

# Gates's grandest challenge: transcending technology as public health ideology

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The numbers are as plain as 1-2-3. Over one million annual deaths from malaria, almost two million from tuberculosis, and more than three million from HIV/AIDS, most of which occur in underdeveloped countries.<sup>1</sup> Among the young, the situation is even more jarring: 2.4 million children dead from perinatal causes, another 1.9 million from lower respiratory infections, 1.6 million from diarrhoeal diseases. And on and on.

At the same time, the approximately US\$75 billion a year globally spent on medical research all but ignores the problems of the developing world, as expressed in the so-called 10/90 gap, whereby only 10% of health sciences' research dollars address the health problems of 90% of the world's population.<sup>2,3</sup> Moreover, only a small portion of this research is published in major medical journals.<sup>4</sup>

Enter the Bill and Melinda Gates Foundation, endowed with 26 billion and a larger annual global health budget than WHO. In January, 2003, the Foundation launched a "Grand Challenges in Global Health" initiative to stimulate scientific researchers to develop "solutions to critical scientific and technological problems that, if solved, could lead to important advances against diseases of the developing world" (<http://www.grandchallengesgh.org>). Administered by the Foundation of the National Institutes of Health, the Grand Challenges initiative issued an open call to investigators from anywhere in the world to propose ideas to an international scientific board. In October, 2003, the first 14 Grand Challenges were announced (panel 1)—selected from more than 1000 submissions—and readied for research proposals,<sup>5</sup> which are currently competing for \$200 million in research grants. Grouped into seven goals, ranging from improving the measurement of health status to bettering nutrition, vaccines, and treatments for infections, and control of vector-borne diseases, the Grand Challenges appear poised to improve the health of the underdeveloped world. But can they?

One way to answer this question is to explore historical evidence of the factors that best explain the decline of mortality in developed countries from the mid-19th to mid-20th centuries. McKeown and colleagues' much-cited studies<sup>6</sup> of the causes of the modern mortality decline in England and Wales concluded that improved nutrition and immunological resistance—stemming from economic growth and a rising standard of living—was the key explanatory factor, with medicine deemed largely irrelevant because effective interventions appeared only after mortality rates had already fallen substantially. This provocative

thesis has stimulated numerous national and local level mortality studies which challenge McKeown's dismissal of the role of human agency in terms of social movements, public health measures—such as sanitation and housing improvements<sup>7</sup>—and political change<sup>8</sup> and reveal an enormous complexity of factors and experiences,<sup>9–13</sup> including discovery of an "urban penalty" of increased mortality in northern Europe during early phases of industrialisation.<sup>14</sup> In his recent synthesis, Riley<sup>15</sup> has shown that countries have historically chosen one or more of six strategies to reduce mortality: better income distribution; improved diet; public health; medicine; changes in household behaviour; and increased education—with no single factor universally successful.

Because these primarily European analyses focused on the era that preceded the expanded armamentarium of antibiotics, vaccines, and vector-control measures in the wake of World War II, some observers have speculated that falls in postwar mortality in developing countries might have derived more from technical and medical interventions than was the case in Europe.<sup>16</sup> However, since these improvements in mortality were coterminous with improvements in social and political conditions (including decolonisation), education, income increases and distribution, and medical and public-health measures, it is nearly impossible to untangle the separate effects of each factor. A study of this question in the developing country setting of Uruguay offers some hints. Although Uruguay's mortality rates began dropping before 1900, its infant mortality rate was constant for almost four decades. From 1905 onwards, Uruguayan politicians and public health officials employed all but one of Riley's sextet of strategies to little avail—until family allowances were legislated in 1943 and infant mortality rates began a steep decline.<sup>17</sup> This case suggests that redistributive measures—and the political struggles that undergird them—play a key enabling role in the successful implementation of medical, public health, educational, and household measures.

