

GLOBAL HEALTH 2035

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Global health 2035: a world converging within a generation

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Executive summary

Prompted by the 20th anniversary of the 1993 World Development Report, a *Lancet* Commission revisited the case for investment in health and developed a new investment framework to achieve dramatic health gains by 2035. Our report has four key messages, each accompanied by opportunities for action by national governments of low-income and middle-income countries and by the international community.

There is an enormous payoff from investing in health

The returns on investing in health are impressive. Reductions in mortality account for about 11% of recent economic growth in low-income and middle-income countries as measured in their national income accounts.

However, although these accounts capture the benefits that result from improved economic productivity, they fail to capture the value of better health in and of itself. This intrinsic value, the value of additional life-years (VLYs), can be inferred from people's willingness to trade off income, pleasure, or convenience for an increase in their life expectancy. A more complete picture of the value of health investments over a time period is given by the growth in a country's "full income"—the income growth measured in national income accounts plus the VLYs gained in that period. Between 2000 and 2011, about 24% of the growth in full income in low-income and middle-income countries resulted from VLYs gained.

This more comprehensive understanding of the economic value of health improvements provides a strong rationale for improved resource allocation across sectors.

Opportunities:

- If planning ministries used full income approaches (assessing VLYs) in guiding their investments, they could increase overall returns by increasing their domestic financing of high-priority health and health-related investments.
- Assessment of VLYs strengthens the case for allocating a higher proportion of official development assistance to development assistance for health.

A "grand convergence" in health is achievable within our lifetimes

A unique characteristic of our generation is that collectively we have the financial and the ever-improving technical capacity to reduce infectious, child, and maternal mortality rates to low levels universally by 2035, to achieve a "grand convergence" in health. With enhanced investments to scale up health technologies and systems, these rates in most low-income and middle-income countries would fall to those presently seen in the best-performing middle-income countries. Achievement of convergence would prevent about 10 million deaths in 2035 across low-income and lower-middle-income countries relative to a scenario of stagnant investments and no improvements in technology. With use of VLYs to estimate the economic benefits, over the period 2015–35 these benefits would exceed costs by a factor of about 9–20, making the investment highly attractive.

Opportunities:

- The expected economic growth of low-income and middle-income countries means that most of the incremental costs of achieving convergence could be covered from domestic sources, although some countries will continue to need external assistance.
- The international community can best support convergence by funding the development and delivery of new health technologies and curbing antibiotic resistance. International funding for health research and development targeted at diseases that disproportionately affect low-income and middle-income countries should be doubled from current amounts (US\$3 billion/year) to \$6 billion per year by 2020. The core functions of global health, especially the provision of global public goods and management of externalities, have been neglected in the last 20 years and should regain prominence.

Fiscal policies are a powerful and underused lever for curbing of non-communicable diseases and injuries

The burden of deaths from non-communicable diseases (NCDs) and injuries in low-income and middle-income

countries can be reduced by 2035 through inexpensive population-based and clinical interventions. Fiscal policies are an especially promising lever for reducing this burden.

Opportunities:

- National governments can curb NCDs and raise significant revenue by heavily taxing tobacco and other harmful substances, and they can redirect finances towards NCD control by reducing subsidies on items such as fossil fuels. Investment in strengthening health systems to deliver packages of cost-effective clinical interventions for NCDs and injuries is another important national opportunity.
- International action should focus on provision of technical assistance on fiscal policies, regional co-operation on tobacco, and funding of population, policy, and implementation research on scaling-up of interventions for NCDs and injuries.

Progressive universalism, a pathway to universal health coverage (UHC), is an efficient way to achieve health and financial protection

The Commission endorses two pro-poor pathways to achieving UHC within a generation. In the first, publicly financed insurance would cover essential health-care interventions to achieve convergence and tackle NCDs and injuries. This pathway would directly benefit the poor because they are disproportionately affected by these problems. The second pathway provides a larger benefit package, funded through a range of financing mechanisms, with poor people exempted from payments.

Opportunities:

- For national governments, progressive universalism would yield high health gains per dollar spent and poor people would gain the most in terms of health and financial protection.
- The international community can best support countries to implement progressive universal health coverage by financing population, policy, and implementation research, such as on the mechanics of designing and implementing evolution of the benefits package as the resource envelope for public finance grows.

Our report points to the possibility of achieving dramatic gains in global health by 2035 through a grand convergence around infectious, child, and maternal mortality; major reductions in the incidence and consequences of NCDs and injuries; and the promise of universal health coverage. Good reasons exist to be optimistic about seeing the global health landscape utterly transformed in this way within our lifetimes.

Introduction

In 1978, the World Bank initiated an annual flagship publication, the World Development Report (WDR),¹

which aims to inform global thinking on a specific topic (panel 1). WDR 1993, *Investing in Health* (figure 1), is the only WDR so far that has focused on global health. It was the first major health report to be targeted at finance ministers and remains one of the most widely cited WDRs in the Bank's history.²

WDR 1993 showed finance ministers that well-chosen health expenditures were not an economic drain but an investment in economic prosperity and individual well-being. It argued that allocation of resources towards cost-effective interventions for high-burden diseases offered a rapid and inexpensive pathway to improvements in welfare.

Prompted by the 20th anniversary of WDR 1993, a *Lancet* Commission on Investing in Health was launched in December, 2012. The Commission was chaired by Lawrence Summers, the Chief Economist at the World Bank responsible for choosing global health as the focus of WDR 1993, and co-chaired by Dean Jamison, lead author of WDR 1993. The Commission aimed to consider the recommendations of WDR 1993, examine how the context for health investment has changed in the past 20 years, and develop an ambitious forward-looking health policy agenda targeting the world's poor populations.

The time is right to revisit the case for investment in health. We are in the closing era of the Millennium Development Goals (MDGs). Although tremendous progress has been made towards MDGs 4–6, a very high preventable burden of infectious, maternal, and child mortality will still remain by 2015. The global development community is debating both a new set of post-2015 sustainable development goals and the positioning of health, including universal health coverage (UHC), in such goals. We are also in an era in which the landscape of global health financing is undergoing major changes. After a decade of rising aid for health—a “golden age” for global health assistance³—development assistance budgets are strained. At the same time, the economic growth of many low-income and middle-income countries means that they are increasingly able to step up their domestic health investments.

This evolution in the aspirations, landscape, and financing of global health is being accompanied by a rapid shift in the global disease burden away from infectious diseases and towards non-communicable diseases (NCDs) and injuries. This shift has been slower in some low-income and middle-income countries than in high-income countries, such that they face a heavy triple burden of infections, NCDs, and injuries, with tremendous health and financial consequences for households and societies. On top of these health problems, we face emerging global threats, such as antimicrobial resistance, new pandemics, emerging infections, and global climate change. Our commission set out to answer the question: how should low-income and middle-income countries and their development partners target their future investments in health to tackle this complex array of challenges?

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Panel 1: What are World Development Reports and why did the World Development Report 1993 focus on health?

The World Bank’s annual World Development Reports (WDRs), probably the world’s most widely distributed economic publication, are its chief mechanism for taking stock of the evidence on a specific topic and for developing and sharing its policy messages with member countries, other development agencies, and the academic community. The reports are produced by the Bank’s research community, headed by its Chief Economist, who has overall responsibility for the report.²

Why did Lawrence Summers, the Bank’s Chief Economist in 1991–93, and Chair of this Commission, choose health as the focus of WDR 1993? Summers saw three benefits of publishing a WDR about health. First was the opportunity to amplify the Bank’s strategy to combat poverty. Second, health represented an area in which a central and constructive role existed for government. Third, Summers believed that the potential gains from getting the correct health policies in place were enormous.

Every year, a small team of World Bank staff and others is seconded from their regular positions to work full time authoring that year’s WDR. WDR 1993 was written by Dean T Jamison, Seth Berkley, José Luis Bobadilla, Robert Hecht, Kenneth Hill, Christopher J L Murray, Philip Musgrove, Helen Saxenian, and Jee-Peng Tan, under the general direction of Lawrence Summers and Nancy Birdsall. The report’s preparation was facilitated by 19 international consultations and several seminars during a 9-month period.

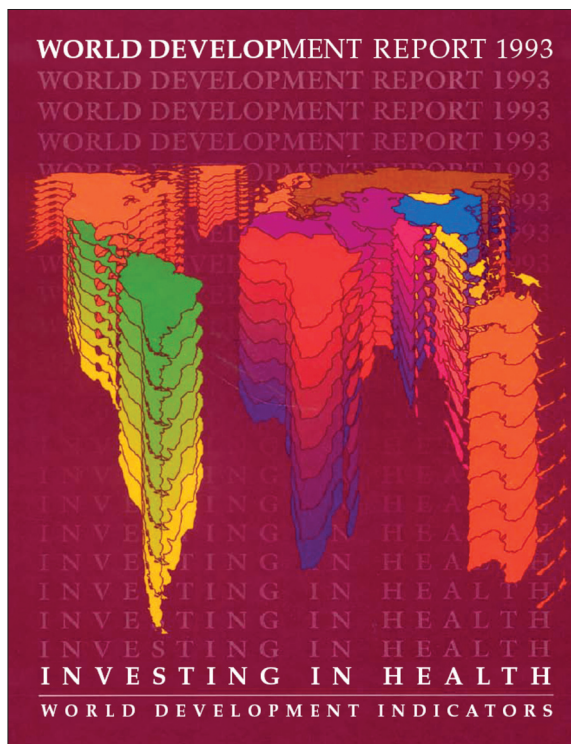


Figure 1: The World Development Report 1993

Our report proposes a new pro-poor investment plan that lays out key priorities and essential packages of interventions to accelerate the recent progress in global health and achieve dramatic gains within a generation—that is, by 2035. The report is divided into seven sections.

Section 1 sets the scene by laying out the context for investment in health. We begin by briefly looking back at WDR 1993 to assess its legacy, both positive and negative, and to draw lessons that can be applied to future investment planning. We then discuss the key advances and challenges in the global health landscape in the past 20 years that have resonance for health investment. We lay out three domains of health challenges that national governments will be grappling with over the next 20 years. The *first domain* is the ongoing high rates of infectious disease and mortality from reproductive, maternal, newborn, and child health (RMNCH) disorders in poor populations, especially in rural regions. Since most of the world’s poor people are now in middle-income countries, tackling such disorders will require focused attention, not only to low-income countries but to the lower-income and rural subpopulations of middle-income countries. The *second domain*, a consequence of tackling the conditions of the first domain, is demographic changes and the shift in the global disease burden towards NCDs and injuries. Increasing rates of NCDs, associated with the rise in behavioural risk factors such as smoking, alcohol consumption, and sedentary behaviour, are compounded by often weak institutional arrangements to tackle these diseases and risks. Governments in many low-income and middle-income countries that have curbed their burden of infectious mortality are now facing a growing burden of deaths from road traffic injuries, associated with increasing rates of urbanisation and motorisation. Such injuries are the world’s leading cause of death among people aged 15–29 years.⁴ The *third domain*, a consequence of inadequate financial arrangements for addressing the other two domains, is the potential for impoverishing medical expenditures together with sharp and unproductive increases in health-care costs.

In **section 2** of our report, we examine the latest evidence on the impressive economic returns to investing in health. This evidence includes new data derived from valuation of improvements in life expectancy in monetary terms, an approach that leads to a more comprehensive concept of income called full income.⁵ The notion of a change in full income includes change in GDP but goes beyond it by also including a valuation of change in life expectancy.

In **section 3**, we briefly highlight the crucial role of a diagonal approach to tackling infections, RMNCH disorders, NCDs and injuries—that is, stronger health systems that are focused on achieving measurable health outcomes. We also stress the importance of population-based policies, especially in curbing NCDs and injuries.

In **section 4**, we propose an ambitious, yet feasible, integrated investment plan for achievement of a “grand convergence” in health by 2035. By grand convergence, we mean a reduction in the burden of infections and RMNCH disorders in most high-mortality low-income and middle-income countries down to the rates presently seen in the

best-performing middle-income countries (eg, Chile, China, Costa Rica, and Cuba, conveniently labelled the “4C” countries). We show that convergence could be achieved through enhanced investments to scale up health technologies and systems. Although our analysis suggests that the annual price tag to achieve convergence is large, with a full income approach we find that the benefits would be enormous, which makes the investment highly attractive. Our report’s notion of a grand convergence in health echoes Mahbubani’s recent suggestion of a “great convergence” in the global economy,⁶ with decreasing absolute poverty and a rising middle class.

In **section 5**, we propose a framework to sharply reduce the burden of NCDs and injuries within a generation through scale-up of essential packages of population-based and clinical interventions.

In **section 6**, we study the role of UHC in providing financial risk protection. We argue for public financing of progressive pathways towards UHC that are pro-poor from the outset. We also propose steps that low-income and middle-income countries can take to avoid unproductive health cost escalation.

Finally, in **section 7**, we assess the role of international collective action in provision of technical and financial assistance to national governments; preparation for emerging risks of the 21st century (eg, pandemics and antibiotic resistance); financing of new product development; and in supporting what we call population, policy, and implementation research (PPiR).

Our analyses were done by an international multi-disciplinary group of 25 commissioners. We synthesised available evidence, undertook primary research on key topics, and met for three in-person consultations during the course of 8 months (in Norway, Rwanda, and the USA). Smaller subgroups of commissioners held additional consultations about specific topics with experts who generously contributed their time. The Commission co-hosted two collaborative meetings: a colloquium with the Council on Health Research for Development on sustainable investments in research and development (R&D), and a meeting with the GAVI Alliance on the economic value of vaccines. We also commissioned several teams of researchers to produce background papers that informed our analysis (available online).

We focused mainly on health improvements that could be achieved by the health sector. One key exception, which we discuss in this report, is population-wide interventions (eg, taxation and regulation) to address risk factors for NCDs and injuries. The Commission firmly believes that tackling the social and intersectoral determinants of health is central to achieving long-term health gains, as has been argued by several highly influential reports (panel 2). For some of these determinants, however, complex and entrenched political obstacles exist to addressing them, and for others, the effect will not be realised for a long period. For these reasons, the Commission believes that the health needs of the vulnerable

Panel 2: Social and intersectoral determinants and consequences of better health

Three key WHO publications have advanced our understanding of these relations:

- The 1999 World Health Report (WHR), the first WHR issued by WHO Director General Gro Harlem Brundtland, estimated that half of the health improvements between 1960 and 1990 in low-income and middle-income countries were from changes in two social determinants: income and education.⁷ The report noted that these determinants affect health through consequences such as poor nutrition, sanitation, and other risk factors for ill health. Nevertheless, WHR 1999 argued that the health community could have the greatest effect on health by focusing on the health sector, including health systems strengthening, rather than by taking action outside this sector.
- The 2001 report of the Commission on Macroeconomics and Health, chaired by Jeffrey Sachs, emphasised the importance of investment not only in the health sector but also in education, water, sanitation, and agriculture, to reduce poverty.⁸ By quantifying both the substantial economic consequences of better health and the costs of achieving it, the report had a hugely important role in informed advocacy for the health sector.
- The Commission on Social Determinants of Health, chaired by Michael Marmot, was established by WHO in 2005 to lay out evidence for how to promote health equity through sound social and economic policies and to foster a global movement towards its achievement.⁹ The Commission made three broad recommendations: improve daily conditions; take “far-reaching and systematic action” to improve the distribution of resources to ensure “fair financing, corporate social responsibility, gender equity and better governance”; and improve data collection for better measurement of health inequities and monitor the effect of interventions in improving these inequities.

will be most directly and expediently addressed by investments and action within the health sector.

To examine the context for investing in health, we begin by briefly looking back over the past 20 years, beginning with WDR 1993. We revisit the report’s key messages and findings, and the criticisms that it received, to draw out the lessons for health investments that remain equally relevant today. We then review the remarkable changes in the world during the past 20 years, and the unanticipated obstacles, that have shaped today’s global health landscape. We define in more detail the three major domains of health challenges, mentioned briefly earlier, that low-income and middle-income countries will be grappling with in the next 20 years. Finally, we analyse new research that provides a deeper understanding of the profound economic benefits of better health—research that we hope will lead to improved financing of the health sector.

For the background papers see <http://globalhealth2035.org>

Section 1. 20 years of advances and unanticipated challenges

In the 40 years before 1993, dramatic improvements in health had already been achieved. Smallpox had been eradicated. Vaccines had driven down the number of annual deaths from measles and polio. In 1950, 28 of every 100 children died before their fifth birthday, but by 1990 this number had fallen to ten.¹ WDR 1993 argued that these successes could be explained by scientific advances delivered by health systems, economic growth, and expanded access to education and health services.

However, ongoing poverty, low educational opportunities for girls, and poor public policy decisions had prevented about a billion people in low-income and middle-income countries from fully sharing in these health gains. Health systems were facing major problems, from underfunding and misallocation of funds to an explosion of health care costs in some middle-income countries. The global HIV/AIDS pandemic had also taken hold.

WDR 1993

Key messages

WDR 1993 proposed a three-pronged approach to government policies, underpinned by investment in scientific research to amplify the effect of each prong.

The first prong was to foster an environment that enables households to improve health. This goal could be achieved through pursuit of growth-enhancing macroeconomic policies, expansion of schooling (especially for girls), and promotion of women's rights and status through political and economic empowerment and legal protection against abuse. The report argued, for example, that providing education for girls and women would have one of the greatest payoffs for averting death and disability through improving knowledge about health and increasing contact with the health system. WDR 1993 also framed violence against women as a major global public health issue requiring urgent action.

The second prong was to improve government spending on health, particularly by targeting public spending towards a specific set of diseases and interventions. WDR 1993 combined cost-effectiveness analysis with burden of disease assessment to specify a set of "minimum packages" of cost-effective public health interventions (eg, HIV prevention and immunisations) and clinical services (eg, treatment of childhood illnesses). The report argued that these packages would have enormous potential to avert deaths and reduce disability, especially among the world's poorest billion people (the so-called "bottom billion").¹⁰ For example, WDR 1993 urged countries to scale up the six vaccines included in the Expanded Programme on Immunization (EPI) to achieve 95% coverage, and to consider adding iodine, vitamin A, and vaccines against hepatitis B and yellow fever. "In most developing countries," the report argued, "such an 'EPI Plus' cluster of interventions in the first year of life would have the highest cost-effectiveness of any health measure available in the world today." The report claimed that countries could reduce their disease burden by doubling or tripling their spending on such cost-effective packages. It recommended that these packages should be publicly financed, and urged donors to increase development assistance for health (DAH) to help cover the costs of these packages in low-income countries.

The third prong was to promote diversity and competition in the supply of health services and inputs. Although governments should finance the essential

packages, these publicly financed services might in some cases be best provided by non-governmental organisations or the private sector. The "remaining clinical services" would need to be financed privately or through publicly mandated social insurance within a strong government regulatory framework.

The report made a strong case that the international community should devote more resources to health. It recommended that health funding should be immediately restored to 7% of official development assistance (ODA); such funding had declined to 6% of ODA in 1986–90. It called on donors to provide an additional US\$2 billion per year (1993 US dollars) to "finance a quarter of the estimated additional costs of a basic package in low-income countries and of strengthened efforts to prevent AIDS". WDR 1993 endorsed the call from WHO's Global Program on AIDS to increase funding for HIV/AIDS prevention activities by a factor of 10–15.

Although the primary focus of WDR 1993 was the health sector, the report also emphasised the importance of intersectoral action, particularly the value of linking health with water and sanitation, food regulation, and education. It argued forcefully for action on tobacco control, including tobacco taxation, bans on smoking in public places, and public education campaigns. It proposed measures to combat climate change, such as promotion of clean technologies and greater energy efficiency.

Impact and influence

WDR 1993, which itself was influenced by the powerful ideas contained in the Declaration of Alma-Ata, is credited for having helped to place health firmly on the global development agenda. It laid the groundwork, along with initiatives such as the Commission on Macroeconomics and Health (CMH) and the MDGs, both established in 2000, for many of the key global health milestones of the past 20 years.

By proposing a vision for health improvement, a broadly applicable method for informing health policy priorities (combining disease burden with cost-effectiveness analysis), and an agenda for action, the report put pressure on other international agencies to respond. One response was the launch of the WHO's World Health Report (WHR) series in 1995. Several WHRs have been influenced by WDR 1993.

A 1993 editorial in *The Lancet* argued that WDR 1993 could provide a "cure for donor fatigue" at a time when "international public health is drifting".¹¹ However, although annual DAH doubled between 1990 and 2001, from US\$5.8 billion to \$11.0 billion in 2001 (data from reference 3, converted to 2011 US dollars), there is no evidence to prove that WDR 1993 played a part in this rise. A much more rapid increase in DAH occurred in the period after the year 2000, in the wake of the CMH and MDGs. WDR 1993 might, however, have had a role in creating a climate for innovation in global health financing that influenced new funding mechanisms

such as the Global Fund to Fight AIDS, Tuberculosis, and Malaria (Feachem R, Global Health Group, University of California, San Francisco, personal communication).

One identifiable effect of the report is that it motivated Bill Gates to invest in global health through the Bill & Melinda Gates Foundation.^{12,13} In a 2002 speech to a United Nations Special Session on Children, Gates said:¹² “I remember reading the 1993 World Development Report. Every page screamed out that human life was not being as valued in the world at large as it should be. My

wife Melinda and I were stunned to learn that 11 million children die every year from preventable causes. That is when we decided to make improving health the focus of our philanthropy.”

Improved measurement to inform health policy was at the heart of WDR 1993. The report documented total and public expenditures on health in 1990, and trends in ODA from 1981 to 1990. Following its publication, WHO, in collaboration with the World Bank and the US Agency for International Development (USAID), instituted better and closer tracking of national health accounts and of ODA.

Panel 3: Measurement of the global burden of disease before, during, and after World Development Report 1993

Assessment of death rates by age and cause allows countries to track their public health status. These mortality data have long been available for high-income countries and for some low-income and middle-income countries. However, many countries do not have well-functioning vital registration systems. In the early 1990s, the absence of high-quality national data meant that it was common practice for governments or WHO to assign deaths to causes in a way that typically inflated the apparent importance of each cause. Such inflation was discovered by censuses and sample surveys that allowed demographers to generate reasonable estimates of total deaths by age, especially for children. When the cause-specific estimates from governments or WHO were summed for each age, the sum was much higher than the total number of deaths that the demographers had estimated.

World Development Report (WDR) 1993 generated the first estimates of the global burden of disease (GBD) by extrapolating estimates of death by cause worldwide in a way that was consistent with demographically derived totals, and by including an assessment of burden from non-fatal outcomes. In its estimates, WDR 1993 used three key building blocks:

- Research by Alan Lopez provided the first building block, because Lopez had assembled consistent estimates of death by cause worldwide.^{14,15}
- Richard Zeckhauser and Donald Shepard's quality-adjusted life-year (QALY) provided the second building block.¹⁶ The QALY combines fatal and non-fatal health outcomes by adjusting life-years lived by a factor representing loss of quality of life from a particular disorder. For example, blindness in both eyes might receive a quality of life rating of 0.5, thereby weighting 1 life-year lived with blindness at half the value of a life-year of a healthy person with normal vision. The GBD's burden estimates use disability-adjusted life-years (DALYs), a variant of the QALY. The DALYs for a particular disorder are the sum of the years of life lost because of premature mortality and the years lost due to disability for people living with that disorder.
- A third building block was Barnum's illustration from Ghana,¹⁷ which built on data assembled by Richard Morrow and colleagues,¹⁸ of how non-fatal outcomes and consistent cause of death estimates could be combined to generate a national burden of disease account.

Building on these three previous efforts, WDR 1993 generated the first GBD estimate for the year 1990. This initial assessment of GBD 1990 appeared in appendix B of WDR 1993 and was expanded by Murray and colleagues.¹⁹

Updated GBD estimates have been published over the years and two variants are now available, one from the GBD 2010 study,²⁰ and one from WHO.²¹ Although broadly similar, the two approaches have several important differences, including their assessments of the cause of death in childhood and deaths from cancer. The WHO assessment is consistent with the UN Population Division's most recent estimates of total numbers of deaths by age and cause, whereas the death totals from GBD 2010 are substantially lower. In an analysis undertaken for our Commission, Hill and Zimmerman generated improved empirical estimates of the number of deaths in the 5–14 years age group.²² These estimates exceeded those of GBD 2010 by about one million deaths and are much closer to (although still larger than) the UN numbers.

The GBD 2010 study provides estimates of the 1990 burden that use the newer data and methods available in 2010 and it thus enables us to retrospectively assess the GBD results reported in WDR 1993. To make the comparison requires adjustments to account for changes in methodological assumptions—most notably that the GBD 2010 study assigns about 2.5 times as many DALYs to a child death as did previous analyses, including WDR 1993. Although these adjustments can only be approximate, our retrospective assessment (appendix 1, pp 9 and 33) suggests that WDR 1993 did a reasonable job of estimating GBD, except with respect to maternal causes, HIV/AIDS, and diabetes.

Aggregate measures such as DALYs necessarily depend on key assumptions that are of a sensitive and non-transparent nature. For example, assumptions exist about the relative importance of adult deaths versus child deaths versus stillbirths, and assessments of weights given to disability vary. For most purposes, reporting of deaths (or specific disabilities) by age and cause will prove robust to operator variability and will be clear to readers. Therefore, in our Commission we report disease burden using deaths by age and cause, based on the numbers from the UN system²¹ (see appendix 1, pp 14–25 for summary tables for 2000 and 2011 organised by the World Bank's income grouping of countries).

See Online for appendix 1

Panel 4: The mixed legacy of World Development Report 1993 at the national level

Julio Frenk, Mexico's Minister of Health in 2000–06, and one of this report's Commissioners, believes that World Development Report (WDR) 1993 had "a huge effect" at country level. "Its most influential feature", he says "was that, as a report issued by the World Bank, it was read by finance ministries, where some of the most important decisions affecting health in a country are made." In the case of Mexico, WDR 1993 helped to persuade many of those decision makers to invest in health.

The analytical methods featured in WDR 1993 inspired a reform, explains Frenk, that was designed and implemented making use of evidence derived from the local adaptation of knowledge-related global public goods. These goods included the measurement of global burden of disease and the specification of priority interventions, among others. "In turn, this reform experience fed back into the global pool of knowledge about health improvement. Thus, WDR 1993 helped launch a process of shared learning among countries."

Rajiv Misra, India's health secretary at the time that WDR 1993 was published, also believes that WDR 1993 helped to shape India's health policy and strategy in the 1990s. The concepts of burden of disease and cost-effectiveness, introduced in the Disease Control Priorities Project²⁴ but popularised by WDR 1993, gave the Indian Government the tools to rationally identify programmes that dealt with the most important diseases in a way that offered the best value for money.²⁵ "This was truly revolutionary", he says, "for an organisation used to taking decisions on an ad-hoc basis without any analysis and data."

However, the effect on sub-Saharan Africa was much more mixed, argues Agnes Binagwaho, Rwanda's Minister of Health and another of this report's Commissioners. "From my point of view", she says, "WDR 1993 has a complex legacy for Africa. The report cemented for once and for all the universal link between health and economic development, but also helped some countries to justify a costly retreat from rights-based approaches to health and education. At this critical juncture, we aim to reflect on how the insights of and questions raised by WDR 1993 might contribute to an era of shared, sustainable, and people-centered growth. As we have learned in Rwanda, it is the people who are our greatest resource."

WDR 1993 generated the first estimates of the global burden of disease (GBD; panel 3). The metric for the GBD was disability-adjusted life-years (DALYs), in which 1 DALY can be regarded as 1 lost year of healthy life. The DALY concept was closely related to quality-adjusted life-years (QALYs), which came from health economics.¹⁶ Just as WDR 1993's work on health expenditures became institutionalised at WHO, estimates of disease burden became institutionalised both at WHO and more recently at the Institute for Health Metrics and Evaluation in Seattle (WA, USA).

WDR 1993's work on tracking of intervention options, effectiveness, and costs drew on, and was in turn carried forward by, the Disease Control Priorities Project (DCP),²³ which is undergoing a third revision. The idea of essential public health and clinical packages gained widespread traction among donors, UN agencies, and countries themselves. For example, a recent desk review by USAID found that the concept of essential packages is universal in all USAID priority countries (Cavanaugh K, USAID, personal communication). Panel 4 shows examples of the influence of WDR 1993 at a national level in India, Mexico, and Rwanda, which suggest a mixed legacy of positive and negative effects. WDR 1993,

published in nine languages, has been used widely in health education worldwide.

Criticisms

WDR 1993 has also attracted much criticism, both for its methods and its policy recommendations. Although the report's assessment of disease burden has been adapted and used widely, the use of the DALY to combine measurement of disability and premature mortality remains controversial. Critics argue, for example, that the measurement is too simplistic, assigns somewhat arbitrary disability weights to different diseases, and values years saved for able-bodied people more than those for disabled people.^{2,26} Although WDR 1993 drew upon literature reviews from its companion document, DCP,²⁴ the evidence base underlying the WDR 1993's recommendations nevertheless came under scrutiny.²⁶

In the USA, the report was criticised by right-wing think tanks for its endorsement of the government's role in the financing and delivery of health care. The pharmaceutical industry trade group PhRMA objected to the report's support for the idea of an essential medicines list. From the other side of the political spectrum, in Europe WDR 1993 was criticised for its "encouragement of private health care provision in countries with limited capacity for effective regulation".²⁷ The notion of minimum packages of interventions came under attack for being too vertical in orientation and a distraction from the creation of comprehensive, integrated health-care systems.²⁷

The scope of the interventions in the packages suggested by WDR 1993 was very much in the spirit of two previous packages. The first package, promoted by the United Nations Children's Fund, had seven interventions: growth monitoring, oral rehydration therapy, breastfeeding, immunisation, female education, food supplementation, and family planning.²⁸ The second package was selective primary health care, defined by Walsh and Warren as "a rationally conceived, best-data-based, selective attack on the most severe public-health problems facing a region".²⁹ Although the WDR 1993 packages had a wider scope than either of these two packages, they were nevertheless criticised for being too minimal.³⁰

WDR 1993 was published at a time of "great enthusiasm for health reform" in low-income and middle-income countries,³¹ exemplified by the September 1993 conference, International Conference on Health Sector Reform: Issues for the 1990s. To an important community of scholars and practitioners, the report became synonymous with a health sector reform model characterised by privatisation, decentralisation, structural adjustment, and imposition of user fees—a model that many viewed as damaging.³¹

WDR 1993's discussion of user fees remains controversial to this day.³² Although the report argued that "studies on the effect of user fees are inconclusive and contradictory", it suggested that low-income and middle-income countries would be justified in choosing to fund essential health interventions from general

For the Disease Control Priorities Project see <http://www.dcp-3.org/>

revenues “with perhaps some contribution from user fees”. However, the report did state that “reducing charges or exempting the poor from the fees may be warranted”. Since 1993, evidence has mounted that user fees can exclude poor people from services, such that by 2012 *The Lancet*, in its theme issue on UHC, argued that user fees are “a locked gate that prevents access to health care for many who need it most” and “they should be scrapped”.³³ The Commission fully acknowledges that user fees can be exclusionary and cause impoverishment, and later in this report we endorse a progressive pathway to UHC that involves zero user fees for poor people.

Limitations and how we address them

On re-reading WDR 1993, admittedly with the benefit of hindsight after two decades, we believe that it had two major limitations. First, although WDR 1993 discussed the “instrumental value” of better health (eg, better health improves worker productivity), it did not attempt to quantify the “intrinsic value” of health (the value of good health in and of itself). Our report summarises research that quantifies the intrinsic value of mortality reduction—the findings should, we hope, lead to a notable reassessment of the priority of health in national and international investment portfolios. In particular, benefit-to-cost assessments and a strong implementation record point to the value of increased commitment to health.

Second, financial protection failed to receive sufficient attention in WDR 1993, although very few data were available in 1993 about out-of-pocket spending and catastrophic financial expenditures. Moreover, only a few analyses pointed to financial protection as an important goal of health systems. By contrast, the role of UHC in providing financial protection is a major feature of our report.

Building on the legacy

Despite the many criticisms of WDR 1993, we believe that it provided a valuable investment framework that we can now build on. WDR 1993 introduced an economic logic to international health. It launched a line of reasoning around explicit priority setting. With the recognition that choices must always be made, WDR 1993 argued that such choices should be explicit and that making explicit choices is the key to defining priorities for government health spending and donor assistance. The vision of our new investment and financing framework is very much based on a “WDR 1993 way of thinking” when it comes to the need for prioritisation in the next two decades.

Investing in Health was also catalytic in showing that health investments have forward links to economic growth and productivity. We now strengthen this argument even further, with compelling full income approaches. WDR 1993 saw support for R&D as a crucial investment for making health gains, a view that we strongly echo and amplify further in this report.

