Health, Wealth, and Welfare

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New evidence coupled with a wider perspective suggest sizable economic returns to better health

THE LAST 150 years has witnessed a global transformation in human health that has led to people living longer, healthier, more productive lives. While having profound consequences for population size and structure, better health has also boosted rates of economic growth worldwide. Between the 16th century and the mid-19th century, average life expectancy around the world fluctuated but averaged under 40 years, with no upward trend. Life spans slowly but steadily increased in the second half of the 19th century and then jumped markedly in the 20th century, initially in Europe and then in the rest of the world (see table). Economic historians and demographers still debate the genesis of these changes, but they increasingly point to rising incomes (and resulting improvements in sanitation and food availability) as the major cause of declines in 19th-century mortality rates. For the 20th century, however, they believe technical improvements were the catalysts—particularly the discovery of the germ theory of disease, a better understanding of

hygiene, and the development of antibiotics and vaccines.

Chile provides a well-documented example of dramatic mortality decline. A Chilean female born in 1910 had a life span of 33 years. Today, her life expectancy exceeds 78 (only 2 years shorter than that in the United States). In 1910, the odds were more than one in three that she would die before age 5; today, they are less than one in fifty. Moreover, for middle-aged people, death rates are also now far lower: today's Chilean female is far less likely to die as a young adult from tuberculosis or childbearing or in middle age from cancer. Mirroring these mortality changes are marked changes in her quality of life. She can choose to have fewer pregnancies and spend less time raising children: from an average of 5.3 children in 1950, Chilean women's fertility has dropped to 2.3 (barely above replacement). She suffers fewer infections and has greater strength and stature and a quicker mind. Her life is not only much longer, it is much healthier as well.

What has this improvement in population health since the mid-19th century meant for economies as a whole? And what does the recent fall in life expectancy in Africa and elsewhere as a result of the HIV/AIDS epidemic portend? This article tries to answer these questions by exploring the increasingly strong body of evidence showing that better health contributes to the more rapid growth of GDP per capita. The article also delves into recent studies that argue that past estimates of economic progress have been understated and that recent economic losses caused by HIV/AIDS are likewise being understated if economists rely on GDP per capita as a yardstick. A better indicator would be "full income," a concept that captures the value of changes in

Living longer

Life expectancy rose sharply around the world in the second half of the 20th century, but AIDS is undermining progress in Africa and elsewhere.

	Life expectancy, years			Rate of change in years per decade	
Region	1960	1990	2001	1960–90	1990–2001
Low and middle income	**44**	**63**	**64**	**6.3**	**0.9**
East Asia and Pacific	39	67	69	9.3	1.8
Europe and Central Asia	n/a	69	69	n/a	0.0
Latin America and Caribbean	56	68	71	4.0	2.7
Middle East and North Africa	47	64	68	5.7	3.6
South Asia	44	58	63	4.7	4.5
Sub-Saharan Africa	40	50	46	3.3	-3.6
High income	**69**	**76**	**78**	**2.3**	**1.8**
World	**50**	**65**	**67**	**5.0**	**1.8**

Source: *World Development Indicators 2003* (Washington: World Bank, 2003).
Note: Entries are the average of male and female life expectancies. Assignment of countries to regions uses the World Bank convention for 2003 that is listed on the inside back cover of *WDI 2003*.

Filipinos light candles to commemorate AIDS victims while marking AIDS Day in Manila.

occurred in much of West Africa prior to the successful control of river blindness. Yet another channel is through boosting education. Healthier children have higher rates of school attendance and improved cognitive development, and a longer life span can make investment in education more attractive.

The initial beneficiaries of health improvements are often the most vulnerable group: children. Lower infant mortality initially creates a "baby boom" cohort and often leads to a subsequent reduction in the birth rate as families choose to have fewer children in the new low-mortality regime. A baby-boom cohort is thus unique and affects the economy profoundly as it enters education, then finds jobs, saves for retirement, and, finally, leaves the labor market. The cohorts before and after a baby boom are much smaller.

If better health improves an economy's productive potential, we would expect good health to go hand in hand with higher steady-state output. However, there may be a lag such that

life expectancy by including them in an assessment of economic welfare. For Africa, this new yardstick sharply illuminates the economic consequences of AIDS in the past 15 years and signals catastrophe ahead.

