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Human Kinetics
COMMENTARY

Relevance of Life Course Epidemiology for Research on Physical Activity and Sedentary Behavior

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The importance of physical activity for health, well-being, and the economy is well established.[1] However, much assumed knowledge in this field is based on methods that empirically fail to consider that life circumstances, including physical activity and sedentary behavior, constantly change across the lifespan. To date, most epidemiological research on determinants and health consequences of physical activity and sedentary behavior has relied on the premise that behaviors (eg, physical activity) and social conditions (eg, socioeconomic position) assessed in one time point represent an individual's behavior or condition over the years. With the increased availability of historical data, it is becoming apparent that assumptions about the causes and consequences of physical activity and sedentary behavior may have been overly simplistic. This commentary intends to reinforce the broad appeal of the life course perspective and raise discussions on how physical activity and sedentary behavior research could benefit from complementary approaches and methods of life course epidemiology.

Life course epidemiology was first defined in 1997 as "the study of long-term biological, behavioural, and psychosocial processes that link adult health and disease risk to physical or social exposures acting during gestation, childhood, adolescence, earlier in adult life, or across generations".[2] However, despite growing interest in using life course epidemiology models to explore causal pathways between risk factors and development of diseases in adulthood,[3] the use of life course models in physical activity research is still limited to few studies. This is demonstrated by a rapid search on PubMed for studies that include broad terms for physical activity and life course in the title or abstract (Figure 1).

Many Life Stories in One Time Point

Although maintaining physical activity and sedentary behavior at recommended levels over time is thought to be essential for good health, physical activity levels change continually across the lifespan. For example, it may be the case that the current low levels of physical activity and high sedentary faced by many readers of this journal is a poor representation of their physical activity levels during childhood and adolescence (as it is the case of the author). In fact, the current state of knowledge still does not allow us to comprehend the extent to which the physical activity accumulated in specific periods of the lifespan may trigger health benefits later in life or whether the benefits of high levels of physical activity accumulated during a life stage are "washed out" when life constraints lead to periods of inactivity.

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Physical activity research can benefit from several conceptual models that focus on the nature and determinants of life transitions, timing, links to events in other life stages, and respective consequences for human health and development.[2] Conceptual models such as critical/sensitive period models, accumulation, chains of risk models, and trajectories[3] can be modeled to address different aspects of the individual's life history related to physical activity, thus accounting for the variety of life stories that remain hidden when physical activity and sedentary behavior are considered only in a single time point.

For example, the accumulation hypothesis assumes that cumulative exposures during the life course increase the risk of disease regardless of the timing.[3] Modeling this hypothesis in physical activity means exploring the extent to which growing a "physical activity bank savings" throughout the lifespan is important for preventing diseases. In addition, if the accumulation of physical activity is important irrespective of timing, public health messages could be tailored to consider the broad saga of an individual's physical activity. Furthermore, this could also mean that periods of inactivity imposed by life constraints may not be as deleterious to health as thought, as long as an individual has enough savings in their physical activity bank or compensates for the negative balance in the near future.

Critical and sensitive period models focus on the timing of exposure.[3] Critical and sensitive periods can be used to explore how biological and social transitions during life stages may have more impact on behavior adoption and risk of disease than other times. These life course models are well placed to explore how physical activity during specific trimesters of gestation impacts early development or to investigate in which time-window during childhood and adolescence enhancing participation in physical activity would have the most substantial effect on the maintenance of physical activity during adulthood.

Another approach still to be further explored in the field of physical activity is the modeling of physical activity trajectories. Recent studies have modeled trajectories of physical activity using a variety of methods[4,5] and investigated whether the risk/protective effect associated with physical activity is different between those who have always been active and those who were always inactive or became inactive. Overall, the findings from these studies have suggested that individuals who were inactive in a period of life but became physically active during mid-age had better health outcomes than those who were always inactive.[4,5]

A life course framework is also a powerful tool for better understanding the determinants and social inequalities in physical activity, hence providing important insights into how social inequalities impact the etiology of chronic disease conditions. This has been demonstrated in previous studies that found childhood socioeconomic position may have a lasting impact on physical

