Commentary: Did Preston underestimate the effect of economic development on mortality?

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A welcome antidote to medical nihilism...

In the mid-1970s, when Preston's classic article appeared, the field of population health research was in the spell of Thomas McKeown, who persuasively argued that advances in medical care and public health had not made important contributions to the secular decline of mortality in Western Europe and North America. On the basis of largely indirect evidence, McKeown suggested that increased living standards were the main driving force behind mortality declines, particularly through improved nutrition.

Preston's article concluded that world-wide increases in life expectancy between the 1930s and 1960s were unlikely to be wholly explained by increases in living standards, and suggested that advances in medical care and public health did make important contributions to mortality decline, at least world-wide and in the 20th century. Although Preston's article could have been a welcome antidote against McKeown's medical nihilism, it had little influence on this debate, and McKeown's view that improved living standards had been the main driver behind mortality decline became the conventional wisdom in public health and epidemiology.

Over the years, many of McKeown's claims have come under serious attack, and it has even recently been argued that it is time for a decent burial. The criticism includes his views about the negligible role of medical care in the decline of mortality in the Western world. While McKeown's assessment of the role of medical care was largely qualitative, and based on a visual inspection of changes in cause-specific mortality trends coinciding with the introduction of certain medical advances, several quantitative analyses have shown that these effects were far from negligible, apparently in line with Preston's hypothesis.

Between 1950–54 and 1980–84, declines in mortality from conditions which had become amenable to medical intervention added 3 years to life expectancy at birth of Dutch men, and 4 years to that of Dutch women. In another analysis of cause-specific mortality, it was shown that between 1875 and 1970 improvements in medical care accounted for between 5 and 10% of total mortality decline in The Netherlands. On the basis of documented gains in survival from medically preventable or treatable diseases, and of the reach of these interventions in the population, the gain in life expectancy at birth in the United States during the 20th century which was attributable to advances in medical care, was estimated to be 5 years, out of a total gain of around 30 years.

While these estimates are likely to be on the generous side, they still fall far short of filling the gap which Preston's analysis brought to light. Between the 1930s and 1960s, average life expectancy at birth in the world rose by 12 years, of which Preston's analysis attributed only 2 years to rises in national income. Although this was a period of rapid declines in mortality due to advances in medical care in the First world, and due to advances in public health in the Third world, it seems implausible that these advances contributed 10 years to average life expectancy at birth.

...but likely to underestimate the effects of economic development...

This raises the question whether Preston's analysis may have underestimated the mortality effects of economic development. I argue that, although Preston's article is admirable for utilizing 'readily available evidence in a new but obvious way to estimate the relative contribution of economic factors to increases in life expectancy during the twentieth century', its main conclusion, that 'income has been a trivial factor in recent mortality trends', is indeed likely to be exaggerated.

Helped by Preston's own critical discussion of the findings, most epidemiologists will have little difficulty in identifying the main weakness of the analysis. While the article is consistently couched in causal language (e.g. 'contribution' to mortality decline, 'sources' of mortality decline, 'influence' on mortality decline), it is based on a cross-sectional study design, without control for confounding variables. It translates the crude cross-sectional association (between variations in national income and variations in national life expectancy) into a longitudinal inference (about how growth in income leads (or does not lead) to growth in life expectancy).

The article concludes that 'factors exogenous to a country's current level of income probably account for 75–90% of the growth in life expectancy for the world as a whole between the 1930s and 1960s. Income growth per se accounts for only 10–25%.' Preston carefully explains some of the main assumptions behind this analysis (e.g. 'that the curves fitted to the 1930s and 1960s data accurately represent the relationship for all countries in those years, including those for which data are not available'). He also lists some sources of uncertainty (e.g. 'a large but unspecifiable margin of error should be attached to this estimate because of faulty data and the simplicity of assumptions'). He even notes that the formulation...
of his conclusion is inevitably ‘cumbersome’, because ‘the analysis does not account for the possibility that the shift in the curve itself [of life expectancy versus income] may be partly a produce of growth in income’.

Although these points are relevant, they skew the main problem, which is that historical growth in income is a phenomenon which is not necessarily approximated by between-country differences in income. There is no guarantee that the cross-sectional association between variations in national income (‘the value of all final products produced in a certain period’) and variations in life expectancy accurately captures the effects of economic development on declines of mortality.

The first reason is that economic development is a historical process which leaves memories in the population. Populations with a relatively high income in the 1930s and 1960s, such as countries in Western Europe and North America, had gone through this process for half a century or more. Improvements in living standards which already occurred in earlier stages may have positively affected the health status of people born in those years, and these changes in health status may partly explain the mortality declines observed around the middle of the 20th century.

The second reason is that economic development actually implied that countries became more dependent on each other, so that cross-sectional associations between income and mortality became less reliable as indicators for the effect of economic growth on mortality. Part of the world-wide growth in income between the 1930s and 1960s was based on international trade and other flows of goods and services, and the economies of the First and Third world became increasingly interconnected. As Preston notes, transfer of goods and services from high-income to low-income countries may effectively have increased the availability of goods and services in low-income countries beyond what would have been expected on the basis of their national incomes.

References

... and of course based on a false dichotomy

While it seems likely that Preston’s analysis underestimated the mortality-lowering effects of economic development, a more obvious but also more fundamental problem is, that the opposition between economic development on the one hand, and medical and public health advances on the other hand, is based on an unnecessarily crude conceptualization of the relationship between the two.

The lack of a well-articulated conceptual model underlying this analysis is already evident from the fact that the independent variable is variously referred to as ‘economic development’, ‘economic factors’, ‘income’, and ‘standards of living’. ‘Economic development’ is a much broader concept than ‘standards of living’, and refers to changes in the way goods and services are being produced. These do not only lead to changes in the quantity and quality of goods and services available to the population, captured by the concept of ‘living standards’, but also require and facilitate changes in technology. Because of their overlapping bases, it is difficult to separate advances in medical and public health technology from advances in other technologies. It would indeed be difficult to imagine 20th century advances in medical and public health technology without ‘economic development’ in this broader sense.

In any case, although one cannot safely conclude from Preston’s analyses that ‘income has been a trivial factor in recent mortality trends’, this article certainly shook the foundations of simple economic determinism, and helped to start investigating economic determinants of population health in a more sophisticated manner.