How health affects GDP per capita

How does health influence GDP per capita? To begin with, healthy workers are more productive than workers who are otherwise comparable but for their health. One strand of supporting evidence comes from studies on individuals that link investments in health and nutrition of the young to adult wages.

Better health also raises per capita income through a number of other channels (see Chart 1). One way is by altering decisions about expenditures and savings over the life cycle. The idea of planning for retirement occurs only when mortality rates become low enough for retirement to be a realistic prospect. Rising longevity in developing countries has opened a new incentive for the current generation to save—an incentive that can have dramatic effects on national saving rates. While this saving boom lasts for only one generation and is offset by the needs of the elderly once population aging occurs, it can substantially boost investment and economic growth rates while it lasts. Another channel is by encouraging foreign direct investment: investors shun environments where the labor force suffers a heavy disease burden. Endemic diseases can also deny humans access to land or other natural resources, as

Chart 1
Health's links to GDP
Poor health reduces GDP per capita by reducing both labor productivity and the relative size of the labor force.
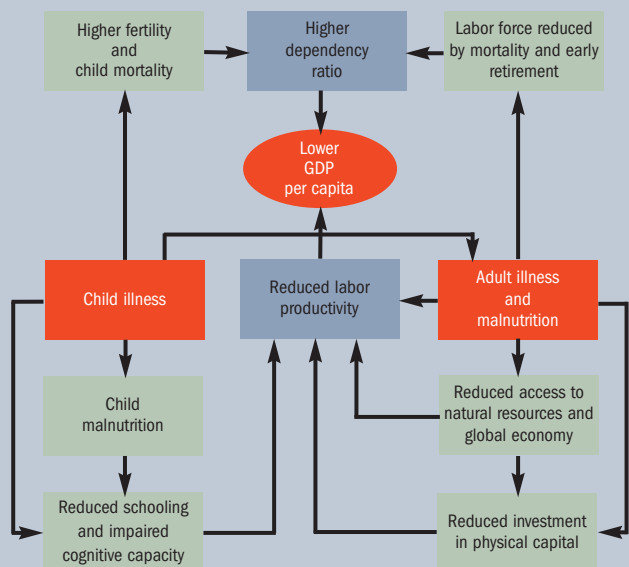
Source: Ruger, Jennifer Prah, Dean T. Jamison, and David E. Bloom, 2001, "Health and the Economy," page 619 in *International Public Health*, edited by Michael H. Merson, Robert E. Black, and Anne J. Mills (Sudbury, Massachusetts: Jones and Barlett).

The East Asian "miracle"

There is a growing body of evidence that the East Asian countries that sustained high rates of economic growth in the second half of the 20th century did so largely thanks to high rates of growth of factor inputs—labor, physical capital, and human capital—rather than increases in total factor productivity. One reason for the rapid increase in labor supply per capita in East Asia has been the effect of better health. Improvements in health, feasible at modest cost, preceded and helped catalyze the so-called miracle. Life expectancy increased from 39 years in 1960 to 67 years in 1990, with a concomitant decline in fertility. Declining mortality and fertility rates meant that between 1960 and 2000 the ratio of working-age people (15–64) to the dependent population (0–14 and 65 plus) rose from about 1.3 to over 2, which facilitated a much higher input of workers per capita into production and a higher GDP per capita.

Another key element in East Asia's economic success stories was the region's exceptionally high rates of capital accumulation, driven by saving levels that often exceeded 30 percent of income. Increases in longevity led to an increase in the need for saving to secure retirement income, as studies have suggested. Savings by individuals peak when they are between 40 and 65 and are preparing for retirement, resulting in a savings boom when the baby-boom cohort enters this age range. Not only did East Asia have a large fraction of its population in this peak savings age range, but also this cohort was the first in the region to be living in a low-mortality environment and to be saving for retirement on a large scale.

economies adjust gradually to their steady-state output level over time. In this case, we expect countries that have high levels of health but low levels of income to experience relatively faster economic growth as their income adjusts. How big an overall contribution does better health make to economic growth? Evidence from cross-country growth regressions suggests the contribution is large. Indeed, the initial health of a population has been identified as one of the most robust and potent drivers of economic growth—among such well-established influences as the initial level of income per capita (once countries reach their steady-state level of income, growth slows), geographic location, institutional environment, economic policy, initial level of education, and investments in education. For example, Bloom, Canning, and Sevilla (Harvard University) found that one extra year of life expectancy raises steady-state GDP per capita by about 4 percent.