Our framework goes far beyond what was proposed in 1993. 20 years ago, the report’s authors could not have envisaged a grand convergence to be already within our reach when it comes to infectious, maternal, and child deaths. The financial resources and technologies were unavailable. Today, in addition to having better technological tools at our disposal, the financing, architecture, and governance of global health have been transformed in ways that were scarcely imaginable two decades ago.

These transformations have already led to impressive reductions in mortality in low-income and middle-income countries. We now assess these health improvements of the past 20 years, the advances that made mortality reductions possible, and the unanticipated challenges of that period. We also set out what we believe to be the global health challenges that low-income and middle-income countries will probably face in the next 20 years.

The past 20 years: unprecedented progress and unanticipated problems

Dimensions and magnitude of progress

From 1990 to 2011, the annual number of under-5 deaths worldwide fell from 12 million to 6·9 million, and the under-5 mortality rate fell from 87 to 51 per 1000 livebirths.³⁴ Between 1990 and 2010, the annual number of maternal deaths worldwide fell from 546 000 to 287 000, and the global maternal mortality ratio fell from 400 to 210 maternal deaths per 100 000 livebirths.³⁵ The rates of increase of life expectancy in the second half of the 20th century in some countries (eg, China and Mexico) are at least twice as fast as those that occurred in high-income countries in the same period. Nevertheless, the rate of decline in maternal and child mortality will not be sufficient to reach MDGs 4 and 5 by 2015.

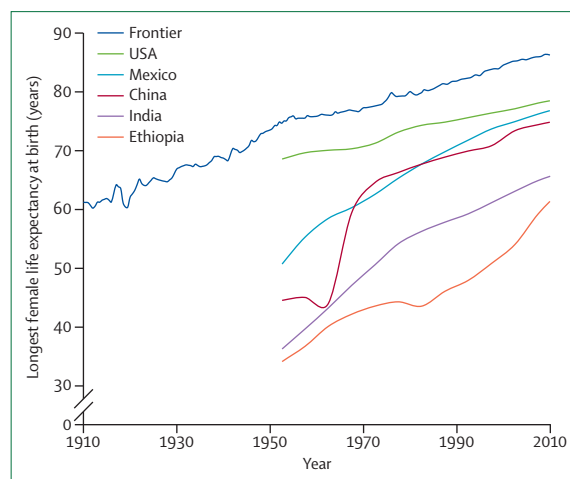


Figure 2: Female life expectancy at birth for selected countries compared with the frontier

The frontier line indicates female life expectancy in the best-performing country in that year, which has been Japan for the past 20 years. Data from references 36 and 37 and Vallin J, Institut national d'études démographiques, personal communication.

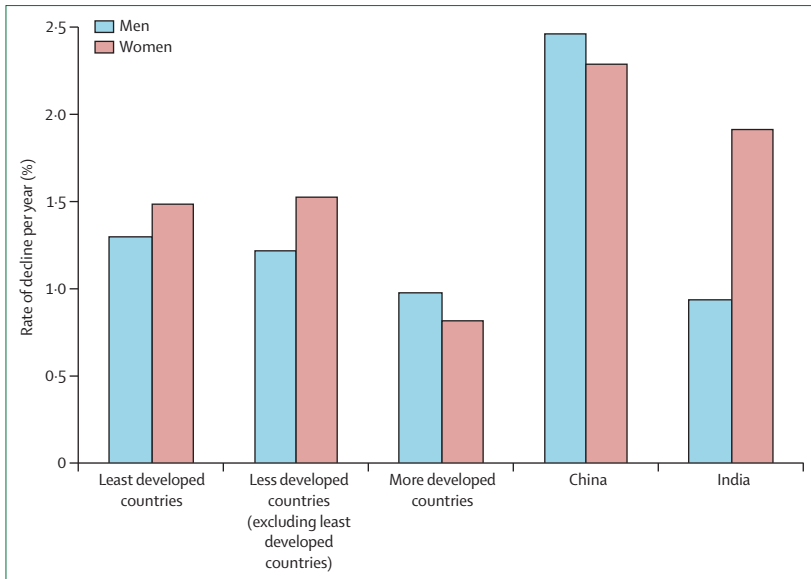


Figure 3: Annual rates of decrease in adult mortality by sex and income group, 1992–2012
 Adult mortality rates are defined as the probability of dying between the ages of 15 and 60 years at the age-specific mortality rates of the indicated year (denoted by demographers as 45q15). The bars show the rate of decrease per year between 1992 and 2012, in which “1992” refers to estimates averaged for the period 1990–2005 and “2012” refers to UN medium projections for 2010–15. The figure uses the UN classification of countries, which is specified in appendix 1, p 7. Data from reference 37.

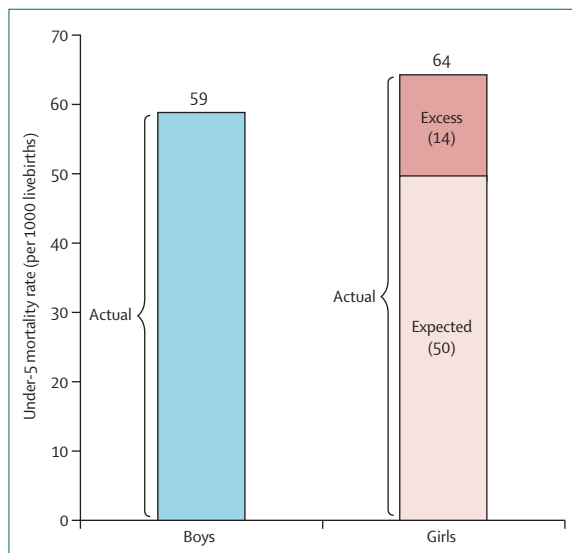


Figure 4: Excess under-5 mortality rate in girls compared with boys in India, 2005
 In low-income and middle-income countries as a group, the under-5 mortality rate is 18% higher for boys. The expected under-5 mortality rate for girls in India shows what the female rate is expected to be, given the rate in boys in India and the rate for low-income and middle-income countries as a group. The actual rate of 64 per 1000 exceeds the expected rate of 50 by 28% for girls. Data from reference 40.

The story of health improvement in the past 20 years has generally, although not universally, been more impressive for women than for men. In many low-income and middle-income countries, female life expectancy

between 1961 and 2010 has moved towards that in the best-performing country (the “frontier” of life expectancy, which is presently Japan). Some countries are progressing at an especially rapid pace (figure 2). Female life expectancy in China increased dramatically from 1960 to the late 1970s, related to expanded health services provided by the Rural Cooperative Medical System, but then the rate of improvement slowed down after the system was mostly dismantled.³⁸

Figure 3 shows that between 1992 and 2012 the rate of decline in adult mortality in countries that the UN classifies as least developed and less developed has been faster in women than in men. Progress has been very rapid in adult women in India and Iran. The annual rate of decline in adult mortality between 1992 and 2012 was more than 1% higher in women than in men in India (figure 3; appendix 1, p 13). In Iran, in 1990–2010, the rate was 3·5% higher in women than in men. These gains in the health of adult women are likely to have even greater economic and other payoffs than had been previously thought, according to early findings of an ongoing study, funded by the Norwegian Agency for Development Cooperation, of the returns to investment in women’s health (Onarheim KH, Iversen JH, Harvard School of Public Health, personal communication).

Nevertheless, progress for women has not been faster than for men everywhere, and important outliers exist. An example is the poor state of girls’ health in India and China, the only two countries in the world where girls are more likely than boys to die before 5 years of age.³⁹ Across several demographic and health surveys in low-income and middle-income countries, the male:female ratio of under-5 mortality rates was an average of 1·18 in 2011 (ie, the mortality rate was 18% higher for boys), and this ratio did not change between 1990 and 2011. However, in India there was an excess in the female under 5-mortality rate in 2005 (figure 4). Since the male under-5 mortality rate was 59 per 1000 livebirths, with a male:female ratio of 1·18, the female rate should have been 50 per 1000 livebirths but it was actually 64 per 1000 livebirths—an excess of 14 per 1000 livebirths (ie, 28% higher than expected). In China, in the 2000s, the male under-5 mortality was 27 per 1000 livebirths and so the female under-5 mortality rate should have been 23 per 1000 livebirths, but the observed rate was 34 per 1000 livebirths (ie, 48% higher than expected). Overall, a sharp contrast exists in India and China between the poor progress of girls in terms of under-5 mortality and the rapid improvement in adult female mortality from 1997 to 2010. The poor progress in these countries can be explained by female infanticide and discrimination against girls when it comes to receiving vaccinations, medical care for acute illnesses, and adequate nutrition.³⁹

In addition to the poor state of girls’ health in India and China, both countries have a skewed sex ratio at birth (the ratio of male:female births in a population,

multiplied by 100). Whereas the normal sex ratio value ranges from 104 to 106, the ratio is 113 in India and 120 in China, because of the practice of sex-selective abortions.⁴¹ Both countries have launched campaigns to reduce such prenatal discrimination.

A further example of worsening female health is the rising rates of cervical cancer deaths in low-income and middle-income countries. Each year, roughly the same number of women die from cervical cancer as from pregnancy and if current trends continue, cervical cancer death rates will soon exceed pregnancy-related deaths, according to WHO's burden of disease assessment.²¹

Explaining progress

Transformations in the global health landscape that led to the mortality outcomes described previously include technological advances, focused attention by many low-income and middle-income countries to health (often through substantially increased domestic health financing), the astonishing economic growth of many middle-income countries, and mobilisation of substantial amounts of DAH (table 1).

New tools have had a large role in the achievement of health gains.⁴² To give a sense of the scale of technological progress, WDR 1993 was published before the advent of highly active antiretroviral therapy,⁴² long-lasting insecticidal bednets for malaria prevention,⁴³ artemisinin-based combination therapy for malaria treatment,⁴⁴ and new highly effective vaccines, such as those against

pneumococcus and rotavirus. Large reductions in mortality have occurred in sub-Saharan Africa since 2004, coinciding with increased coverage of HIV and malaria control methods.⁴⁵ The digital explosion and rapid spread of knowledge about such control tools—including diagnostics for infections such as malaria, measles, and rubella—helped to shape vaccination and other national disease control campaigns in countries such as Ethiopia, Ghana, and Rwanda. Overall, historical experience suggests that the adoption of new technologies is associated with a decrease in the under-5 mortality rate of about 2% per year.⁴⁶

Such advances were made possible in part from an increase in funding for health R&D. In 1990, only US\$47 billion was spent on health R&D worldwide.⁴⁷ By 2009, annual funding had risen to \$248 billion, of which 60% came from the business sector and was mostly targeted at NCDs, especially cancer (data from reference 48, both figures converted to 2011 US dollars). Nevertheless, only about \$3 billion is spent annually on R&D for infectious diseases of particular concern to low-income and middle-income countries,⁴⁹ representing just 1–2% of total R&D, which suggests a mismatch between needs-priorities and R&D investments in low-income and middle-income countries.⁴⁸

The past two decades have witnessed innovations in institutional arrangements for R&D. A catalytic period in drug development for poverty-related infectious diseases began in the 1990s, with the launch of an entirely new

	Effect on global health in the past 20 years	Opportunities and concerns for the next 20 years
New technologies	Scale-up of new tools was associated with major reductions in mortality	History of successful product development points to a likely high yield from continued investments. Completion of the grand convergence will be helped greatly by new technologies
Focused domestic attention to health (especially infectious disease control)	Many low-income and middle-income countries instituted important health systems reforms, often accompanied by increased domestic health financing	Domestic financing will need to increase further to help fund convergence and curb NCDs
Growing influence of MICs	Economic growth of some large MICs has led them to become financially self-sufficient in health; some are now aid donors and international suppliers of key health technologies (eg, antiretroviral drugs and vaccines)	Economic growth in many other countries will create fiscal space for increased domestic spending on health. As donors, MICs are adopting new forms of global health assistance, such as South-South cooperation and transfer of cost-effective health solutions
Increased funding and institutional innovations for health R&D	Funding for R&D for infectious diseases of poverty is now about US\$3 billion per year, which has enabled development of new drugs, vaccines, and diagnostics. PDPPPs and institutional capacity-building for R&D in MICs has led to a healthier product pipeline. 43 new products for infectious diseases of poverty have been registered in the past decade	Investments in new technologies to address infections and RMNCH disorders fall far below the potential for achieving a high payoff. PDPPPs are likely to have a central role in the development of new products for these diseases and disorders. However, PDPPPs face an uncertain future
Mobilisation of DAH	Global health architecture was transformed by a slew of new actors. There was a period of innovation and experimentation in mobilising and channelling DAH. An explosive rise in DAH occurred, from US\$5.8 billion in 1990, to \$28.8 billion in 2010 (in 2011 US dollars), which was mainly channelled into control of HIV, tuberculosis, and malaria, and the introduction of new and underused vaccines	DAH levels stagnated in 2010–12 in wake of the financial crisis. If the “envelope” of official development assistance remains at about US\$120–130 billion per year (in 2011 US dollars), aid efficiency, including intersectoral allocation, will become increasingly important. The core functions of global health have been under-funded in the past 20 years and must regain prominence

NCD=non-communicable disease. MIC=middle-income country. R&D=research and development. PDPPP=product development public-private partnership. RMNCH=reproductive, maternal, newborn, and child health. DAH=development assistance for health.

Table 1: Key enabling advances, 1993–2013

Panel 5: Product development public-private partnerships

Product development public-private partnerships (PDPPPs) involve public sector and non-profit entities partnering with pharmaceutical and vaccine companies to design and implement product development programmes.⁵⁰ About 75–85% of all research and development (R&D) projects for addressing infectious diseases of particular concern to low-income and middle-income countries are now done by PDPPPs.^{51,52} In 2011, such partnerships received US\$451.4 million in funding, 14.8% of all global funding, and 23% of all global grant funding for R&D for infections of poverty.⁴⁹ Most global funding for such R&D continues to be in the form of direct external (extramural) funding to researchers and developers, and intramural funding (self-funding), especially by drug companies.

The five PDPPPs that received the most funding in 2011 were the Program for Appropriate Technology in Health (US\$87.8 million), which develops products such as vaccines for meningitis, rotavirus, and Japanese encephalitis; the Medicines for Malaria Venture (MMV, \$71.7 million); the International AIDS Vaccine Initiative (\$60 million); Aeras (\$38.7 million), which develops tuberculosis vaccines; and the Drugs for Neglected Diseases Initiative (DNDi, \$36.8 million).

Examples of product development success stories from such partnerships include the development of the antimalarial artemether-lumefantrine through a partnership between MMV and Novartis, a short-course therapy (sodium stibogluconate and paromomycin) for visceral leishmaniasis by DNDi, and meningococcal A meningitis vaccine by the Meningitis Vaccine Project. Before the explosion of PDPPPs that began around 2000, TDR, the Special Programme for Research and Training in Tropical Diseases, had collaborated with industry since its initiation in 1976.⁵³ For example, TDR collaborated with Bayer in the late 1970s on praziquantel for schistosomiasis, and with Merck in the early 1980s on ivermectin for onchocerciasis.

PDPPPs face an uncertain financial future. For example, more than half of all funding for PDPPPs comes from the Bill & Melinda Gates Foundation. A 2012 survey of R&D financing for infections of poverty reports that the foundation's overall funding for infectious disease R&D has fallen by more than a quarter since 2008, and its funding for PDPPPs has also followed this trend.⁴⁹ The foundation has clarified that the decrease during the reporting period was largely due to the completion of several PDPPP grants and large-scale clinical trials (Saad S, Bill & Melinda Gates Foundation, personal communication).

In addition to this decline, public sector funding from high-income countries for infectious disease R&D has recently shifted away from product development towards basic research. This shift, combined with the decrease in philanthropic funding, makes it likely that there will be a "product development crunch" in the next few years for infectious diseases that have little commercial appeal.⁴⁹

R&D implementation mechanism, product development public-private partnerships (PDPPPs; panel 5). The first PDPPP was the International AIDS Vaccine Initiative, launched in 1996 and funded by the Rockefeller Foundation. This initial investment was followed by a further large injection of funds from the Bill & Melinda Gates Foundation into this "high-risk entrepreneurial area,"⁵⁴ and from public donors, particularly the US and UK Governments and the European Commission. Other important drivers of R&D were a rise in direct grant funding to researchers and developers (about three-quarters of all grant funding for R&D for infectious diseases of particular concern to low-income and middle-income countries is direct funding) and the establishment of research divisions within several drug companies aimed at developing new products for these diseases.

Additionally, several middle-income countries are investing heavily in developing institutional capacity for undertaking R&D and are beginning to reap the benefits. The antimalarial drugs artemisinin and artemether were developed in China and India, respectively. Middle-income countries are producing a wide range of high-quality, low-cost health technologies that are helping to supply global needs.⁵⁵ More than half of the GAVI Alliance's vaccine suppliers are based in low-income and middle-income countries.⁵⁶ Since 2006, more than 80% of all donor-funded antiretrovirals (ARVs) in these countries have been supplied by Indian generic producers.⁵⁷ Such supply has been based both on ingenuity in India in reverse engineering of ARVs developed by companies in Europe and North America, and on innovative out-licensing arrangements between these companies and the Indian pharmaceutical industry.

Collectively, these institutional innovations have led to a healthier pipeline for new drugs, vaccines, and diagnostics for the infectious diseases that disproportionately burden low-income and middle-income countries. Over the last decade, 43 new products for these diseases have been registered, and an additional 359 are in development.⁵⁸ For many of these diseases, however, the number of tools is still inadequate. The products for these diseases registered in the past decade make up only 4–5% of all new therapeutic products.⁵⁹ Furthermore, although PDPPPs have been increasingly important in helping to create a pipeline of products, they now face an uncertain financing climate (panel 5).

An important driver of health progress was focused national attention to control of major infectious diseases, funded mostly through domestic resources. Some countries, such as Mexico, were able to keep their HIV epidemic contained through robust national health policies, such as control of the blood supply and preventive interventions (eg, condom distribution) for commercial sex workers.⁶⁰ Many low-income and middle-income countries also instituted important health systems reforms, often accompanied by increased public health financing. Burkina Faso, Chile, Ghana, Vietnam, and Zambia have all increased the proportion of general government expenditure devoted to health while undergoing health system reforms.^{61,62} Public sector action is well documented to have an important role in mortality decline—for example, Easterlin showed that public policy initiatives based on new knowledge of disease played a central role in Europe's rapid mortality decline in the 19th and 20th centuries.⁶³

Evidence suggests that a causal relationship exists between income and infant mortality,⁶⁴ even though very substantial health gains are possible in low-income settings.^{65,66} Therefore, the extraordinary economic growth of many middle-income countries has in all likelihood contributed to improved health outcomes. Most attention has been focused on the BRICS countries (Brazil, Russia, India, China, and South Africa). In 1990,

these five countries made up 12% of world economic output. By 2011, this figure had risen to 20%, and the UN projects that by 2040, Brazil, China, and India will account for 40% of global economic output.³⁷ The success stories, however, go beyond the BRICS countries. Based on World Bank data, between 1990 and 2011, 11 countries in sub-Saharan Africa achieved real growth in income per person averaging at least 2.5% per annum. From 2000 to 2011, 20 countries in sub-Saharan Africa achieved growth in income per person of at least that rate.

Nevertheless, a recent study of 46 low-income and middle-income countries showed that general government health expenditure as a share of general government expenditure is still less than 10% for more than half of these countries, and is less than 5% in ten countries.⁶² Similarly, in 2001, African heads of state pledged to allocate 15% of their national budgets to health, yet by 2011 only two of the 55 African Union member states, Rwanda and South Africa, had met this target.⁶⁷

Economic growth in the past 20 years in low-income and middle-income countries has generated fiscal headroom for growing public spending on health. Furthermore, most countries have broadened their tax bases and improved tax administration, which has also generated fiscal space for increased public spending on health. The International Monetary Fund (IMF) estimates that low-income countries, in aggregate, increased their tax revenue from 13 to 17% of GDP between 1990 and 2011. For lower-middle-income countries, in aggregate, the percentage increased from 16% to 20%, and for upper middle-income countries, it increased from 22% to 28% (Gupta S, IMF, personal communication).

Figure 5 dramatically illustrates the broad movement of populations from low-income to middle-income status. Nevertheless, a group of low-income countries, including those that are regarded as failed states (eg, the Democratic Republic of the Congo and Somalia), experienced very little or even negative economic growth in 1990–2011.⁶⁹

Since 1993, an unprecedented mobilisation of DAH has occurred, which went beyond even the most optimistic scenarios suggested in WDR 1993. Health has also been prioritised over other development sectors in recent years.⁷⁰ The explosive rise in DAH was made possible by the arrival of new public and private actors that could not have been imagined in 1993. These actors, such as the Global Fund, the GAVI Alliance, the Bill & Melinda Gates Foundation, and UNITAID, have created a new global health architecture characterised by tremendous experimentation and innovation in mobilisation and channelling of money, pooling of demand, shaping of markets, and improvements in the security of commodity supply. This architecture has supported the national introduction of important new technologies into routine systems at affordable prices.

Much of the new money was channelled into vertical programmes to tackle HIV/AIDS, tuberculosis, and malaria, and the introduction of new and under-used vaccines, with a major focus on sub-Saharan Africa. WDR

1993 stressed the importance of allocative efficiency—health expenditures should be targeted towards rapid expansion of interventions that provide the greatest value for money. Evidence shows that such allocative efficiency in the channelling of DAH, such as in achieving high coverage with insecticide-treated bednets and malaria treatment, led to important health gains.^{45,71} However, other health areas, including RMNCH, nutrition, health systems strengthening (HSS), and NCDs, have not seen the same kind of increases in foreign assistance,⁷⁰ which could potentially lead to unbalanced health systems development.

The donor landscape has also been shifting, with the increasing influence of donors outside of the Organisation for Economic Co-operation and Development (OECD), including Brazil, China, Russia, and Saudi Arabia.⁷² These donors are adopting approaches to giving DAH that are very different to those used by traditional donors, emphasising South–South cooperation and strong domestic health programmes. A key feature of such assistance is that middle-income countries have experience in tackling their own health problems with cost-effective domestic solutions, and some of these countries, such as Argentina and Brazil, are collaborating with other low-income and middle-income countries on transferring these approaches.⁷²

Unanticipated problems

The period 1993–2013 was also marked by two major problems for the global health enterprise that could not have been anticipated in 1993.

First, the global financial crisis of 2008–09 and subsequent austerity programmes in high-income countries were associated with flat-lining of DAH. Based on preliminary estimates for 2012, annual DAH seems to have stagnated from 2010 to 2012.³ Aid stagnation is one factor that drives a new value for money agenda in global health, in which funding agencies are placing a greater

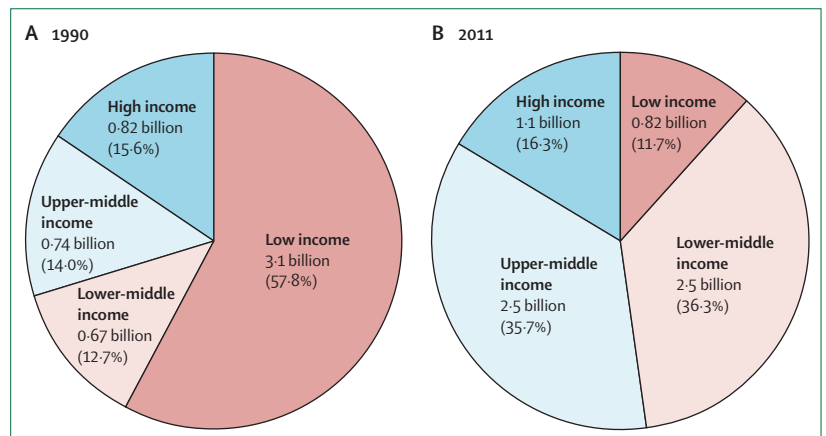


Figure 5: Movement of populations from low income to higher income between 1990 and 2011

Data refer to classifications based on (A) 1990 and (B) 2011 gross national income per head that were the basis for the World Bank's lending classifications for its financial year 1992 and financial year 2013, respectively. The World Bank did not classify all countries into income groups. Countries that were unclassified in either 1990 or 2011 were removed from the calculations. Data from reference 68.

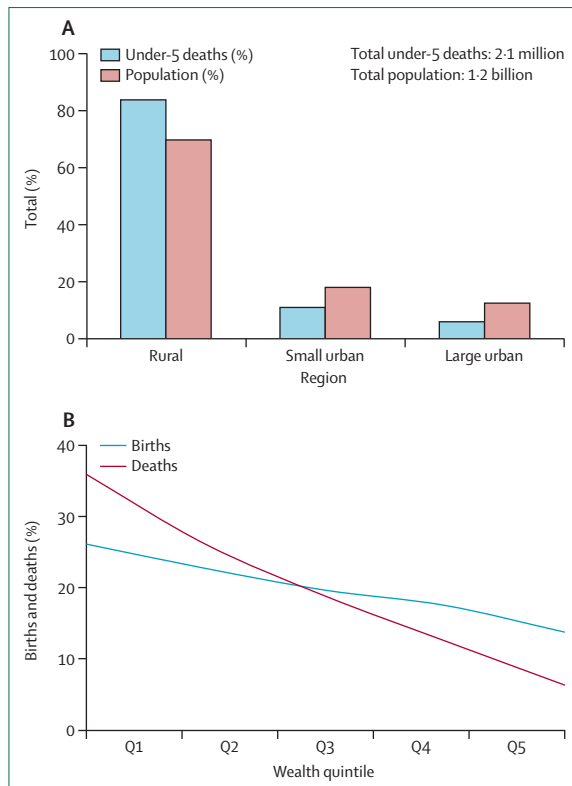


Figure 6: Child deaths and births by region and wealth quintile in India, early 2000s
 (A) Under-5 deaths and total population in rural and urban India. (B) Births and under-5 deaths by wealth quintile in India. Data for (A) from reference 79; data for (B) from reference 40.

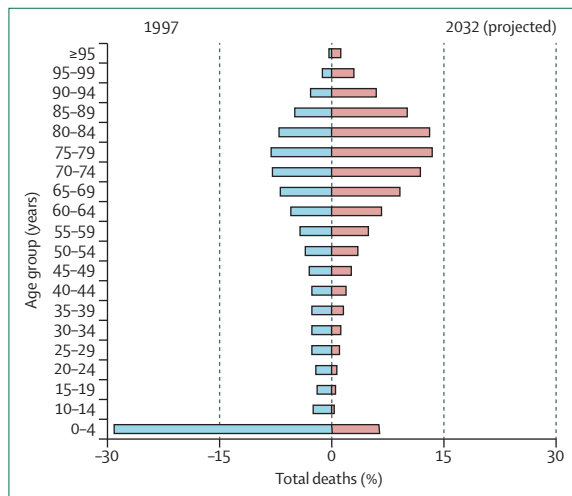


Figure 7: Evolving age distribution of mortality in south Asia
 The 1997 side of the figure shows estimates averaged for the period 1995–2000 and the 2032 side shows the UN medium projections for 2030–35. Data from reference 37.

focus on spending each dollar wisely by investing in “the highest impact interventions among the most affected populations”.⁷³

Second, although the profound changes in the nature and architecture of global health cooperation discussed earlier have brought much-needed energy, focus, and creativity to the global health enterprise, they have also introduced a new set of governance challenges.⁷⁴ Coordination of several vertical initiatives and actors has proven to be difficult, fuelling concerns about inefficiency, duplication and fragmentation of activities, unclear expectations of different donors’ roles, poor accountability, and potential distortion of countries’ national health policies.^{75,76} Additionally, the serious underfunding of global public goods (GPGs), such as health R&D, disease surveillance, and setting of global norms and standards, has now reached a crisis point. Such underfunding is exemplified by WHO’s budgetary crisis. Since 1994, WHO’s regular budget has decreased steadily in real terms,³ and the organisation is struggling to fund its basic administrative functions.⁷⁷ The WHO’s entire influenza budget in 2013 is just US\$7.7 million—less than a third of what one city, New York, devotes to preparing for public health emergencies.⁷⁸

Three health challenges of the next 20 years

To consider the challenges that national governments will be grappling with in the next two decades, the Commission organised its work into three interrelated domains. The national investment opportunities laid out later in this report are structured around tackling these three domains.

The *first domain* is the health challenges of vulnerable groups in low-income and middle-income countries. Background analyses undertaken for the Commission show that the rates of avoidable infectious diseases, maternal mortality, and under-5 mortality are higher in people living in rural areas than in urban settings (figure 6A) and are higher in poor people than in wealthier people (figure 6B).^{40,79} For example, average under-5 mortality rates in 2001–10 are estimated to be 92 deaths per 1000 livebirths in rural areas, compared with 73 per 1000 in small urban areas and 56 per 1000 in large urban areas. This stark rural–urban difference has changed little since 1991. Children growing up in rural areas continue to account for an overwhelming majority of child deaths in low-income and middle-income countries. More than half of the population of these countries still lives in rural areas, although the UN projects that this proportion will fall to about a third by 2050.⁸⁰

These findings call into question the traditional way of viewing disease distribution, which often assumes that the so-called hot spots of preventable mortality fall within the national boundaries of the world’s poorest countries. In view of our new analyses showing that avoidable mortality is concentrated in poor rural regions, and the fact that over 70% of the world’s poor now live in middle-income countries rather than low-income countries,⁸¹ achievement of the grand convergence will require focused attention to lower-income groups in rural subregions of middle-income

countries and populations in low-income countries. Our understanding of the global map of disease is therefore changing.

The *second domain*, a consequence of tackling the conditions of the first domain, is the demographic transition and a consequent shift in the disease burden towards NCDs in low-income and middle-income countries.^{82,83} Figure 7 shows the age distribution of mortality in south Asia from 1995 to 2000 and the UN Population Division projection for 2030–35. The figure shows ageing at the top of the population pyramid—the relative proportion of elderly people is increasing as life expectancy rises.

Since children in these countries are increasingly surviving the risks of childhood illness, a second demographic transition is occurring: a bulge in the adolescent band of the population pyramid.⁸⁴ In many low-income and middle-income countries, often those with a double burden of infectious diseases and NCDs, adolescents now account for more than a third of the population. This group will soon be entering adulthood and if they can be reached now with health preventive interventions (eg, human papillomavirus [HPV] vaccination and education about NCD risk factors), future diseases of later life could be avoided or postponed. As noted in the recent report by the Independent Expert Review Group on Information and Accountability for Women's and Children's Health, "the global community does not monitor adolescent health", which is a major barrier to improvement in health in this age group.⁸⁵

The growing burden of NCDs in low-income and middle-income countries is compounded by rising rates of deaths from road traffic injuries, which are the number one cause of death in young people. The highest death rate is in sub-Saharan Africa, where pedestrians and other vulnerable road users are at greatest risk. The burden is highest among the poor, who are less likely to have access to emergency injury care.⁸⁶

Although a detailed discussion about globalisation is beyond the scope of this report, the Commission briefly notes that three particular aspects of globalisation could impede future efforts to tackle the health problems of the first and second domains (panel 6).

The *third domain*, a consequence of inadequate financial arrangements to address the other two domains, is the effect of medical expenditures on households and societies. At the household level, studies published since 1993 have shown the impoverishing effects of medical expenditures in low-income and middle-income countries. About 150 million people suffer financial catastrophe each year because of medical spending, where catastrophe is defined as devoting more than 40% of non-food spending to health expenses.⁹⁴ About a quarter of households in low-income and middle-income countries borrow money or sell items to pay for health care.⁹⁵

At the societal level, health-care expenditures have been rising rapidly in the past two decades, not just in the

USA but in many emerging economies, such as Argentina and South Korea, which puts huge fiscal pressure on households and governments. Such escalating costs are driven by the increase in health spending that accompanies rising GDP,⁹⁶ expensive new technologies, population ageing, the shift from infectious diseases to NCDs, the increasing use of unnecessary procedures and treatments, and the Baumol effect (rising salaries in jobs that have seen no productivity gains, such as health sector jobs, in response to rising salaries in other jobs that did see such gains). As the GDP of low-income and middle-income countries rises, health spending will inevitably increase, and these countries will need to take steps to prevent unproductive cost escalation.⁹⁷

A historic opportunity

A unique and defining characteristic of this generation is that, with the right investments, the first domain of health challenges could largely disappear within our lifetimes. The stark differences in infectious, maternal, and child mortality outcomes between countries of differing incomes could be brought to an end by 2035.

WDR 1993 was published in an era when the economies of many developing countries were stagnant

Panel 6: How globalisation could impede future health progress

Three particular aspects of globalisation could impede efforts to tackle infections, reproductive, maternal, newborn, and child health disorders, and non-communicable diseases (NCDs).