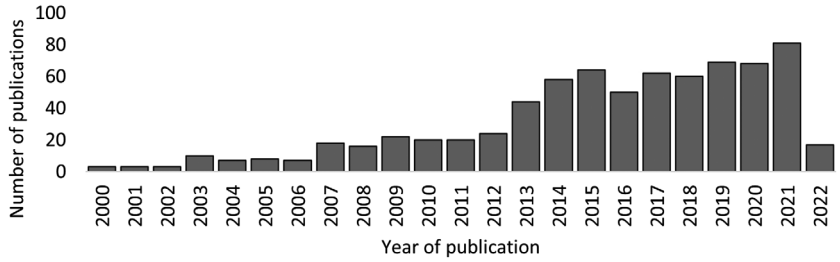

Figure 1 — Number of publications[a] identified by literature search on PubMed. March 2022. [a]Search terms: ("physical activity"[Title/Abstract] OR "exercise"[Title/Abstract] OR "inactivity"[Title/Abstract]; >400,000 titles retrieved) AND ("life course"[Title/Abstract] OR "lifecourse"[Title/Abstract]; > 10,000 titles retrieved).

activity and sedentary behavior even when the adult socioeconomic position is taken into account.[6,7] In addition, it has been shown that intergenerational social mobility may affect physical activity. Even when socioeconomic changes occur between generations, it may take further generations before the full implications regarding physical activity levels are felt.

Life course epidemiology has challenged the complacency of the adult lifestyle model of chronic disease risk. It can be used to elucidate new mechanisms and disease pathways, and to explain social, geographical, and temporal patterns of disease distribution.[8] Using the life course epidemiology framework in physical activity and sedentary behavior research can provide a rich and interdisciplinary opportunity to understand how the contribution of early life factors influence and interact with physical activity on determining health in adulthood. Furthermore, this framework can be adopted to drive research that acknowledges that people's lives are uniquely shaped by the timing and sequencing of life events,[8] hence providing insights into how public health interventions could embrace real-world complexities to increase population level physical activity.

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References

1. Bull FC, Al-Ansari SS, Biddle S, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *Br J Sports Med*. 2020;54(24):1451–1462. PubMed ID: 33239350 doi:10.1136/bjsports-2020-102955
2. Kuh D, Shlomo YB. *A Life Course Approach to Chronic Disease Epidemiology: Tracing the Origins of Ill-Health from Early to Adult Life*. 1st ed. Oxford University Press; 1997.
3. Kuh D, Ben-Shlomo Y, Lynch J, Hallqvist J, Power C. Life course epidemiology. *J Epidemiol Community Health*. 2003;57(10):778–783. PubMed ID: 14573579 doi:10.1136/jech.57.10.778
4. Gomes GAO, Brown WJ, Codogno JS, Mielke GI. Twelve year trajectories of physical activity and health costs in mid-age Australian women. *Int J Behav Nutr Phys Act*. 2020;17(1):101. PubMed ID: 32778110 doi:10.1186/s12966-020-01006-6
5. Saint-Maurice PF, Coughlan D, Kelly SP, et al. Association of leisure-time physical activity across the adult life course with all-cause and cause-specific mortality. *JAMA Netw Open*. 2019;2(3):e190355. PubMed ID: 30848809 doi:10.1001/jamanetworkopen.2019.0355
6. Mielke GI, Brown WJ, Ekelund U, et al. Socioeconomic position and sedentary behaviour in Brazilian adolescents: a life-course approach. *Prev Med*. 2018;107:29–35. PubMed ID: 29277415 doi:10.1016/j.ypmed.2017.12.008
7. Silverwood RJ, Pierce M, Nitsch D, Mishra GD, Kuh D. Is intergenerational social mobility related to the type and amount of physical activity in mid-adulthood? Results from the 1946 British birth cohort study. *Ann Epidemiol*. 2012;22(7):487–498. PubMed ID: 22534178 doi:10.1016/j.annepidem.2012.03.002
8. Ben-Shlomo Y, Kuh D. A life course approach to chronic disease epidemiology: conceptual models, empirical challenges and interdisciplinary perspectives. *Int J Epidemiol*. 2002;31(2):285–293. PubMed ID: 11980781 doi:10.1093/ije/31.2.285