But not all countries benefit equally from this link. Alok Bhargava (University of Houston) and colleagues found that better health matters more for wages in low-income countries than in high-income ones. Studies also show that better health matters more for countries with good economic policies, such as openness to trade and good governance. Work undertaken by Bloom, Canning, and Malaney (Harvard University) concluded that the East Asian growth miracle was actually no miracle at all: rather, it represents compelling evidence for a process in which health improvements played a leading role in the context of generally favorable economic policies (Box 1).

Virtuous and vicious circles

Health improvements can spur economic performance, but causality also runs in the reverse direction. This reverse causality makes estimating the causal effect of health on economic performance difficult, but work in the area usually identifies the effect through timing; using childhood health

The "value of a statistical life"

How should governments evaluate the consequences of public sector health, safety, and environmental interventions that reduce mortality risks? Over several decades, a substantial body of research has addressed this question by using information from individuals' choices about willingness to take risks. W. Kip Viscusi of Harvard University has closely tracked this literature, and, in a recent overview, he and colleague Joseph Aldy provide a clear statement of the approach:

Individuals make decisions everyday that reflect how they value health and mortality risks, such as driving an automobile, smoking a cigarette and eating a medium-rare hamburger. Many of these choices involve market decisions, such as the purchase of a hazardous product or working on a risky job. Because increases in health risks are undesirable, there must be some other aspect of that activity that makes it attractive. Using evidence on market choices that involve implicit tradeoffs between risk and money, economists have developed estimates of the value of a statistical life (VSL). (Viscusi and Aldy, 2003)

If, for example, a worker requires (and is paid) $500 a year of additional pay to accept a more risky but otherwise similar job, where the increase in the mortality rate is 1 in 10,000 a year, the value placed on reducing risk by this magnitude is simply $500. The value of a statistical life is defined as the observed amount required to accept a risk divided by the level of the risk—that is, in the example we have chosen, the VSL would be $500/(1/10,000) = $5,000,000, a number in the range of estimates for the United States today. Viscusi and Aldy provide a comprehensive overview of the methods used in this research and summarize results of 60 studies from 10 countries.

Willingness to pay to avoid risks rises, not surprisingly, with income. A reasonable range of values for a country's VSL appears to be 100–200 times GDP per capita, with values estimated in richer countries more likely to occur toward the high end of the range.

An obstetrics ward in the Ethiopian capital, Addis Ababa.

and nutrition inputs as a determinant of adult wages or taking population health in, say, 1960 as a factor influencing economic growth during 1960–95. More important, this two-way causality can give rise to cumulative causality, with health improvements leading to economic growth, which can facilitate further health improvements, and so on. While this virtuous circle of improvements in health and income can continue for a time, it will eventually come to an end as returns to health improvements diminish and demographic change leads to an aging population.

There is also scope, however, for vicious circles, with health declines setting off impoverishment and further ill health. This pattern has been particularly evident in the former Soviet Union, where male life expectancy declined sharply during the transition from communism, and in sub-Saharan Africa, where HIV infection rates are high and AIDS is already dramatically increasing adult mortality rates.

The effect of HIV/AIDS on GDP per capita could eventually prove devastating. There is an enormous waste of human capital as prime-age workers die. A high-mortality environment deters the next generation from investing in education and creating human capital that may have little payoff. The creation of a generation of orphans means that children may be forced to work to survive and may not get the education they need. High mortality rates may reduce investment. Saving rates are thus likely to fall, as the prospect of retirement becomes less likely. And foreign companies are less likely to invest in a country with a high HIV prevalence rate because of the threat to their own workers, the prospect of high labor turnover, and the likely loss of workers who have gained specific skills by working for the firm.