Today, poverty is often cited as the underlying reason that life expectancy in residents of western Europe and North America is about 30 years longer than that of people living in sub-Saharan Africa. Indeed, in the mid 1990s, WHO named poverty as the world's leading killer, responsible for more than half of 12 million children dying per year from poverty-induced malnutrition.<sup>18</sup> Gauged in absolute terms, poverty refers to deprivation of the material goods and services necessary to sustain health and wellbeing.<sup>19</sup> According to



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the estimates of the World Bank (in all likelihood underestimates by several hundred percent),<sup>20,21</sup> about 1.3 billion people in underdeveloped countries live on less than one dollar a day, and another 2.8 billion on less than two dollars per day. Increasingly, they live in urban squatter settlements—and do not have access to even the most basic levels of nutrition, housing, water, and sanitation, without mentioning schooling, safe and stable employment, health-care services, and other elements of human wellbeing. In the immunological force field of exposure, susceptibility, and resistance, the more than half of humanity living in dire poverty stands the lowest likelihood of decent health and long life.

But absolute poverty alone does not explain global mortality patterns. Relative poverty<sup>22</sup>—as reflective of

hierarchies of access to material, social, and political power—demonstrates a clear gradient effect, whereby each step down the ladder is associated with worse health.<sup>23</sup> Indeed, when the average indicator of life expectancy is disaggregated, enormous differences in life expectancy by social class, race or ethnic origin, and other factors become evident within both developed and developing countries.<sup>24</sup> This distributional effect—mediated through class struggle and political processes<sup>25</sup>—helps explain why some settings with low per-person incomes, such as Costa Rica and the Indian state of Kerala, nonetheless enjoy life expectancy levels over 70 years, similar to those of highly developed, high-income countries.<sup>26</sup> Conversely, in the USA, high per-head income (and by far the world's largest per-head medical care spending) does not translate into superior health outcomes; sharp social and wealth gradients in the USA are associated with rankings of 45th in the world in life expectancy and 41st in infant mortality,<sup>27</sup> one of the worst records for an industrialised country.

Both historical and contemporary studies suggest that the problems of international health demand a combination of social, political, and health-care measures. What role, then, might the Grand Challenges play in improving health in developing countries?

Alas, probably a limited one. In calling on the world's researchers to develop innovative solutions targeted to “the most critical scientific challenges in global health”, the Gates Foundation has turned to a narrowly conceived understanding of health as the product of technical interventions divorced from economic, social, and political contexts.

Take the six challenges relating to improving vaccine delivery and creating new vaccines. Certainly, development of vaccines that do not require a cold chain could increase coverage in areas without electricity and refrigerated transport. At the same time, electricity is potentially a key element in promotion of health and development on other grounds, for example keeping food fresh, enabling study after sundown, and providing cleaner sources of fuel. Why not support both approaches as elements of health improvement? Likewise, the development of single-dose or needle-free vaccines would undoubtedly prove cost effective, but such vaccines might reduce the number of well-baby visits, which are essential to monitoring healthy growth and development. More ominously, effective vaccines against diarrhoeal diseases would probably mean that the problem of extending clean water and sanitation services to the half of the world's population without access<sup>28</sup> would seem far less pressing. Since effective vaccines already exist for almost a dozen of the leading childhood diseases, and the Gates Foundation-supported Global Alliance for Vaccines and Immunisation is currently engaged in the financing, development, and distribution of new and existing vaccines—an effort whose sustainability has been

#### Panel 1: Grand Challenges in global health

##### Goal: To improve childhood vaccines

GC#1: Create effective single-dose vaccines that can be used soon after birth

GC#2: Prepare vaccines that do not require refrigeration

GC#3: Develop needle-free delivery systems for vaccines

##### Goal: To create new vaccines

GC#4: Devise reliable tests in model systems to evaluate live attenuated vaccines

GC#5: Solve how to design antigens for effective, protective immunity

GC#6: Learn which immunological responses provide protective immunity

##### Goal: To control insects that transmit agents of disease

GC#7: Develop a genetic strategy to deplete or incapacitate a disease-transmitting insect population

