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## The Future of Global Health

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Given the importance of health to all individuals and societies, surprisingly few previous volumes have looked extensively at the future of global health. We have aimed to make contributions on two fronts. The first is to improve our tools for thinking about alternative global health futures. The second, interacting with the first, is to use that enhanced toolkit to explore where patterns of change in human health might be taking us, to consider how much leverage we might have to improve health around the world relative to those patterns, and to think about how more rapid improvement in health might interact with broader human development.

### **Expanding Capability for Health Forecasting**

Although forecasting of human population size and characteristics routinely extends to mid-century, and often to the end of the century or beyond, forecasting of health has for the most part not looked beyond 2030, and has been

relatively rare in general. As in other volumes in this series on the Patterns of Potential Human Progress, we look out a half century, and we have targeted 2060 in most of this volume's analysis. There is little doubt that the global community will continue to set goals for health, and that insights gained from longer horizons can inform that process.

More generally, governments at all levels need to understand the size of their prospective future populations, their age patterns, and their likely health conditions. Limited information is available to most countries concerning prospective health (both risks to health and opportunities for improving health) of their populations. The tables that accompany this volume, and the public availability of the International Futures (IFs) system for further analysis, help fill that hole for 183 countries, as well as for the many groupings that build on them.

Societies not only want to understand the possible future health of citizens, they want

to know how to improve it. Although our forecasting tool and analysis are at a high level of aggregation, we have explored several sets of important drivers of change in health, in part so as to expand our understanding of human leverage. We began with the distal drivers (income, education, and time/technology) of the World Health Organization's Global Burden of Disease project. That was possible only because of that project's generosity in providing us with its data and modeling formulations. We expanded our model and exploration to include some of the more immediate or proximate risks to human health, again building on work from the World Health Organization (WHO) and its Comparative Risk Assessment project, creating what we have termed "an integrated, hybrid model." We further expanded our conceptualization of the drivers of health to include super-distal factors, such as change in natural and social environments.

As important as it is, health is only one part of the larger human development system, and understanding the linkages between health and other elements of that system is critical as a foundation for forecasting health futures. As super-distal, distal, and proximate drivers shape changes in health, so health changes in turn affect demographic and economic systems in particular, and all of human development more generally. Integrating our health model within the broader IFs modeling system has been another key element of our effort to build a stronger forecasting tool. That integration allowed us to analyze in some detail the implications of health for economic growth and to develop and explore scenarios that sketch very different health futures than our base case forecast.

We hope and expect that integrative analysis of health and the broader human development system will be able to build on and go beyond our efforts (including further use of the IFs system for analysis of both base case and many alternative scenarios). Our modeling and analysis represent only one milestone in collective efforts to conduct integrative, policy-relevant forecasting of global health futures. We invite readers to explore potential applications of the International Futures platform in their own efforts (the full system is available at [www.ifs.du.edu](http://www.ifs.du.edu)).

## **Understanding the Future of Global Health**

Over at least four decades, social and medical scientists have mapped the broad outlines of a nested and overlapping set of global health transitions, elaborating them with increasing detail. Most societies have moved through or are moving through multiple stages in a broadly encompassing demographic/epidemiologic transition (see Chapter 1). In the process, most are moving also through a general risk factor transition (see Chapter 5) and even more specific risk transitions such as that for environmental factors (see Chapter 6). While noting the inherent danger of assuming that these transitions will inevitably take place at all, or that they must unfold in a particular fashion, we do find that the most likely path forward for global health involves a continuation of these transitions for most countries (and a resumption for some whose progress has been stalled or reversed), with mostly positive consequences for other dimensions of human development. The next 50 years will, of course, offer up many surprises; it will require much hard work to remain on the current, mostly optimistic path.

With these caveats in mind, this volume has provided a great deal of information concerning the current and prospective future movement of developing countries across geographic regions, and all countries across economy classifications, through these transitions. One of the central forecasts of the volume is that progress against communicable diseases will likely continue at a quite rapid pace. In our base case forecast, the battle against communicable diseases will largely be won by the end of our primary forecast horizon in 2060. Sometime between 2040 and 2050 the annual global deaths attributable to communicable diseases will very likely fall below 10 percent of those from noncommunicable diseases (from about 50 percent now), and will also fall below the numbers due to injuries. Within this global pattern there are variations by country and by region; we have traced the patterns by region within the volume, and present them for individual countries in the end tables at the back of this volume. Our forecast of continued quite rapid decline of communicable diseases has broad demographic ramifications.