Brain drain

Migration of health professionals from low-income and middle-income countries to high-income countries contributes to weakening of health systems. Such migration is partly due to insufficient opportunities for professional development in many low-income and middle-income countries.⁸⁷ How to tackle this brain drain was addressed in a 2004 analysis of the global health workforce undertaken by the Joint Learning Initiative and in a 2010 *Lancet* Commission on the Health Professions.^{88,89} Among other recommendations, both these initiatives drew attention to the role of global open access to learning resources for professional development in low-income and middle-income countries and the power of information technology for worldwide learning, including distance learning.

Global spread of NCD risk factors

The global spread of such risk factors, particularly a rapid rise in the prevalence of smoking and the consumption of high-calorie processed foods and sugary sodas, is a key driver of the dramatic rise in annual deaths from NCDs in low-income and middle-income countries.^{90,91} The age-adjusted mortality rates of several NCDs are now higher in low-income and middle-income countries than in high-income countries.⁹²

Global climate change

Unless countervailing measures are taken, the death toll and reach of vector-borne infectious disease is likely to increase because of global climate change.⁹³ Other health consequences of climate change and environmental biodegradation will be experienced through increased water and food insecurity, extreme climatic events, displaced populations, and vulnerable human settlements. As WDR 1993 pointed out, "the societies that will suffer least from these global changes are those that are wealthier".¹

Panel 7: How improved health leads to increased personal and national income

Improved health raises per-person income through five main channels (figure 8).^{99,100}

Productivity

Healthier workers are more productive and have lower rates of absenteeism.

Education

Healthier children are more likely to attend school and have greater cognitive capacity for learning; improved education is a powerful mechanism of income growth.

Investment

Increased life expectancy is an incentive to save for retirement, which can have a dramatic effect on national savings rates, which in turn can boost investment and economic growth. Healthier populations also attract direct foreign investment. Eventually, however, as healthier cohorts start to retire, pressure might then be exerted on national savings rates.

Access to natural resources

Control of endemic diseases, such as river blindness, can increase human access to land or other natural resources.

Demographics

A fall in infant mortality in high-mortality populations initially boosts population growth, slowing economic growth, but fertility then decreases as families choose to have fewer children when they realise that the mortality environment has changed. The reduced child mortality and reduced fertility leads to an increased ratio of working-age people (15–64 years) to dependent people (children and people aged 65 years and older), facilitating a higher input of workers per person and an increased GDP per head. This phenomenon, known as the demographic dividend, is temporary.

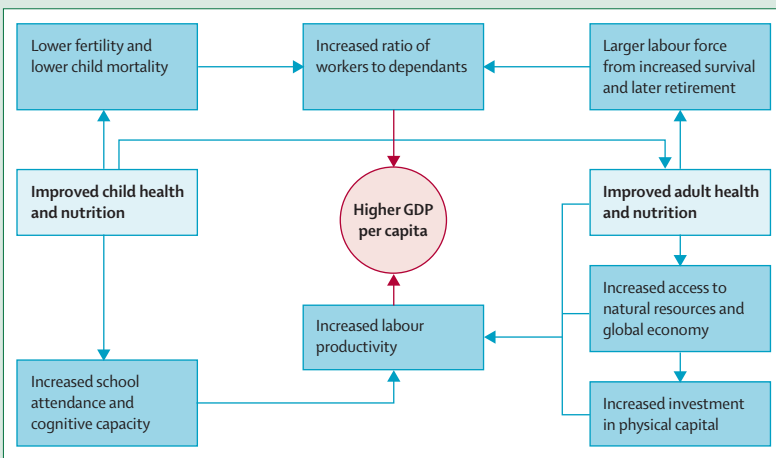


Figure 8: Links between health and GDP per person
Adapted with permission from reference 101.

Collectively, we also have the financial and technical means to tackle the other two domains—NCDs and injuries, and the impoverishing effects of health expenditures—within a generation, which will bring tremendous health and economic benefits. Since the publication of WDR 1993, important advances have been made in our understanding of the very impressive economic returns to investing in health, which we turn to next.

Section 2. The returns to investing in health

Since the publication of WDR 1993, important advances in health economics have been made that have helped to better quantify the value of investing in health. In particular, increasingly good evidence, summarised in this section, shows that health improvements can both boost personal and national income, and increase full income—a broader concept that goes beyond national income accounting to also assess the direct welfare gains of improved life expectancy.

Better health can boost personal and national income

Bloom and Canning⁸ argue that we now have “good reasons and strong evidence” to believe that health improvements stimulate economic development. The “good reasons” include the effect of improved health on labour productivity, education, investment, access to natural resources, and the ratio of workers to dependants (panel 7 and figure 8). The “strong evidence” comes from three types of research: historical case studies, micro-economic studies at the individual or household level, and macroeconomic studies that assess the effect of measures of health at the national level on income, income growth, or investment rates.

These three types of evidence—discussed in more detail in appendix 2—were comprehensively synthesised in the CMH’s 2001 report, chaired by Jeffrey Sachs, the most important and influential recent contribution on the link between health and wealth.⁸ In particular, the CMH Working Group 1 on Health, Economic Growth, and Poverty Reduction, chaired by George Alleyne and Daniel Cohen, marshalled compelling evidence to show that “a healthy population is an engine for economic growth”.¹⁰²

Historical case studies

Fogel’s 1997 review of historical case studies¹⁰³ concluded that improvements in health and nutrition have in the past been associated with GDP growth. For example, such improvements may have accounted for up to 30% of GDP growth in Britain—a growth rate of around 1·15% per person per year—between 1780 and 1979.

Microeconomic studies

Since WDR 1993, economic studies have analysed the links between health and income at the individual (microeconomic) level. Advantages of focusing on

See Online for appendix 2

and early in the revolution in R&D for diseases of poverty. By contrast, the combination of today’s economic growth in many low-income and middle-income countries coupled with the increasing availability of high-impact health technologies makes a grand convergence in health achievable within about two decades. An unprecedented opportunity exists for nearly all countries to reach the frontier of feasibility—that is, to reduce their mortality rates to those presently seen in the 4C countries.

individuals rather than countries include the use of more detailed measures of health and income, and their determinants, and the ability to do randomised controlled trials or natural experiments.¹⁰⁰ Such microeconomic studies can provide important information about biological or behavioural causality.¹⁰⁴

In recent studies, investigators have assessed the relation between health and outcomes such as adult worker productivity or childhood educational attainment, cognitive function, and years of schooling, all of which correlate with future earnings.^{100,104,105} Such studies investigated proxies for health (eg, nutritional status or height) or specific diseases such as malaria or intestinal worms. Although some studies reported no association, most of the evidence, together with inherent plausibility, generally points to better health being associated with higher income. For example, in the Indonesia Family Life Survey, a 1% increase in height was associated with a 5% increase in earnings in adult men.¹⁰⁴

Macroeconomic studies

Since microeconomic studies do not capture the effects of growth on a country's aggregate income, such studies should be complemented by macroeconomic research that uses national growth measures. Several macroeconomic studies done in the past two decades suggest that the effect of improved health on income at the national level might be even greater than the effects seen at the individual level.^{98,99,106} This greater effect seen in national studies represents the increase in foreign direct investment that accompanies successful disease control efforts, such as malaria control.¹⁰⁷ Such investment is not captured in microeconomic studies.

As is typical of cross-country studies, causality is difficult to establish, and is often best provided by ancillary evidence from microeconomic and historical studies, as noted earlier. The published literature about the relationship between health and economic growth is no exception. A recent report by Acemoglu and Johnson¹⁰⁸ shows that although health improvements do lead to income growth, they also lead to more than compensatory reductions in fertility and a potential reduction in income per person. Bloom and colleagues,¹⁰⁹ however, argue that a longer term perspective suggests that the positive effect on income ultimately dominates.

Jamison and colleagues¹¹⁰ reviewed the historic, microeconomic, and macroeconomic studies and concluded—on the basis of their own analyses—that about 11% of economic growth in low-income and middle-income countries in the period 1970–2000 resulted from reductions in adult mortality.

The totality of this new evidence points to an important major conclusion. In the allocation of finite budgetary resources, making the right investments in health improves social welfare and stimulates economic growth.

Better health can increase full income and sustainable wealth

Imagine two countries that have an identical GDP per person, but that have stark differences in their health status. The population of country A lives longer and in better health than the population of country B. If GDP per person is used as the only measure of wealth, this approach does not capture the monetary value of country A's better performance. The reduced mortality risk in country A will not be accounted for in national income accounts.⁹⁹ When it comes to estimating changes in the welfare status of a population, this failure to account for reduced mortality is a major omission.

People place a high value on living a longer and healthier life, and in the past 40 years, methods have been developed and refined to quantify this value in monetary terms. Many willingness-to-pay studies have shown that people would pay large amounts for safer living and working conditions. They would demand a higher wage to take on dangerous, life-threatening work. Such studies allow researchers to quantify the economic value of living longer. Such research is not attempting to put a monetary value on any one person's life.¹¹¹ Instead, it is valuing changes in mortality risk.

The value of better health—or reduced mortality—is captured in the notion of full income. Growth in a country's full income in a period is the sum of the income growth measured in the national income accounts, plus the value of the change in mortality (or life expectancy), in that period.

The Commission believes that such full income approaches give a more accurate and complete picture of health's contribution to a nation's economic well-being. We therefore use such approaches, which put an economic value on additional life-years gained (VLYs), to estimate the economic benefits of the integrated investment framework laid out later in this report. A VLY is the value in a particular country or region of a 1-year increase in life expectancy. We estimate that in low-income and middle-income countries, one VLY is 2·3-times the per-person income (appendix 3).

See Online for appendix 3

In the following paragraphs, we summarise key research and recent advances in full income accounting. The term full income is increasingly used to denote GDP change adjusted for the value of mortality change. However, although full income approaches have many advantages, they nevertheless still fail to include other items that have an economic value, such as natural resource depletion, environmental change, or change in the amount of leisure time.

Health and full income

In a groundbreaking study published in 1973, Usher brought the monetary value of changes in mortality risk into national income accounting.¹¹² With use of a full income framework, he estimated growth in six countries

and territories. In the high-income countries, about 30% of the growth in full income was due to reduced mortality. In a historical study following Usher's approach, Williamson estimated full income growth in Britain for the period 1781–1931 and reported that reductions in mortality had a limited effect early in that period.¹¹³ By contrast, major improvements in longevity after 1911 resulted in almost 30% of the gain in full income coming from this source.

Nordhaus¹¹⁴ studied full income per person in the USA in the 20th century and showed that the economic value of increased longevity was roughly the same as the value of economic growth measured in the national income accounts. "The medical revolution over the last century", wrote Nordhaus, "appears to qualify, at least from an economic point of view, for Samuel Johnson's accolade as 'the greatest benefit to mankind'". Recent work assessing the improvements in the full income of European countries noted similarly large contributions from reductions in mortality.¹¹⁵

About a decade ago, two studies were published that assessed changes in economic inequality worldwide from 1820 to 1992 using an approach that took life expectancy or full income into account (as a proxy for population health). In the first study, Bourguignon and Morrisson¹¹⁶ reported that global economic inequality fell from 1950 onwards as a result of a large decline in international disparities in life expectancy. Becker and colleagues¹¹⁷ were also concerned about inequality between countries. They argued that reliance on conventional measures of national income gave a misleading account. With the full income concept, they found that, when comparing 1960 with 2000, "countries with lower incomes tended to grow faster than countries starting with higher income. We estimate an average yearly growth in 'full income' of 4.5 percent for the poorer 50% of countries in 1960, of which 1.7 percentage

points are due to health, as opposed to a growth of 2.6 percent for the richest 50% of countries of which only 0.4 percentage points are due to health" (page 277). Note that Nordhaus gave a much higher weight than Becker and colleagues to health in the USA.

Mortality can, of course, increase as well as decrease, and the concept of full income also proves relevant in circumstances of rising mortality. In a study of the effect of the HIV/AIDS epidemic on economic growth, Bloom and Mahal¹¹⁸ concluded that the epidemic had had an "insignificant impact on the growth rate of per capita income". The authors then acknowledged the shortcomings of looking only at income per person. If the reduction in income in the numerator of the per person income ratio is balanced by a reduced population size in the denominator, to conclude that no change in welfare has occurred is clearly inappropriate. Replacement of GDP per person with full income per person conveyed a very different and much more plausible story.

Analyses undertaken for the CMH,⁸ for the IMF,¹¹⁹ and in the academic literature¹²⁰ assessed the effect of the HIV/AIDS epidemic on full income and all three analyses reached a broadly similar conclusion that differed greatly from that of Bloom and Mahal. The value of eradicating AIDS in Africa, concluded Philipson and Soares,¹²⁰ would be in the order of the value of the annual economic output of the continent (about US\$800 billion at the time), and this value is "overwhelmingly larger" than would be estimated by looking at the effects of AIDS on income alone.

When health is valued inclusively with the methods described previously, the inclusively measured economic benefits of improved health are shown to be decisively greater than when health is valued only by its effect on national income accounts. Figure 9 summarises our estimates of the contribution of health to growth in full income in 1990–2000 and in 2000–10 for different regions of the world. We find that across low-income and middle-income countries as a whole, health contributes to annual growth in full income by about 1.2% per year of the initial value of GDP for the period 1990–2000 and 1.8% per year in the period 2000–11. In south Asia, to take a specific example from 2000 to 2011, the annual value of mortality change was equivalent to 2.9% of average income during the period, which was almost half as large as the value of the increase in GDP. Across low-income and middle-income countries, the value of improved life expectancy was lower in the first of these two periods because of life expectancy declines in eastern Europe and central Asia, and stagnation in Africa. Overall, these numbers represent enormous value.

Appendix 3 discusses the methods and data that underlie figure 9. One point illustrated well in appendix 3 is that the estimated value of mortality reductions when initial life expectancies are low is highly sensitive to how values are assigned to changes in child mortality rates. The appendix presents the results of three alternative

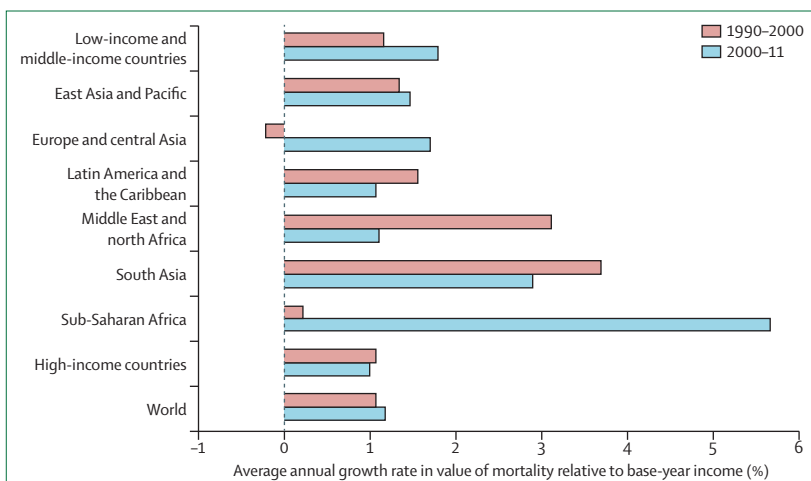


Figure 9: Contribution of change in life expectancy to growth in full income, 1990–2000 and 2000–11. Data from appendix 3.

	Community outreach	Clinics	District hospitals	Referral and specialised hospitals
Reproductive, maternal, newborn, and child health	Immunisation	Antenatal care	Treatment of severely ill children; caesarean section	Neonatal and paediatric intensive care
AIDS and tuberculosis	Support from community health workers for medication adherence	Antiretroviral treatment	Treatment of severely ill patients; surgical diagnosis of extrapulmonary tuberculosis	Treatment of multidrug-resistant tuberculosis
Neglected tropical diseases	Mass drug administration	Multidrug treatments for leprosy	Medical treatment of visceral leishmaniasis, human African trypanosomiasis, and Chagas disease; hydrocele surgery for lymphatic filariasis	Management of rabies
Cardiovascular diseases (including stroke and diabetes)	Community-based diabetes prevention programmes	Drugs for primary or secondary prevention of cardiovascular disease	Medical treatment of acute myocardial infarction; foot amputation for diabetes	Angiography services
Cancers	Human papillomavirus vaccination	Cervical cancer screening or treatment	Hormonal therapy for breast cancer; surgery for breast cancer	Treatment of selected paediatric cancers
Psychiatric and neurological diseases	Rehabilitation for chronic psychosis	Antidepressants and psychological therapy for depression or anxiety	Detoxification for alcohol dependence	Neurosurgery for intractable epilepsy
Injuries	Training of lay first responders	Treatment of minor burns	Management of fractured femur	Complex orthopaedic surgery—eg, for pelvic injury

Clinics play a central part in delivery, supported on either side by community outreach and hospitals. For most delivery platforms, one example of an intervention from each package is shown. For district hospitals, a mixture of medical and surgical examples is given.

Table 2: Examples of interventions delivered across key delivery platforms

assumptions (low, middle, and high value assigned to the change). Figure 9 is based on the middle assumption (the underlying data for this figure are in appendix 3), which follows the Institute of Medicine in valuing reductions in child mortality at only half of the life-years gained from those reductions.¹²¹ Fully valuing child mortality reductions in terms of life-years gained (appendix 3) notably increases the estimated contribution of longer life expectancy to full income in south Asia and sub-Saharan Africa.

A second point illustrated in the appendix is that reductions in mortality rates associated with reported increases in life expectancy concentrate increasingly on older ages as life expectancy increases (ie, most of the gains are now realised late in life). Eggleston and Fuchs¹²² recently emphasised the economic implications of this concentration—the benefits of increased life expectancy beyond 65 years of age will be realised only to the extent that societies take full advantage of their increasingly large cohorts of older, healthy people.

To estimate the returns on investment in our convergence investment framework later in this report, we adopt a full income approach to give a more complete picture of the benefits of convergence. The Copenhagen Consensus, a global development priority-setting project, uses a close analogy to the full income approach to assess the benefit:cost ratios and the overall priority for investments in health, investments that affect health (eg, water and sanitation), and other types of investments in development. The 2012 Copenhagen Consensus found that all five of the top development investment opportunities were in health or nutrition (as were four of the next ten).¹²³ Our findings of very high benefit:cost ratios for convergence are consistent with the Copenhagen Consensus findings, and with a recent assessment of surgical intervention for obstructed labour.¹²⁴

	Price changes (taxes and subsidies)	Laws and regulations	Information and communication	Improved built environment
Inadequate household environment (poor water and sanitation, polluted air, and exposure to disease vectors)	+	+	+	+++
Unsafe sex	++*	+	+	-
Unsafe roads and vehicles	++	++	+	+++
Tobacco use	+++	++	+	-
Harmful alcohol use	++	++	+	-
Poor diet	++	++	+	-
Physical inactivity	-	-	+	++
Ambient air pollution	+++	++	-	++

The number of + signs conveys the Commission's judgement of the potential for the indicated instrument to affect each risk factor cluster. Potential varies from little potential (-) to high potential (+++). When one policy method operates mainly through another (eg, price subsidies for improved indoor stoves and fuels lead to an improved built environment), the table places credit on the downstream instrument (in this case, on "improved built environment" rather than "price changes"). *Free or subsidised condoms and rapid saliva-based HIV tests.

Table 3: Policy instruments to reduce risk of disease and injury, by risk factor cluster

Health and wealth

GDP provides a measure of the annual output of a country's economy. A country's wealth, however, consists of the stock of all the assets—such as factories, rail lines, and educated people—that can produce GDP. Economists have only recently begun to provide measures of national wealth. Part of the motivation behind such measures was to note that natural resources (eg, oil underground, clean air, and water above ground) provide important productive assets to many countries, but that increasing income at the cost of depleting natural resource stocks could be unsustainable. One notion of sustainable development for a country was that its wealth, defined appropriately, should not decrease over time.

In their study on sustainability and the measurement of wealth, Arrow and colleagues¹²⁵ provide a broad definition of wealth and assess the contribution to wealth in five countries of natural resources, physical capital, education capital, carbon damages, and “health capital”. The authors define health capital in a way that is analogous to how changes in health have been valued in assessments of full income. They conclude that health capital contributes more to wealth than do the other dimensions of comprehensive wealth combined. A key to sustainability is to ensure continued improvements in health. The UN system has begun to improve and institutionalise the measurement of wealth, broadly defined, through its Inclusive Wealth Reports.¹²⁶

Section 3. Stronger health systems and policies

As we discuss later in this report, we believe that there are unprecedented opportunities for the national governments of low-income and middle-income countries to tackle infections and RMNCH disorders (to achieve a

grand convergence in mortality outcomes), to curb NCDs and injuries through essential packages of population-based and clinical interventions, and to provide financial risk protection through UHC while also taking steps to avoid unproductive health cost escalation. However, such progress will only be possible through strong health systems. In this section, we briefly discuss the essential components of health systems and the role of policy instruments for achieving health progress. Most services can be delivered through stronger primary care clinics, supported on either side by community health workers and hospitals.

Tackling infections and RMNCH disorders, while also reducing NCDs and injuries, will best be achieved in most countries through a diagonal approach, with stronger health systems that are focused on achieving measurable health outcomes.¹²⁷ However, many low-income and middle-income countries are struggling with insufficient resources and training to build the institutions and health workforce that are needed to achieve this dual agenda.

The health interventions that we focus on in sections 4 and 5 of this report require systems for their delivery. The major health systems functions—service delivery, health workers, drugs, information systems, governance, and financing—require substantial additional investment in all low-income and middle-income countries.¹²⁸ The scarcity of human resources is a particular bottleneck for service expansion—there are too few doctors and nurses providing medical services, most work in cities, and low skills and motivation are common.¹²⁹ Facilities are under-equipped to provide high-quality care.¹³⁰

Structural investments in the health system should accompany all spending—global or domestic—on discrete interventions. Over time, such investments would coalesce into a basic multifunctional health service delivery platform that can provide lifelong care for people with chronic diseases and can establish a base to treat a range of health concerns. Although this investment can be financed by domestic funds in some countries, components of this platform will need ongoing global health assistance in many low-income countries. In the early stages of health systems development, scarce managerial resources might best be targeted at specialised services (eg, HIV services or antenatal care). But as countries’ resources and service packages grow, management expertise will be needed to integrate service delivery to prevent inefficiencies and duplication that drive up costs and reduce health effects. Integration is particularly crucial for NCDs, which have clinical features that often need a comprehensive diagnostic and treatment approach.

Where to start? The health system offers several platforms for delivery of packages of interventions for infections, RMNCH disorders, NCDs, and injuries—these platforms include a community health worker platform, primary care clinics, first-level hospitals, and referral hospitals. Many diseases can be treated at a

	Under-5 mortality rate per 1000 livebirths	Tuberculosis deaths (per 100 000 population)	AIDS deaths (per 100 000 population)	Maternal mortality ratio (deaths per 100 000 livebirths)*
China	14	3.5	1.9†	37
Chile	9	1.3	7.0‡	25
Costa Rica	10	0.7	8.7	40
Cuba	6	0.3	1.4	73
Low-income countries‡	82	33	72	410§
Ethiopia	68	18	60	350
Rwanda	55	22	58	340
Lower-middle-income countries‡	61	22	25	260§
India	56	24	14†	200
Upper-middle-income countries‡	20	6	20	64§
South Africa	45	49	535	300
Worldwide‡	48	14	25	210§

*Data from reference 35. †2009 data from <https://www.cia.gov/library/publications/the-world-factbook>. ‡2007 data from data.un.org. §2010 data from data.worldbank.org. Other data are from reference 138.

Table 4: Health indicators in 4C countries and in other selected regions and countries, 2011

	Total	Under-5 mortality	Tuberculosis (age >5 years)	HIV/AIDS (age >5 years)	Maternal mortality*
Low-income countries†	19.5	6.7	0.6	1.4	0.5
Ethiopia	16.5	4.2	0.4	2.1	0.6
Rwanda	17.3	2.6	0.4	2.4	0.7
Lower-middle-income countries†	9.9	3.6	0.3	0.3	0.2
India	11.4	3.4	0.4	0.1	0.2
Upper-middle-income countries†	5.8	0.8	0.0	0.4	0.0
South Africa	18.6	2.1	0.5	3.0	0.9
Worldwide†	9.0	3.8	0.2	0.5	0.2

*Life expectancy changes for women only. †Based on 2008 WHO life tables. Data from reference 136.

Table 5: Years of life expectancy lost relative to the 4C countries in 2008, by region

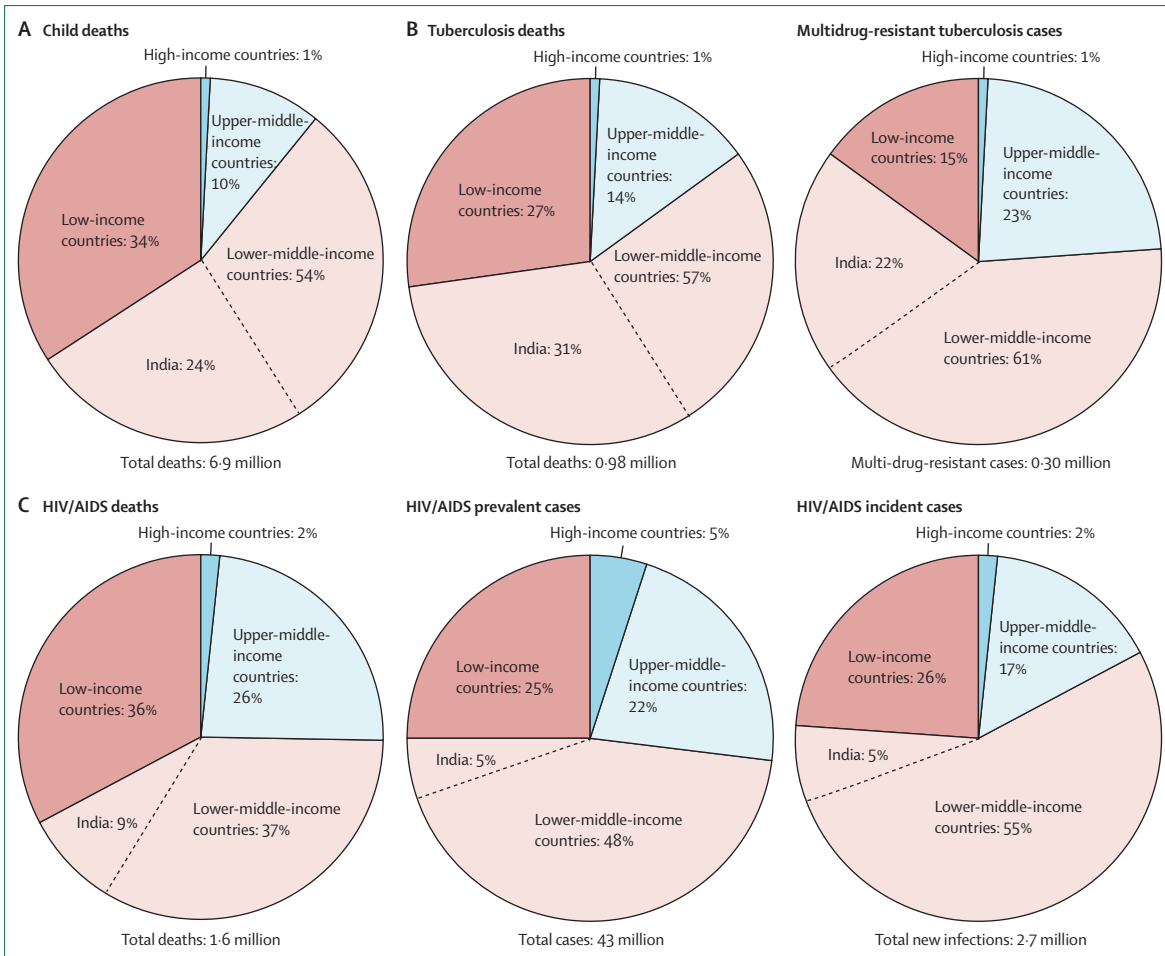


Figure 10: Worldwide distribution of child deaths and infectious diseases by country income level, 2011
 (A) Child deaths (birth to 5 years of age). Data from reference 138. (B) Tuberculosis deaths and multidrug-resistant cases. Data from reference 138. (C) HIV/AIDS deaths, prevalent cases, and incident cases. Data from references 138–141.

primary care level by primary care providers (nurses and clinical officers), with support from community health workers (table 2). In several countries, robust primary care clinics with qualified providers and strong infrastructure and commodity supply chains have proven to be an effective platform for HSS.¹³¹ In some countries, large-scale chronic care systems have been developed to provide HIV services; these might be leveraged to “jumpstart” programmes for chronic NCDs.¹³²

However, primary care clinics and community health workers alone are insufficient: treatment of injuries and obstetric, acute infectious, cardiovascular, and other disease complications will also require district hospital emergency and surgical capacity. The primary care clinic, with its strong functional links to both the community and the district hospital, has an important role in clinical coordination across the different platforms. The ability to offer a smoothly functioning continuum of care (eg, to move an injured patient from the community to a local clinic for first aid and then on to a district hospital with

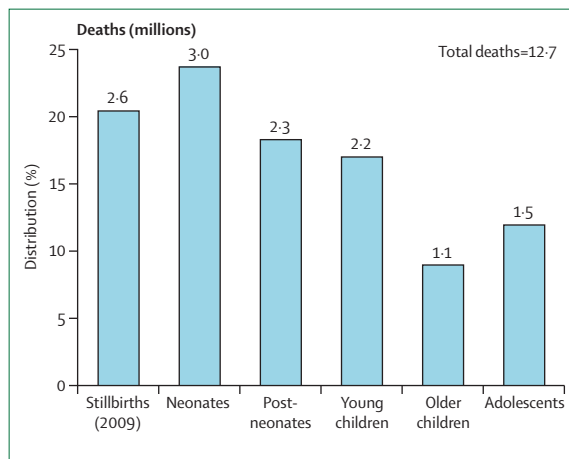


Figure 11: Age distribution of child and adolescent mortality in low-income and middle-income countries, 2010
 Neonates=day 0 to <28 days. Post-neonates=28 days to <1 year. Young children=1 year to <5 years. Older children=5 years to <10 years. Adolescents=10 years to <20 years. Data from references 21, 34, 142.

surgical capacity for definitive treatment) is one characteristic of an advanced health system.

Outside the health system, an important role exists for population-based policies to tackle the key risk factors associated with infections, NCDs, and injuries, such as poor water and sanitation, unsafe sex, tobacco use, and unsafe roads. In this report, we examine the role of four particular policy tools: taxes and subsidies, laws and regulations, information and communication, and improvements to the built environment. Table 3 lists these instruments in the context of managing risk in populations. As Jamison and colleagues²³ have emphasised, the same tools affect the uptake and quality of delivery of clinical services. However, relatively little economic evaluation has been done to assess the attractiveness of these instruments for improving clinical care.

Section 4. Towards a “grand convergence” in health?

Despite great progress since 1993, a huge burden of preventable mortality persists in low-income and middle-

income countries. The main contributors to this burden include child and maternal mortality, stillbirths, HIV/AIDS, tuberculosis, malaria, and the neglected tropical diseases. The Commission examined the following question: with sustained investments in scaling up of existing and new health interventions, could mortality rates from these diseases in most low-income and middle-income countries converge with those seen currently in today’s high-performing middle-income countries within a generation?

Historical precedents certainly exist for achieving rapid declines in avoidable child and maternal mortality, even in low-income settings. For example, Bangladesh, Ecuador, Egypt, and Indonesia were all able to reduce their under-5 mortality rate by at least 40% between 1991 and 2000, mostly through targeted health interventions and leveraging of DAH.¹³³ Such gains were possible even under situations of poverty, weak economies, poor governance, and political turmoil. Rwanda’s aggressive scale-up of health interventions was associated with a 60% reduction in the maternal mortality ratio and a 67%

Panel 8: Summary of methods used to estimate costs and outcomes of achieving convergence

We first did a bottom-up analysis with the OneHealth Tool, which allows country-based scenario planning for maternal and child health, and HIV and malaria control.¹⁴⁷ The tool builds on previously used costing methods and incorporates epidemiological reference models, including the Lives Saved Tool, the AIDS Impact Model for HIV/AIDS interventions, the DemProj model for demographic projections, and the FamPlan model that computes the association between contraception and total fertility rate. Users of the OneHealth Tool select a country, a set of health interventions, a timeframe for scaling these up, and the achievable coverage levels of these interventions within this timeframe. The software models the health effects and costs of a chosen scale-up scenario.

We modelled scale-up of the interventions shown in detail in appendix 4 (summarised in panel 9) in 34 low-income countries and 48 lower-middle-income countries. We modelled a status quo baseline scenario, which assumes constant coverage of interventions over time, and an enhanced investment scenario, in which all countries accelerate the scale-up of interventions to the existing rate in the “best performing” countries. At this accelerated rate, countries would reach coverage levels of most interventions of at least 90% by 2035 (Walker N, Johns Hopkins University, personal communication). The results, summarised in tables 6–9 (the individual country results are in appendix 5), present incremental costs and benefits of the enhanced investment versus status quo scenarios.