GC#8: Develop a chemical strategy to deplete or incapacitate a disease-transmitting insect population

##### Goal: To improve nutrition to promote health

GC#9: Create a full range of optimal, bioavailable nutrients in a single staple plant species

##### Goal: To improve drug treatment of infectious diseases

GC#10: Discover drugs and delivery systems that minimise the likelihood of drug resistant microorganisms

##### Goal: To cure latent and chronic infections

GC#11: Create therapies that can cure latent infections

GC#12: Create immunological methods that can cure chronic infections

##### Goal: To measure disease and health status accurately and economically in developing countries

GC#13: Develop technologies that permit quantitative assessment of population health status

GC#14: Develop technologies that allow assessment of individuals for multiple conditions or pathogens at point-of-care

Source: <http://www.grandchallengesgh.org>.

questioned<sup>29</sup>—global health might be better served through political support for universal, accessible, and comprehensive public-health systems (to ensure vaccine coverage, among many activities) in the context of overall improvements in living and working conditions.<sup>30</sup>

The two chemical and genetic Grand Challenges to vector-borne diseases are similarly problematic. The insecticide DDT, for example, once served as an effective method of species eradication against malaria, but only under particular circumstances: for example in the 1940s, on the island of Sardinia,<sup>31</sup> where reintroduction of the *Anopheles* mosquito could be controlled and in Brazil, where *Anopheles gambiae* was eradicated after it had been introduced from west Africa.<sup>32</sup> Elsewhere, DDT proved useful for malaria control in the short term (such as in the south Pacific theatre of World War 2), but ineffective in the long run because of mosquito resistance to DDT, which ultimately doomed the WHO's Global Malaria Eradication Campaign in the late 1960s. Genetic modification is a more frightening proposition that could backfire on the scale of a science fiction horror story. Most importantly, known successful control of malaria in places such as the Tennessee Valley in the 1940s and northern and central Mexico the following decade was far more a function of large-scale social and economic development than of vector-control measures.<sup>33,34</sup>

Three more Grand Challenges addressing drug resistance and the development of cures for latent and chronic infections are also short-sighted. While access to effective immunotherapies for HIV/AIDS, tuberculosis, and other ailments has been appropriately termed a human right,<sup>35</sup> integration of treatment with the well-established social and economic components of prevention surely merits at least one Grand Challenge. Here what deserves careful consideration are the factors associated with both HIV and multiple drug resistant tuberculosis: typically a combination of deprived social conditions—poor nutrition, overcrowded and unsanitary housing, economic insecurity, and inadequate health-care services—which lead to disease and can inhibit the taking of a complete course of medication. The simplicity, dignity and cost effectiveness of a “healthy housing” approach to prevent tuberculosis, as opposed to New York's punitive incarceration of recalcitrant tuberculosis patients to control its tuberculosis epidemic in the early 1990s, are undeniable.<sup>36,37</sup>

Two other challenges—calling for more accurate and economical measurement of disease and health status in developing countries—could provide a much-needed baseline in parts of the world where few ailments are diagnosed and less than a quarter of deaths are medically certified. The ability to carefully gauge problems and progress in the distribution of health and disease within and across populations is a key starting point to the improvement of global health. Yet more

refined diagnostic, surveillance, monitoring, and analytic methods perforce depend upon the critical realms of civil registry systems and health services infrastructure, which in turn demand continuous political commitment.