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■ *Our modeling and analysis represent only one milestone in collective efforts to conduct integrative, policy-relevant forecasting of global health futures.* ■

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■ *Our forecast of continued quite rapid decline of communicable diseases has broad demographic ramifications.* ■

■ *Lag effects associated with many risk factors, especially those for chronic diseases, reinforce the critical need to anticipate the extent of such risks.* ■

■ *Within the general patterns, the epidemiologic, demographic, and health risk transitions all have distinct geographic and temporal footprints.* ■

Since communicable diseases mainly strike the young, the reduction's early impact will be a demographic dividend. Over the longer run it will add to the challenges of old age dependency and chronic diseases.

Another important implication is that the effort to reduce specific risk factors that affect the earlier stages of the risk transition will have special importance in the window of time through about mid-century, by which time the world will have largely passed through those earlier stages and the character of dominant risks will have shifted significantly. We have seen that risk factors as different as undernutrition; unsafe water, sanitation, and hygiene; and indoor air pollution each tend to contribute to between 1 and 2 million deaths annually, most of those falling among the roughly 16 million deaths from communicable diseases (and most among the roughly 9 million deaths of children under five years of age). By mid-century, the total deaths from communicable diseases could fall to about half that level (with child deaths falling below 2 million by 2060), largely because of the extensive attacks mounted on such risk factors and on key diseases such as AIDS and malaria. The speed of progress in this period is literally a matter of life and death, and of reduced morbidity burden and better life-course health, for many tens of millions.

As the world as a whole increasingly moves through and beyond the receding pandemic stage of the broad epidemiologic transition, other risk factors will become steadily even more important, including overweight, smoking, road traffic accidents, and outdoor air pollution. While deaths from communicable diseases will likely decline by 50 percent toward mid-century, those from both noncommunicable diseases and injuries will probably each more than double. Again, there are broad ramifications. The lag effects associated with many risk factors predisposing people to chronic diseases means that anticipation of their future impacts becomes even more important. Changing patterns will also increasingly direct our attention to middle-income countries where such risks are often growing most rapidly, and to working-age and older adults, whom they affect the most. Nearly 15 million working-age adults die

globally each year now from all causes, and we anticipate that number will not decrease significantly by mid-century.

In Chapter 6 we considered the complicated interactions linking varying risk factors to one another and to specific health outcomes. Our ability to track and model these connections at the country level lags far behind our ability to model individual risks. Nevertheless, we have traced in this volume the generalized process of transition in both communicable and noncommunicable diseases and associated risk factors, again by region in the text and by country in the accompanying tables.

Epidemiologic, demographic, and proximate risk transitions play out within the larger human development process. The embedding of our integrated, hybrid health model in the larger set of models of the IFs system has allowed us to explore broad systemic linkages. It facilitated our consideration of super-distal factors, such as change in the natural environment via global warming. We found, for example, that the impact through 2060 of changes in temperature and precipitation on undernutrition and attributable childhood mortality was not as great as some analyses conclude, in large part because we forecast significant decline in undernutrition levels by mid-century (driven most fundamentally by increasing incomes) even as climate change effects intensify. Similarly, we were able to enrich forecasts of other risk factors including body mass index, smoking, and indoor/outdoor air pollution, so as to deepen our understanding of their interaction with the larger epidemiologic transition. All such factors have distinct geographic and temporal footprints (see again Chapters 5 and 6).

Our integration of health forecasting with that of broader human development systems has had other benefits. We were able (see especially Chapters 7 and 8) to link changing mortality outcomes to fertility within the population model so as to see their aggregate impact (and to have that impact on population then re-enter and close the loop with the health model). We found the effects of improved health on population growth to be substantial, with large-scale health interventions potentially increasing global population by hundreds of millions of

people. These effects have positive implications but also give rise to concerns. Many in this increased population would initially be part of “demographic dividend” cohorts (that is, working-age adults rather than dependent populations), driving nations to development. Yet these positive effects would be limited without accompanying declines in fertility, a finding that supports efforts to connect family planning activities with health initiatives. Moreover, large and increasing numbers of these survivors would already be elderly or eventually reach old age, increasing dependency ratios for retired populations.

