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Commentary: Value of the life course approach to the health care of older people

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Population ageing is a global phenomenon, and increasing numbers of people will now live into their sixties and beyond.[1] Understanding the link between ageing and health is of major importance, and Ben-Shlomo and colleagues have contributed critically to the field through life course epidemiology studies exploiting rich data from an array of birth and ageing cohorts, as described in their review in this special issue.[2] The authors describe how the seminal work of David Barker from the 1980s focusing on the fetal and developmental origins of health and disease (DOHaD) was the catalyst for a revival in a life course approach to epidemiology, and they outline three key phases—the first focused on clinical disease end-points as exemplified by DOHaD, the second focused on an expansion of outcomes to include measures of physiological function and the third focused on the application of life course epidemiology to the study of ageing. Of note, ageing was featured in early DOHaD research, as evidenced by innovative findings from the Hertfordshire Ageing Study, a birth cohort with historical records of early growth from the 1920s, which demonstrated that small size in early life was associated with markers of accelerated ageing across a range of body systems in later life.[3] This work led to a chapter describing a life course approach to biological ageing in the second edition of the original life course textbook.[4]

The ageing markers studied in the Hertfordshire Ageing Study included increased lens opacity, reduced hearing, thinner skin and lower hand grip strength; the latter has led to a series of studies investigating early influences on sarcopenia, the loss of skeletal muscle mass and function with older age. Life course studies have subsequently demonstrated consistent relationships between low birthweight and lower muscle strength in later life,[5,6] independent effects of pubertal growth on midlife grip strength[7] and strong associations between body mass index from age 15 years[8] and physical activity across adult life,[9] respectively, and strength in early old age. Interestingly, Ben-Shlomo and colleagues highlight the importance of identifying the consequences as well as the causes of functional change. Systematic reviews have now identified a range of adverse health outcomes associated with lower muscle strength across the life course, including increased disability, morbidity[10] and mortality.[11] Characterizing lifetime functional trajectories is another important area identified. Because longitudinal data across the life course are not yet available for muscle strength, trajectories have been approximated by combining cross-sectional data from multiple cohorts with an age range of 4–90 years.[12] The ultimate availability of life course data on physical and cognitive function from prospective birth cohort studies, such as the Southampton Women's Survey (SWS), is an exciting prospect. For example, grip strength was first collected at 4 years of age and is currently being collected in 11–13-year-old children participating in the SWS.[13] Representative cohorts recruited in mid and late life are also important, enabling findings to be translated into policy and practice in the shorter term.

Direct demonstration of the value of life course epidemiology to the health care of older people has been identified as a major challenge, but progress is now being made. For example, methodological advances in the UK have allowed linkage of birth cohort data from the Hertfordshire Cohort Study to routine National Health Service data on Hospital Episode Statistics, thereby facilitating research into the life course determinants of hospital

admission. A recent novel finding is that low grip strength in community-dwelling older men and women predicts the likelihood of hospital admission during the following decade, after adjustment for potential confounders.[14] This adds to existing evidence that grip strength measured on the day of admission to hospital is associated with the subsequent length of stay.[15] To improve the health and health care of older people, it will be necessary to translate the results of life course epidemiology focusing on aetiology to the development and evaluation of successful interventions. Much can be learned from clinical disciplines such as geriatric medicine where the results of longitudinal epidemiological studies have informed the development of interventions to improve functional outcomes in older persons.

A study from 1999, using data from two cohort studies, found that among community-living older persons, baseline vulnerability and precipitating hospital events contributed independently to the development of functional dependence, and proposed that each should be targeted for intervention.[17] However, it was noted that ascertaining the occurrence of disability using long assessment intervals could be problematic because of failure to account for the possibility of recovery or for deaths or losses to follow-up. A subsequent study comparing the rates of disability obtained from single follow-up assessments with those obtained from monthly assessments for intervals up to 24 months found that the occurrence of disability was substantially underestimated by longitudinal studies with long assessment intervals.[18] The primary reason for this is that disability is a dynamic process that is often characterized by repeated episodes of disability and recovery over discrete periods of time.[19] When trying to predict the occurrence or progression of disability, it is intuitively appealing to consider changes or trajectories in important risk factors, such as functional limitations, as suggested by Ben-Shlomo and colleagues; but there is some evidence that changes in physical performance over time do not add useful prognostic information beyond that available from a single assessment.[20]

Importantly for translational relevance, this observational research has been accompanied by intervention studies, including a ground-breaking trial showing the benefit of a home-based programme targeting underlying impairments in physical abilities in preventing functional decline among physically frail, older people.[21] In the UK, life course epidemiology is also starting to be linked to intervention. The Hertfordshire Physical Activity Trial was an exploratory study that demonstrated the feasibility and acceptability of a 12-week aerobic exercise intervention in participants recruited from a birth cohort (the Hertfordshire Cohort Study); the intervention had a beneficial effect on the Timed Up and Go test but not grip strength.[22] Incorporating intervention studies into observational cohorts is an efficient approach but can potentially alter functional trajectories. Therefore this has to be taken into account when designing analysis strategies.

In summary, there are several promising avenues that will enhance the value of a life course approach to the health care of older people, including linkage of cohort data to routine data on health care, using insights from the clinical care of older people to answer important questions with translational relevance and applying life course findings to the development and evaluation of interventions. These approaches can only enhance the already extensive contribution of life course epidemiology to the field of ageing research.

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Commentary: Life course epidemiology: the past two decades and future directions

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Life course epidemiology has the great potential to help us understand why and how we age. Ultimately, the goal of such research is to identify the critical time points where interventions could ameliorate the disabling consequences of ageing. Epidemiological studies have assessed risk for disability in late life or have focused on longevity. It is now clear that we need to look back to earlier points in life to understand the origins of these important outcomes. The review by Ben-Shlomo, Cooper and Kuh[1] provides an important perspective on how life course and ageing research are linked and can inform each other.

Ageing is most easily recognized in the very old with a stereotypical pattern of slowing gait, greying hair and loss of function in many organ systems. For being so universally recognizable, it is perhaps surprising that ageing is so difficult to measure. Genetic and environmental manipulations such as caloric restriction clearly promote longevity in animal models.[2] In these models, researchers are advocating for more emphasis on measuring health span and adopting measures of the signs of ageing such as motility or mobility.[3] In humans, measures of physical and cognitive performance are often used to define the degree or rate of ageing.[4] Changes in these domains are often only apparent very late in life.[5] This lack of sensitivity results in a 'ceiling effect', where we cannot detect better than usual function. Since most younger-old and middle-aged adults function in this