

This section looks back to some ground-breaking contributions to public health, reproducing them in their original form and adding a commentary on their significance from a modern-day perspective. Jack Caldwell reviews Samuel Preston's 1975 paper on the link between mortality rates and economic development. The original paper is reproduced with the permission of *Population Studies*.

Mortality in relation to economic development

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Before the Second World War, high mortality in developing countries, especially those in Africa and Asia, was generally regarded as arising from Malthusian constraints (populations would grow geometrically until "natural" checks such as famine, plague and war re-established an equilibrium), as well as from very limited access to modern medicine.

Papers published from conferences held in 1944, however, showed that during the previous decades the mortality rates of most colonies had fallen significantly because of administrative public health interventions (1). Nevertheless, there was general surprise when evidence began to accumulate in the late 1940s and 1950s that mortality was falling rapidly and population growth rates rising in most of the developing world. The United Nations devoted a *Population Bulletin* to the matter, including a WHO report on the decline of specific causes of death (2). Stolnitz, in a 1965 analysis of the situation in Latin America, Asia and Africa, concluded: "it now seems that economic misery as such is no longer an effective barrier to a vast surge in survival opportunities in the underdeveloped world" (3).

This was the situation until Samuel Preston published his elegant and easily understood paper (in 1975), which is reproduced here (4). His scatter diagram of relations between life expectancy at birth (hereafter "life expectancy") and national income per head for nations in the 1900s, 1930s, and 1960s remains one of the most memorable illustrations in the population sciences. That diagram and its accompanying text showed that, at any given level of real per capita income, life expectancy rose substantially in the first three decades of the twentieth century and to an even greater extent in the next three decades. Thus, with a gross national income per capita in 1963 (henceforth "income") of US\$ 500, life expectancy was typically 50 years in the 1900s, 58 years in the 1930s, and 69 years in the 1960s. Furthermore, the greatest gains were increasingly concentrated at the very beginning of economic development. As average incomes rose from near zero to US\$ 200, the proportion of increased life expectancy gained compared with that achieved in the richest societies was around 70% in the 1930s and 87% in the 1960s.

These demonstrations were achieved with only two well-understood variables, life expectancy at birth and per capita income at fixed prices. The greatest challenge had been to as-

semble adequate data, especially for the 1900s, which Preston showed merely as point values unconnected by a logistic curve. He concluded that, if income had been the only determining factor, global life expectancy over the three decades to the 1960s would have risen only 2.5 years rather than the actual 12.2 years. Thus, "factors exogenous to a country's current level of income probably account for 75–90 per cent of the growth in life expectancy for the world as a whole between the 1930s and the 1960s". Furthermore, this situation was equally true for industrialized and developing countries.

The next question was one that could not be answered by the data, namely, what were these exogenous factors that had been so powerful? Preston nominated for industrialized countries: vaccines, sulfonamides and antibiotics; and for developing countries: insect control, environmental sanitation, health education, and mother and child health services. It may well be that he underestimated the extent to which the first group had been spreading from industrialized to developing countries by the 1960s. How, then, did he explain the explosion of health improvement in the developing world in the second half of the twentieth century, given that the United Nations Population Division (5) estimated life expectancy in the less developed countries to have risen from 35 years in 1950 to 45 years in 1970 (compared with 65 to 72 years in the more developed countries)? Preston's explanation is that nearly all advances against mortality were invented somewhere else, where they circulated freely from the time of the promulgation of germ theory (roughly the 1880s), while the poorer world had to wait until after the Second World War. At that time, governments assumed responsibility for providing health services to their citizens, and international institutions and rich nations began to take responsibility for helping poorer countries.

Preston did not greatly modify this analysis, though in 1996, when summarizing advances in demographic mortality research (6), he said that his 1975 paper had fallen for the temptation that had beset Thomas McKeown, namely elimination of a variable which was explained by preconceived ideas. He was referring to the omission of social change, especially the greater survival of the children of educated mothers, which he first discussed in 1978 (7) and 1982 (8), drawing on developing research in that area (9).

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That Preston's 1975 paper has stood up well to subsequent research and continues to provide guidance is shown by the draft of the World Bank's *World Development Report 2004* (10), which interprets Preston's work as explaining advances in health at the same income level as attributable to "advances in *technologies* and leaps in *knowledge* about health and hygiene" (the report's emphasis). In a slightly altered form, the publication reproduces his iconic figure to illustrate that factors exogenous to economic development continued to reduce child mortality during the 1990s.

Dissenting quibbles come mainly from economists. Pritchett & Summers (11) argued that national income growth flows eventually into raising the level of education and health services, and its relative importance is obscured by inadequately employing a time dimension. Rodgers (12) and Flegg (13) argued that measures of per capita income ignore the impact on

constraining mortality decline that is exerted by an unequal distribution of income, but Gravelle et al. (14) reported that their global data did not confirm this effect.

Nevertheless, Preston's 1975 demonstration that the dramatic reductions in mortality, which have characterized the final 55 years of the twentieth century, were based to a much greater extent on globalization than rising income remains intact. Preston, as a good demographer, confined himself to what could be measured most accurately around the world, namely mortality; others in the debate have referred to health, assuming its level to have a close relationship with mortality, as Preston probably does too. By 1978 he was including reference to morbidity as well as mortality in his analysis (7). ■

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