In looking at the connections between health and broader human development systems, we also tackled the contentious issue of the implications of improvement in health outcomes for economic performance. Building on past analyses that have teased apart the positive and negative consequences of health, we have incorporated these pathways into our integrated IFs modeling system (Chapter 7). While many analysts have raised concerns that population increases of the scale noted in the preceding paragraph could lower economic well-being, we find a significant, albeit modest, net positive impact of health improvements on per capita GDP. We see little evidence of a potential Malthusian trap in which health improvements merely lead to overpopulation and reduced growth, as demonstrated by the substantially more positive returns to health for sub-Saharan Africa and South Asia than for other regions. The economic returns to health improvements, however, would be further enhanced not only by family planning activities but also by add-on investments in agriculture and nutrition. Finally, the less beneficial impact of mortality reductions on high-income societies and East Asia (dominated by China) points once again to the costs of old age dependency; yet even here we find that mortality reductions are largely neutral to growth, not negative.

Throughout the volume, the issue of uncertainty in forecasting arose again and again. Somewhat belying the rather simple description above of the major transition stages and their implications for mortality and morbidity patterns, scenario analysis suggests quite broad confidence intervals around the base case forecast (see Chapter

8). Moreover, our analysis could by no means even identify, much less address, all sources of systemic risk or uncertainty (as well as weaknesses in our forecasting specifications). In the environmental arena, for instance, it is quite possible that through 2060, overuse of fossil groundwater could prove a more significant factor in constraining food production and slowing or stopping reduction in undernutrition than will global warming, and we did not explore that issue. Although Chapter 8 noted the possibility of extremely negative wild-card events around infectious diseases, we were not able to explore them meaningfully. Not least, in the face of great uncertainties around the longevity potential of the human genome (and our ability to modify it), some stages of the ongoing epidemiologic transition have barely been conceptualized. Given the larger confidence intervals around mortality in low- and middle-income countries, our scenarios illustrate the uncertainty not merely in overall global health but also in the pace at which the majority of the world’s population can potentially achieve the levels of health currently attained by only a small number of societies.

Although we have substantial confidence in the methods by which we arrived at our generally optimistic conclusions, we remain cognizant not only of the high level of uncertainty just noted but also of the tendency for long-term, macro-level forecasts such as ours to obscure the conditions of individuals who will actually live throughout this forecast horizon. Even our most optimistic scenarios will see millions of lives lost or wasted to poor health, both along the way and still in 2060. Most of our readers would probably endorse the ambitious cross-societal goals of the WHO Commission on Social Determinants of Health, but even our optimistic forecast will see us fall well short of some of its goals. Our ability to assess the local or global value of governance interventions that might allow us to achieve these goals—such as tobacco control treaties, the scale-up of cost-effective health systems in poor countries, or truly collaborative infectious disease control regimes—remains preciously thin. Finally, we reiterate that broad trajectories of transition and improvement in poor and rich countries alike obscure the significance of health

■ *The integration of health forecasting with that of other global systems provides insights, including the size of net economic gains that health improvements bring.* ■

■ *Much uncertainty surrounds both the pace of health advance in system leaders and the speed of convergence or catch-up by other countries.* ■

■ *Global health forecasting will continue to improve, and those improvements should in turn help us improve health itself.* ■

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differentials within societies. IFs is not able to address explicitly the continued exclusion of many disadvantaged group members (women, minorities, indigenous populations, those in rural areas and slums) from improvements that may be observed at the societal level. Future forecasting must pay increasingly close attention to the within-society health issues and goals that were also a focus of the Commission on Social Determinants of Health.

The development and presentation of this new global health forecast do leave us completely certain of two things. First, health will remain fundamentally important in efforts to enhance human development. Second, our collective desire and ability to anticipate possible health futures, and thereby to shape better ones, will continue to develop.