The reproductive, maternal, newborn, and child health (RMNCH) interventions included in the modelling were based on evidence from a recent systematic review.¹⁴⁸ Our convergence analysis was conducted in close collaboration with Flavia Bustreo and colleagues, who recently published an

investment case for women’s and children’s health in *The Lancet* that modelled scale-up of these RMNCH interventions.¹⁴⁹ The HIV interventions were based on those suggested by the Investment Framework Study Group, and they included prevention, behaviour change, and creation of a supportive policy environment.¹⁴⁴ The malaria control tools were those suggested by the Roll Back Malaria Taskforce’s Global Malaria Action Plan.¹⁵⁰

For broader health system strengthening costs, neglected tropical diseases, and tuberculosis, the projections drew on sources and estimates outside the OneHealth software:

- The costs and effects of broad health system strengthening were based on estimates from the Taskforce on Innovative International Financing for Health Systems.¹⁴³
- For control and elimination of neglected tropical diseases, WHO, the World Bank, and the Ghana Ministry of Health conducted a secondary data analysis that leveraged previous work by the Bill & Melinda Gates Foundation and African ministries of health.¹⁵¹ The analysis focused on five diseases that can be controlled by mass drug administration: lymphatic filariasis, onchocerciasis, schistosomiasis, trachoma, and the soil-transmitted helminths.¹⁵²
- For tuberculosis control, we used the OneHealth Tool to create a starting point that was indicative of the existing rates of tuberculosis in a country and to estimate rates of mortality in people with HIV co-infection. A separate calculation was made of the projected overall decrease in tuberculosis incidence and mortality, based on analyses provided by WHO’s Stop TB Department.

Finally, as described in the report, we factored the effects and costs of scale-up of new tools into our modelling.

decrease in the under-5 mortality rate between 2000 and 2010.¹³⁴

Verguet and Jamison¹³⁵ systematically reviewed the rates of decline in under-5 mortality in 113 low-income and middle-income countries and assessed how these rates were affected by income and education. They recorded many examples of rates of mortality decline that rose substantially over a period of just years. Appendix 1, pp 37–39 shows the results for six countries. Turkey's performance is especially impressive—the rate of decline recently rose to about 8% per year and has stayed there. This rate results in a halving of under-5 mortality in less than 10 years, and provides further precedent for the feasibility of rapid convergence.

In this section, we examine the convergence agenda, give our best estimates of the technical and financial resources needed to achieve convergence by 2035, and describe the likely health and economic benefits of such an achievement. For our estimates of the economic gains, we adopt a full income approach for the reasons described earlier in this report.

The convergence agenda

A new analysis that Norheim did for the Commission estimated the size of the gap in preventable mortality and infection between high-mortality and low-mortality countries.¹³⁶ To close this estimated gap would represent what could be achieved by convergence.

For this analysis, we chose a group of reference countries that were classified as low-income or lower-middle-income in 1990 and that had achieved high levels of health status by 2011. Any choice would necessarily be somewhat arbitrary, but for our calculations we selected what can be conveniently labelled the 4C countries—Chile, China, Costa Rica, and Cuba. Abraham Horwitz, the first Latin American Director of the Pan American Sanitary Bureau, characterised Chile, Costa Rica, and Cuba as a trio of what he called “countries that cope”.¹³⁷ What they had in common, he argued, is that despite exposure to “political vicissitudes, severe economic crisis, epidemic outbreaks, and other social banes”, they overcame these challenges to sharply reduce avertable mortality, largely because of scale-up of health sector interventions. We believe that China also fits this description. All of the 4Cs started off at similar levels of income and mortality as are seen in today's low-income countries and lower-middle-income countries. Table 4 shows the under-5 mortality rate, tuberculosis and HIV/AIDS mortality rates, and the maternal mortality ratio in the 4C countries, low-income countries, and middle-income countries in 2011, the most recent year for which data are available. Based on table 4, we define convergence as meaning that most low-income and middle-income countries would achieve an under-5 mortality rate of 16 per 1000 livebirths, an annual AIDS death rate of eight per 100 000 population, and

an annual tuberculosis death rate of four per 100 000 population (or, in short, “16–8–4”).

Our analysis of the mortality gap that could be closed by convergence measured years of life expectancy lost because of these disorders relative to the 4C countries. Table 5 summarises the results of the analysis. In low-income countries as a group, for example, 6·7 years of life expectancy are lost because of under-5 mortality, 0·6 years because of tuberculosis in those older than 5 years, 1·4 years because of HIV/AIDS in those older than 5 years, and 0·5 years because of maternal mortality.

Most child deaths, tuberculosis deaths, cases of tuberculosis drug resistance, and HIV deaths and cases are in middle-income countries (figure 10), which is partly because of the shift of the population from low-income

Panel 9: Interventions included in the Commission's analysis of convergence

Reproductive, maternal, newborn, and child health

- Pregnancy-related interventions (antenatal care, treatment of pregnancy complications, delivery interventions, and post-partum care)
- Abortion and complications
- Family planning
- Diarrhoea management
- Pneumonia treatment
- Immunisation
- Nutrition (breastfeeding and supplementation)

HIV

- Prevention activities: community mobilisation; working with specific groups (intravenous drug users and men who have sex with men)
- Management of opportunistic infections
- Care and treatment
- Collaborative tuberculosis–HIV treatment

Malaria

- Treatment with appropriate drugs for adults, children, pregnant women, and those with severe malaria
- Indoor residual spraying
- Long-lasting insecticidal bednets
- Intermittent presumptive treatment in pregnancy

Tuberculosis

- Diagnosis, care, and treatment of drug-sensitive tuberculosis
- Diagnosis, care, and treatment of multidrug-resistant tuberculosis

Neglected tropical diseases

Community-directed interventions to control:

- Lymphatic filariasis
- Onchocerciasis
- Schistosomiasis
- Trachoma
- Soil-transmitted helminths

to middle-income countries (figure 5) and partly because in many large middle-income countries, geographical regions with sizeable populations still have large pockets of high mortality. As noted previously, achievement of a grand convergence will therefore demand action that goes beyond the low-income countries to also focus on middle-income countries—especially the poor, rural populations within them.

Although our analysis of the feasibility of convergence for RMNCH disorders focuses specifically on children younger than 5 years and on mothers, background research undertaken for the Commission has provided improved quantitative estimates of mortality in older children (aged 5–9 years) and adolescents (aged 10–19 years). The number of deaths is surprisingly high (figure 11). In view of the magnitude of mortality in older children and adolescents, a policy priority must be to develop interventions and platforms to reach these age groups.

See Online for appendix 4

For a detailed account of the methods see <http://globalhealth2035.org>

Modelling the scale-up of convergence interventions

Several major efforts have been made to model the technical and financial resources that would be needed to dramatically enhance the control of individual

diseases, such as HIV or malaria, or to scale up health systems components. Examples include the Taskforce on Innovative International Financing for Health Systems' estimates of the costs of scaling up health systems to deliver maternal and child health interventions,¹⁴³ estimates by the Investment Framework Study Group of the effects and costs of responding more effectively to HIV/AIDS,¹⁴⁴ and the *Lancet* Diarrhoea and Pneumonia Interventions Study Group's modelling of the effects and costs of scaling up interventions for these two diseases.¹⁴⁵

Building on these existing models, the Commission, in collaboration with many international agencies and institutions (see Acknowledgments), took an integrated approach across several disorders to estimate what it would take to achieve convergence. We assessed whether increased investment in health in low-income and lower-middle-income countries to scale up health interventions to high coverage levels could feasibly reduce mortality rates from infections and RMNCH disorders to close to those in the low-mortality 4C countries by 2035. We studied the mortality effect in 34 countries recently categorised by the World Bank as low-income (gross national income per person lower than US\$1035) and in the 48 countries presently classed as lower-middle income. We also estimated the rough costs of such investment, and then used full income approaches to derive a benefit-to-cost ratio. Our integrated investment framework combined two types of analyses: a country-based (bottom-up) analysis of the costs and effects of scaling up existing RMNCH tools, HIV, and malaria interventions (appendix 4), and selected health systems costs, with use of software called the OneHealth Tool;¹⁴⁶ and a global (top-down) analysis of the costs and effects of scaling up existing tools for tuberculosis and neglected tropical diseases and the broad health systems costs of achieving a grand convergence.

Panel 8 summarises the analytical approaches that we took, including a brief explanation of how we modelled the health effects and costs of a baseline scenario, which assumes constant coverage of health interventions over time, versus an enhanced investment scenario that achieves rapid intervention scale-up. The overall effects and costs of the integrated investment framework were derived from the difference between the enhanced investment and baseline scenarios. Panel 9 summarises the interventions included in our analysis.

For the low-income countries, we did the modelling on a country-by-country basis for all 34 countries, and then summed the results. For the lower-middle-income countries, we modelled three countries with very large populations—India, Indonesia, and Nigeria—which constitute 71% of the population of all lower-middle-income countries. We then extrapolated the findings from these three countries to all 48 lower-middle-income countries. Further details of the methods are in appendix 4, and a detailed account of the entire analysis is available online.

	Baseline 2011	Constant coverage scenario 2035	Enhanced investment scenario with R&D 2035	Events averted by enhanced investment in 2035*	
				A	B
Reproductive, maternal, newborn, and child health					
Births	27 500	48 500	24 100	24 400	24 400
Total fertility rate†	4.2	4.3	2.2	..	..
Maternal deaths	110	210	25	190	190
Stillbirths	740	1300	250	1000	500
Total under-5 child deaths	2900	5300	500	4800	2400
Under-5 mortality rate‡	104	110	23	..	..
Maternal mortality ratio§	412	436	102	..	..
Tuberculosis					
New cases	2010	2100	600	1500	1500
Deaths	430	450	40	410	410
HIV/AIDS					
New infections	860	1620	120	1500	1500
Deaths in people aged 5 years and older	600	1060	70	990	990
Total deaths	4600	8200	900	7400	4500

For births, stillbirths, cases, deaths, and infections, the annual rate is in thousands. The results have been rounded. R&D=research and development. *Events averted in 2035 is defined as the difference between the constant coverage scenario in 2035 and the enhanced investment scenario with R&D in 2035 (ie, enhanced investment including scale-up of new tools developed by R&D). Column A includes stillbirths and child deaths averted because a pregnancy was averted—ie, column A includes potential deaths among individuals who never existed. Column B excludes these deaths—ie, column B shows only deaths associated with pregnancies that did actually occur. †The total fertility rate is expressed as the number of births expected per woman at the then-prevailing age-specific mortality and fertility rates. ‡The under-5 mortality rate is defined as the probability of dying between birth and 5 years of age at the age-specific mortality rates of the indicated year (denoted by demographers as 5q0). §The maternal mortality ratio is the number of women who die during pregnancy and childbirth, per 100 000 livebirths.

Table 6: Effect of enhanced investment scenario across low-income countries as a group

Estimation of programmatic costs and health systems strengthening costs

The OneHealth Tool estimates, on a country-by-country basis, the programmatic costs of scale up of health interventions. These costs include drugs and commodities, plus the health systems costs associated with the direct delivery of health interventions—that is, health worker time, time spent in a health facility, and the maintenance costs of that facility as it operates at present. We assumed a small (4%) annual increase in non-commodity costs to capture the effect of rising health worker salaries in real terms.

As discussed previously, structural investments in HSS, a key public sector responsibility, must accompany programmatic spending. We therefore estimated the costs of such system improvements, including strengthening infrastructure, transport, logistics, human resources, information technology, regulation, and management of health financing. The modelling incorporated strategic investments at district, regional, and national levels to strengthen programme and systems performance. We modelled strategies and activities on both the supply side (eg, building of new hospitals), and the demand side (eg, mass media campaigns to encourage breastfeeding and care seeking for childhood illness). For the baseline scenario, we assumed no such strengthening (ie, these costs were zero).

For the scale-up scenario, we used the estimates of the costs of HSS from the Taskforce on Innovative International Financing for Health Systems, which show a front-loaded pattern, rather than a gradual cost increase over time.¹⁴³ Such front-loading is aimed at

accelerating progress in intervention scale-up. The taskforce estimated the costs for HSS across a wide range of health conditions; since we were modelling only HIV, tuberculosis, malaria, neglected tropical diseases, and RMNCH disorders, we assumed that the HSS costs for low-income countries would be 80% of the taskforce estimates. For lower-middle-income countries, we made an adjustment to account for pre-existing health systems capacity (appendix 4); with this adjustment, the HSS costs were about 30% of the taskforce estimates.

As discussed in a companion paper about investments in women's and children's health,¹⁴⁹ our analysis assumed that health interventions would be delivered across four platforms: hospital, first-level facility, outreach, and the community. Such delivery is based on existing best practice outlined in WHO treatment guidelines. We were not able to factor "task-shifting" across different delivery points into the analysis.

Estimation of the cost and effect of scale-up of new tools

The use of health technologies is not a static process—existing technologies will be superseded by newer products. In a recent analysis, Moran and colleagues⁴⁹ concluded that a healthy pipeline of products for infectious diseases is likely to become available within years. Scale-up of such new technologies is associated with an annual decline of about 2% per year in the under-5 mortality rate,⁴⁶ and therefore in the final stage of our analysis we factored this decline into our models. We applied a 2% per year decline to the under-5 mortality rate, the maternal mortality ratio, and the annual number

	Incremental costs 2015 (US\$ billion)	Incremental costs 2025 (US\$ billion)	Incremental costs 2035 (US\$ billion)	Incremental costs 2016–25 (US\$ billion)	Incremental costs 2026–35 (US\$ billion)
Programmatic investment (scale-up of existing interventions)					
Family planning	<1	<1	1	3	5
Maternal and neonatal health	<1	1	1	5	11
Immunisation	1	1	<1	6	4
Treatment of childhood illness	<1	1	<1	4	4
Malaria	1	2	2	15	19
Tuberculosis	1	1	1	8	7
HIV/AIDS	1	3	5	22	43
Subtotal	4	9	10	63	94
Health system strengthening					
Incremental investment	17	14	17	150	160
Programmatic investment (scale-up of new tools)					
All new tools and interventions	2	2	3	18	22
Total investment	24	24	30	230	270
Ratios					
Cost per death averted (US\$)	11 500	4600	4100	5700	4200
Population (millions)	900	1100	1250	10 300	11 900
Incremental cost per person (US\$)	26	22	24	22	23
The results have been rounded.					

Table 7: Incremental costs of enhanced investment scenario across low-income countries as a group

of infections and deaths from tuberculosis and HIV/AIDS. For the cost estimates, we assumed that the cost per death prevented by scale-up of new tools (ie, the programmatic and HSS costs) would be the same as that of scaling-up of existing tools. We discuss the costs of new tool development separately in section 6.

Integration of the estimates

The integrated investment framework aimed to give a big picture perspective to help scenario planning in the next generation. We integrated the estimates from the bottom-up and top-down analyses, together with the effects and costs of scale-up of new tools, taking into account potential synergistic or cascade effects of specific interventions, and the problem of double counting (eg, counting the costs of malaria interventions for pregnant women twice—ie, during pregnancy and then again when calculating the sum of intervention costs for all adults).

Our analysis showed that if choices are being made about which interventions to scale up first, early investments in family planning would significantly reduce unwanted pregnancies and birth rates, yielding significant savings in the costs of maternal and newborn care and immunisation. This finding is consistent with

See Online for appendix 5

the findings of Bustreo and colleagues' recently published investment framework for women and children.¹⁴⁹ Since a substantial proportion of tuberculosis is related to HIV infection, the synergistic benefits of investment in prevention and early HIV treatment to improve tuberculosis control could justify these investments being made early in the scale-up process. Early implementation of cost-effective interventions that place comparatively modest demands on health system capacity, such as immunisation (appendix 1, pp 41–42), would also bring large pay-offs.

Methodological caveats

Our approach has several methodological caveats, and uncertainty around the estimates clearly exists. First, new data for the costs or effectiveness of the existing interventions that we modelled would cause our projections to change. Second, irrespective of the funding available, whether all countries would have the institutional and absorptive capacity to achieve coverage levels of the magnitude that we modelled is unclear. Moreover, a potential risk of backsliding exists if some interventions lose effectiveness (eg, if sub-Saharan Africa experienced resistance to artemisinin, a key drug for malaria control). Additionally, costs can change with the scale-up of interventions, and such cost elasticity may not have been captured adequately in the models. The modelling also did not take into account any changes in development sectors outside the health sector—for example, it did not incorporate improved water and sanitation or the effects of climate change. The projections assumed that no new disease threats would emerge to derail scale-up, and that sufficient peace and stability would be present to maintain coverage without backsliding. Finally, our integrated investment framework assumes that countries will adopt a mindset towards universal health coverage of publicly financed interventions for infections and RMNCH disorders (as discussed later in this report), and towards ensuring the rights of groups that are key to this scale-up (eg, girls and women, or men who have sex with men). This assumption might not hold true in all countries.

Costs and consequences of convergence

As table 6 shows, across the 34 low-income countries, the enhanced investment scenario would prevent about 7.4 million deaths in the year 2035 relative to the baseline scenario (deaths averted in intervening years are shown in appendix 5). These averted deaths include deaths averted from preventing pregnancies through the scale-up of family planning programmes. Table 6 also shows, in the final column labelled B, the number of deaths averted associated with those pregnancies that actually occur. The total, in column B, is about 4.5 million averted deaths, which is the number we use in our benefit-cost calculations. The costs are estimated to be an additional US\$23 billion per year from 2016 to 2025, and \$27 billion per year from

	Baseline 2011	Constant coverage scenario 2035	Enhanced investment scenario with R&D 2035	Events averted by enhanced investment in 2035*	
				A	B
Reproductive, maternal, newborn, and child health					
Births	60 200	75 400	52 800	22 600	22 600
Total fertility rate†	2.9	2.9	2.1	..	..
Maternal deaths	160	220	30	190	190
Stillbirths	1300	1800	440	1400	1000
Total under-5 child deaths	3800	5100	600	4500	3200
Under-5 mortality rate‡	63	68	11	..	..
Maternal mortality ratio§	260	292	64	..	..
Tuberculosis					
New cases	4300	3800	1100	2700	2700
Deaths	700	630	65	570	570
HIV/AIDS					
New infections	720	1100	100	1000	1000
Deaths in people aged 5 years and older	570	860	50	810	810
Total deaths	6400	8500	1200	7500	5800

For births, stillbirths, cases, deaths, and infections, the annual rate is in thousands. The results have been rounded. R&D=research and development. *Events averted in 2035 is defined as the difference between the constant coverage scenario in 2035 and the enhanced investment scenario with R&D in 2035 (ie, enhanced investment including scale-up of new tools developed by R&D). Column A includes stillbirths and child deaths averted because a pregnancy was averted—ie, column A includes potential deaths among individuals who never existed. Column B excludes these deaths—ie, column B shows only deaths associated with pregnancies that did actually occur. †The total fertility rate is expressed as the number of births expected per woman at the then-prevailing age-specific mortality and fertility rates. ‡The under-5 mortality rate is defined as the probability of dying between birth and 5 years of age at the age-specific mortality rates of the indicated year (denoted by demographers as 5q0). §The maternal mortality ratio is the number of women who die during pregnancy and childbirth, per 100 000 livebirths.

Table 8: Effect of enhanced investment scenario across lower-middle-income countries as a group

2026 to 2035—an incremental cost per person of about \$24 in 2035 (table 7). Specific country-by-country results (health effects and costs) for each country are shown in appendix 5.

Most of these incremental costs are health systems costs, which account for 70% of all costs in the first 10 years and 60% in the second 10 years. Of these systems costs, the main component is infrastructure, including equipment and vehicles (appendix 1, p 40). An important outcome from such investments is that it leads to a functional health system platform for service delivery that can tackle other long-term health challenges, not just infections and RMNCH disorders.

With a full income approach to estimating the economic benefits of convergence, the benefits would exceed costs by a factor of about 9 (appendix 3). Based on the under-5 mortality rate, low-income countries would reach about two-thirds of the way towards convergence from scale-up of existing tools and the remaining gap would be closed through scale-up of new tools. By 2035, the under-5 mortality rate would be 23 per 1000 livebirths, which is just above the convergence goal of 16 per 1000 livebirths. Based on the population projections for 2035 in these 34 low-income countries (calculated from data in appendix 1, p 28), the AIDS death rate would be about six per 100 000 population (below the convergence target of eight per 100 000) and the tuberculosis death rate would be around three per 100 000 (below the convergence target of four per 100 000).

For the 48 lower-middle-income countries, the enhanced investment scenario would prevent about 7.5 million deaths in the year 2035, relative to the

baseline scenario (table 8). Table 8 also shows, in the final column labelled B, the deaths averted among pregnancies actually occurring, which we estimate to be about 5.8 million deaths. The estimated costs would be an additional US\$38 billion per year in 2016–25 and \$53 billion per year in 2026–35, which is an incremental cost per person of about \$20 in 2035 (table 9). Most of these incremental costs are for programmatic scale-up rather than HSS; in the first 10 years, HSS makes up 40% of the total costs, falling to 30% in the next 10 years. Benefits would exceed costs by a factor of about 20. Lower-middle-income countries would reach about four-fifths of the way towards convergence from scale-up of existing tools, with the remaining gap closed by scale-up of new tools. By 2035, these countries would achieve our definition of convergence: the under-5 mortality rate would be 11 per 1000 livebirths, and both the AIDS and tuberculosis death rates would be about two per 100 000 population.

For low-income and lower-middle-income countries taken together, deaths averted in pregnancies that actually occur are estimated at about 10 million in 2035.

In modelling of neglected tropical disease elimination undertaken for this Commission, Seddoh and colleagues⁵¹ estimated that five neglected tropical diseases, which account for 90% of the burden of such diseases in sub-Saharan Africa, could be close to eliminated with mass drug administration at an annual cost of only about US\$300–400 million up until around 2020. The cost would then begin to fall as transmission is interrupted and as the burden falls to a level that can be managed by the public health system. Elimination of these five

	Incremental costs 2015 (US\$ billion)	Incremental costs 2025 (US\$ billion)	Incremental costs 2035 (US\$ billion)	Incremental costs 2016–25 (US\$ billion)	Incremental costs 2026–35 (US\$ billion)
Programmatic investment (scale-up of existing interventions)					
Family planning	<1	1	1	4	7
Maternal and neonatal health	2	5	8	32	68
Immunisation	1	4	5	28	44
Treatment of childhood illness	1	5	6	33	59
Malaria	4	6	9	51	74
Tuberculosis	2	2	2	17	15
HIV/AIDS	1	4	7	24	56
Subtotal	11	27	38	189	323
Health system strengthening					
Incremental investment	19	14	16	150	150
Programmatic investment (scale-up of new tools)					
All new tools and interventions	4	5	6	40	57
Total investment	33	45	61	380	530
Ratios					
Cost per death averted (US\$)	11 100	7700	8300	7800	8000
Population (millions)	2500	2800	3100	27 000	29 700
Incremental cost per person (US\$)	13	16	20	14	18

The results have been rounded.

Table 9: Incremental costs of enhanced investment scenario across lower-middle-income countries as a group

high-burden diseases for such low costs would represent very good value for money.

The anticipated successes in reducing child mortality, and the concomitant reduction in fertility, will lead to two major changes in global health: a rise in the proportion of deaths that are due to NCDs, and a transition away from consideration of child mortality towards child welfare and development (including cognitive

development). This childhood transition will require a focus on illnesses such as neglected tropical diseases, recurrent and persistent low-level infections (eg, diarrhoea), and poor nutritional status. Such diseases can cause debilitating morbidity, including retardation of children’s mental and physical development, and, in the case of the neglected tropical diseases, blindness and stigmatising disfigurement.

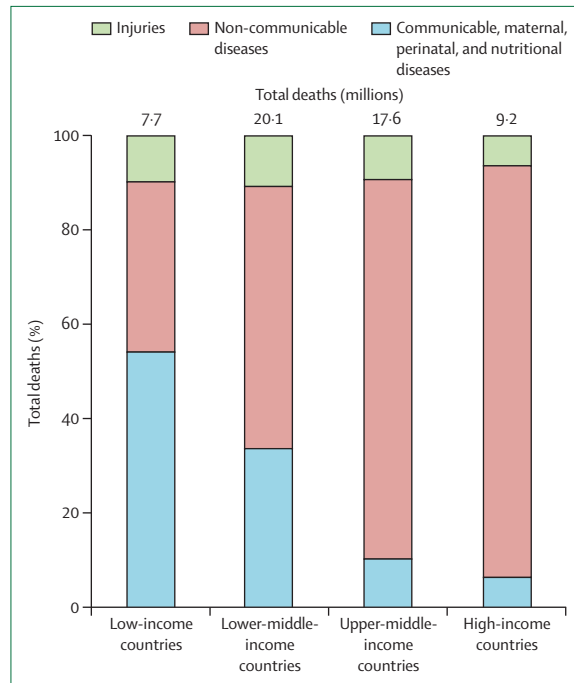


Figure 12: Deaths by broad groups of cause across different income levels, 2011
Data from reference 138 and appendix 1, pp 20–25.

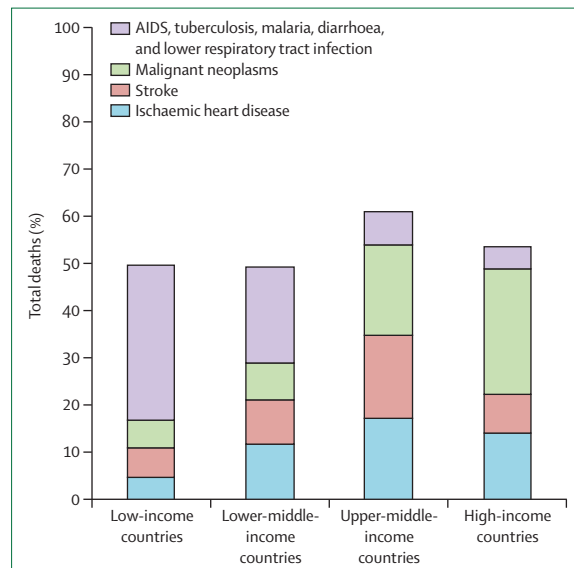


Figure 13: Deaths from selected important causes across different income levels, 2011
Data from reference 138 and appendix 1, pp 20–25.

Section 5. Non-communicable diseases and injury

One paradox of success in global health is that when low-income and middle-income countries successfully tackle infectious and RMNCH diseases, they then accelerate the shift in disease burden to NCDs and injuries of adults and elderly people. This transition is occurring through ageing of the population—the effect of this shift is large enough to more than compensate for potential reductions in age-specific incidence rates of NCDs that might be accompanying the economic development process. What steps can these countries take to delay the onset of NCDs to as late as possible in life, and thus reduce premature morbidity and mortality?

In this section, we propose essential packages of cost-effective population-based and individual clinical interventions that all low-income and middle-income countries could feasibly scale up to significantly curtail the health and economic effects of NCDs by 2035. The specific interventions in each package that should be prioritised will vary by country, depending on which risk factors are dominant or are expected to become more prominent. An essential population package would reduce NCD and injury incidence. An essential clinical package would help to reduce risk of disease and injury and to manage their consequences if they do occur.

The increasing significance of NCDs and injuries and their risk factors

WDR 1993 correctly predicted that the global burden of disease from NCDs, particularly heart disease and cancers caused by tobacco, would rise rapidly. The report was itself strongly influenced by earlier work on China that pointed particularly to the increasing significance of smoking and high blood pressure.¹⁵³ NCDs are now dominant in lower-middle, upper-middle, and high-income countries as measured by cause of death (figure 12). As incomes rise, the proportion of deaths from cancers increases steadily, while the share from AIDS, tuberculosis, malaria, diarrhoea, and lower respiratory infections decreases (figure 13). In sub-Saharan Africa, infectious diseases and RMNCH disorders dominate. However, as figure 14 shows, age-standardised rates of cardiovascular disease are now higher in all six World Bank regions than in high-income countries.⁹²

The main determinants of NCDs and injuries can be grouped into environmental and behavioural risk factors, which are potentially modifiable; non-modifiable risk

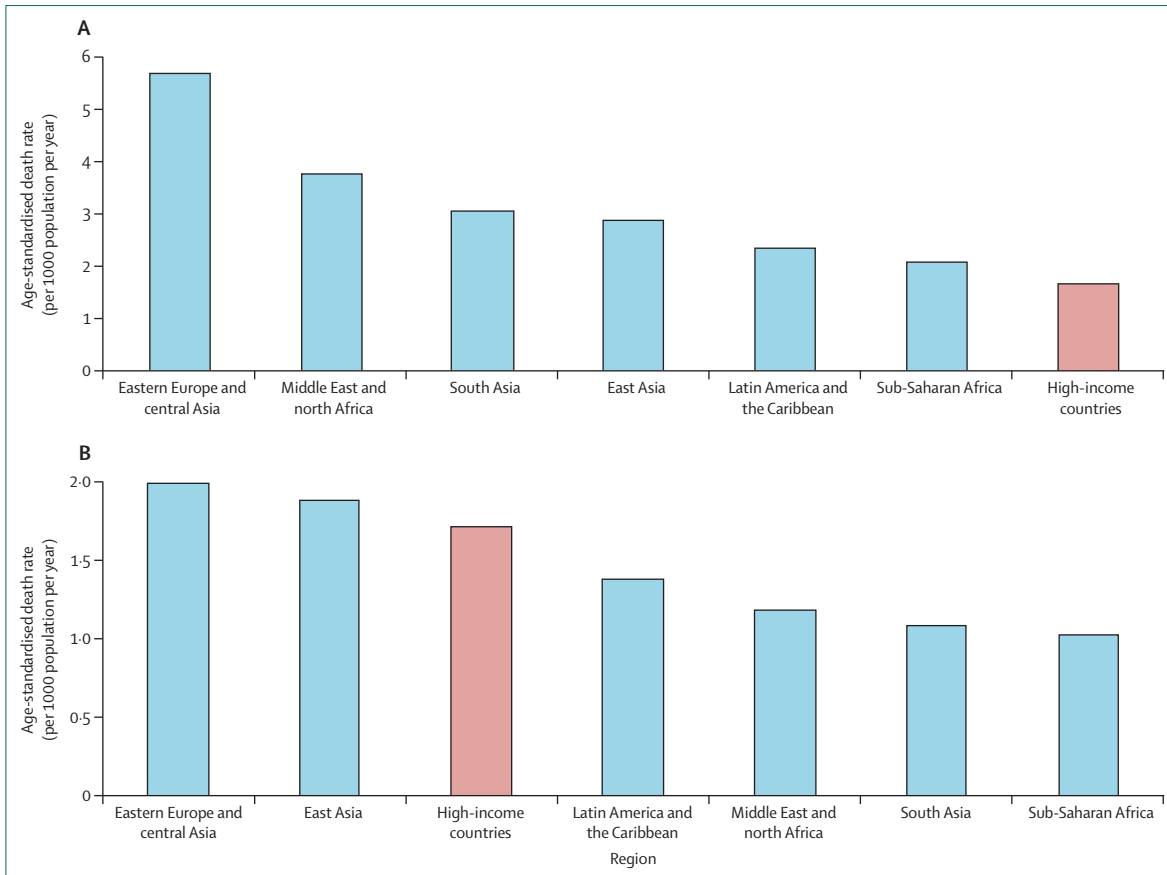


Figure 14: Age-standardised death rates for cardiovascular diseases and cancers in men by world regions, 2010 (A) Cardiovascular diseases. (B) Cancers. Data from reference 92 and Di Cesare M, Imperial College London, personal communication.

factors such as a person’s age, genes, and fetal origins; and physiological risk factors, such as obesity, hypertension, and adverse serum cholesterol concentrations (figure 15). Effective, low-cost drugs are available to control high blood pressure and abnormal serum cholesterol. The intrauterine environment is an NCD risk factor that is not modifiable from the affected person’s point of view, although inter-generationally, this risk can be reduced at a population-wide level by improving the health and nutritional status of girls, adolescents, and pregnant women.

