Educational inequalities in life expectancy: Measures, mapping, meaning

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Abstract: Inequalities in life expectancy by education have long been a focus of epidemiological and demographic research. Monitoring these inequalities is important, and it comes with challenges. For many of these challenges there is no easy solution. We argue that researchers need to be aware of them when studying, and reading about, educational inequalities in mortality. In this editorial, we outline some of these challenges. Most of them are not restricted to educational inequalities in mortality, but apply more broadly to socio-economic inequalities. Specifically, we see three main challenges: measures, mapping, and meaning. These challenges relate to three questions. How do we measure inequalities? How do results map to policy measures? And what meaning do the results have in a broader context of mortality change?

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Individuals with low socio-economic status have, on average, a shorter lifespan than individuals with high socio-economic status. These inequalities are found across the globe; they are large; and they are persistent over time. Socio-economic inequalities in life expectancy are a key challenge of modern societies. They are both a cause and a consequence of unequal opportunities, and they have far reaching consequences at both the individual and the societal level. For instance, they are a serious concern for the equitable design of pension policies, as individuals with high-socio-economic status spend more time in retirement and receive pensions for a longer time [1].

Inequalities in life expectancy by education have long been a focus of epidemiological and demographic research, as education is comparatively straightforward to measure, it is fixed from early adulthood and precedes other markers of attained socioeconomic status such as income or wealth, and it is a strong predictor of the overall socio-economic status [2]. Trends in educational inequalities in mortality are heterogeneous across countries. The gap between the lowest and highest educated has increased in some countries and decreased in others [3].

The paper by Zazueta-Borboa et al. [4] provides an important contribution to our understanding of these changing inequalities. Using high-quality register data from three European countries (England/Wales, Finland, and Italy represented with data from Turin), it assesses long-term trends in the gap in remaining life expectancy at age 30 between the high and low educated from 1971/72 to 2017/19. A key finding is that all countries experienced both narrowing and widening gaps in life expectancy across educational groups, or what they refer to as "reversals of inequalities". For Finnish men inequality first increased over time, but recently started to decrease; and for English men the opposite holds. Using decomposition techniques, the authors show these reversals have largely been driven by the mortality dynamics of the low educated aged 30 to 54. This accords with research arguing that differences in the institutional, economic, and environmental contexts matter most for disadvantaged groups [5].

Monitoring inequalities in life expectancy is important, and it comes with challenges. For many of these challenges there is no easy solution. We argue that researchers need to be aware of them when studying, and reading about, educational inequalities in mortality. We outline some of these challenges below. Most of them are not restricted to educational inequalities in mortality, but apply more broadly to socio-economic inequalities. Specifically, we see three main challenges: *measures*, *mapping*, and *meaning*. These challenges relate to three questions. How do we measure inequalities? How do results map to policy measures? And what meaning do the results have in a broader context of mortality change?

First, there are many *measures* available to assess mortality inequalities, and our assessment might depend on the measure we use. Zazueta-Borboa et al. used the range in life expectancy, which ignores the impact of intermediate groups on the gradient. Measures also vary in their response to mortality change at different ages, as well as in their substantive interpretation. Life expectancy is equal to the average length of lifespans in a life table population. In contrast, measures of lifespan variation move away from the average and aim to capture the variability in lifespans. This includes, for instance, the variance of lifespans.

The variance of lifespans can be decomposed into the variance between educational groups and the variance within educational groups. Empirically, the variance between educational groups is much smaller

than the variance within groups, and education explains only little of the overall variance, usually less than 10% [6]. While low explanatory power is not uncommon for socio-economic variables, it puts educational inequalities into perspective, and there are many other factors determining the length of lifespans. Recent methodological developments try to reconcile inconsistent findings from different measures with new approaches which take into account both the overall variability of lifespans and the relative performance of different socio-economic groups [7].

Second, is the question of how measures are *mapping* to policy recommendations and interventions. Measures based on life tables – including life expectancy and measures of lifespan variation – do not use the actual age structure of populations, but the artificial age structure implied by the life table. This has the benefit of removing the impact of the age structure from group comparisons, making these comparisons easier to interpret. However, policy interventions are not applied to artificial but to real populations. For instance, consider two groups which have the same age-specific mortality rates, but one group is very young and the other group is very old. When comparing life tables, both groups will appear to be equal. However, if mortality rates increase with age, the older group will have more deaths. When the older group is also the more disadvantaged (as in the case of the low educated) reducing inequalities at older compared to younger ages would have a larger absolute impact on the total inequalities, even if relative inequalities in rates are smaller at these ages [8].

Finally, the changing magnitude of mortality inequality only has *meaning* in a broader historical context of intertwined social, economic, and political developments. What do inequality trend reversals really mean? By analyzing these reversals, Zazueta-Borboa et al. [4] implicitly suggest that inequalities in life expectancy should remain stable. Why should we expect this? Life expectancy regularly converges and diverges between populations [9]; diseases rise and fall [10]. Inequalities widen when medical innovation is first adopted by the most advantaged, and narrow as technologies become widely available. New healthy and unhealthy behaviors also spread through social diffusion processes [11]. The myriad of pathways through which socioeconomic status acts as a fundamental cause of disease cause both continuities and change in mortality gradients [12]. These more distal long-running patterns occur simultaneously, and on top of the more proximate policy changes singled out by Zazueta-Borboa et al. in the discussion. While it is certainly plausible that changing alcohol patterns (Finland) and austerity measures (UK) are driving some of these patterns we are witnessing, we have to be careful in interpreting trend reversals in all-cause mortality through shifts in single policies without an eye on longer-running mechanisms.

Reducing educational inequalities in mortality, and socio-economic inequalities more broadly, will crucially depend on reliable reporting of levels and trends, and on identifying viable targets for interventions based on this reporting. Understanding mortality measures, how they map to policies, and their context-depending meaning is required to achieve these aims. The paper by Zazueta-Borboa et al. [4] takes an important step in this direction.

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