1993–1997) (Gray, 1998; Gelb, 2009).

The 1989 policy was the basis for programme development and service planning for women’s health services at all levels of government. It also led to the establishment of the Australian Longitudinal Study on Women’s Health. This study began in 1995 and has run over a 20-year period, providing information to government and researchers on women’s health and well-being across three generations. Over 40 000 women participants have been surveyed at least four times over the past 12 years on issues including physical health, relationships, reproductive health, body weight, emotional and mental health, paid work and retirement, ageing and caring roles (Department of Health and Ageing, 2010).

The end of the second period of funding for the 1989 policy coincided with conservatives taking control of national-level politics. During the ensuing period of 1996–2007, national policies on women’s health were not updated, though the service structure that was developed under the 1989 policy remained in place (Gelb, 2009). With a change to a more supportive Commonwealth government in 2007, the decision was made to update the National Women’s Health Policy. Consultations beginning in 2009 focused on five principles – gender equity, health equity between women, a life course approach to health, a focus on prevention, and a strong and emerging evidence base – and the challenge of addressing inequalities stemming from the socioeconomic determinants of health. Launched in 2010, the updated policy emphasizes the importance of taking a life course approach “preventing the accumulation of health risk factors and giving girls and women the age-appropriate health care they need” (Department of Health and Ageing, 2010). However, the only new funding announced at its launch was $5.3 million for the Australian Longitudinal Study on Women’s Health – women’s groups expressed disappointment that no additional funding had been announced to further the policy’s goals (Metherell, 2010). While there is less
information available on the implementation of the life course approach beyond the policy arena, the Australia case provides an example of how the life course can be integrated into a national policy document in a way that looks at links across the life span, and focuses on the accumulation of risk and interrelationship of health outcomes.

5.2 The life course approach at WHO

One of the strategic objectives of WHO is “to reduce morbidity and mortality and improve health during key stages of life including pregnancy, childhood and adolescence and improve sexual and reproductive health and promote active and healthy ageing for all individuals” (WHO, 2010). Since the mid-1990s, WHO has promoted a life course approach as both a means of achieving such an objective and as a response to the growing global burden of noncommunicable disease.

In 1995, WHO launched the Ageing and Health Programme (AHE), formally adopting the life course approach for the first time. In 1999, the AHE and the UK International Longevity Centre carried out a joint workshop with financing from the Japanese Government (WHO/ILC-UK, 2000). The workshop led to a document that specifically addressed implications for curriculum development and training should countries choose to adopt a life course approach (WHO/ILC-UK, 2000). WHO then released the report on A Life Course Perspective of Maintaining Independence in Older Age. It looked specifically at the cumulative effect of fetal development, infancy and early childhood influences, adolescent and adult lifestyle, and social environment on disease across the life course and, in particular, on healthy ageing outcomes and the ability of older people to maintain functional capacity. A framework was developed to promote “action toward active ageing”, proposing a range of both individual and policy actions aimed at improving: fetal environment; early childhood environment; behaviours related to smoking; alcohol and physical activity; diet; adult disease; social integration; gender equity; and income security (Stein and Moritz, 1999).

In 2000, organizational restructuring at WHO led to the establishment of the Department of Noncommunicable Diseases Prevention and Health Promotion (NPH). In 2001, NPH held a meeting of experts on life course and health with the goal of improving the utilization of the life course approach for policy. A 2002 report reviewed evidence of life course impacts on risk of coronary heart disease, stroke and diabetes, and identifies agendas for policy and research (Aboderin et al., 2002). Though just focused on three diseases, the report sought to provide a starting point for life course assessments for other noncommunicable diseases. The following year, a joint WHO/FAO expert consultation on diet, nutrition and the prevention of chronic diseases met to review the latest scientific evidence from a life course perspective and update recommendations for action to governments, international agencies and other public and private sector partners (WHO/FAO, 2002).
In 2008, WHO established the Department of Ageing and Life Course within the Family, Women’s and Children’s Health Cluster, in order to attempt to more fully promote the life course approach across the organization. To date, however, the approach has not been fully integrated across the organization. Its many departments are instead focused on targeting disease- or health-problem objectives and prioritizing appropriate packages of projects or interventions (WHO, 2012).