The Grand Challenge “to improve nutrition to improve public health” seems the most promising until one reads the specifics: “Create a full range of optimal, bioavailable nutrients in a single staple plant species”. According to such an approach, the malnutrition problem in the developing world could disappear with no need to produce and distribute more than a single crop in any particular region. The glitch: reliance on a single crop is a recipe for disaster. Such reliance on potato production to improve caloric intake and agricultural efficiency—and reserve large tracts of arable land for export-oriented agriculture—resulted in the devastating 1840s Irish potato famine, which either killed or forced emigration on a quarter of the population.<sup>38</sup>

This approach also overlooks key distributional questions. Many of the regions with the worst malnutrition problems—such as Central America, the Andes, East Africa, and India—have extremely fertile growing conditions and produce some of the world's most nutritious fruits and crops. As Nobel-winning economist Amartya Sen has demonstrated, malnutrition and famine are not caused by technical roadblocks but rather by political and economic ones: local populations are priced out of their food entitlement due to poor income distribution and market shifts, such as production for export, that have little to do with food supply or nutritional content.<sup>39</sup>

Individually and as a whole, the 14 Grand Challenges share an assumption that scientific and technical aspects of health improvement can be separated from political, social, and economic aspects. Indeed, the Grand Challenges initiative has made this division explicit by excluding the problems of “poverty, access to health interventions, and delivery systems”<sup>5</sup> from this competition. This is not simply an argument of economics versus medicine: if isolated technical approaches may result in few sustained health gains, historical evidence suggests that laissez-faire economic growth, with no focus on wealth redistribution is likely to provoke “the four D's of disruption, deprivation, disease, and death”.<sup>40</sup>

In view of the enormous cultural attention to technological advancement in the 20th century and the persistent social and political problems of our era, it is easy to be seduced by technical solutions and far harder to fathom the political and power structure changes needed to redistribute economic and social resources within and between societies and foster the equitable distribution of integrated health-care services. How might the Gates Foundation play its part?

It could begin by revisiting the premise of the Grand Challenges and other initiatives: that the problems of

global health stem from a shortage of scientific knowledge, translated into technical interventions. The world's leading authorities on global health hold that two-thirds of child deaths<sup>41</sup> and four-fifths of all deaths in developing countries are preventable through existing measures.<sup>42</sup> Many international public health experts are understandably frustrated at how effective measures to forestall preventable mortality remain unused,<sup>43</sup> and have targeted tailored health-systems development<sup>44</sup> and strengthened health systems research in developing countries<sup>45</sup> as the keys to improving global health. These avenues are undoubtedly vital, but in the absence of redistribution of power and resources, health systems alone cannot undo the economic and political underpinnings of poor health (<http://phmovement.org>).<sup>46</sup>

Since social and medical measures currently exist for most disease problems in developing countries, I would suggest that the Gates Foundation take up a larger challenge: to integrate social and medical/technical means of improving global health. This challenge could be taken up on three levels (panel 2). First, the Foundation could propose a new set of Grand Challenges to study in depth the role, magnitude, range,

and interaction of factors that affect long-term improvements in health outcomes, particularly in developing society settings. Features such as housing stock, sanitation coverage, schooling, social security, income distribution, neighbourhood characteristics, imports, exports, and production, workplace and environmental protection, public revenues and spending, debt and banking patterns, migration flows, medical services coverage, and employment patterns would be examined, as would the experience of social movements and community action, patterns of cultural, racial, gender, and class interaction, oppression, and (in)tolerance, and the situation of human rights and justice systems.

These studies would also entail asking “impolite” questions of societies about the distribution of power, the ownership of assets, and how the labour force and political decision-making are structured at national and local levels.<sup>47</sup> The Rockefeller Foundation began such an effort in the mid 1980s, with its *Good Health at Low Cost* study of Costa Rica, China, Kerala, and Sri Lanka,<sup>48</sup> but the initiative was, curiously, abandoned, perhaps when it became clear that the “political will” necessary for good health required the fulfilment of a political pledge to redistribution. Certainly Cuba—the developing country that has arguably best integrated medicine and technology with social redistribution—could be included in the initial round of cases. If such a study seems a far cry from the standard research activities in global health, we should “resist the hubristic belief that, as health professionals, we have all the answers or can by ourselves improve the public's health without efforts to ensure social and economic justice”.<sup>49</sup>