How health influences "full income"

Judging countries' economic performance by GDP per capita, however, fails to differentiate between situations where health differs: a country whose citizens enjoy long and healthy lives clearly outperforms another with the same GDP per capita but whose citizens suffer much illness and die sooner. Individual willingness to forgo income to work in safer environments and social willingness to pay for health-enhancing safety and environmental regulations provide measures, albeit approximate, of the value of differences in mortality rates. Many such willingness-to-pay studies have been undertaken in recent decades, and their results are typically summarized as the "value of a statistical life" or VSL (Box 2).

Although the National Income and Product Accounts (NIPA) include the value of inputs into health care (such as drugs and physician time), standard procedures do not incorporate information on the value of changes in mortality rates. In a pathbreaking (but long-neglected) paper, Dan Usher of Queen's University, Canada, first brought the value of mortality reduction into the economic analysis of national income accounting. He did this by generating estimates of the growth in "full income"—a concept that captures the value of changes in life expectancy by including them in an assessment of economic welfare—for six countries and territories (Canada, Chile, France, Japan, Sri Lanka, and Taiwan Province of China) during the middle decades of the 20th century. For the upper-income countries in this group, perhaps 30 percent of the growth of full income resulted from declines in mortality. In the developing countries, where this was a period of particularly rapid mortality decline, full income was influenced even more by mortality changes. Estimates of changes in full income are typically generated by adding the value of changes in annual mortality rates (calculated using VSL figures) to changes in annual GDP per capita. Even these estimates of full income are conservative in that they incorporate only the value of mortality changes and do not account for the total value of changes in health status.

The devastating economic impact of AIDS in sub-Saharan Africa

Life expectancy in Africa increased from 40 years in 1960 to 50 years in 1990, but the AIDS epidemic is reversing these gains. By 1990, infection with HIV had penetrated deeply into Africa, although the number of deaths remained fairly small (218,000 out of an estimated 7,940,000 deaths in 1990, or 2.7 percent of the total). But by 2001, the number of AIDS deaths had climbed to an estimated 2,197,000, or 20.6 percent of total deaths, with projections for continued increases. As a result, life expectancy has declined to 46 years.

Despite this fall in life expectancy, however, many investigators have so far found little, if any, impact of the AIDS epidemic on GDP per capita in the region—pointing to the shortcomings of GDP per capita as a measure of national economic well-being. While GDP per capita may suffer in the long run as education rates and savings fall because of high mortality rates, AIDS has certainly created a human disaster in many countries in sub-Saharan Africa. The measures of full income now entering the literature—a concept that captures the value of changes in life expectancy by including them in an assessment of economic welfare—provide a quantitative indicator of this disaster and convey a more accurate picture of the economic effect of AIDS. They suggest that AIDS is already having a devastating economic effect on Africa.

How is the change in full income resulting from the AIDS epidemic assessed? It consists of two components: the change in GDP per capita and the value of changes in mortality rates as estimated in the VSL literature. To obtain the latter component, the first step is to calculate the impact of AIDS on mortality rates. By 2000, the epidemic had, on average, progressed to the point that mortality rates (in middle ages) were beginning to increase substantially. In 1990, a 15-year-old male had a 51 percent chance of dying before his 60th birthday, and this had increased to 57 percent by 2000. For females, the increase was from 45 to 53 percent. (By comparison, in Japan, the comparable probability for females in 1999 was only 4.8 percent.) Taking the average of the change in annual mortality probabilities gives 0.35 percent a year from 1990 to 2000.

The next step is to calculate the economic cost of these mortality increases. Conservatively, using 100 times GDP per capita as the VSL, Africa's mortality changes imply an economic cost of the epidemic approximately equal to 15 percent of Africa's GDP in 2000 (assuming that about 50 percent of the population is aged 15–60 and that 90 percent of AIDS deaths are in this age group). This corresponds to a decline in income of 1.7 percent a year from 1990 to 2000, far higher than existing estimates of the effect of AIDS on GDP.