For example, in 2010 WHO/Europe reiterated its objective to provide technical assistance to its 53 Member States so as “to deliver integrated, effective care in a continuum, rather than through separate and sometimes fragmented policies” (WHO, 2010: 2). The main policy document, however, is organized wholly around programmatic silos: maternal health, child and adolescent health, sexual and reproductive health, and healthy ageing. For each silo, age-specific packages of service are recommended (e.g. safe pregnancy initiatives, Integrated Management of Childhood Illness (IMCI) strategies, youth friendly services, safe abortion) without reference to the interconnection and interdependence of health problems across the life span. WHO’s experience with utilizing the life course approach thus far demonstrates the organizational challenges of translating a comprehensive theory into practice within a large organization.

5.3 Shifting to a life course approach in the maternal and child health field in the United States

Much of the detailed documentation of how the life course approach has been implemented within the context of public health initiatives can be found in literature describing efforts taking place in the United States. Here we describe in some detail six such attempts at applying the life course approach in the context of implementing MCH programmes both nationally and in specific states across the US.

*Conceptual frameworks and strategic planning*

In 2006, the Life Course Work Group (consisting of a small group of MCH experts) began to examine the application of the life course approach to the MCH field in the US. The goal was to ensure that life course stages were being addressed not as disconnected stages but as an integrated continuum (Pies et al., 2009). The state and federal MCH experts leading this effort believed that a paradigm shift in the MCH field was needed because the current approach was not working. This was demonstrated by the large and persistent gaps in the health status of mothers and infants of different racial-ethnic and socioeconomic groups (Pies et al., 2009). A meeting was held with MCH experts in 2008 to explore how the field would have to change by adopting, integrating and utilizing life course theory successfully in practice, policy, research and education and training. The meeting agreed to: 1) develop an overarching vision statement; 2) map the landscape of what is currently being done in the field and share it; 3) recognize that the life course approach offers multiple points for intervention; 4) utilize health equity as a guiding principle; 5) set an agenda to support priorities for changes in MCH policy; and
6) develop a toolbox for practitioners, academics and policy-makers (Pies et al., 2009). The experts discussed the need to merge two conceptual frameworks – the life-course health development model (Halfon and Hochstein, 2002; Lu and Halfon, 2003) and a health equity approach grounded in a commitment to rights, justice and equity.

Following this meeting, the Maternal and Child Health Bureau (MCHB) of the US Department of Health and Human Services commissioned a concept paper to clarify how life course theory could be used as a strategic planning framework, guiding its work as well as the work of its grantees and partners over five years. The paper noted that much of the work done thus far with respect to translating the life course approach into practice had focused on particular points in the life course (e.g. pregnancy or early childhood) (MCHB, 2010). Instead, the MCHB sought a framework and action plan that “promotes optimal health and health development across the lifespan, as well as across generations, and that promotes equity in health across communities and populations” (MCHB, 2010). It recognized that this transformation would require an iterative, collaborative effort by a broad “MCH learning community.” The paper identified six key life course concepts that they could use to redirect public health practice for greater impact: timeline, timing, environment, equity, interactive processes, and lifelong development/lifelong intervention. It concluded that change would require: a) expanding the knowledge base around both concept and practice; b) translating life course theory into concrete policy and programmes; and c) building political will (engagement and buy-in) among a broad base of stakeholders. Since then, a number of community-based MCH organizations across the US have been translating the life course approach into practice.

The Alameda County Building Blocks Collaborative
Shrimali et al. (2014) documents how the Alameda County Public Health Department (ACPHD) in California – utilizing the life course health development and health equity frameworks – launched the Building Blocks Collaborative (BBC). This is a multisector initiative to engage community partners in improving neighbourhood conditions in low-income communities, with an emphasis on young children. A broad range of stakeholders concerned about racial and economic inequities in children’s health came together to launch the BBC and develop a bill of rights that emphasizes the diverse factors that influence children’s health. Partners started working together to improve community conditions by learning and sharing ideas and strategies, with ACPHD staff linking participants to opportunities for learning more about the life course perspective and health equity.

With the stage set for thinking differently and for shared ownership (among over 100 partners from 50 plus organizations), BBC began serving as an incubator for projects such as: a) Food for Families which provides vouchers for fresh food to pregnant women; b) the County Prosperity Project to improve health by supporting financial well-being by helping residents access nonpredatory financial services; and c) the Best Babies Zone Initiative that develops solutions to neighbourhood issues and fosters new county
collaborations, with the goal of ensuring a healthy future for the neighbourhood’s children. The authors conclude that it takes time to achieve a paradigm shift, and that sufficient attention needs to be given to laying the groundwork for lasting change. They argue that it is important to welcome both the ambiguity required to develop new approaches and the contradictions intrinsic in challenging the status quo. They emphasize that the growth of BBC has been influenced by: supportive health department leadership; dedicated staff; shared vision and ownership; a flexible partnership structure; support for building BBC partners’ capacity; and broad collective goals that build on partners’ strengths, priorities and financial resources to allow learning, sharing, creating and launching of projects.