Studies have estimated the loss of life expectancy from some of these risk factors. Smokers in the USA lose at least 10 years of life expectancy compared with non-smokers, but those who stop smoking by 40 years of age avoid about 90% of the excess risk of continuing to smoke.¹⁵⁵ For women aged 65 years, living in a moderately polluted Chinese city reduces life expectancy by 4 years compared with cities with good air quality, after controlling for sociodemographic factors.¹⁵⁶ A review of 57 studies showed that for both sexes, at age 60 years life expectancy falls by 1–2 years for those with a body-mass index (BMI) of 27–30 kg/m², 2–4 years for a BMI of 30–35 kg/m², and 8–10 years for a BMI of 40–50 kg/m² (morbid obesity),

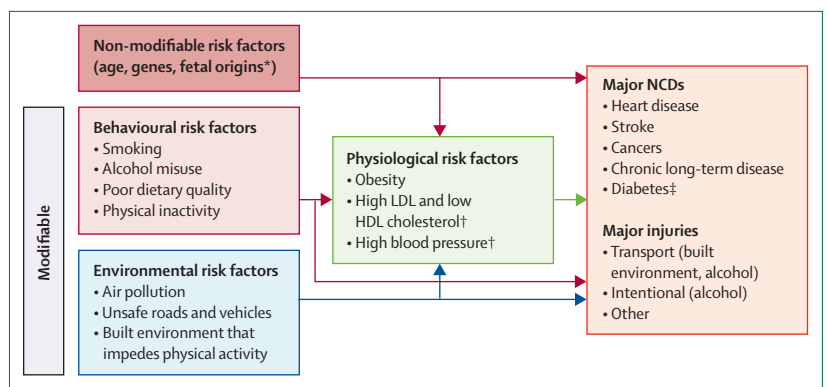


Figure 15: Relations between key risk factors for major NCDs and injuries NCD=non-communicable disease. LDL=low-density lipoprotein. HDL=high-density lipoprotein. *Fetal origins linked to the mother’s health and nutrition that increase the risk of NCDs later in life are not modifiable from the affected individual’s point of view, but maternal health and nutrition can be improved over time and this risk factor can be reduced. †Drugs are available that can reduce the amount of risk from these risk factors. ‡Diabetes is both a disease and an important risk factor for other disorders. Adapted with permission from figure 23–4 in reference 154.

after controlling for factors such as age, sex, and smoking status.¹⁵⁷ Although poor dietary quality and physical inactivity are major risk factors for obesity, they are also important risk factors themselves for heart attacks,

strokes, and cancers. Central (abdominal) obesity, measured by waist circumference, is associated with insulin resistance and is linked to a range of inflammatory and hypercoagulatory states that contribute to the development of cardiovascular disease and diabetes.¹⁵⁸ Obesity is also a risk factor for morbidity in children, such as asthma, and musculoskeletal and mental health problems.¹⁵⁹

An essential package of population-based interventions

The Commission studied the evidence on population-wide measures that governments can take to reduce major risk factors for NCDs and injuries.^{160–162} WHO has identified and costed an essential package of “best buy” population-wide interventions.¹⁶³ These interventions use three types of approaches—taxation, regulation or legislation, and information—to address tobacco, harmful use of alcohol, poor dietary quality, and physical inactivity (table 10). The interventions are judged to be best buys on the basis of their cost-effectiveness, effect on health, feasibility, and low implementation costs. Across all low-income and middle-income countries, the package would cost only about US\$2 billion annually (2011 US dollars). The Commission recommends that all national governments should scale up this essential package. In particular, very good evidence suggests that the single most important intervention in this package is tobacco taxation.

Below we summarise the methods available to governments to curb NCDs and injuries (table 10). A more detailed account is available online. Although the standard approach is to discuss each risk factor separately, the different policy instruments are typically the cross-sectoral responsibility of many different branches of government. Thus we have structured our discussion by method rather than by risk factor.

Taxation and subsidies

Taxation is a powerful lever to reduce risks from exposure to or consumption of unhealthy products, and taxes on

alcohol and tobacco have long been a major source of substantial revenue generation worldwide. Subsidies can promote health (eg, subsidies for healthy school lunches) or harm health (eg, subsidies for petroleum and coal that generate air pollution).

WDR 1993 noted that a 10% price increase in tobacco would be expected to reduce consumption by about 4% in the population overall and by substantially more in adolescents. Today, more than 100 published studies, including evidence from low-income and middle-income countries, show how tobacco excise taxes can generate reliable tax revenue and reduce tobacco use.¹⁶⁵ Taxes on tobacco and alcohol can be important quantitatively and qualitatively because they do not have the adverse incentive effects of taxes on capital or labour. Such taxes as a share of GDP vary substantially across countries (table 11), but can be significant. Although alcohol and tobacco taxes are regressive, and consume a larger fraction of the income of poor than of rich people, the consequences are likely to be favourable for the poor because they benefit disproportionately more in terms of health gains.¹⁶⁶

A 50% price increase in cigarettes from tax increases in China would prevent 20 million deaths and generate an extra US\$20 billion in revenue annually in the next 50 years.¹⁶⁷ In India, in the same timeframe, a 50% price increase would prevent 4 million deaths and would generate an extra \$2 billion in revenue annually.¹⁶⁷ The additional tax revenue would decrease over time as consumption patterns are adjusted, but is expected to remain higher than existing levels even after 50 years. Tax increases are also a highly cost-effective approach to reduce total alcohol consumption and the number of episodes of heavy drinking, especially in young people.¹⁶⁸

Verguet and colleagues¹⁶⁹ studied the distributional effect of a 50% cigarette price increase on different income groups in the Chinese population, with a focus on men, who represent most smokers in China. They estimate that after 50 years, the largest share of life-years gained (34%) accrues to people in the bottom income

For a more detailed account of population-based approaches to NCD control see <http://globalhealth2035.org>

	Price changes (taxes and subsidies)	Laws and regulations	Information and communication	Improved built environment
Tobacco use	Large (170%) excise taxes*	Bans on use in public places and on promotion*	Mass media messages*	..
Alcohol use	Large taxes in countries with high burden of alcohol consumption*	Bans on promotion and restrictions on sales*	Mass media messages*	..
Poor diet	Tax sugar and potentially other foods	Bans on salt and trans fats in processed food*	Increase public awareness of healthy diet and physical activity*	..
Unsafe roads and vehicles	..	Enforce speeding and drink-driving laws	..	Safe roads and vehicles
Air pollution	Reduce coal and petroleum energy subsidies. Selectively subsidise LPG to replace kerosene for household use. Tax sources of ambient pollution	Promote LPG use	..	..

LPG=liquefied petroleum gas. *Represent some of WHO's so-called best buys for control of non-communicable diseases.¹⁶⁴

Table 10: Key population-based interventions for non-communicable disease risk factors

quintile group, in view of their increased sensitivity to price increases. Similarly, this increased price sensitivity means that the bottom income quintile group contributes far less to the tax revenue increases than do upper quintile groups.

Several lessons emerge from experience with taxation of tobacco and alcohol. Taxes and price increases need to be substantial to achieve the desired changes in consumption. Excise taxes, with periodic adjustments for inflation, are effective. In view of the importance of large tax increases, tax avoidance (through loopholes) and tax evasion (through smuggling and bootlegging) need to be prevented domestically and regionally. Regional prevention needs coordinated policy making and enforcement, especially for tobacco products, which are quite easy to transport and trade illegally. Tax design needs to consider the range of relevant products and the changes in consumption that consumers might make if a tax is imposed in only one area (eg, from sugar-sweetened beverages to salty, high-fat snacks). Young people and low-income populations tend to respond most to price increases on unhealthy foods and beverages, tobacco, and alcohol. Finally, consideration could be given to allocation of a portion of revenues to fund other key interventions to reduce NCD risks.

Fiscal policies can also play a part in encouraging diets that reduce NCD risk. The risk of NCDs is reduced by promotion of a diet of fish and seafood, whole grains, fruits and vegetables, nuts, vegetable oils, and moderate dairy intake, while restricting starches, refined grains, sugars, processed meats, sweetened drinks, industrial trans-fat, and salt.^{170,171} Taxation of empty calories, such as sugar-sweetened beverages, can reduce the prevalence of obesity and generate public revenue.¹⁷² Such taxation does not hurt the poor, since the main dietary problem in low-income groups is poor dietary quality rather than insufficient energy.¹⁷³ A role might exist for taxes on other food substances, such as highly processed grains, but policy will need to be guided by research on the effects of such taxes and their feasibility in different countries and cultural contexts. Taxes would probably need to be sizeable (at least 20%) to significantly change behaviours and would need to be designed carefully to avoid the problem of substitution, in which consumers reduce their consumption of the taxed food but increase consumption of other unhealthy foods.¹⁷⁴ Removal of subsidies on highly processed grains and sugar would make the price of healthy foods relatively lower, and would have a positive fiscal effect.

Energy subsidies on coal, gasoline, and diesel are widespread and have substantial health and economic consequences. Such subsidies encourage excessive energy consumption and production of ambient particulate matter pollution and other pollutants that cause lower respiratory infections in children, and cancers, heart diseases, and chronic obstructive pulmonary disease in adults. Subsidies also divert public

	Tobacco	Alcohol
Armenia	0.54%	0.33%
Bulgaria	1.81%	0.40%
Chile	0.60%	0.38%
Colombia	0.11%	0.67%
Ghana	0.02%	0.19%
Jordan	0.92%	0.19%
Kenya	0.39%	0.68%
Kyrgyzstan	0.16%	0.37%
Mauritius	0.29%	0.86%
Nigeria	0.07%	0.09%
Peru	0.04%	0.32%
Philippines	0.13%	0.13%
Poland	1.17%	0.46%
Russia	0.32%	0.58%
Rwanda	0.14%	1.01%
Thailand	0.62%	1.05%
Ukraine	1.01%	0.52%

Tobacco estimates refer to 2012 excise taxes only. Sources: WHO for tax revenue and World Bank for GDP. Alcohol estimates refer to 2011. Data from references 68, 138.

Table 11: Tobacco and alcohol taxes as percentage of GDP in selected countries

resources away from spending that could be more pro-poor, such as on health interventions that address infectious diseases and NCDs, education, and social protection programmes. The IMF estimates that worldwide, energy subsidies on a post-tax basis were US\$2.0 trillion in 2011, which is 2.9% of GDP or 8.5% of total government revenue. Post-tax energy subsidies are higher than public spending on health and education in many countries, including Bangladesh, Indonesia, and Pakistan.¹⁷⁵ The Commission believes therefore that energy subsidy reform, followed by appropriate tax measures, should be a priority measure to reduce NCDs.¹⁷⁶

Regulation and legislation

Bans on tobacco and alcohol advertising, the designation of smoke-free public places, restrictions on access to retailed alcohol, and the establishment and enforcement of drink-driving laws are important elements of comprehensive efforts to reduce the risks from tobacco smoking and alcohol use.

WHO recommends restrictions on marketing of unhealthy food and beverages to children, although uptake of this approach has been low so far. Sweden took the earliest action—in 1991, it banned all television advertising of food to children. In response to the rapidly rising rates of obesity in school-age children in Mexico, the government introduced regulation to improve access to safe water and healthy foods in schools, and to prohibit sugary drinks and whole milk.¹⁷⁷ One of the most powerful and immediate levers governments can use to reduce dietary risk factors for chronic disease is to ban industrially processed trans-fats from the food supply.

Regulation of the amount of salt in processed foods can reduce the occurrence of cardiovascular diseases.

For air pollution, four key regulatory measures are: requirements for emission control tools on new vehicles; standards for cleaner fuels; inspection and maintenance of vehicles; and fuel efficiency standards in vehicles. In areas where household coal use is common, banning of coal for household use—and enforcement of this ban—is important. The Irish Government banned the sale of coal in Dublin in 1990. In the 6 years after the ban, the standardised respiratory death rate fell by 15·5% and the standardised cardiovascular death rate fell by 10·3%.¹⁷⁸

Regulation and legislation can also play an important part in reducing the two most common causes of deaths from injury: transportation-related deaths and deaths from self-harm. The World Bank and WHO predict a large increase in transport-related deaths in low-income and middle-income countries in the coming years unless road safety policies are instituted.¹⁷⁹ Chisholm and colleagues¹⁶² modelled the cost-effectiveness of strategies to prevent road traffic injuries in sub-Saharan Africa and southeast Asia and reported that a combination of enforcing speed limits and motorcycle helmet use, plus drink-driving laws, would be cost effective. A 2005 systematic review reported evidence showing a reduction in suicide deaths in response to pesticide restrictions, firearm control legislation, detoxification of domestic gas, restrictions in the prescribing and sale of barbiturates, changes in the packaging of analgesics to blister packets, and mandatory use of catalytic converters in cars.¹⁸⁰

Homes, schools, workplaces, and the built environment

Household air pollution from solid fuels lies between smoking and exposure to second-hand smoke in terms of its harm to health. Although the improved biomass cooking stoves that have been promoted in recent years can save on fuel, much cleaner technologies will be needed before health benefits are seen. Typical household exposure to fine particulate matter (PM_{2.5}—ie, matter less than 2·5 µm in diameter) from solid fuel use, which is more closely linked to adverse health effects than larger particles, is about 200 µg/m³. Little cardiovascular benefit will result until very clean interventions are introduced that bring down total exposure to PM_{2.5} to less than 35 µg/m³.¹⁸¹ Several measures can help to promote the substitution of solid fuels with cleaner technologies, including increasing access to electricity. Although cooking everything with electricity might be too expensive for poor households, some important cooking tasks—such as use of a hot water kettle or rice cooker—could be within reach if a household has access to electricity. Governments can support measures to expand access to liquefied petroleum gas for cooking (appendix 1, p 43).

Good evidence shows that public health interventions are most effective when they are reinforced in several sites where people make choices about nutrition, physical

activity, and tobacco use. The recent Institute of Medicine report on reducing obesity, for example, called for action across a range of venues, including schools and workplaces.¹⁸² An innovative workplace intervention that shows promise in tackling obesity is conditional cash transfers—the use of financial incentives to employees to meet a target BMI.¹⁸³

The built environment, such as streets and pavements, affects how safe and accessible it is to cycle, walk, and pursue other physical activity. This environment can be modified through street connectivity, pavement design, dedicated recreation and exercise spaces, set-aside street space for recreation on particular days of the week, and proximity to urban transport. Separation of four-wheeled vehicles from pedestrians and cyclists, engineering of traffic calming measures to reduce speeds, and identification and correction of dangerous sections of the road are important measures to reduce traffic-related injuries. Changes to the built environment, such as through construction of barriers at bridges and other sites that people might jump from, can also reduce suicide risk.¹⁸⁰

Empowerment of consumers with better information

Information can improve peoples' knowledge about the health consequences of their choices, although there is little evidence that information alone changes behaviour. For example, just providing people with information about indoor air pollution without the introduction of better technologies seems to have little effect. Although product labelling on foods gives consumers more knowledge, it is relatively ineffective at stimulating behavioural change.^{184,185} However, evidence does suggest that product labels have resulted in changes in food industry behaviour.¹⁸⁶

Information on menus at the point of purchase modestly improves food choices, but some studies have shown that food labelling might result in higher energy intake in some population subgroups.¹⁸⁷ Nevertheless, as is the case with product labelling, information on menus might change the food industry's choice of product ingredients or menu option choices.

Public information and education campaigns have also been tested as a way to reduce self-injury. Research so far shows that although these campaigns can increase awareness of mental illness, they have “no detectable effect on primary outcomes of decreasing suicidal acts or on intermediate measures, such as more treatment seeking or increased antidepressant use”.¹⁸⁰

An essential package of clinical interventions

The burden of illness and mortality from NCDs and injuries can be reduced substantially by increasing the availability of drugs, technologies, and clinical procedures. However, when resources are constrained, explicit choices must be made about how best to target funding. In countries with weak infrastructure for

delivery of clinical tools, scale-up should start with highly effective interventions that are cost effective and appropriate to the available amount of resources. Many of these interventions can be delivered in primary care by community health workers, but some essential, highly cost-effective interventions, discussed in the following section, require delivery via a district hospital platform.

Best buy clinical interventions

WHO has identified an essential package of best buy clinical interventions for NCD control in low-income and middle-income countries.¹⁶³ For cancer, the interventions are hepatitis B vaccination to prevent liver cancer, prevention of cervical cancer with low-cost screening (visual inspection with acetic acid), and treatment of pre-cancerous lesions of the cervix. For ischaemic heart disease, stroke, and type 2 diabetes, the interventions are counselling and multidrug therapy (aspirin, beta-blockers, antihypertensives, lipid-lowering drugs, angiotensin-converting enzyme inhibitors, and glycaemic control) for people who have had a heart attack or stroke and for those at high risk ($\geq 30\%$) of a cardiovascular event in the next 10 years, and treatment of heart attacks with aspirin. Various combinations of generic drugs for cardiovascular risk reduction can be packaged conveniently into polypills.¹⁸⁸

With the exception of hepatitis B vaccination, coverage rates of the best buy interventions are thought to be very low across low-income and middle-income countries, although coverage data for many countries are weak (Alwan A, WHO Eastern Mediterranean Regional Office, personal communication). WHO estimates that scale-up of the essential clinical package to 80% coverage across all low-income and middle-income countries by 2025 would avert 37% of the global burden of cardiovascular disease and diabetes and 6% of the global cancer burden. To achieve such coverage would cost an average of US\$9.4 billion per year from 2011 to 2025,¹⁶⁴ representing an annual median cost per person of less than \$1 in low-income countries, less than \$1.50 in lower-middle-income countries, and about \$2.50 in upper-middle-income countries.

A strong rationale exists for low-income countries and middle-income countries to initially focus on achieving universal coverage of the best buy tools outlined above, as recommended by WHO. These tools have a large effect on cardiovascular disease and diabetes, they are highly cost effective, and they are feasible to implement. Prioritisation and financing of this package of best buys would be an important first step for all low-income and middle-income countries. Although the WHO package does not include HPV vaccination, the WHO recommendations were made before the recent HPV vaccine price reductions. With today's lower price, the Commission believes that HPV vaccination should also be included in this first phase of scale-up.

Expansion pathways

Going beyond this first step, low-income and middle-income countries will then have the option to follow expansion pathways that build upon the essential package to include more aggressive screening and treatment of diseases tackled by the best buy interventions and to include additional diseases. The choice of these extra clinical interventions will vary by country and there can be no single prescription for all countries. The right interventions will depend on factors such as national patterns of disease, health systems capacity (eg, availability of secondary care facilities and professionals to deliver chemotherapy and radiotherapy for cancer), and amounts of domestic spending on health.

To maximise operational efficiency and to address the shared clinical features of health disorders, interventions from different packages need to be grouped onto coherent platforms that should be scaled up systematically (table 2). As previously discussed, such scale-up is also the mechanism for building up the health system in a way that keeps it focused on effective delivery of priority interventions. Many countries are already on the pathway to introducing packages for NCDs, including a basic mental health package.

Figure 16 shows an example of an illustrative two-phased expansion pathway that uses two delivery platforms. Appendix 1, pp 26–27 gives details of the specific interventions, including the avoidable burden in low-income and middle-income countries, cost-effectiveness, implementation cost per person, and feasibility of scale-up.

In the early phase, these interventions can be delivered as basic packages via primary care and hospital platforms. The basic cardiovascular package is the WHO essential package (discussed previously) plus the addition of beta-blockers to aspirin to treat acute heart attacks. The basic pulmonary package is treatment of asthma and chronic obstructive pulmonary disease with inhaled corticosteroids and β -2 agonists. The basic mental health and neurological package contains a core set of highly cost-effective interventions that can be delivered in resource-poor settings, which have been identified by WHO. These are first-line anti-epileptic drugs; generic anti-depressants and brief psychotherapy for depression; and older antipsychotic drugs, lithium,

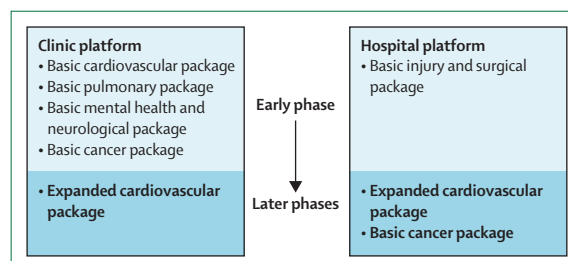


Figure 16: A phased expansion pathway for delivery of packages of clinical interventions for non-communicable diseases and injuries

and psychosocial support for psychosis.¹⁸⁹ Ethiopia recently launched a National Mental Health Strategy that aims to scale-up these best buy interventions in the next 5 years. The basic cancer package encompasses the WHO best buy interventions for cancer, with the addition of HPV DNA testing, HPV vaccination, and oral morphine for palliation. Finally, the basic injury and surgical package consists of improvements in emergency and surgical capacity at the district general hospital. Such capacity would help to address injuries, treatment of surgical infections (eg, infected wounds and abscesses), cancers, and obstetric and other disorders.¹⁹⁰ Such capacity strengthening could be accompanied by training of lay first responders (eg, taxi drivers) in initial injury management.¹⁹¹

In later phases, additional interventions can be delivered across both platforms as expanded packages. The expanded cardiovascular package would involve, at the primary care platform level, multidrug therapy (as defined earlier) given to a broader at-risk population—that is, those who have a risk of 20% or more of a cardiovascular event in the next 10 years—and the institution of aggressive interventions to promote treatment adherence. WHO estimates that the scale-up of such expanded prevention to 80% coverage by 2025 in all low-income and middle-income countries could avert 40% of the cardiovascular disease burden.¹⁶⁴ WHO states that the intervention would be “quite cost-effective” (the cost per life-year gained would be less than three-times GDP per person), but the implementation cost would exceed US\$1 per head in the population. At the hospital platform level, expansion would involve the addition of streptokinase to aspirin and beta-blockers for the treatment of acute heart attacks. DCP2 noted that in all six World Bank regions, compared with a baseline of no treatment, the incremental cost per life-year gained was about US\$600–750 for a combination of aspirin, a beta-blocker, and streptokinase.¹⁹² In much of sub-Saharan Africa, an important cause of morbidity and premature mortality in middle age is heart failure of non-ischaemic origin, which is amenable to medical treatment.¹⁹³

The expanded cancer care package includes mammography every 2 years between 50 and 70 years of age, treatment of all stages of breast cancer, screening and treatment of all stages of cervical cancer, screening for colorectal cancer at age 50 years and treatment of the disease, early detection and treatment of oral cancer, and treatment of paediatric cancers (appendix 1, p 44).

For drugs, diagnostics, and vaccines, which can usually be delivered without complex infrastructure, price reductions can sometimes occur very rapidly and the price drop might be sufficiently large for the intervention to be used earlier in the expansion pathway.

Section 6. Health systems finance

Perhaps the most central aspect of health system design is how countries mobilise resources to pay for health services.

Three important questions surround such mobilisation: where will the revenue come from and what mix of public and private resources is possible? What is the right financial architecture to ensure UHC—ie, to guarantee that the population receives needed quality services without incurring unnecessary financial hardship? And how can unproductive cost escalation be avoided?

In this section, we address each of these questions in turn. Our aim is to lay out potential ways in which countries can achieve UHC within a generation through pathways that especially protect the poor.

Sources of revenue

Our focus here is mostly on the revenue needed to advance the convergence agenda and so we emphasise public revenue generation and public finance more generally, partly because of its record of being effective for the poor.¹⁹⁴ The role of private sources will be discussed in the section about pathways to UHC.

As described in section 3, we estimated that the average annual incremental costs of convergence for 34 countries presently defined as low-income would be about US\$23 billion per year from 2016 to 2025, rising to around \$27 billion per year from 2026 to 2035 (2011 US dollars). For lower-middle-income countries, the average annual costs would be about US\$38 billion per year from 2016 to 2025, rising to \$53 billion per year from 2026 to 2035 (2011 US dollars).

How might this sizeable increase be financed and sustained? Such additional financing could be drawn from a combination of several sources, described in the following paragraphs.

Economic growth

Economic growth generates, all things held equal, increased taxes and increased government spending, including for health. From 1990 to 2011, GDP growth in real terms averaged about 3·9% for the existing group of low-income countries, 4·6% for lower-middle-income countries, 5·1% for upper middle-income countries, and 2·1% for high-income countries.¹⁹⁵ Growth is lower if expressed on a per-person basis, especially for the low-income countries with the highest fertility rates.

Looking forward, our projections forecast real GDP growth per year at 4·5% for low-income countries, 4·3% for lower-middle-income countries, and 4·2% for upper-middle-income countries from 2011 to 2035. Expressed in per-person terms, this growth would be 2·7%, 3·1%, and 3·9%, respectively (appendix 1, p 28). At these rates, GDP in 2035 would be 195% higher in low-income countries, 180% higher in lower-middle-income countries, and 174% higher in upper-middle income countries than in 2011. The GDP in low-income countries would then have increased by US\$920 billion per year, of which the annual incremental cost of convergence from 2026 to 2035 would be about \$27 billion or just 3% of the increase in GDP. For lower-middle-income countries,

the GDP would have increased by \$8719 billion per year, of which the annual incremental cost of convergence from 2026 to 2035 would be around \$53 billion, or less than 1% of the GDP increase. Although these calculations clearly indicate financial feasibility, resources will in fact need to be specifically allocated to and within public budgets for health, as discussed later.

Increased mobilisation of domestic resources

GDP growth has generated increases in government revenue, but broadening of the tax base and better tax administration have also helped to raise revenue. In section 4 of this report, we made specific recommendations on increased taxation, particularly of tobacco, in order to reduce the risk of NCDs. These taxes could generate substantial revenue. Many countries are poised to benefit from new natural resource discoveries, and additional domestic revenues could be generated through appropriate taxation of the extractive industries¹⁹⁶ and of multinational corporations; the latter would require increased international coordination. A valuable first step would be to encourage greater transparency in the taxes and royalties paid by multinational corporations, especially by the extractive industries, as championed by the campaign group Publish What You Pay and by the Extractive Industries Transparency Initiative.

Intersectoral reallocations and efficiency gains

Many countries have large energy subsidies on air-polluting fuels. Energy subsidies worldwide on a pre-tax basis amounted to US\$492 billion in 2011 and \$2.0 trillion on a post-tax basis.¹⁷⁵ For sub-Saharan Africa, the estimate is 3.5% of GDP on a post-tax basis. For countries with these or other unwarranted subsidies, reducing or eliminating them could create far more budgetary room for high-priority public spending, such as for achieving the convergence agenda. The large benefits of improvements in health previously discussed would naturally inform these intersectoral and resource allocation decisions. Efficiency gains within the health sector provide an additional avenue for generating resources. Both the CMH and WHR 2010 point to real, although quite low, potential from such efficiencies.

External resources

On the basis of our projections, as described below, if achievement of convergence was made a national priority, lower-middle-income countries as a group could be expected to finance the required expenditures from domestic resources combined with non-concessional loans from the World Bank and the regional development banks.⁸ In low-income countries, DAH (a mix of external grants and concessional loans) would be needed to supplement increased government spending.

Public spending on health is about 2% of GDP for low-income countries and 1.7% of GDP for lower-middle-income countries. Over time, as country income grows,

the share of GDP devoted to health tends to increase.¹⁹⁷ The precise responsiveness of health expenditures to income changes remains a topic of research. And as income grows, the share of health spending that is prepaid tends to grow as countries move towards UHC. Over and above these broad trends, the Commission has argued in this report for the value of greater investment in health.

To estimate the potential need for external finance of convergence, we have projected two scenarios about public spending on health as a share of GDP in 2035 for both low-income and lower-middle-income countries. The first scenario is that such spending grows from present levels (2% of GDP for low-income countries and 1.7% for lower-middle income countries) to 3% of GDP by 2035, and a second, more optimistic, scenario is that it grows to 4% of GDP by 2035. Under both scenarios, with the growth in GDP that is projected, low-income and lower-middle-income countries would have substantially more resources to devote to health.

In the case of the 3% scenario, if low-income countries allocated two-thirds of the increment in public spending on health to the convergence agenda, in 2035 these countries could finance US\$21 billion of the cost of convergence from domestic resources, with the remaining gap of \$9 billion coming from DAH. In the case of the 4% scenario, and an allocation of two-thirds of the increment to the convergence agenda, convergence could be financed completely from domestic resources. Some countries will, of course, need more help from DAH than others.

For the lower-middle-income countries as a group, in both the 3% and 4% scenarios, convergence could be funded entirely domestically. In the case of the 3% scenario, convergence would require an allocation of just 19% of the increment in public spending on health; for the 4% scenario, the allocation would be just 13% of the increment.

This analysis has focused on achieving convergence, which will be costly, but financing will also be needed for NCD interventions. Initially, much of this financing will be private, but as national incomes grow, public finance will ideally supersede private sources. Some of the population-wide NCD interventions recommended in this report would generate substantial net revenue (including taxation of tobacco, alcohol, and sugar-sweetened beverages, and removal or reduction of energy subsidies). External finance is likely to play a small but important part in enabling the generation and transfer of relevant knowledge.

Alternative pathways to UHC

WHO illustrated the three essential elements of UHC with its now famous cube,¹⁹⁸ a variant of which was developed in preparation for WDR 1993.¹⁹⁹ Figure 17 presents the three dimensions of the cube: the percentage of the population covered, the percentage of costs prepaid

For more on **Publish What You Pay** see <http://www.publishwhatyoupay.org/>

For the **Extractive Industries Transparency Initiative** see <http://www.eiti.org>

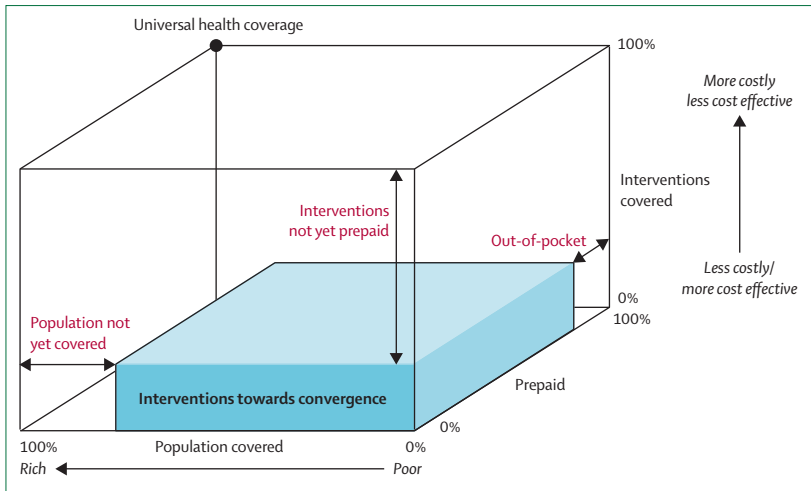


Figure 17: Pathways towards universal health coverage

at the point of service (the remainder being out-of-pocket expenses), and the percentage of interventions that are covered by prepaid schemes.

UHC is the end state of universal population coverage with a comprehensive set of interventions and zero or close to zero out-of-pocket expenses for all those interventions.¹⁹⁸ Resource constraints will imply that most countries fall short of UHC on some or all of those three dimensions. A central question for health policy is deciding whether to move in a balanced way from a country's status quo, advancing on all three dimensions, or to emphasise movement on one or more dimensions first while waiting for the other or others.

In this subsection of the report, we address the question of how best to move through the cube. What will work best depends on a country's starting point, the nature and capacity of its institutions, and the values it brings to the decision making. But across all country settings, value for money can inform the choice of pathway to UHC.

We have previously pointed to the importance of achieving large health gains from public spending and have laid out exceptional opportunities for doing so (see section 3). However, health systems have the additional objective of protecting populations from large or unexpected financial losses associated with ill health or treatment costs. Therefore, value for money in use of funds to purchase financial protection is an additional consideration for all countries. As we discuss below, it is important to explicitly acknowledge that tradeoffs sometimes exist between getting the most health for the money versus the most financial protection.

Extensive published literature on cost-effectiveness provides guidance, albeit imperfect, on the likely health outcomes per dollar spent—that is, on value for money in achieving health outcomes. However, although many studies now show the extent of household impoverishment caused by health expenditures,^{94,95,200} there have been

surprisingly few attempts to measure the amount of financial protection provided per dollar spent. We are only beginning to learn about value for money in purchasing protection against such impoverishment or against suffering devastating economic losses from illness. We therefore begin our discussion of alternative pathways to UHC with a brief discussion of financial protection.

Purchasing of financial protection

WDR 1993 pointed to the insurance value in the essential packages that it recommended. The report argued more generally for mechanisms to improve provision of insurance. But it did too little to emphasise the important role of health systems in providing financial risk protection (FRP)—that is, in preventing households from incurring high medical expenses or the risk of impoverishment.