Before 1990, in contrast, improvements in adult health led to large economic benefits relative to changes in GDP per capita. The estimated effect adds several percentage points a year to the GDP growth rate in many African countries during 1960–90. This changes the overall perception of performance. Malawi, for example, in the 1980s had a slightly negative growth rate of GDP per capita, but a rather larger positive growth rate of full income that turned sharply negative in the 1990s. The chart illustrates the contrast for Kenya. To the extent that full income is a better indicator of overall economic performance than GDP per capita, Kenya's economic performance before 1990 has been significantly underestimated and, after 1990, dramatically overestimated.

Chart 2

Differing yardsticks

Trends in full income tell a very different story about Kenya's economic performance than trends in GDP.

(Average annual percentage change)
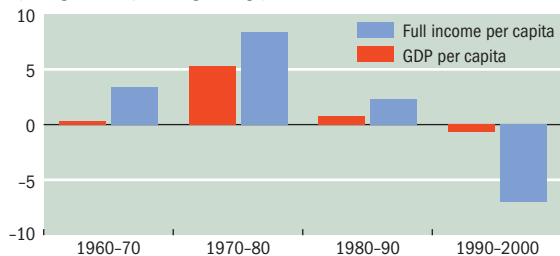
Source: Jamison, Sachs, and Wang, 2001.

For almost 15 years, little further work was done on the effects of mortality change on full income (although the number of carefully constructed estimates of VSLs increased enormously). Two papers then appeared that kindled substantial new interest. Newly appointed World Bank Chief Economist François Bourguignon and Christian Morrisson (University of Paris) addressed the long-term evolution of inequality among world citizens starting from the premise that a "comprehensive definition of economic well-being would consider individuals over their lifetime." Their conclusion was that rapid increases in life expectancy in poorer countries had resulted in declines in inequality, broadly defined, beginning sometime after 1950, even though income inequality had continued to rise. (The table on page 10 shows life expectancy increasing between 1960 and 1990 in develop-

ing countries at a rate of 6.3 years a decade, whereas in the high-income countries, the rate was "only" 2.3 years a decade.) In another important paper, Yale University's William Nordhaus assessed the growth of full income per capita in the United States in the 20th century. He concluded that somewhat over half of the growth in full income in the first half of the century had resulted from mortality decline, and somewhat less than half in the second half of the century. This was a period when real income in the United States increased sixfold, and life expectancy increased by a little over 25 years. Nordhaus's paper also provides a valuable summary of the theory and methods of estimation of full income.

Three lines of more recent work extend these methods to the interpretation of the economic performance of developing countries in recent decades, and all reach conclusions that

differ substantially from analyses based on GDP alone. Two of these studies—one undertaken for the World Health Organization's Commission on Macroeconomics and Health (CMH) and the other at the IMF—assessed the impact of the AIDS epidemic on full income. Both concluded that the AIDS epidemic in the 1990s had far more adverse economic consequences than its effects on per capita GDP would suggest (see Box 3). Gary Becker and colleagues at the University of Chicago extended the earlier work of Bourguignon and Morrisson in finding strong absolute convergence in full income across countries over time, in contrast to the standard finding of continued divergence of GDP per capita. Finally, Jeffrey Sachs (Columbia University) and colleagues have extended the earlier CMH work by using standard cross-country growth regressions to model determinants of full income (rather than GDP per capita). They also conclude that economies have been converging in terms of full income, and, tentatively, they find the determinants of growth in full income to be similar to those of growth in GDP.

Conclusion

The dramatic mortality declines of the past one and a half centuries—and their reversal by AIDS in Africa and elsewhere subsequent to 1990—have had major economic consequences. The impact of health on GDP is substantial—an extra year of life expectancy is estimated to raise a country's per capita GDP by about 4 percent, for example. The intrinsic value of mortality changes—measured in terms of the value of a statistical life or VSL—is even more substantial.

What are the implications of these findings for development strategy and for benefit-cost analyses of public sector investment options? Using full income in benefit-cost analyses of investments in health (and in health-related sectors such as education, water supply and sanitation, and targeted food transfers) would markedly increase our estimates of net benefits or rates of return. Currently, only about 10 percent of official development assistance (ODA) is committed directly to health. Given the highly efficacious and low-cost technologies that exist for improving health (particularly in high-mortality settings), a careful, quantitative reassessment of competing investment priorities for improving living standards will likely conclude that existing ODA and budgetary allocations to health are richly deserving of a substantial boost. ∎

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