The Contra Costa County Life Course Initiative
In another county in California, the family maternal and child health programmes of Contra Costa County Health Services (CCHS) established a 15-year Life Course Initiative (LCI) in 2005 to guide its programmes and services (Pies et al., 2012). Rates of low birth weight and infant mortality continued to be high in the county, especially among African Americans, despite high rates of early entry into prenatal care. The LCI sought to reduce inequities in birth outcomes, improve reproductive potential and change the health of future generations through implementation of the life course approach in the maternal and child health programmes of CCHS. Its work was guided by the 12-point plan to close the black-white gap in birth outcomes, described in Lu et al. (2010).

In its first five years of implementation, LCI created educational materials on the life course perspective; conducted educational sessions about the new approach with staff, leadership and community partners; assessed the effectiveness of these sessions; established a team to oversee programme planning and evaluation activities from the life course perspective; and developed an intervention entitled Building Economic Security Today. Pies et al. (2012) point to several lessons learned. First, making a paradigm shift to a life course approach is a slow process and requires substantial groundwork. Gaining staff buy-in took longer than expected, so a flexible timeline was essential. Second, it was important to involve public health leaders and policy-makers early on to gain support for the immense amounts of staff time and programme resources that were needed to implement the LCI. Finally, it was a challenge to determine which measures to use to evaluate the LCI. The authors state that measuring outcomes intermediate to health outcomes (such as financial stability) is one approach for determining the LCI’s success.

The Wisconsin Lifecourse Initiative for Healthy Families
In another setting, Frey et al. (2014) assess the application of the life course perspective to a regional multimillion dollar funding initiative, the Wisconsin Lifecourse Initiative for Healthy Families. In 2010, the programme funded four two-year planning grants to develop strategic plans for improving birth outcomes among African Americans. The planning period was structured on the 12-point plan (Lu et al., 2010) which has three
intersecting domains: a) improving health care access over the life course; b) improving families and communities; and c) addressing social and economic inequities. The convening organizations for these grants engaged multisector partners around a common agenda, with emphasis on leadership from African American agencies and inclusion of leaders and community residents across the life span. Grantees used the funds to develop life course strategies that support women and their families to have healthy birth outcomes. Each collaborative sought continuation funding for work related to leadership, buy-in to the community action plan, change at the community and environmental levels, and leveraging resources. The planning process took longer than expected leading to the need for extension to allow all stakeholders to share a common language, build trust and set the stage for consensus building and joint action. Despite these challenges, the authors stated that the life course perspective was welcomed by the collaboratives, challenged community assumptions on the root causes of poor birth outcomes, and provided a unifying funding construct for organizing and planning complementary individual-level interventions with social and physical environmental change strategies.

The Northeast Florida Healthy Start Coalition
Brady and Johnson (2013) describe how the Northeast Florida Healthy Start Coalition adopted the life course approach in order to address disparities in infant mortality rates. The Coalition began by utilizing the life course framework in local planning and needs assessments in which they started with birth and ended with pregnancy, reversing the order used in previous planning. This re-ordering created a continuum starting at birth, included childhood and adolescence and ended at pregnancy, highlighting the cumulative effects of risks, health and social determinants at interim life stages (Northeast Florida Health Start Coalition, Inc., 2008). These assessments in turn led to modifications of key services so that they addressed not only health behaviours but also underlying social determinants and community factors. Group activities were developed to increase participants’ social capital; inter-agency collaboration was encouraged that went beyond just referral relationships; and participant advocacy and community leadership skills were cultivated to support social change in neighbourhoods.

The authors point out that one challenge encountered in implementation was that while initially staff were positive to the new approach, it became difficult to sustain change once it was brought to scale – group activities required more work from staff than was needed for traditional one-on-one case management services. Another challenge was related to resources, in that funding levels were not sufficient for programmes needed to address social determinants and community development, and existing funding was primarily targeted to individual interventions and outcomes. A third challenge was the lack of intermediate outcome measures that can be used by community-based programmes in addition to available process measures and qualitative information. The authors summarize that operationalizing the life course approach is a lengthy process, and required the Coalition to think in a new way about risks, levels of interventions and the way services are organized and delivered. Successfully addressing these requires
investment in staff training to promote buy-in, flexible resources and the development of new metrics for measuring individual and programmatic impact.