This role was recognised early on in the establishment of both the UK National Health Service (NHS) and the US Medicare system (a national social insurance programme that guarantees coverage for those over 65 years and young people with disabilities). FRP, rather than equity or health improvement, was the key goal in the 1948 founding of the UK NHS.^{201,202} A leaflet distributed to all British households, entitled *The New National Health Service*, noted that the NHS “will relieve your money worries in time of illness”. FRP was also highlighted when the US Medicare Act was signed into law.²⁰³ An important early academic paper by Enthoven and Kronick critiqued the broader US health care system for exposing an estimated 35 million people to the financial risks associated with medical expenses.²⁰⁴

As discussed earlier, since WDR 1993's publication, the evidence base has grown steadily regarding the extent to which out-of-pocket health spending in low-income and middle-income countries reaches catastrophic levels for households and the extent to which it pushes households into poverty. Research also studied the extent to which households were forced to sell assets or borrow to finance health spending. By 1997, the World Bank's Flagship Course on Health Sector Reform and Sustainable Financing conceptualised the two main goals of health systems as improving health status, and providing FRP.²⁰⁵ By 1999, WHO's WHR⁷ included “protecting individuals, families, and communities from financial loss” as one of the main goals of health systems, a notion more fully developed in WHR 2000.²⁰⁶

The role of the national health system in provision of FRP is now widely recognised as one of its fundamental goals, along with improving health outcomes. The value of insurance is provided by the combination of the availability of good quality health services and the knowledge that FRP is associated with their use. Insurance allows the insured to sleep at night knowing that services are available and affordable if they need to use them. Access to services alone, without protection from financial ruin, provides an empty promise.

Similarly, there is little insurance value or peace of mind in providing FRP alone without access to quality services. WHR 2010, *Health Systems Financing: The Path to Universal Coverage*, has been influential in articulating both these dimensions of UHC.²⁰⁷

Measurement of FRP is a key starting point for assessment of efficiency in purchasing. The published literature contains two broad measurement approaches. The dominant approach measures the number or fraction of a population that exhibits a specific adverse outcome, such as crossing a poverty threshold, being forced into borrowing or asset sales, incurring excessively high out-of-pocket expenditures, or foregoing necessary health services.^{95,200} A second approach to measurement attempts to measure the value of insurance that is provided by public intervention. Appendix 1, p 45 illustrates this second approach with assessments of the insurance value of the US Medicare programme, including, in one study, weighing of that value against the cost of the programme.

By adopting the value of insurance approach to measuring financial protection, Verguet and colleagues²⁰⁸ have undertaken what they call an “extended cost-effectiveness analysis” of universal public finance of tuberculosis treatment in India. The cost-effectiveness analysis is “extended” in the sense that it not only assesses how much health is gained per million dollars spent but also how much financial protection is purchased. The authors conclude that both the financial protection benefits and the health benefits of public finance would accrue principally to the bottom quintile of the income distribution and to men. Verguet and colleagues’ study is the first of a broad range of extended cost-effectiveness analyses being undertaken in the context of preparing a third edition of *Disease Control Priorities in Developing Countries* (DCP3). In a somewhat different context, Smith²⁰⁹ has recently advanced approaches to include financial protection in health-related cost-effectiveness analyses.

Research done for DCP3 on the effect of different health interventions in Ethiopia illustrates the potential value of extended cost-effectiveness analyses. The results of these analyses quantitatively pose the potential tradeoffs between choosing interventions that have high financial protection gains per million dollars spent and those that have high health gains. Figure 18 plots the potential number of cases of poverty averted and the number of deaths averted per US\$100 000 spent for nine different health interventions. The figure shows that although two different interventions, such as tuberculosis treatment and treatment for high blood pressure, can prevent the same number of deaths, one of them (in this case, treatment for high blood pressure) averts a much larger number of cases of poverty. Extended cost-effectiveness analyses can help to demonstrate these types of tradeoffs to inform policy makers in choosing between different interventions, packages, and platforms.

In addition to these initial quantitative analyses of efficiency in buying financial protection, case studies of

the introduction of UHC can provide valuable insights. Although the results of retrospective case studies should be interpreted with caution, a recent systematic review by the World Bank of experiences with UHC suggested that UHC often has a positive effect on FRP as measured by out-of-pocket expenditures.²¹⁰ For example, the probability of incurring catastrophic health expenditures was 8% less for households enrolled in Mexico’s *Seguro Popular* programme (a national health insurance scheme launched in 2003) compared with un-enrolled households, after controlling for covariables.²¹¹ Thailand’s introduction of UHC in 2001 also led to a decrease in the incidence of catastrophic health expenditures, from 2.7% in 2000 to about 0.5% in 2009.²¹² After universal coverage was introduced, two key factors were associated with ongoing catastrophic expenditures. The first was patients bypassing designated health providers, which forced them to pay in full for services. The second was the use of high-cost services, such as renal dialysis and cancer chemotherapy, which were not covered by the system because of fiscal constraints.²¹³ Obviously resource availability can limit—often sharply—the capacity of a system to finance costly interventions.

Three essential elements to improving financial protection are expansion of prepayment and risk pooling over time to cover everyone, elimination of out-of-pocket expenses at the point of service delivery for the poor for high-value health interventions, and provision of a more comprehensive benefit package as resources grow.

Other options—beyond the extension of prepaid care—need to be considered for provision of increased financial protection. Limwattananon and colleagues²¹³ point out that in Thailand, supply-side interventions to improve the quality of care and build greater patient confidence in the system can encourage patients to see designated providers, thus reducing catastrophic expenditures even further. In China, improvements in the quality of care,

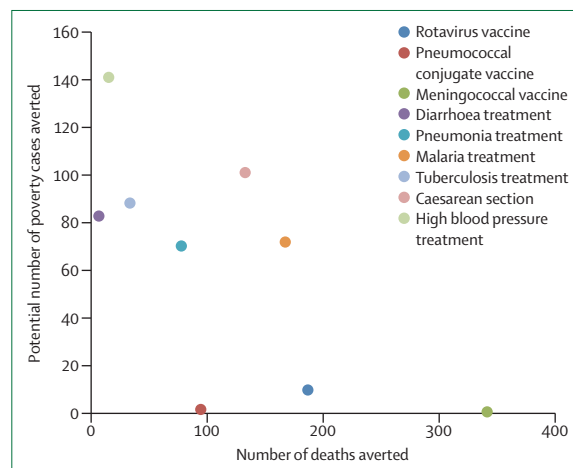


Figure 18: Health and financial risk protection benefits afforded by selected interventions, Ethiopia, 2012
Data from reference 208.

Panel 10: Mexico's transition to universal health coverage—the challenges of harmonising several insurance schemes

In 2003, Mexico introduced *Seguro Popular*, a national health insurance scheme funded by the government through general revenue taxation. Its goal was to provide health insurance to the 50 million people outside the social security system (the unemployed, self-employed, and those working outside the formal labour force). During the next decade, the country invested heavily in the scheme, to expand the benefits package and increase the population covered. Although initially a large gap existed between the benefits package and per-person financing in *Seguro Popular* and the insurance package received by salaried workers and their families through social security mechanisms (financed by payroll taxes), that gap has been closing. In 2004, health spending per person on *Seguro Popular* was only 48% of that in social security schemes, but by 2010 this figure had reached 86%. Similarly, the gap in several key health service indicators narrowed during this period for the two populations (González Pier E, Funsalud, personal communication).

Over time, the benefit packages have converged between the general revenue tax-financed system and the social security system. Concerns have arisen that this convergence creates an incentive for individuals to switch from formal to informal employment to avoid the payroll tax (while continuing to benefit from comprehensive services).²¹⁷ In theory at least, such switching could have consequent effects on productivity and pensions. However, a recent review of 12 studies on the effects of *Seguro Popular* on enrolment in social security concluded that although this scheme has affected the size of the formal sector, “the size of the observed effect is much smaller than it has often been argued”.²¹⁸ The review also concluded that this effect is dwarfed in importance by the scheme's positive effects in improving health insurance coverage, access to quality care, and financial protection for most of the population.

Side by side systems might also create inefficiencies. As benefit packages converge, many reasons exist to consider folding the financing into one fund with or without a change in the financing formulas.

such as through the introduction of clinical treatment protocols and essential drug lists, and the adoption of price controls, was more successful at reducing catastrophic expenditures than was the expansion of community health insurance coverage.²¹⁴

What can be achieved in terms of financial risk protection will partly depend on what is affordable for a particular country. The highest rates of catastrophic payments tend to occur in the poorest countries. But financial risk protection is not just a case of universal insurance covering high-cost interventions. Important financial risk protection effects can result from widespread coverage of low-cost interventions, such as vaccinations or tuberculosis control, since these interventions reduce the risk of more costly medical expenditures later in life. Similarly, with chronic illnesses such as diabetes, small but continual expenses can be financially debilitating. Figure 18 illustrates this point: the public sector can often buy financial protection more efficiently through prevention and early treatment than by assuming responsibility for expensive hospital bills.

Two progressive pathways towards UHC

Figure 17 suggests where a balanced expansion pathway towards UHC, involving simultaneous movement along

all three dimensions of the cube, might lead. An alternative approach, and one that this Commission strongly endorses because of its particular benefits to the poor, is what Gwatkin and Ergo²¹⁵ have termed progressive universalism—a “determination to include people who are poor from the beginning”. Progressive universalism traces its origin to the “new universalism” initially advocated by WHO 14 years ago, but places more explicit emphasis on dealing with the needs of the poor. WHO's Director General at the time, Gro Harlem Brundtland, advocated a new universalism that recognised that “if services are to be provided for all then not all services can be provided. The most cost-effective services should be provided first”.²¹⁶

Two major types of progressive universalism exist. Although both types represent ways to use pre-payment and pooling of funds to extend publicly financed insurance, they differ in the way in which they target the poor.

The first type involves insurance that covers the whole population but targets the poor by insuring health interventions for diseases that disproportionately affect this group. This pathway would initially finance an essential set of highly cost-effective interventions addressing infectious diseases and RMNCH disorders, and it would include the essential packages of NCD interventions described earlier. These interventions would be publicly financed through tax revenues, payroll taxes, or a combination of both. For the defined benefit package of publicly financed services, there would be no user fees, defined as fee-for-service charges at the point of care without the benefit of insurance.

One major advantage of this approach is that the government does not have to incur expensive administrative costs trying to identify who is poor, since the benefit package covers everybody. Another is that a universal package promotes broader support for the scheme in the population and in health providers than one focused solely on the poor, and such support will help to sustain financing over time.

Figure 17 shows the early stages of a trajectory of progressive universalism toward UHC, with high population coverage and no copayments, defined as payments on top of prepaid insurance mechanisms, but quite low intervention coverage. As the resource envelope for public finance grows, so too will the range of interventions financed, as has been seen in Mexico's trajectory towards UHC (panel 10).

It is important to be explicit that a consequence of this first approach is that other interventions will require private finance from those who are well enough off to seek them. Figure 19 also illustrates this requirement—the area of the cube outside the coloured box requires private finance. Another consequence is that high-cost interventions will typically be covered by public finance late in the pathway towards UHC. Most, but not all, high-cost interventions will provide low value for money in terms of both health and financial protection.

The second type of progressive universalism provides a larger package of interventions to the full population with some patient copayment, from which poor people would be exempt. This approach can be financed through a greater range of financing mechanisms than the first type, with the poor exempt from contributing to these mechanisms; they include general taxation revenue, payroll taxes, mandatory insurance premiums, and copayments. The advantages of this second type of progressive universalism are that a wider range of health services can be offered, the non-poor are engaged in a prepaid mandatory scheme from the outset, and in many low-income countries, the transition from the status quo, in which the poor pay mostly out of pocket for health services, might be more financially and logistically feasible than transitioning to the first type. Rwanda provides a good example of this second type of progressive universalism. The country is moving towards UHC through mandatory insurance and copayments, with exemptions for the poor.

A variant of this second type, as seen in Thailand's approach before its decision to go universal with the Universal Coverage scheme of 2002, is to provide publicly financed health care, with a large benefits package given only to the poor. This approach left the rest of the population to finance their care either through out-of-pocket payments or private voluntary insurance. Subsequently, Thailand decided to extend insurance coverage to all people who were not formally enrolled in the civil servant or formal sector health insurance schemes with insurance premiums paid entirely out of government revenues. Thailand's experience suggests that it is feasible to target the poor initially but then continue on a pathway towards UHC.^{219,220}

However, this second type of progressive universalism, in which the poor are exempt from payments, does have several disadvantages. The approach requires robust, and often very costly, administrative arrangements to identify and protect the poor and to organise the collection and use of copayments and premiums from the non-poor. There is also the potential for corruption and misuse of political influence in decisions about who is exempt from payments.

Expansion of insurance coverage without reaching UHC

The Commission assessed two other pathways that could be regarded as alternative routes to reaching UHC. There are also potential variants of these two alternatives, such as medical savings accounts as a form of publicly mandated finance. We concluded that neither of these pathways hold any promise to achieving UHC and thus cannot be recommended.

The first pathway is to expand private voluntary insurance. There are two alternative approaches for extending prepaid care and increasing its scope—one relies mainly on public (or publicly mandated) finance, and the other on voluntary purchase of private insurance. Figure 19

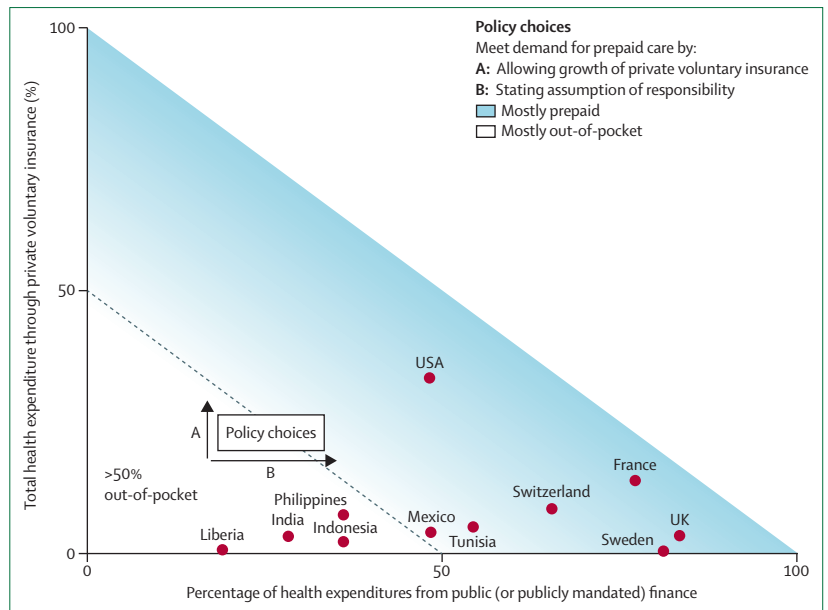


Figure 19: Prepaid health services—the roles of private voluntary insurance and public finance
Data are for 2011, and are from reference 138. See appendix 1, p 30 for more complete definitions and data.

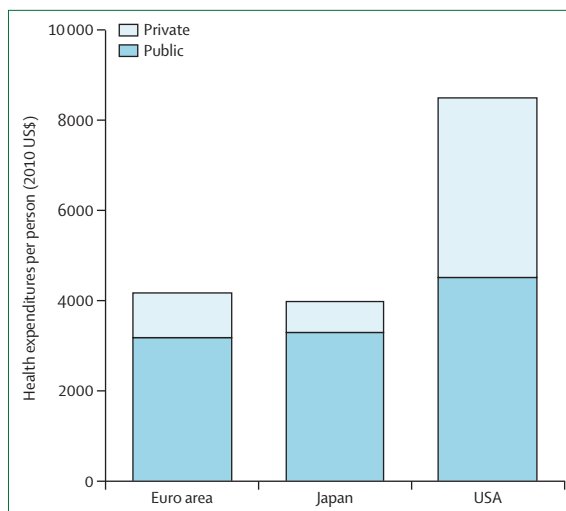


Figure 20: Health expenditures per person in selected high-income regions, 2010
Data from appendix 1, p 31.

illustrates how much progress different countries have made in providing prepaid care and the extent to which they use public funds (compulsory social insurance or funding from general government revenue) or private voluntary insurance. The absence of countries near the top of figure 19, and the large number to the lower right, suggests that the goal of UHC will need to be met mainly through government or publicly mandated finance. No country can achieve UHC on the basis of voluntary purchase of private health insurance: some of the population who could afford it will not join, and some

will not be able to join because of affordability (assuming regulation prohibits excluding those with pre-existing illnesses). Achievement of UHC requires compulsory enrolment or automatic entitlement.²²¹

A potential argument in favour of private voluntary insurance is that by transferring health insurance costs to people who are able to qualify and pay for insurance, demand on public finances will be contained. However, the experience of the USA, which relies heavily on private voluntary insurance (figure 19), suggests that such containment does not occur. Figure 20 compares public and private sector health spending in the USA, the Euro area, and Japan. Far from having constrained public expenditures through private voluntary insurance, the USA actually spends more per person through the public sector than the Euro area or Japan spends in total. These public expenditures in the USA are high despite the USA having a much smaller fraction of the population aged over 65 years (13% in the USA vs 23% in Japan, with Europe in between), and the USA having poor public health outcomes relative to other high-income countries.

The second pathway is public financing of catastrophic coverage, in which public finances are focused on high-cost procedures that are usually of low health value for money and are often provided in tertiary settings. The aim is to use public funds to cover costly interventions that individuals are unable to cover for themselves. Less catastrophic expenses are covered out of current income or with precautionary savings.

The most obvious administrative difficulty with the use of public funds for catastrophic coverage is that the definition of catastrophic for individual patients depends on their income. Therefore, means testing at all income levels must be enforced or, more typically, catastrophic coverage is defined at such a high level that many expenses that are catastrophic for poor people remain uncovered. As the health economist Austin Frakt has

argued, “almost any cost is catastrophic if you are poor”.²²² A second difficulty is that the natural response of providers and patients will be to avoid less costly interventions in favour of more costly ones in order to receive coverage. Third, and most important, as discussed at the beginning of this section, evidence suggests that coverage of only high-cost procedures might be an inefficient way to buy financial protection.

Making the right choice

We have outlined two broad variants of progressive universalist pathways to UHC (table 12) and have discussed the comparative benefits and disadvantages of these two approaches. Both are likely to have a role in different countries. We have also described a “balanced” pathway that might in the long run lead to UHC but that, along the way, is neither universalist nor pro-poor. By contrast with progressive universalist pathways, private voluntary insurance and public finance of catastrophic coverage, also summarised in table 12, are highly problematic approaches to increasing insurance coverage. Many variations exist around these pathways. Many high-income European countries, for example, use private voluntary insurance only to supplement universal public finance of an extensive package of interventions—a use that seems to be broadly consistent with UHC.

Avoiding unproductive cost escalation

As discussed in section 1 of this report, health-care costs have been rising rapidly in the past two decades in high-income and many middle-income countries, which puts financial pressure on households and governments. From 2000 to 2010, for example, for OECD countries, total spending on health grew at an average of 4·3% per annum above inflation, and public spending on health grew at 4·5% per annum.²²³

	Initial pathway through cube			Efficiency in producing health or FRP	
	% of population covered by publicly financed interventions	Initial fraction of interventions covered by public financing	Copayments or premiums	Health	FRP
1. Progressive universalism (initially targets poor people by choice of interventions)	100%	+	No	++	+++
2. Progressive universalism (initially targets poor people by exempting them from insurance premiums and copayments)	100%	++	Yes (poor people exempt)	+++	++
3. Balanced pathway to universal health coverage	Depends on size and use of public finance	++	Yes	++	+
4. Private voluntary insurance (with some public finance)	Depends on size and use of public finance	+	Yes	+	+
5. Public finance of catastrophic coverage	Depends on size and use of public finance	+	Depends on design	+	++

In the column entitled “Initial fraction of interventions covered by public financing”, “+” refers to a low fraction, and “++” to a larger fraction. In the columns entitled “Health” and “FRP”, “+” refers to low efficiency, “++” to medium efficiency, and “+++” to high efficiency. Assessments in this table are based on a small amount of data. Results might vary substantially between countries. The fourth and fifth pathways in this table cannot achieve universal health coverage and are not recommended. FRP=financial risk protection.

Table 12: Five potential pathways to universal health coverage

Such rapid cost escalation, which all countries will probably experience as their GDP rises (the first law of health economics, figure 21), is related to the demand for increased health care that accompanies income growth.¹⁹⁷ Additionally, cost growth is associated with population ageing and the associated change in disease profile towards NCDs, the tendency for the relative prices of many health-care inputs to increase (as a result of the Baumol effect on labour costs), and technological advances. Figure 22 shows the effects in OECD countries of ageing populations and new technology in shifting the relationship between health expenditures and income up over time while maintaining the first law of health economics at any point in time. Although a lot of this expenditure, and much of its increase, responds productively to changing patterns of needs and opportunities, some is wasteful. Unproductive cost escalation can also be caused by complicated administrative arrangements that incur wasteful administrative costs, especially arrangements involving several payers and opportunities for providers to game the system (eg, through fee-for-service payments).

Many countries, irrespective of their GDP per person, have instituted policy reforms to contain unproductive cost escalation and to improve efficiency in health spending. Most of the published literature about these reforms, however, still comes from high-income and upper-middle-income countries and a clear need exists for research to be done in countries of lower income. The Commission studied these policy reforms, and found evidence (albeit of mixed quality) on several different policy approaches to control cost escalation. The three most promising approaches are discussed below; other approaches that have been tried with varying success are summarised in panel 11.

In addition to the three approaches described in the next paragraph, policy makers should avoid falling into the traps of thinking that unproductive costs can be contained by underproviding health care, spending less on effective interventions, or shifting costs. Underprovision of health care is not cost containment—it is output reduction. Policy makers should spend more (not less) on effective interventions that are presently underprovided. Moreover, cost shifting (eg, to patients in the form of user fees, coinsurance, and deductibles) is exactly that—shifting rather than containing costs.

Most low-income countries are not grappling with the problem of cost containment—instead, they are aiming to spend more on health. Thus the recommendations below are mostly relevant to those middle-income countries that are experiencing unproductive cost growth.

Ensuring hard budget constraints, particularly those imposed high up in the system, can raise awareness of costs and can be an effective method to reduce unproductive cost growth. Care must be taken to minimise incentives for under-provision of needed services. Figure 23 illustrates where budget constraints

apply by identifying who bears the risk for payment: the patient, the clinical service provider, or a third party payer. If the budget constraint is low in the figure (in which the patient or provider bears the risk), incentives exist to under-provide services. Conversely, a third party payer with no budget constraints (eg, Medicare in the USA) virtually ensures overprovision of services. Trade-offs clearly exist between these positions; figure 23 shows a potential ideal zone.

Budget constraints limit access to publicly financed care. For example, Canada’s single-payer ability to impose budget constraints has led to relatively high amounts of

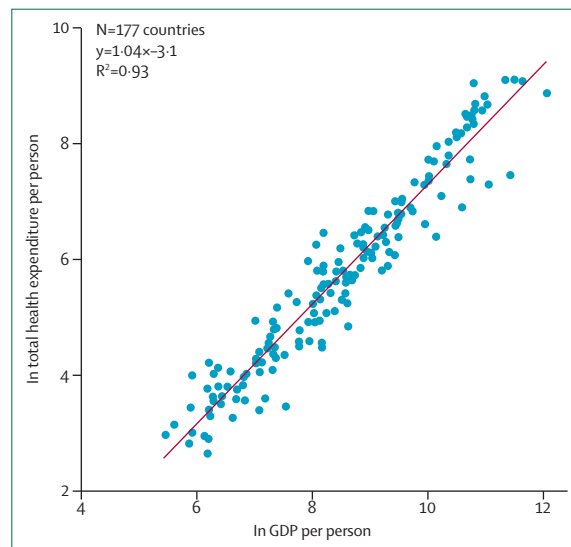


Figure 21: Relation between income and health spending
Ln=logarithm. Data from reference 68.

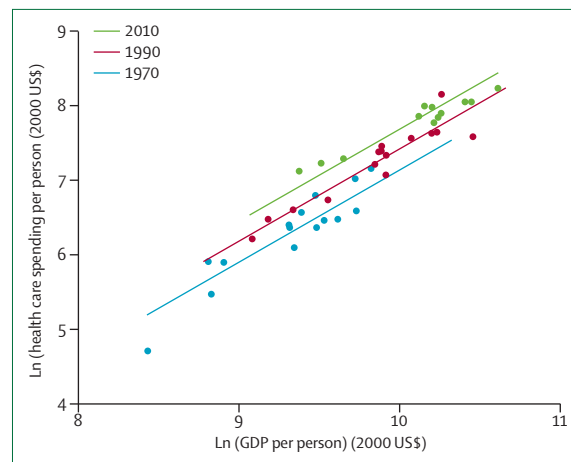


Figure 22: The first law of health economics in Organisation for Economic Co-operation and Development countries
This figure presents natural logarithms of GDP per person and health-care spending per person. The plotted lines represent a pooled regression of the natural logarithm of health-care spending per person on the natural logarithm of GDP per person with dummy variables for the years 1990 and 2010. Note that the elasticity of health spending with respect to income is greater than unity (1.24), with a standard error of 0.08. Ln=logarithm. Data from references 68 and 223.

private expenditure (almost 30%) on private insurance and out-of-pocket expenditures.²³³ In working towards a grand convergence in health, it will therefore be essential to protect the interests of poor people by ensuring that incremental public resources are used to reduce user fees and expand coverage of interventions that are of particular importance to the poor.

Experience has further shown that budget constraints will not be very effective in systems such as the US Medicare system, where insurers can simply pass their deficits on to the overall fiscal deficit (which is a soft budget constraint).²³⁵

Minimisation of fee-for-service payments to providers is one of the most important steps that can be taken to avoid unproductive cost growth. Fee-for-service payments reward quantity over quality, drive up health costs, and do nothing to promote the use of services

such as prevention and patient education, which are high value and low cost.²³⁶ Such payments not only increase costs but can also result in serious deterioration in the quality of health care.

Paying providers on a salaried basis, by capitation, or a combination of the two, can control costs, especially for treatment of chronic illnesses.²³⁷ The per-person system might need to be adapted to reduce the potential incentive for under-provision of services (figure 23). Studies have suggested that paying providers for results can incentivise them to improve the quality of patient care and reduce unnecessary hospital admissions.²³⁸

Many low-income and middle-income countries are struggling with under-provision of essential services, such as maternal and child health care, rather than overprovision, and under these circumstances some level of fee-for-service could be beneficial to

Panel 11: Additional approaches used to curb unproductive cost escalation

Single payer approaches

These approaches reduce administrative costs, partly through use of uniform, integrated information technology platforms.^{97,224}

Policies to control health care supply

Containment of pharmaceutical spending through negotiations with drug companies and promotion of generic drugs reduces drug costs for public payers.²²⁵ Many countries, including middle-income countries (eg, South Africa and Thailand), use health technology assessment to restrict the introduction of new technologies that are not supported by good evidence. Such assessment improves efficiency, but little evidence exists to show that it produces substantial cost containment.²²⁵

Strategic purchasing

Strategic decision making about which specific services should be purchased and who should provide them, which assumes a purchaser-provider split, was recommended by the World Health Report 2000. Such purchasing might improve efficiency provided there is strong stewardship of the overall health system.^{226,227} A wide range of strategic purchasing approaches exists, including contracts between the government and private providers or between different tiers of government, such as central government and regional health authorities.²²⁸ Although the purchaser-provider split is now in place in health systems worldwide, it has also been highly contentious and has come under criticism for promoting inequity and for failing to live up to the promise of greater efficiency.²²⁹

Gatekeeping arrangements

Some evidence suggests that gatekeeping, in which health systems require patients to see a primary care provider before they can be referred for specialised care, is associated with cost containment.²³⁰

Postponing the incidence of non-communicable diseases

Scale-up of the population-based and clinical packages described in section 5 of this report is likely to be a crucial policy

for low-income and middle-income countries to avoid health cost escalation. Without such postponement, these countries will see skyrocketing rises in the direct medical costs of non-communicable diseases.²³¹

Private financing

In many countries with health systems largely funded by public financing, private voluntary insurance is available to cover what is not in the publicly financed package (supplemental coverage), copayments (complementary coverage), or a privately financed alternative to public universal coverage (duplicative coverage).²³² Although such private financing might be intended to relieve pressure on public spending on health, it can contribute to cost escalation, inequities, and fragmentation. In most Organisation for Economic Co-operation and Development countries, spending on private voluntary health insurance is substantially lower than 10% of total health spending for the most recent year available (2010).²³³ In the USA, where private voluntary insurance covers 40% of costs, public expenditures on health are nonetheless typical of other high-income countries as a percentage of GDP (and much higher in absolute terms). Patient cost-sharing, with exemptions for the poor, is now being used by some low-income countries (eg, Rwanda is using copayments) to raise domestic revenues for health.²³⁴ The available evidence suggests that such cost-sharing can deter patients from using high-value health interventions, such as antenatal care, beta-blockers for heart disease, and antiretroviral and anti-tuberculous drugs.²³⁴ This under-use of high-value interventions can result in adverse health consequences and increased costs (eg, through increased hospital admissions due to delayed care seeking). However, the health economists Katherine Baicker and Dana Goldman have suggested that very carefully designed cost-sharing schemes for patients with high incomes could potentially have a role in cost containment if fees are applied selectively to low-value interventions.²³⁴

incentivise provision of such services. For example, impact evaluations of nationwide pay-for-performance schemes in Burundi and Rwanda showed that these schemes led to a substantial increase in uptake of facility-based births,^{239,240} although other studies have had negative results.²⁴¹ However, longer-term risks to cost containment are created by the use of fee-for-service payments.

Implementation of reference pricing mechanisms, in which a cap is placed on how much the public sector will pay for a specific drug, procedure, or insurance plan, is an effective approach to control unproductive cost escalation. A 2012 systematic review of 16 studies in six high-income countries that assessed the use of reference pricing policies noted strong evidence that such policies can constrain costs without affecting quality.²⁴² However, unless the payment cap is set at an appropriately high level, the approach can harm the poor.

Section 7. The essential role for international collective action

In the final section of our report, we focus on the essential role for international collective action in meeting the three major health challenges of the next generation: achievement of convergence, curbing of NCDs and injuries, and movement towards progressive UHC.

One year after publication of WDR 1993, the 1994 Human Development Report argued that the world needs a “new framework for international cooperation to deal with global threats and to promote global goods that serve our common interest”.²⁴³ Since then, encouraging innovations in such cooperation have occurred, including the launch of global public-private partnerships for health product development, new multilateral financing mechanisms to promote GPGs such as child vaccination, and the emergence of non-OECD donors (panel 12) and new forms of development assistance. Nevertheless, the framework for international cooperation will need to evolve further to help accelerate global health progress. In particular, an evolution in global health institutions and in the financing and institutional capacity for R&D is necessary.

The Commission considered the essential functions of global health institutions that must be strengthened if the world is to tackle the next generation of health challenges. Our work was informed by four previous efforts to define these functions. The first of these was the CMH working group’s report on GPGs for health, which emphasised three core functions: research, prevention of the cross-border spread of communicable diseases, and standardised data collection.²⁴⁴ The second attempt was WHO’s efforts to continually update its key functions.²⁴⁵ The third was Jamison, Frenk, and Knaul’s²⁴⁶ categorisation of the essential functions of international collective action into core versus supportive. Core functions, such as ensuring provision of GPGs and managing international externalities, transcend the sovereignty of any one nation state and represent the permanent responsibilities of global health institutions.

Supportive functions, such as provision of technical assistance and DAH, tackle time-limited problems within individual countries that justify international collective action because of highly constrained national capacity. As

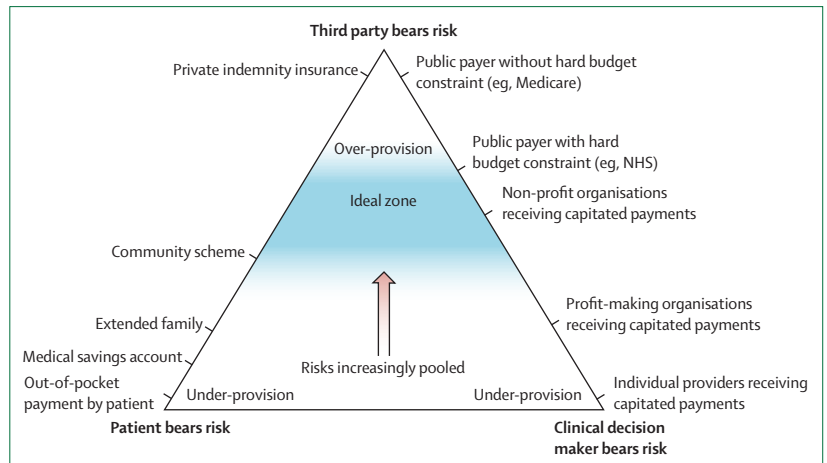


Figure 23: Financial risk sharing and incentives for over-provision or under-provision of services
NHS=National Health Service.