Second, the Gates Foundation could take one of its existing Grand Challenges and modify it to incorporate an integrated approach. For example, the goal “to improve nutrition to promote health” could be refashioned as a combined political, economic, scientific, and social challenge. The Foundation could pilot a system of nutritional security in a particular region or country that would work with local communities, nutritionists, immunologists, transporters, farmers, doctors, economists, agricultural scientists, meteorologists, and others to determine the best mix, quantity, enrichment, and distribution of crops to ensure local availability of nutritional foods at an affordable price. At the same time, a nutritional safety net could be organised that would combine elements of international currency bailouts, farming subsidies in industrialised countries, and social security systems, whereby drops in income, crop failures, or increases in prices that affected nutritional entitlements would trigger immediate actions, including new sources of food supplies and income subsidies. Ideally, this system would be funded and governed at a regional or national level in the long term, but it might benefit from start-up

#### Panel 2: Alternative Grand Challenges

##### Goal: To improve human health by addressing inherently global issues

GC#1: Develop international systems for fair trade and fair commodity pricing; support democratic mechanisms for human rights and redistribution of entitlements to peace and stability; and create incentives for redistributive social welfare efforts including humane employment and living wages, workplace safety, healthy housing and neighbourhoods, education and leisure needs, and safe environments

##### Goal: To foster “best practices” models of integrated political, social, and medical means of reducing social inequalities in health

GC#2: Learn from developing societies that have achieved substantial and sustained health improvements across social groups by studying what combinations, implementation processes, triggers, enabling aspects, and timing of political, social, economic, public health, and medical factors have been effective and achievable over the long term

##### Goal: To improve nutrition to promote health

GC#3: Create a system of food subsidies and income supports, analogous in size to the farm subsidies provided in industrialised countries, that would prevent poverty-induced malnutrition; work with local farmers, nutrition specialists, and agricultural scientists to develop methods of crop rotation and inter-cropping and other locally based approaches to improve the range and output of farming products for domestic consumption



funds from the Gates Foundation or from farming subsidisation schemes in industrialised countries.

At the most ambitious level, the Gates Foundation could take on its concern for poor health as an impediment to international development by addressing “inherently global health issues”<sup>50</sup> relating to international trade, finance, and economic exploitation. Here Gates would be acting not just as a donor but also as an enlightened and influential businessman promoting a socially just system of development that would heighten the effectiveness of technical interventions and lead to the broad enjoyment of health and human rights.

There is a certain irony in asking Gates—whose wealth was amassed through the current economic system—to play a part in reforming that very system. To be sure, any effort in favour of social justice would depend on broad-based political movements, particularly at regional and national levels. Yet Gates might prove instrumental in urging the international community to refrain from impeding elected governments with redistributive platforms maintain their commitments to the electorate, even if debt-servicing were suspended or the profits of multinational or national companies were at stake. He might also support the creation of a fair international system of commodity pricing, inviolable labour standards, and economic incentives for higher wages, increased social spending, and other forms of redistribution, including universal health care services. This challenge would entail dirty work indeed—not only because much-needed sewerage systems would be built, but because of the enormous threat such an approach poses to existing power structures both locally and globally.

Who, one might reasonably ask, could oppose the goals of the Grand Challenges? After all, any concerted effort to address the health problems of the developing world must surely be welcome. But the longer we isolate public health’s technical aspects from its political and social aspects, the longer technical interventions will squeeze out one side of the mortality balloon only to find it inflated elsewhere. Rudolf Virchow—founding father of both cellular pathology and social medicine—perhaps stated this most succinctly and most presciently in one of his lesser known quotes: “The improvement of medicine may eventually prolong human life, but the improvement of social conditions can achieve this result more rapidly and more successfully.”<sup>51</sup> Integration of the two strategies is the grandest challenge of them all.

#### Conflict of interest statement

I declare that I have no conflict of interest.

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