The development of MCH programme indicators
Based on these experiences, the US Association of MCH Programs began in 2012 to develop indicators to assess, monitor and evaluate the application of the life course approach in public health at the state or community level (Callahan et al., 2012). The life course stages considered were perinatal/infancy, early childhood, school age, adolescent, young adult and adult. With the participation of a team of MCH experts, 413 indicators were initially proposed and 59 indicators were chosen for final recommendation as MCH life course indicators. Indicators were chosen after assessment of five core features related to the life course approach – equity, resource realignment, impact, intergenerational wellness and life course evidence – and on the three data criteria of quality, availability and simplicity. The final set of 59 indicators overlap with existing MCH measures, demonstrating that shifting to a life course approach does not require starting from scratch. The final set does, however, include indicators not as commonly used for MCH programmes, such as fluoridation, concentrated disadvantage and homelessness. The authors note limitations with the final set of indicators and point out that, because of current data availability, the availability of indicators on resiliency and protective factors is restricted. They also note a lack of indicators in the final set that are based on longitudinal data because of a lack of this type of data. This means that many of the indicators rely on cross-sectional data that cannot be specifically tied back to related critical periods as defined through research on life course development.

6. Summary and recommendations

Populations and health issues studied in the life course literature
Much (although not all) of the literature on the life course focuses on NCDs – in particular obesity, diabetes and CVD – along with dental and bone health, and cognitive function and physical mobility in old age. This means the literature is biased toward: a) adults and b) higher-income countries where the burden of NCDs is now quite high. Currently, many LMICs share an equal, if not greater, burden of infectious disease, and the population pyramid in these countries is skewed toward children and adolescents. Adults in many LMICs do not reach old age, dying of infection or accident sometime between childhood and mid-adulthood. In many countries there is a demographic transition underway in which NCDs will gradually become more and more prevalent. However, currently, much of the existing literature has limited relevance to the health problems in LMICs. Any framework on the life course must involve strong consideration of the particular needs, concerns and realities of ageing in the global south. How can a framework account for HIV, TB, malaria, pneumonia, malnutrition, maternal health conditions, water and sanitation-based diseases and other health problems?
Life course approaches and audiences
The life course approach is not a one-size-fits-all model. The approach can be applied in a number of different ways, depending on the audience and the health problem targeted. All models have their uses and, more often than not, authors attempt to synthesize approaches. A life course framework should synthesize models, but also have a clearly specified purpose, objective and audience.

Age categories for a life course approach framework
There is no clear age range in the literature establishing set age categories (and age ranges) across the life span. Some papers include a clear differentiation between infancy, early childhood, middle childhood, adolescence, early adulthood, middle adulthood and old age. Others do not even specify what is meant by, for example, adolescence.

In terms of the position of pregnancy in the life course, it depends on the approach used, the health problem considered and the particularities of the available cohort data (i.e. because so many studies report on birth cohorts, age ranges depend on when researchers returned to study the cohort and, thus, are not fixed). A critical or sensitive period model understands pregnancy as placed together with fetal development. However, an accumulation of risk model examining obesity, for example, might see pregnancy as both a factor in fetal development and a factor in adult health risk. An accumulation of risk model studying the risk of breast cancer might see pregnancy in relation to inheritance of genetic predisposition, or timing of pregnancy in relation to both risk and protective factors. Pregnancy, thus, can be simultaneously a stage and a factor. One of the better models for conveying the placement of pregnancy on the life course is from Callahan et al. (2015). This conceives of life span stages as circular, and positions pregnancy as a factor at the juncture between adolescent/young adult/adult and perinatal/infancy. Furthermore, the paper by Brady and Johnson (2013) describes how a community-based MCH organization utilized the life course health development framework in local planning and needs assessments in which they started with birth and ended with pregnancy, reversing the order used in previous assessments, and creating a continuum that highlighted the cumulative effects of risks, health and social determinants at interim life stages.