Panel 12: China as a donor to global health

China is both a recipient of development assistance for health (DAH) and also a donor. In 2007, it received just over US\$308 million in DAH, including \$89.3 million from the Global Fund, \$69.2 million from Japan, and \$31.8 million from the UK (data from reference 3, converted to 2011 US dollars). Wang and colleagues⁴⁵ recently tried to estimate China’s bilateral and multilateral DAH allocations, an analysis that was greatly hindered by an absence of public data for financing flows. The largest amounts of bilateral aid for health and development seem to have gone to sub-Saharan Africa. For example, in 2006 China gave US\$66 million to Ghana to establish a malaria prevention centre, build a primary school, and improve telecommunications networks, and in 2007 it gave an estimated \$60–70 million to Zambia to fund a malaria centre, two rural schools, an agricultural demonstration project, and a sports centre. Between 2007 and 2012, China invested \$116 million in bilateral assistance for malaria control activities in high-burden African countries. The available data for China’s multilateral assistance suggest that in 2007, the country gave US\$15.6 million to UNICEF, \$2 million to the Global Fund, \$0.9 million to UNFPA, \$0.7 million to the International Committee of the Red Cross, and \$0.1 million to the Joint United Nations Programme on HIV/AIDS.

Much of China’s health aid is delivered by in-kind services through its Health Aid to Foreign Countries programme, which celebrates its 50th anniversary this year, commemorated by the inaugural Ministerial Forum on China–Africa Health Development held in Beijing, China, in April, 2013. The programme began with the deployment of a medical team to Algeria, expanded through the 1960s to seven other African countries, and reached 29 countries in the 1970s. Since 1963, Chinese medical teams have involved more than 18 000 physicians practising in 46 countries, covering as many as 200 million patient encounters. The programme includes delivery of medical equipment and drugs, hospital construction, development of human resources for health, and the establishment of malaria control centres.

Since the late 1970s, China has refocused its foreign aid agenda beyond health and economic development to also help facilitate its foreign policy and economic interests, as is the case for most donors.

countries undergo economic development, the need for supportive functions should diminish. The final effort was Frenk and Moon's²⁴⁷ recent examination of the global health system, which they define as “the group of actors whose primary intent is to improve health, along with the rules and norms governing their interactions”. In addition to providing GPGs and managing externalities, the authors argue that the system must also provide stewardship and mobilise international solidarity.

The Commission built upon this previous work to define four essential functions of international collective action (table 13). Appendix 1, p 32 shows how each of these four functions could have several roles. We will focus on some of the most important of these roles.

Achievement of a grand convergence

Development of new tools

Today's health tools, which are mostly based on R&D that occurred several decades ago, will not be sufficient to achieve a grand convergence. The discovery, development, delivery, and widespread adoption of new technologies will be essential. The Commission believes that the most effective form of international collective action to help achieve convergence would be to direct a substantial portion of DAH towards this R&D enterprise.

The product of R&D is new knowledge, which constitutes the classic example of a GPG: once it is made

available to anyone, it can benefit everyone, and this benefit is not diminished by its use. These features create potential incentive problems that constitute a key rationale for prioritisation of the use of international financial resources to pay for R&D. Investment in R&D as a GPG leverages the neglected comparative advantage of DAH and provides perhaps the most direct way that external funding can benefit high-mortality populations in middle-income countries.

Our emphasis on R&D echoes and amplifies WDR 1993's strong call for strengthening health research. *Investing in Health* argued that “investments in research have been the source of the enormous improvements in health in this century.” WDR 1993 urged governments to support national health research, including gathering of health information to guide policies and study of variations in clinical practice. The international community should support R&D in a range of ways, argued WDR 1993, including helping to build local research capacity, supporting international research networks, and investing in R&D for infectious diseases, RMNCH disorders, and NCDs.

WDR 1993 undertook an R&D prioritisation exercise to identify the most important technologies and approaches to tackle the highest-burden health problems (table 14). Targeted investments towards some of the desired items on WDR 1993's “wish list”, such as rotavirus and pneumococcus vaccines, has paid large dividends in

	Examples
Leadership and stewardship (core function)	Convening for negotiation and consensus building; consensus building on policy; cross-sectoral advocacy (eg, on trade and health); agency for the dispossessed; advocating for sustainability and the environment
Ensuring provision of global public goods (core function)	Discovery, development, and delivery of new health tools; implementation research, extended cost-effective analyses, research priority-setting tools, and survey methodologies; knowledge generation and sharing; sharing of intellectual property (eg, drug patent pools, technology transfer); harmonised norms, standards, and guidelines (eg, quality assurance of medicines, WHO's vaccine position papers); market shaping (eg, pooled procurement to reduce drug prices)
Management of externalities (core function)	Responding to global threats (eg, pandemic influenza, antibiotic resistance, counterfeit drugs); surveillance and information sharing
Direct country assistance (supportive function)	Technical cooperation at national level; development assistance for health; emergency humanitarian assistance

Table 13: Four essential functions of international collective action

	Priority areas
Perinatal and maternal disorders	Methods to reduce costs of intervention; improved delivery in rural areas
Respiratory infections	Effect of indoor air pollution on pneumonia (to guide interventions designed to reduce pneumonia by use of improved stoves); inexpensive or simplified antibiotics regimens; inexpensive, simple, and reliable diagnostics; pneumococcal vaccine
Diarrhoeal diseases	Rotavirus and enterotoxigenic <i>Escherichia coli</i> vaccines; improved cholera vaccine; methods to improve hygiene; better case management of persistent diarrhoea; prevention of diarrhoea by the promotion of breastfeeding and improved weaning practices
Vaccine-preventable childhood illnesses	Development of new and improved vaccines to reduce patient contacts, allow immunisation at younger ages, and improve heat stability of some vaccines
Tuberculosis	Methods to ensure compliance; monitoring tools for drug resistance; simpler diagnostics; new and cheaper drugs
Cardiovascular disease	Low-cost prevention, diagnosis, and management methods for ischaemic heart and cerebrovascular disease

Table 14: Priorities for research and product development identified by World Development Report 1993

terms of successful product development. However, progress in other areas, such as the search for new and cheaper drugs for tuberculosis, has been disappointing.

WDR 1993 concluded that health R&D has enormous value, a declaration that is just as true today as it was 20 years ago. Health research improves health directly, through new technologies (drugs, diagnostics, vaccines, and devices), better ways to reach high coverage with existing technologies, and improvements in quality of care and service delivery. It also has indirect benefits through, for example, the effect of improved health on economic growth and activity and through “creating and maintaining a culture of evidence and reason”.²⁴⁸

The economic benefits of health research become even more impressive when full income approaches are used for assessment. For example, most HIV researchers believe that an HIV vaccine of 50% efficacy will become available by 2030, at a cost of around \$800–900 million per year in R&D investments. A benefit–cost analysis with full income approaches found that the benefit:cost ratio would be between 2 and 67.²⁴⁹ Even if there is a time lag to 2040 (a pessimistic scenario), the investment would still be compelling (appendix 1, p 46). “Our conclusion that vaccine investments have high benefit:cost ratios despite their attendant uncertainty”, say the authors of the analysis, “leads us to feel that R&D investments more generally are likely to have high payoff.”

Which other R&D investments are attractive? An analysis for this Commission entailed a review of more than 60 reports that identified more than 500 individually listed research gaps in basic science and product development (diagnostics, drugs, vaccines, and vector control) for tuberculosis, malaria, HIV/AIDS, childhood pneumonia or diarrhoea, and neglected tropical diseases.²⁵⁰ Figure 24 shows present levels of spending on closing some of these gaps. To build on this background work, and in consultation with a wide range of experts, the Commission considered the pipeline of products that could be important—or potentially game changing—to achieve convergence. Table 15 shows a snapshot of this pipeline and an estimate of the timeframe for product development. Some products, such as a moderately efficacious malaria vaccine, a conjugated typhoid vaccine, curative drug therapy for hepatitis C, and a single encounter cure for vivax and falciparum malaria, are likely to be developed within a short timeframe.

The global crisis of antibiotic resistance, which England’s chief medical officer recently described as “an apocalyptic threat” that is similar to climate change,²⁵¹ warrants a particular priority in the R&D agenda (appendix 1, p 47). The antibiotics used for decades to treat tuberculosis no longer work in 20% of patients in some countries.²⁵² For malaria, just one new drug class—the artemisinins—stands between cure and failure. Even more dangerous, and with greater consequences in the long term, common fatal infections are becoming

resistant to first-line penicillins, cephalosporins, and macrolide antibiotics. Yet, since 2000, just ten new antibiotics have been approved in the USA, and only two of these since 2009. The development of antibiotics has decreased steadily since the 1960s, with fewer companies bringing forth ever fewer compounds. Although no single technological fix exists for antimicrobial resistance, new antibiotics, vaccines, and point-of-care diagnostics will be needed, along with a reduction in both inappropriate use of, and the need for, antibiotics.

Pandemic preparedness

In our modelling on achieving a grand convergence, we did not include the resource demands to prepare for new infectious threats, such as pandemic influenza. Nevertheless, a key role clearly exists for international collective action in pandemic preparedness. Concern is growing that the world could soon face an especially deadly global pandemic, similar to the 1918 influenza pandemic, which will disproportionately affect poor populations.²⁵³ Table 16 shows that the 1918 influenza pandemic, which occurred before the era of mass, rapid international transit, affected the entire world population (1.85 billion people) and caused 50 million deaths. Twice as many years of life were lost per person because of the pandemic than because of World War 1, and the loss from influenza occurred in just 1 year rather than the 4 years of the war. The international community should support the development of new pandemic control methods, such as a universal influenza vaccine, and national and international surveillance and response systems. Other aspects of

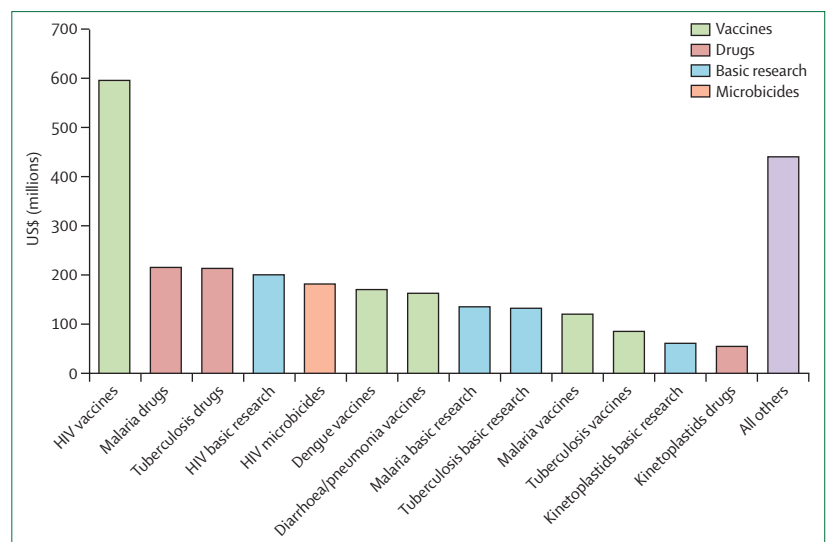


Figure 24: Research and development expenditures for infectious diseases of particular concern to low-income and middle-income countries in 2011
 “All others” includes HIV drugs and diagnostics; malaria diagnostics and vector control; tuberculosis diagnostics; diarrhoea or pneumonia drugs, basic research, and diagnostics; dengue drugs, basic research, diagnostics, and vector control; kinetoplastid (sleeping sickness, Chagas disease, and leishmaniasis) vaccines, diagnostics, and vector control; vaccines, drugs, basic research, diagnostics, and vector control for helminths; and control tools for salmonella, leprosy, rheumatic fever, Buruli ulcer, and trachoma. Data from reference 49.

	Diagnostics	Drugs	Vaccines	Devices
Short term (available for use before 2020)				
Important	Point-of-care diagnostics for HIV, tuberculosis, and malaria; point-of-care viral load for HIV	New artemisinin coformulations for malaria; new tuberculosis drug coformulations; curative drugs for hepatitis C; new antivirals for influenza; long-acting (5-year) contraceptive implant to reduce total fertility rate; safe, effective, and shorter duration therapy for active and latent tuberculosis; new drugs for neglected tropical diseases (with high efficacy and few side-effects)	Moderately efficacious (50%) malaria vaccine; conjugated typhoid vaccine; staphylococcal vaccine; heat-stable vaccines; new adjuvants to reduce multiple dosing of vaccines; more effective influenza vaccines in elderly people	Self-injected vaccines
Potentially game-changing	..	Single-encounter treatment for malaria: a one-dose cure for falciparum and vivax malaria	..	..
Medium term (available for use before 2030)				
Important	..	Antimicrobials based on a new mechanism of action	Combined diarrhoea vaccine (rotavirus, enterotoxigenic <i>Escherichia coli</i> , typhoid, and shigella); protein-based universal pneumococcal vaccine; respiratory syncytial virus vaccine; hepatitis C vaccine	..
Potentially game-changing	..	New classes of antiviral drugs	HIV/AIDS vaccine; tuberculosis vaccine; highly efficacious malaria vaccine; universal influenza vaccine	..

Table 15: Examples of products that could help achievement of convergence

	Excess deaths (millions)	Population affected (millions)	YLLs per person*	YLLs per person per year†
World War 1 (1914–18)	17	1800	0.6	0.15
Influenza pandemic (1918)	50	1840	1.2	1.2
World War 2 (1937–45)	71	2280	3.1	0.4
Bengal famine (1943)	3	400	0.5	0.5
Chinese famine (1958–61)	29	640	3.0	1.0

YLL=years of life lost. *The YLLs per person are calculated based on the total number of excess deaths during the indicated time period for the affected population. †YLLs per person per year are calculated by averaging the YLLs per person over the time period of the mortality shock. Data from reference 254.

Table 16: Years of life lost per person in major mortality shocks of the 20th century

preparation include ensuring that intellectual property concerns and production capacity for drugs and vaccines have been addressed ahead of any outbreak.

Advocacy and targeted financing

Additional forms of collective action that could help to tackle infections and RMNCH disorders are global advocacy for high-risk, neglected populations (eg, girls in India and China) and provision of financial support to low-income and selected lower-middle-income countries to scale up health tools. Donor agencies have traditionally focused on the poorest countries with the greatest disease burdens. Yet, financing of an internationally coherent strategy to eliminate malaria and to tackle drug-resistant tuberculosis and artemisinin resistance will need to provide support to middle-income countries. Progressive elimination of malaria cannot be achieved just by financing malaria control in the poorest, highest burden countries of sub-Saharan Africa.²⁵⁵ It will also require financial support to eliminating countries that have shown good progress and that now have low burdens,

many of which are middle-income countries. Similarly, to tackle the international threat of artemisinin resistance will require support to Burma, Cambodia, China, Thailand, and Vietnam (eg, providing assistance in driving out the use of monotherapies).

As we discussed in section 5, many of these countries will certainly be able to mobilise significant domestic resources for health in the coming years. However, sudden transitions away from DAH and toward domestic financing of malaria control are impossible in most cases.²⁵⁶ Furthermore, national incentives for such a transition are quite weak since the benefits are global, not national—hence the argument for global financing.

Curbing of NCDs and injuries

Population, policy, and implementation research

The most important role for the international community when it comes to curbing NCDs and injuries is in financing and assisting in PPIR—ie, studying the population factors, policies, and delivery systems that work best for scaling up of interventions for NCDs and injuries in low-income and middle-income countries. Ebrahim and colleagues²⁵⁷ have identified several key PPIR opportunities, including research on how to strengthen primary care services to deliver interventions; task shifting, family care, and self-care; e-health for NCD prevention and treatment; the evaluation of the health effects of public policies on trade, agriculture, and food security; and the use of health technology assessment and audit to improve the quality of care for NCDs. As countries make the transition from taxation of labour and capital to taxing unhealthy foods and substances, the fiscal, health, and income distribution consequences should be subject to rigorous evaluation.

The capacity to undertake PPIR can be strengthened—and the results more quickly disseminated—by a well-funded mix of South–South and South–North collaborations. Such PPIR should include research not

only on the effectiveness of specific interventions and delivery systems, but also on the adaptation of NCD tools and treatment protocols developed in high-income countries (“the North”) for use in low-income countries (“the South”).²⁵⁷ It should also include research on how high-income countries can benefit from research in low-income countries through reverse innovation—that is, the flow of effective frugal innovation.⁴²

As long ago as 1990, the Commission on Health Research for Development pointed to the key importance of PPIR and of developing national capacity to undertake this type of research. By contrast with other areas of R&D, progress in the arena of PPIR has been slower, although in recent years studies of implementation success factors and barriers have increased in number.²⁵⁸

Tremendous interest now exists in the potential health applications of information and communication technologies (e-health) and mobile phones (m-health) in low-income and middle-income countries. Although the best available empirical evidence so far shows only modest benefits of e-health and m-health in improving the effectiveness of health care,^{259,260} these applications are likely to be an important area of PPIR in the next generation. Such technologies have been successful in promoting inclusive access to financial services (eg, through mobile phone banking) in low-income and middle-income countries, and e-health and m-health approaches will probably become increasingly important for reaching poor, rural communities.

Finally, health systems research must also be at the heart of the international movement towards UHC. Our report has laid out two variants of a progressive universalist pathway towards UHC, a balanced pathway towards UHC, and two less attractive approaches (private voluntary insurance and public funding of catastrophic coverage). As countries set out along these different pathways, evaluations should be done every step of the way as a GPG to guide future efforts. Health systems research is needed not only on the financing side, but also on the delivery side. Studies are needed to identify the advantages and disadvantages of various mixes of public and private provision, and on whether innovative arrangements, such as public–private integrated partnerships, can improve efficiency, access, and quality in health care delivery.²⁶¹

Taxation, trade, and subsidy policies

A second role for international actors in curbing NCDs and injuries is to collaborate with national and international health authorities to review taxation, trade, and subsidy policies to ensure that health considerations are receiving proper weight. Examples include tobacco taxation, tariffs on drugs, and oil subsidies. It will be important to ensure that free trade agreements do not limit national sovereignty with respect to control of substances harmful to a nation’s population health.²⁶² The IMF and possibly the World Trade Organization would have key roles in these types of review.

Global tobacco control

A crucial role also exists for international collective action in global surveillance on implementing the WHO Framework Convention on Tobacco Control, and regional collaboration in policy making and enforcement to prevent tobacco smuggling. A study of cigarette smuggling in China, for example, concluded that “given the inherently transnational nature of smuggling, collective efforts across countries offer the most promising avenue for developing an effective policy response.”²⁶³

Financing of intervention scale-up

Finally, for the low-income countries, DAH will continue to have a part to play in supporting scale-up of particular NCD interventions, such as rollout of the HPV vaccine.

Towards progressive UHC

PPIR

Little empirical research evidence exists about how best low-income and middle-income countries can structure insurance reforms to move towards UHC. International collective action could help to fill this data gap by supporting PPIR to elucidate the implementation and effect of such reforms.²⁶⁴ Evaluation of health systems reforms has been a hugely neglected GPG. Such evaluation should be “an integral part of good practice in health system strengthening efforts to guide planning, policy development, monitoring, and evaluation”.²⁶⁵

DAH

Direct country support in the form of DAH and technical assistance has also played a catalytic role in kick-starting efforts to move towards progressive UHC. For example, about 91% of Rwanda’s population is now covered by community-based health insurance, which reimburses 90% of the total cost of health care. The Global Fund and other development partners are financing about a quarter of the premium contributions for the poorest of the population, and these partners are also providing technical assistance.¹³⁴

The neglect of core functions: a wake-up call

We have argued that to meet the challenges of the next generation, international collective action should focus mainly on the core functions of the global health system: provision of GPGs (especially R&D), management of externalities, and leadership and stewardship. Disease eradication also constitutes an important GPG, but the inherent economic problems of going for eradication make it a “high stakes gamble” and suggest the need for great selectivity in adopting eradication goals.²⁶⁶ The rapid economic growth of many middle-income countries means that supportive functions (particularly the transfer of DAH to countries) will become less important over time.

However, a new analysis undertaken for this Commission that studied global health assistance from 1990 to

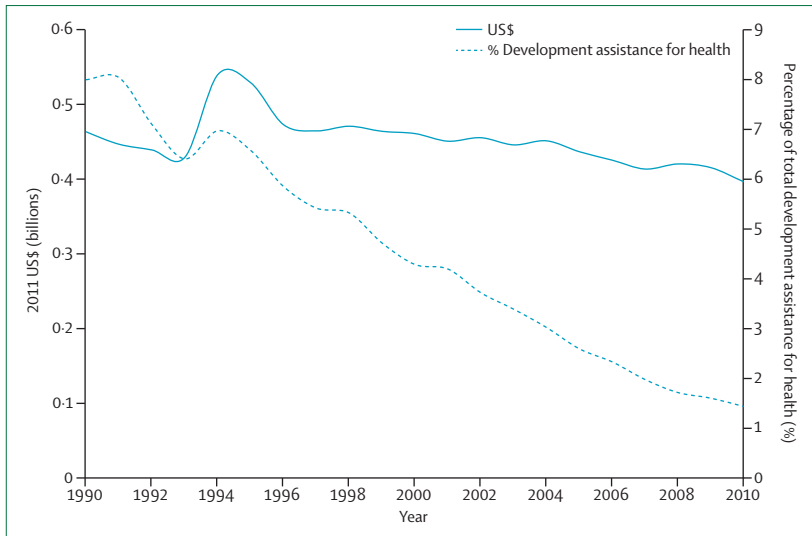


Figure 25: WHO's regular budget expenditures, 1990–2010
Data from reference 3.

2012 finds that, despite expectations that such assistance would increasingly be devoted to core functions as low-income countries developed, the opposite seems to have occurred.⁷⁰ “There appears to be heavy dominance of supportive functions across several of the largest and most prominent DAH actors today”, say the authors, “with likely disproportionate increases in funding for supportive functions relative to core since 1993”.

This neglect of core functions is exemplified by the decline in the WHO's regular budget over the past two decades. As figure 25 shows, the proportion of DAH that is directed towards WHO's core functions has fallen dramatically since 1990. A strong case can be made for the international community to fully support WHO and for the organisation itself to refocus its attention upon these core activities. Such refocusing would necessitate significant organisational restructuring.

We believe that these findings should serve as a wake-up call to the international community. The global health system as it is presently configured is not directing its financing to functions that need strengthening if we are to achieve dramatic health gains by 2035. In particular, in view of the extraordinary value of R&D, and the coming product development crunch for infections and RMNCH disorders affecting mostly low-income and middle-income countries,⁴⁹ the Commission believes that the 2011 levels of funding for R&D for these disorders represent a massive under-investment. The amount should be at least doubled by 2020, with half of this increment coming from middle-income countries. This target of US\$6 billion per year, representing just 2–4% of present global spending on health R&D, is in line with the recent recommendations of the WHO Consultative Expert Working Group on R&D: Financing and Coordination.²⁶⁷

The patent system—state-enforced monopoly rights, of finite duration—turns the public good of new

knowledge into private property as a way to create financial incentives for new product development. The existing patent system has of course been used successfully to create new drugs and vaccines, but it needs to be complemented with mechanisms to ensure public financing of essential R&D to meet the needs of those in low-income and middle-income countries. Profits from commercial sales in these countries will not be sufficient to achieve the doubling in R&D financing called for by this Commission. The WHO Ad Hoc Committee on Health Research Relating to Future Intervention Options and the CMH pointed to potential financing solutions, in particular the development of innovative institutional arrangements and the use of global finance to pay for GPGs (instead of using private finance and the patent system).^{244,268} Perhaps the most compelling role for DAH is to support specific areas of research that would have the greatest benefit for people living in low-income and middle-income countries, such as development of the products identified in table 15 and the types of PPIR discussed previously.

The international community also has a key role in building health research capacity in low-income and middle-income countries, such as through funding doctoral training, post-doctoral research, and research centres of excellence (exemplified by Bangladesh's International Centre for Diarrhoeal Disease Research).

Conclusions and opportunities

The Commission reached four key conclusions. For each one, we identified opportunities for action by both national governments and the international community that could have a transformative effect on health and the economy.

Conclusion 1: there is a very large payoff from investing in health

Health improvements have accounted for about 11% of economic growth in low-income and middle-income countries. These returns become even larger when full income approaches are used, in which national income accounts are augmented to represent the economic value of VLYs. Between 2000 and 2011, about 24% of the growth in full income in low-income and middle-income countries resulted from health improvements.

For all low-income and middle-income countries from 2000 to 2011, the value of annual increases in life expectancy has been about the same as that of a 1.8% annual increase in GDP—a very large effect. This new understanding of the economic value of health improvements provides a strong rationale for improved resource allocation across sectors.

National opportunities

If planning ministries used full income approaches (assessing VLYs) to guide their investment priorities, they would probably increase their domestic financing of

priority health and health-related investments (eg, water or education) by a substantial amount.

Opportunities for international collective action

The impressive returns from investing in health that are captured in assessing VLYs would strengthen the case for giving higher priority to allocating ODA to DAH.

Conclusion 2: a grand convergence is achievable within our lifetime

A unique characteristic of our generation is that, with the right investments, the stark differences in infectious, maternal, and child death rates between countries of differing income levels could be brought to an end within our lifetimes. Economic growth in many low-income and middle-income countries and the increasing availability of high-impact health technologies make a grand convergence in health achievable by 2035.

WDR 1993 argued for investment in public health and clinical packages that could substantially reduce the remaining burden of disease in low-income and middle-income countries at a modest cost. However, a far more ambitious goal is now within our reach, resulting from continued improvement in disease control technologies and the systems for delivering them coupled with greater financial resource mobilisation for health.

The Commission's modelling suggests that by 2035 nearly all countries could reach the frontier of feasibility—that is, they could reduce their infectious, maternal, and child mortality rates down to those currently seen in the best-performing middle-income countries (eg, the 4C countries: Chile, China, Costa Rica, and Cuba). Quantitatively, we express this goal as “16–8–4”, referring to the target of an under-5 mortality rate of 16 per 1000 livebirths, an annual AIDS death rate of eight per 100 000 population, and an annual tuberculosis death rate of four per 100 000 population. Unprecedented opportunities exist for both national governments and the international community to contribute to the achievement of such convergence.

National opportunities

Through aggressive scale-up of existing and new tools to tackle infections and RMNCH disorders, low-income countries could converge with the 4C countries by 2035. Convergence would prevent about 4·5 million deaths in low-income countries in 2035, at an annual incremental cost of around US\$23 billion per year in 2016–25 and US\$27 billion per year in 2026–35. Most of these incremental costs are to finance the crucial health systems components (eg, skilled health workers) that will be needed for the delivery of interventions. With use of full income approaches to estimate the economic benefits of convergence, the benefits would exceed costs by a factor of about 9. Benefits of this magnitude will only be realised if the additional funds are targeted at the correct mix of interventions (ie, if there is allocative efficiency),

and if health systems are strengthened so that they can deliver health services.

The expected rise in GDP in low-income countries will allow them to finance much of the convergence agenda from domestic sources. For example, if public spending on health in low-income countries increases from its current rate of 2% of GDP to 3% by 2035, and if countries allocate two-thirds of this increase specifically to infections and RMNCH disorders, about 70% of the incremental costs of achieving convergence could be financed domestically. Domestic fiscal space could also be created by mechanisms such as increases in tobacco taxation and removal of subsidies on fossil fuels. Nevertheless, for many low-income countries, grant support and highly concessional credits will be needed for years to come, and low-concessional external assistance (eg, World Bank loans) could be of value in middle-income countries.

Most of the burden of infectious and RMNCH diseases lies in the more deprived subpopulations of middle-income countries. Our understanding of the global map of disease is therefore changing. These countries are in a better position than low-income countries to mobilise domestic finance and so they have an even greater opportunity to achieve convergence. Across lower-middle-income countries as a group, such an achievement would prevent about 5·8 million deaths in these countries in the year 2035, costing an additional US\$38 billion per year in 2016–25 and \$54 billion per year in 2026–35. Benefits would exceed costs by a factor of about 20. Our modelling suggests that these countries will easily have sufficient domestic resources in the next 20 years to finance the convergence agenda.

Opportunities for international collective action

The Commission believes that the most important way in which the international community can support convergence is to target most of its support towards providing GPGs and curbing negative externalities.

Investment in product development, a GPG, leverages the neglected comparative advantage of DAH and provides perhaps the most direct opportunity for external funding to benefit high-mortality subpopulations in middle-income countries. Such support should also include funding rigorous evaluations of which delivery approaches are successful and which are not in the real world (“learning by doing”).

Existing levels of financing for developing drugs, diagnostics, and vaccines for infections and RMNCH disorders (\$3 billion/year) should be at least doubled by 2020. Development of new tools to tackle the growing global crisis of antibiotic resistance should be high on the agenda.

The potential for the international spread of emerging infectious threats such as pandemic influenza, which would be particularly devastating to poor populations, and of antibiotic-resistant infections, needs global mechanisms

to contain these negative externalities. Strengthening of surveillance and response capacity is a key priority for international collective action given the very real possibility of a global pandemic in the coming decades.

Another opportunity for international collective action is to adequately finance capacity building within international institutions so that they can transition away from direct country support towards adequately providing key GPGs. These goods include political and technical leadership and advocacy, establishing norms and standards, learning from experience, and facilitating transfer of knowledge. Taking advantage of this opportunity would entail substantial increases in DAH to support institutional strengthening. An important step forward would be for the international community to fully support WHO and for the organisation itself to refocus its attention on these core activities, particularly strengthening its capacity for technical cooperation with and among countries. Such refocusing would require significant organisational restructuring.

Despite our call for a greater focus on provision of GPGs, we recognise that direct financial support to the poorest countries with the greatest burdens of infections and RMNCH disorders will continue to be crucial for achieving convergence. Additionally, a coherent global strategy to eliminate malaria and to combat drug-resistant tuberculosis and artemisinin resistance will in some cases require support to selected middle-income countries. As is the case for domestic spending on infections and RMNCH, DAH targeted at these disorders should include financing for structural investments in the health system.

Conclusion 3: scale-up of low-cost packages of interventions can enable major progress in NCDs and injuries within a generation

Through scale-up of low cost packages of population-based and clinical interventions, major progress can be made within a generation in delaying the onset of NCDs, reducing the incidence of NCDs and injuries, and managing their consequences when they do occur. A substantial proportion of the enormous burden of deaths from NCDs, road injuries, and suicide in low-income and middle-income countries is preventable through no-cost or low-cost population-based interventions. The Commission believes that fiscal policies, which are greatly under-used, are probably the most powerful lever for reducing this burden.

National opportunities

On the basis of evidence from more than 100 studies, including those undertaken in low-income and middle-income countries, the single most important opportunity for national governments worldwide to curb NCDs is to tax tobacco heavily.

Evidence is also emerging of the benefits of taxing other harmful substances (eg, alcohol and sugar-sweetened beverages). Such taxes can be a significant

source of government revenue. Reduction of subsidies on items such as fossil fuels and unhealthy food constituents can also help to curb NCDs. The addition of regulation to taxation can have a large effect on alcohol use, air pollution, and tobacco consumption. Although public education campaigns about NCD risks are popular, little evidence exists to suggest that giving people health information alone changes behaviour.

Transportation-related deaths can be curtailed through legislative approaches, such as enforcement of speed limits, motorcycle helmet use, and drink-driving laws. Regulation and legislation can also help to curb suicide deaths; examples of proven interventions include pesticide restrictions and firearm control laws.

National health systems can build platforms to deliver packages of highly cost-effective clinical interventions for NCDs and injuries. Examples include a community health worker platform to deliver cancer prevention vaccines (hepatitis B, HPV), essential surgical capacity at district hospitals to deal with injury, and primary health clinics providing low-cost diagnostics and treatments to reduce the risk of cardiovascular disease through effective primary and secondary prevention.

Opportunities for international collective action

The international community can help to support NCD and injury control by offering technical assistance on taxation, subsidies, regulation, and legislation, especially related to targets that cut across several sectors (eg, alcohol, road injury deaths); international cooperation to tackle tobacco tax avoidance (through loopholes) and tax evasion (through smuggling and bootlegging); providing targeted financing in the poorest countries to help introduce NCD interventions, such as hepatitis B and HPV vaccines; developing metrics and systems to monitor progress; and helping to build the evidence base for other cost-effective population-wide measures to address NCDs and injuries.

Another opportunity for international collective action on NCDs is to support PPIR, an under-funded GPG. Such research parallels the “learning by doing” approach discussed in Conclusion 2.

Trade agreements between countries should avoid constraining or pressurising countries into loss of sovereignty with respect to their key national public health priorities, such as regulation of tobacco sales or sales of harmful foods.

Conclusion 4: progressive universalism is an efficient way to achieve health and financial protection

UHC—usually achieved through public prepayment of most of the cost of insuring health services for a country’s population—offers the promise of financing health gains and providing health security while minimising the financial risks to households of excessive health expenditures. The Commission endorses two progressive pathways towards UHC that are pro-poor from the outset.