One vital issue when assigning chronological age-to-age categories is that age categories are, frequently, socially (not biologically) determined. This is especially the case outside of high-income countries. For example, the word adolescent does not precisely translate into many African languages. In the case of, for example, Kiswahili, the word kijana more accurately refers to youth, a social category that is not limited to someone aged 13–18, but rather defines a (typically male) individual who has not yet undergone the key social transitions necessary for adulthood (e.g. circumcision, marriage, birth of a child, accumulation of property). Moreover, there may be no local word for female adolescent, as any young female person who has not yet had a child might be considered still a girl. Therefore, while specifying chronological age categories might be
helpful to clinicians or policy-makers seeking to understand purely biological change, they may be meaningless for interventions targeting socioeconomic or cultural factors. Age categories should therefore be developed with insight from the communities in which they will be used.

Factors for a life course approach framework
A wide range of factors are represented in the overall body of life course literature, but the presence of different factors in specific articles is largely determined by the topic of the research being reviewed. Genetic inheritance is discussed, for example, in papers on mental health, body fat and obesity, bone health, diabetes and other health conditions for which there is clear evidence of genetic links to disease. Intrauterine environment and fetal development, including maternal health and nutrition, is discussed, as is birth height and weight, growth, development and nutrition in infancy and early childhood, in papers on dental and oral hygiene, body fat and obesity and risk of NCDs in adulthood. Many papers also describe other factors, including socioeconomic status of families and communities (e.g. material or economic deprivation); psychological conditions (e.g. feelings of helplessness); behavioural issues (tobacco use, alcohol, self-harm, over-eating); as well as sociocultural, political, environmental and historical contexts (e.g. community perceptions of deprivation, public policy environments, environmental degradation and events specific to certain birth cohorts).

The myriad of factors influencing health over the life course are thus well-represented in the literature. Less represented, however, are: a) an understanding of such factors’ role in influencing the life course in LMICs; and b) an in-depth analysis of the many nongenetic or nonbiological factors described as influencing the life course. Aside from a handful of studies (in particular, Victora et al., 2003, on Pelotas, Brazil), the literature does not provide much insight into how lives are lived in the global south, nor the challenges and barriers to integrating a life course approach into local health systems. Social, cultural, economic and behavioural factors are not infrequently treated as variables associated with disease (and thus technical issues that can be targeted with interventions) rather than the complex, messy, unpredictable ingredients of human lives lived (the hows and why's of the life course).

In efforts to shift to a life course approach in MCH programmes in the US, a broader conceptual framework was utilized (Callahan et al., 2015) in which factors were not pre-specified. This broad conceptual framework is now being utilized by community-based MCH organizations to educate staff, leaders and the community about the life course approach, and then to generate factors, interventions and additional partners through bottom-up, multistakeholder planning processes.

Operationalizing the life course approach in policies and programmes
Experience with translating life course theory and research findings into practice is limited. From the few examples we have, it has been shown that three broad areas need to be prioritized to operationalize the approach: 1) expansion of the knowledge base
around concept and practice; 2) translation into concrete policies and programmes; 3) building of political will and stakeholder engagement. Lessons learned from the experience of shifting to the life course approach in MCH programmes in the US include: a) shifting to a life course paradigm takes time and requires a flexible timeline in order to lay groundwork for lasting change, including creating a common language, setting broad collective goals, building trust and gaining buy-in from staff and partners; b) sufficient and flexible resources are needed to allow learning, sharing, creating and launching of projects; c) outcome measures for assessing life course interventions need to be developed, and; d) supportive leadership and dedicated staff are essential.

Research implications of the life course approach:
The life course approach draws on data from long-term cohort studies and therefore sits in contrast to the current emphasis in global health on decision-making based on findings from randomized controlled trials. Moving forward with a life course approach therefore requires investment in long-term cohort studies in LMICs. Victora et al. (2003) point out that the structure of research funding toward LMICs is often subject to “donor fatigue.” In the case of the Pelotas, Brazil, cohort study, “funding agencies were prepared to support only one, or at most two, phases of the cohort. Lack of funding precluded a more regular schedule of visits, and more than once the sampling fractions were determined by availability of funds rather than by scientific principles, as for example in the 1983 and 1995 follow-ups” (Victora et al., 2003, p. 1254). Implementation of the life course approach in global health, therefore, requires a paradigm shift within the field that not only engages with a new conceptual framework and operationalizes the approach in policies and programmes, but also prioritizes funding to longitudinal cohort studies in LMICs.
References


Evans-Polce RJ, Doherty EE, Ensminger ME (2014). Taking a life course approach to studying substance use treatment among a community cohort of African American


Gelb J, Palley ML (2009). Women and politics around the world: a comparative history and survey. Santa Barbara: ABC-CLIO.


http://dx.doi.org/10.1037/hear0000147