Efficiency and equity considerations have led high-income countries, and many middle-income countries, to offer health services, including preventive health interventions, to all households with minimum or no payment at the time of use. Universal prepayment encourages the early use of such services, which can prevent adverse health outcomes, reduce health systems costs (eg, by preventing hospitalisation), and avert catastrophic household expenditures. The WHO's landmark 2010 World Health Report on health systems financing leveraged these arguments to propose the policy goal of UHC. The Commission endorses both this goal and two progressive pathways for achieving it by 2035. The first type of progressive universalism involves initial rapid movement toward publicly financed coverage of the entire population for a defined set of interventions. These would tackle infectious, maternal, and child mortality, to achieve convergence (as discussed in Conclusion 2); and would also include essential packages of interventions to curb NCDs and injuries (as discussed in Conclusion 3). These interventions disproportionately benefit the poor and would require no financial contribution from them. A second type provides a larger package of interventions that might require patients to pay premiums or copayments but exempts the poor from these payments. This approach can be financed through a greater variety of financing mechanisms than the first type, including general taxation revenue, payroll taxes, mandatory premiums, and copayments—but the poor are exempt from contributing.

National opportunities

Adoption of the progressive approach to UHC, with its emphasis on the convergence agenda, could benefit low-income and middle-income countries in four key ways: the poor gain the most in terms of health and financial protection; the approach yields high health gains per dollar spent; public money is used to address the negative externalities of infectious disease transmission; and implementation success in many low-income environments has unequivocally demonstrated feasibility. Nevertheless, the Commission recognises that the exact model of UHC that is appropriate will vary between countries and it should, as far as possible, represent national consensus.

An important finding that provides additional evidence to countries in support of a progressive approach is that insurance covering expensive procedures with limited health benefit sometimes consumes substantial public resources. Such insurance provides only modest protection against financial risk for the money spent and tends to promote unproductive cost escalation. Public finance of such insurance should therefore occur only late in the pathway to UHC. It is now becoming clear that tremendous opportunities exist for greater efficiency in the provision of financial protection. For example, prevention or early treatment can reduce the need for expensive treatments later on, measures to improve the quality of services and availability of essential drugs can

reduce the risk of unnecessary and overly costly expenditures, and there are large efficiency gains from avoiding several small insurance pools.

Opportunities for international collective action

The international community can support national policies to implement progressive UHC in three ways. The first is to support policy research—that is, the policy dimension of PPIR. Much remains to be learned about the financial protection value of specific interventions and platforms. This knowledge would then need to be combined with evidence of the health benefits of these interventions and platforms to chart possible pathways to UHC that can inform national decision making. The second is to support implementation research—the implementation dimension of PPIR—to ensure that today's efforts yield sound empirical guidance for tomorrow's decisions. The third is for the international community to help individual countries finance the institutions for revenue mobilisation and pooling, the mechanics of designing and implementing specific pathways for evolution in the benefit package, and the policies for UHC implementation.

Taking stock: from 2013 to 2035

Our report points to the possibility of achieving dramatic gains in global health by 2035 through a grand convergence around infections and RMNCH disorders, major reductions in the incidence and consequences of NCDs and injuries, and the promise of UHC.

Good reasons exist to be optimistic about seeing the global health landscape completely transformed in this way within a generation. The world has made great progress since 1993 in achieving health goals, even if many people were left behind. The pace of health improvement has been extraordinarily rapid. There is a record of proven success in marshalling health technologies to reduce avoidable deaths. The scientific advances that underpin disease control show every sign of continuing into the future. Economic growth in many low-income and middle-income countries is enabling resource mobilisation for health. With the digital revolution, we envision acceleration in the spread of health knowledge among the public and health workers and in the dissemination of policies that allow national decision makers to fully reap the fruits of global science.

Contributors

The first draft of this report was written by a core writing team led by GY, which also included DTJ and HS; the writing team met regularly during the course of the Commission's work. All commissioners contributed fully to the overall report structure and concepts, the writing and editing of subsequent drafts, and the conclusions. The report was prepared under the general direction of the chair, LHS, and co-chair, DTJ. Data gathering was done by a supporting research team listed in the Acknowledgments. The views expressed herein are those of the authors themselves and they do not necessarily represent the views of WHO or other organisations.

Conflicts of interest

All authors declare that the work of the Commission on Investing in Health was supported by the Bill & Melinda Gates Foundation (Seattle, WA, USA), the Disease Control Priorities Network (DCPN) project funded by the Bill & Melinda Gates Foundation and based at the Department of Global Health of the University of Washington (Seattle, WA, USA), the Harvard Global Health Institute (Cambridge, MA, USA), the Norwegian Agency for Development Cooperation (NORAD, Oslo, Norway), and the UK Department for International Development (DFID, London, UK). Three commissioners (GY, DTJ, and HS) were compensated for their writing time from the grants. DE and FB are employees of WHO. GG is an employee of the Bill & Melinda Gates Foundation (a sponsor of the work), and SJG is director of the Harvard Global Health Institute (also a sponsor of the work). In addition to these grants for the submitted work, several authors declare competing interests. DTJ has received project funding from the Bill & Melinda Gates Foundation; he received support from GlaxoSmithKline to participate in a January, 2012 consultative meeting of the advisory group for evaluating economic models for use of the RTS,S malaria vaccine. RGAF has received grants from the Bill & Melinda Gates Foundation, ExxonMobil, and many other public sources for programmes of the Global Health Group at the University of California, San Francisco, together with fees, non-financial support, and other support from AusAID, Gilead Sciences, Sure Chill, and Vital. GG is a former employee of McKinsey and Co and Google, and has been a paid consultant to the World Bank. SJG has received grants from the Bill & Melinda Gates Foundation. MEK has received grants from Merck for Mothers (an entity of Merck and Co). AM declares that he is a former President of Merck Vaccines (he retired in 2006 and receives a retirement stipend and stock options), a member of the Board of Directors of Becton Dickinson and Inovio, and Chairman of the Board of Directors of the International Vaccine Institute (Seoul, South Korea). HS has received project funding from the GAVI Alliance; the Global Fund to Fight AIDS, Tuberculosis, and Malaria; WHO; and the Children's Investment Fund Foundation. AS is an employee of the African Development Bank. GY has received grant and project funding from the Bill & Melinda Gates Foundation, and project funding from the Global Fund to Fight AIDS, Tuberculosis, and Malaria, the Clinton Health Access Initiative (CHAI), UNITAID, and the Partnership for Maternal, Newborn and Child Health. The other authors declare that they have no conflicts of interest.

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References

- World Bank. World Development Report. 1993. <http://files.dcp2.org/pdf/WorldDevelopmentReport1993.pdf> (accessed Feb 4, 2013).
- Deaton A. The World Development Report at 30: a birthday tribute or a funeral elegy? In: Yusuf S, ed. Development economics through the decades: a critical look at thirty years of the World Development Report. Washington, DC: World Bank, 2008: 105–114.
- Institute for Health Metrics and Evaluation. Financing global health 2012: the end of the golden age? <http://www.healthmetricsandevaluation.org/publications/policy-report/financing-global-health-2012-end-golden-age> (accessed Feb 12, 2013)
- WHO. Global status report on road safety 2013: supporting a decade of action. Geneva: World Health Organization, 2013.
- Cropper M, Hammitt JK, Robinson LA. Valuing mortality risk reductions: progress and challenges. Resources for the Future Discussion Paper no. 11-10. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1788975 (accessed Oct 17, 2013).
- Mahbubani K. The great convergence. Asia, the West, and the logic of one world. New York: Public Affairs, 2013.
- WHO. World Health Report 1999: making a difference. Geneva: World Health Organization, 1999.
- WHO. Macroeconomics and health: investing in health for economic development. Geneva: World Health Organization, 2001.
- WHO. Closing the gap in a generation: health equity through action on the social determinants of health. Final report of the Commission on Social Determinants of Health. Geneva: World Health Organization, 2008.
- Collier P. The bottom billion: why the poorest countries are failing and what can be done about it. New York: Oxford University Press, 2007.
- The Lancet. World Bank's cure for donor fatigue. *Lancet* 1993; **342**: 63–64.
- United Nations. United Nations Special Session on Children. Guest speeches: Bill Gates, Jr, Co-founder of the Bill & Melinda Gates Foundation. 2002. <http://www.unicef.org/specialsession/press/02espbillgates.htm> (accessed Oct 3, 2013).
- Specter M. What money can buy. *New Yorker* (New York), Oct 24, 2005. <http://www.michaelspecter.com/2005/10/what-money-can-buy> (accessed Feb 21, 2013).
- Lopez AD. Causes of death: an assessment of global patterns of mortality around 1985. *World Health Stat Q* 1990; **43**: 91–104.
- Lopez AD. Causes of death in industrial and developing countries: estimates for 1985–90. In: Jamison DT, Mosley WH, Measham AR, Bobadilla JL, eds. Disease control priorities in developing countries. New York: Oxford University Press, 1993: 35–50.
- Zeckhauser R, Shepard DS. Where now for saving lives? *Law Contemp Probl* 1976; **40**: 5–45.
- Barnum H. Evaluating healthy days of life gained from health projects. *Soc Sci Med* 1987; **24**: 833–41.
- Ghana Health Assessment Project Team. A quantitative method of assessing the health impact of different diseases in less developed countries. *Int J Epidemiol* 1981; **10**: 73–80.
- Murray CJ, Lopez AD, Jamison DT. The global burden of disease in 1990: summary results, sensitivity analysis and future directions. *Bull World Health Organ* 1994; **72**: 495–509.
- Murray CJ, Vos T, Lozano R, et al. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2012; **380**: 2197–223.
- WHO. Global health estimates summary tables: deaths by cause, age and sex by various regional grouping. Geneva: World Health Organization, 2013. http://www.who.int/healthinfo/global_burden_disease/en/ (accessed Oct 17, 2013).
- Hill K, Zimmerman L. Adolescent mortality in low- and middle-income countries. Commission on Investing in Health Working Paper, 2013. <http://globalhealth2035.org> (accessed Nov 8, 2013).
- Jamison DT, Breman JG, Measham AR, et al, eds. Disease control priorities in developing countries, 2nd edn. Washington, DC and New York: The World Bank and Oxford University Press, 2006.
- Jamison DT, Mosley WH, Measham AR, Bobadilla JL, eds. Disease control priorities in developing countries, 1st edn. New York: Oxford University Press, 1993.
- Misra R. Disease control priorities in developing countries, second edition: perspective of a policymaker. 2006. <http://www.dcp2.org/main/ExpertEssays.html> (accessed Oct 17, 2013).
- Abbasi K. The World Bank on world health: under fire. *BMJ* 1999; **318**: 1003–06.
- Costello A, Woodward D. World Bank's world development report. *Lancet* 1993; **342**: 440–41.
- Kuhn L, Zwarenstein MF, Thomas GC, et al. Village health-workers and GOBI-FFH. An evaluation of a rural programme. *S Afr Med J* 1990; **77**: 471–75.

- 29 Walsh JA, Warren KS. Selective primary health care: an interim strategy for disease control in developing countries. *N Engl J Med* 1979; **301**: 967–74.
- 30 Jayasinghe KS, De Silva D, Mendis N, Lie RK. Ethics of resource allocation in developing countries: the case of Sri Lanka. *Soc Sci Med* 1998; **47**: 1619–25.
- 31 Berman PA, Bossert TJ. A decade of health sector reform in developing countries: what have we learned? 2000. <http://www.hsph.harvard.edu/ihsq/publications/pdf/closeout.PDF> (accessed Oct 17, 2013).
- 32 Rowden R. The ghosts of user fees past: exploring accountability for victims of a 30-year economic policy mistake. *Health Hum Rights J* 2013; **15**: 175–85.
- 33 The Lancet. The struggle for universal health coverage. *Lancet* 2012; **380**: 859.
- 34 UN Inter-agency Group for Child Mortality Estimation. Levels and trends in child mortality report 2012. New York: United Nations Children's Fund, 2012.
- 35 UN Inter-agency Group for Maternal Mortality Estimation. Trends in maternal mortality 1990 to 2010: WHO, UNICEF, UNFPA, and the World Bank Estimates. Geneva: World Health Organization, 2012.
- 36 Vallin J, Meslé F. The segmented trend line of highest life expectancies. *Popul Dev Rev* 2009; **35**: 159–87.
- 37 United Nations Development Programme. Human Development Report 2013. The rise of the south: human progress in a diverse world. New York: United Nations Development Programme, 2013.
- 38 World Bank. Financing health care: issues and options for China. Washington, DC: World Bank, 1997.
- 39 United Nations, Department of Economic and Social Affairs, Population Division. Sex differentials in childhood mortality. New York: United Nations, 2011.
- 40 Victora CG, Barros AJD, França G, Restrepo MC. Selected analyses on inequalities in under-5 mortality rates and related indicators in low and middle-income countries, 2000–2010. Commission on Investing in Health Working Paper, 2013. <http://globalhealth2035.org> (accessed Oct 22, 2013).
- 41 Guilmo CZ. Skewed sex ratios at birth and future marriage squeeze in China and India, 2005–2100. *Demography* 2012; **49**: 77–100.
- 42 Howitt P, Darzi A, Yang G-Z, et al. Technologies for global health. *Lancet* 2012; **380**: 507–35.
- 43 Guillet P, Alnwick D, Cham MK, et al. Long-lasting treated mosquito nets: a breakthrough in malaria prevention. *Bull World Health Organ* 2001; **79**: 998.
- 44 Sinclair D, Zani B, Donegan S, Olliaro P, Garner P. Artemisinin-based combination therapy for treating uncomplicated malaria. *Cochrane Database Syst Rev* 2009; **3**: CD007483.
- 45 Wang JQ, Liu M, Liu A, Li H. Global health governance in china: the case of China's health aid to foreign countries. In: Lee K, Pang T, Tan Y, eds. Asia's role in governing global health. New York: Routledge, 2013: 39–65.
- 46 Jamison DT, Sandbu M, Wang J. Why has infant mortality decreased at such different rates in different countries? Working paper no. 21. Bethesda: Disease Control Priorities Project, 2004.
- 47 Commission on Health Research for Development. Health research: essential link to equity in development. Report of the Commission on Health Research for Development. New York, NY: Oxford University Press, 1990.
- 48 Røttingen J-E, Regmi S, Eide M, et al. Mapping of available health research and development data: what's there, what's missing and what role is there for a global observatory. *Lancet* 2013; **383**: 1286–307.
- 49 Moran M, Guzman J, Henderson K, et al. G-FINDER, 2012: neglected disease research and development: a five year review. Sydney: Policy Cures, 2012.
- 50 Mahoney RT. Product development partnerships: case studies of a new mechanism for health technology innovation. *Health Res Policy Syst* 2011; **9**: 33.
- 51 Moran M. A breakthrough in R&D for neglected diseases: new ways to get the drugs we need. *PLoS Med* 2005; **2**: e302.
- 52 IFPMA (International Federation of Pharmaceutical Manufacturers and Associations). Pharmaceutical R&D projects to discover cures for patients with neglected conditions. 2012. http://www.ifpma.org/fileadmin/content/Publication/2013/IFPMA_R_D-Status_Report_Neglected_Conditions.pdf (accessed Feb 14, 2013).
- 53 Gutteridge WE. TDR collaboration with the pharmaceutical industry. *Trans R Soc Trop Med Hyg* 2006; **100** (suppl 1): S21–25.
- 54 Moran M. Global health policy responses to the world's neglected diseases. In: Brown GW, Yamey G, Wamala S, eds. The handbook of global health policy. Oxford: Wiley Blackwell, 2013 (in press).
- 55 Morel CM, Acharya T, Broun D, et al. Health innovation networks to help developing countries address neglected diseases. *Science* 2005; **309**: 401–04.
- 56 GAVI. 2013. <http://www.gavialliance.org/about/partners/developing-country-vaccine-industry/> (accessed Oct 17, 2013).
- 57 Waning B, Diedrichsen E, Moon S. A lifeline to treatment: the role of Indian generic manufacturers in supplying antiretroviral medicines to developing countries. *J Int AIDS Soc* 2010; **13**: 35.
- 58 DSW, Policy Cures. Saving lives and creating impact: EU investment in poverty-related neglected diseases. 2012. <http://policycures.org/downloads/DSWreport.pdf> (accessed May 8, 2013)
- 59 Pedrique B, Some C, Ford N, Olliaro P, Strub-Wourgaft N, Bradol J-H. The drug and vaccine pipeline for neglected diseases, 2000–2011: a systematic assessment. 2012. <http://www.doctorswithoutborders.org/events/symposiums/2012-lives-in-the-balance/assets/files/JH-Bradol-The-Drug-and-Vaccine-Pipeline-for-Neglected-Diseases.pdf> (accessed Feb 14, 2013)
- 60 del Rio C, Sepúlveda J. AIDS in Mexico: lessons learned and implications for developing countries. *AIDS* 2002; **16**: 1445–57.
- 61 Clift C. Identifying sustainable methods for improving global health security and access to health care. Chatham House Working Paper, April 2013. <http://www.chathamhouse.org/publications/papers/view/192809> (accessed Oct 17, 2013).
- 62 Elovainio R, Evans DB. Raising and spending domestic money for health. Chatham House Working Paper, May 2013. <http://www.chathamhouse.org/publications/papers/view/191335> (accessed Oct 17, 2013).
- 63 Easterlin R. How beneficent is the market? A look at the modern history of morality. *Res Econ Hist* 1999; **3**: 257–94.
- 64 Pritchett L, Summers LH. Wealthier is healthier. *J Hum Resour* 1996; **31**: 841–68.
- 65 Davis K. The amazing decline of mortality in underdeveloped areas. *Am Econ Rev* 1956; **46**: 305–18.
- 66 Pison G, Trape JF, Lefebvre M, Enel C. Rapid decline in child mortality in a rural area of Senegal. *Int J Epidemiol* 1993; **22**: 72–80.
- 67 WHO. The Abuja declaration ten years on. 2011. <http://www.who.int/healthsystems/publications/Abuja10.pdf> (accessed Oct 17, 2013).
- 68 World Bank. World Development Indicators, 2013. Washington, DC: World Bank, 2013.
- 69 Foreign policy and fund for peace. http://www.foreignpolicy.com/failed_states_index_2012_interactive (accessed Oct 17, 2013).
- 70 Blanchet N, Thomas M, Atun R, Knaul F, Jamison D, Hecht R. Global collective action in health: The WDR+20 landscape of core and supportive functions. Commission on Investing in Health Working Paper, 2013. <http://globalhealth2035.org> (accessed Oct 22, 2013).
- 71 Akachi Y, Atun R. Effect of investment in malaria control on child mortality in sub-Saharan Africa in 2002–2008. *PLoS One* 2011; **6**: e21309.
- 72 Walz J, Ramachandran V. Brave new world: a literature review of emerging donors and the changing nature of foreign assistance. Center for Global Development (CGD) Working Paper 273. 2011. <http://www.cgdev.org/content/publications/detail/1425691> (accessed Oct 17, 2013).
- 73 Center for Global Development. Value for money: an agenda for global health funding agencies. 2012. http://www.cgdev.org/section/topics/global_health/working_groups/value_for_money (accessed Oct 17, 2013).
- 74 Moon S, Omole O. Draft Chatham House background paper: development assistance for health: critiques and proposals for change. <http://www.chathamhouse.org/publications/papers/view/190951> (accessed Oct 17, 2013).
- 75 Biesma R, Brugha R, Harmer A, Walsh A, Spicer N, Walt G. The effects of global health initiatives on country health systems: a review of the evidence from HIV/AIDS control. *Health Policy Plan* 2009; **24**: 239–52.

- 76 Dybul M, Piot P, Frenk J. Reshaping global health. Hoover Institution Policy Review, no. 173, June 1, 2012. <http://www.hoover.org/publications/policy-review/article/118116> (accessed May 7, 2013).
- 77 Legge D. Future of WHO hangs in the balance. *BMJ* 2012; **345**: e6877.
- 78 The Economist. Pre-empting pandemics: an ounce of prevention. April 20, 2013. <http://www.economist.com/news/science-and-technology/21576375-new-viruses-emerge-china-and-middle-east-world-poorly-prepared> (accessed May 7, 2013).
- 79 Fink G, Hill K. Urbanization and child mortality—evidence from the Demographic and Health Surveys. Commission on Investing in Health Working Paper, 2013. <http://globalhealth2035.org> (accessed Oct 22, 2013).
- 80 United Nations, Department of Economic and Social Affairs, Population Division. World urbanization prospects, the 2011 revision. http://esa.un.org/wpp/ppt/CSIS/WUP_2011_CSIS_4.pdf (accessed Oct 17, 2013).
- 81 Glassman A, Duran D, Sumner A. Global health and the new bottom billion: how funders should respond to shifts in global poverty and disease burden. Washington, DC: Center for Global Development, January 2011. http://www.cgdev.org/doc/full_text/BottomBillion/Glassman_Bottom_Billion.html#_ftn2 (accessed May 8, 2013).
- 82 Feachem RGA, Kjellstrom T, Murray CJL, Over M, Phillips MA, eds. The health of adults in the developing world. New York: Oxford University Press, 1992.
- 83 Bobadilla JL, Frenk J, Lozano R, Frejka T, Stern C. The epidemiological transition and health priorities. In: Jamison DT, Mosley WH, Meashem AR, Bobadilla JL, eds. Disease control priorities in developing countries, 1st edn. New York: Oxford University Press, 1993: 51–63.
- 84 Sawyer SM, Afifi RA, Bearinger LH, et al. Adolescence: a foundation for future health. *Lancet* 2012; **379**: 1630–40.
- 85 WHO. Every woman, every child: strengthening equity and dignity through health. The second report of the independent Expert Review Group (iERG) on Information and Accountability for Women's and Children's Health. Geneva: World Health Organization, 2013.
- 86 Marquez PV, Farrington JL. The challenge of non-communicable diseases and road traffic injuries in sub-Saharan Africa. An overview. Washington, DC: The World Bank, 2013.
- 87 Mackey TK, Liang BA. Rebalancing brain drain: exploring resource reallocation to address health worker migration and promote global health. *Health Policy* 2012; **107**: 66–73.
- 88 Joint Learning Initiative. Human resources for health. Overcoming the crisis. 2004. http://www.who.int/hrh/documents/JLi_hrh_report.pdf (accessed Oct 17, 2013).
- 89 Frenk J, Chen L, Bhutta ZA, et al. Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. *Lancet* 2010; **376**: 1923–58.
- 90 Fidler DP, Drager N, Lee K. Managing the pursuit of health and wealth: the key challenges. *Lancet* 2009; **373**: 325–31.
- 91 Stuckler D, Nestle M. Big food, food systems, and global health. *PLoS Med* 2012; **9**: e1001242.
- 92 Di Cesare M, Khang Y-H, Asaria P, et al, and the Lancet NCD Action Group. Inequalities in non-communicable diseases and effective responses. *Lancet* 2013; **381**: 585–97.
- 93 Costello A, Abbas M, Allen A, et al. Managing the health effects of climate change. *Lancet* and University College London Institute for Global Health Commission. *Lancet* 2009; **373**: 1693–733.
- 94 Xu K, Evans DB, Carrin G, Aguilar-Rivera AM, Musgrove P, Evans T. Protecting households from catastrophic health spending. *Health Aff* 2007; **26**: 972–83.
- 95 Kruk ME, Goldmann E, Galea S. Borrowing and selling to pay for health care in low- and middle-income countries. *Health Aff* 2009; **28**: 1056–66.
- 96 van der Gaag J, Štimac V. Towards a new paradigm for health sector development. Amsterdam Institute for International Development, 2008. [http://www.resultsfordevelopment.org/sites/resultsfordevelopment.org/files/resources/Toward a New Paradigm for Health Sector Development.pdf](http://www.resultsfordevelopment.org/sites/resultsfordevelopment.org/files/resources/Toward%20a%20New%20Paradigm%20for%20Health%20Sector%20Development.pdf) (accessed Oct 17, 2013).
- 97 Clements B, Coady D, Gupta S, eds. The economics of public healthcare reform in advanced and emerging economies. Washington, DC: International Monetary Fund, 2012. <http://www.imf.org/external/pubs/ft/books/2012/health/healthcare.pdf> (accessed April 26, 2013).
- 98 Bloom DE, Canning D. Policy forum: public health. The health and wealth of nations. *Science* 2000; **287**: 1207–09.
- 99 Bloom DE, Canning D, Jamison DT. Health, wealth, and welfare. *Finance Dev* 2004; **41**: 10–115.
- 100 Bloom DE, Fink G. The economic case for devoting public resources to health. In: Farrar J, Hotez PJ, Junghanss T, Kang G, Lalloo D, White NJ, eds. Manson's Tropical Diseases, 23rd edn. Philadelphia, PA: Saunders (in press).
- 101 Ruger JP, Jamison DT, Bloom E. Health and the economy. In: Merson MH, Black RE, Mills AJ, eds. International public health, 2nd edn. Sudbury: Jones and Barlett, 2006: 601–47.
- 102 Alleyne GA, Cohen D. Health, economic growth, and poverty reduction. The report of working group 1 of the Commission on Macroeconomics and Health. Geneva: World Health Organization, 2002. <http://whqlibdoc.who.int/publications/9241590092.pdf> (accessed April 26, 2013).
- 103 Fogel RW. New findings on secular trends in nutrition and mortality: some implications for population theory. In: Rosenzweig M, Stark O, eds. Handbook of population and family economics, vol 1A. Amsterdam: Elsevier, 1997: 483–81.
- 104 Thomas D, Frankenberg E. Health, nutrition and prosperity: a microeconomic perspective. *Bull World Health Organ* 2002; **80**: 106–13.
- 105 Strauss J, Thomas D. Health, nutrition, and economic development. *J Econ Lit* 1998; **36**: 766–817.
- 106 Bloom DE, Sachs JD. Geography, demography, and economic growth in Africa. *Brookings Pap Econ Act* 1998; **2**: 207–95.
- 107 Gallup JL, Sachs JD. The economic burden of malaria. *Am J Trop Med Hyg* 2001; **64** (suppl): 85–96.
- 108 Acemoglu D, Johnson S. Disease and development: the effect of life expectancy on economic growth. *J Polit Econ* 2007; **115**: 925–84.
- 109 Bloom D, Canning D, Fink G. Disease and development revisited. National Bureau of Economic Research Working Paper 15137. 2009. <http://www.nber.org/papers/w15137> (accessed March 13, 2013).
- 110 Jamison DT, Lau LJ, Wang J. Health's contribution to economic growth in an environment of partially endogenous technical progress. In: Lopez-Casasnovas G, Rivera B, Currais L, eds. Health and economic growth: findings and policy implications. Cambridge, MA: The MIT Press, 2005: 67–91.
- 111 Cameron TA. Euthanizing the value of a statistical life. *Rev Environ Econ Policy* 2010; **4**: 161–78.
- 112 Usher D. An imputation to the measure of economic growth for changes in life expectancy. In: Moss M, ed. The measurement of economic and social performance. New York: Columbia University Press for National Bureau of Economic Research, 1973.
- 113 Williamson JG. British mortality and the value of life, 1781–1931. *Popul Stud* 1984; **38**: 157–72.
- 114 Nordhaus W. The health of nations: the contribution of improved health to living standards. In: Murphy K, Topel R, eds. Measuring the gains from medical research: an economic approach. Chicago: University of Chicago Press, 2003: 9–40.
- 115 Suhrcke M, Arce RS, McKee M, Rocco L. Economic costs of ill health in the European Region. In: Figueras J, McKee M, eds. Health systems, health, wealth and societal well-being. Maidenhead: Open University Press, 2012.
- 116 Bourguignon F, Morrisson C. Inequality among world citizens: 1820–1992. *Am Econ Rev* 2002; **92**: 727–44.
- 117 Becker GS, Philipson TJ, Soares RR. The quantity and quality of life and the evolution of world inequality. *Am Econ Rev* 2005; **95**: 277–91.
- 118 Bloom DE, Mahal AJ. Does the AIDS epidemic threaten economic growth? *J Econom* 1997; **77**: 105–24.
- 119 Crafts N, Haacker M. Welfare implications of HIV/AIDS. In: Haacker M, ed. The macroeconomics of HIV/AIDS. Washington, DC: International Monetary Fund, 2004: 182–97.
- 120 Philipson TJ, Soares RR. The economic cost of AIDS in Sub-Saharan Africa: a reassessment. In: Lopez-Casasnovas G, Rivera B, Currais L, eds. Health and economic growth: findings and policy implications. Cambridge, MA: The MIT Press, 2005: 315–38.
- 121 Institute of Medicine Committee on Issues and Priorities for New Vaccine Development, Division of Health Promotion and Disease Prevention. New vaccine development: establishing priorities: volume 1, diseases of importance in the United States. Washington, DC: National Academies Press, 1985.

- 122 Eggleston K, Fuchs V. The new demographic transition: most gains in life expectancy now realized late in life. *J Econ Perspect* 2012; **26**: 137–56.
- 123 Kydland FE, Mundell R, Schelling T, Smith V, Stokey N. Expert panel ranking. In: Lomberg B, ed. *Global problems, smart solutions: costs and benefits*. Cambridge: Cambridge University Press, 2013: 701–16.
- 124 Alkire BC, Vincent JR, Burns CT, Metzler IS, Farmer PE, Meara JG. Obstructed labor and caesarean delivery: the cost and benefit of surgical intervention. *PLoS One* 2012; **7**: e34595.
- 125 Arrow K, Dasgupta P, Goulder LH, Mumford KJ, Oleson K. Sustainability and the measurement of wealth. *Environ Dev Econ* 2012; **17**: 317–53.
- 126 United Nations University- International Human Dimensions Programme on Global Environmental Change, United Nations Environment Programme. *Inclusive wealth report 2012, measuring progress towards sustainability*. Cambridge: Cambridge University Press, 2012. http://www.unep.org/pdf/IWR_2012.pdf (accessed April 28, 2013).
- 127 Sepúlveda J, Bustreo F, Tapia R, et al. Improvement of child survival in Mexico: the diagonal approach. *Lancet* 2006; **368**: 2017–27.
- 128 WHO. *Everybody's business: strengthening health systems to improve health outcomes: WHO's framework for action*. Geneva: World Health Organization, 2007.
- 129 Chen L, Evans T, Anand S, et al. Human resources for health: overcoming the crisis. *Lancet* 2004; **364**: 1984–90.
- 130 Hsia RY, Mbembati NA, Macfarlane S, Kruk ME. Access to emergency and surgical care in sub-Saharan Africa: the infrastructure gap. *Health Policy Plan* 2012; **27**: 234–44.
- 131 Kruk ME, Porignon D, Rockers PC, Van Lerberghe W. The contribution of primary care to health and health systems in low- and middle-income countries: a critical review of major primary care initiatives. *Soc Sci Med* 2010; **70**: 904–11.
- 132 Rabkin M, Kruk ME, El-Sadr WM. HIV, aging and continuity care: strengthening health systems to support services for noncommunicable diseases in low-income countries. *AIDS* 2012; **26** (suppl 1): S77–83.
- 133 Croghan TW, Beatty A, Ron A. Routes to better health for children in four developing countries. *Milbank Q* 2006; **84**: 333–58.
- 134 Farmer PE, Nutt CT, Wagner CM, et al. Reduced premature mortality in Rwanda: lessons from success. *BMJ* 2013; **346**: f65.
- 135 Verguet S, Jamison DT. Estimates of performance in the rate of decline of under-five mortality for 113 low- and middle-income countries, 1970–2010. *Health Policy Plan* 2013; published online Jan 30. DOI:10.1093/heapol/czsl43.
- 136 Norheim OF. Estimated impact on life expectancy and mortality inequality of reducing under-five, maternal, tuberculosis and HIV mortality to a level comparable with four well-performing countries (China, Chile, Costa Rica and Cuba). Commission on Investing in Health Working Paper, 2013. <http://globalhealth2035.org> (accessed Oct 22, 2013).
- 137 Horwitz A. Comparative public health: Costa Rica, Cuba, and Chile. September, 1987. <http://archive.unu.edu/unupress/food/8F093e/8F093E04.htm> (accessed Oct 17, 2013).
- 138 World Health Organization. *World Health Statistics*. 2013. <http://apps.who.int/gho/data/node.main.1?lang=en> (accessed Oct 3, 2013).
- 139 UNAIDS. *Report on the Global AIDS Epidemic, 2012*. Geneva: Joint United Nations Programme on HIV/AIDS, 2012.
- 140 AVERT. *HIV and AIDS in India*. <http://www.avert.org/hiv-aids-india.htm> (accessed Oct 3, 2013).
- 141 India UNICEF. *On World AIDS Day: more pregnant women and children must get treatment*. http://www.unicef.org/india/media_7977.htm (accessed Oct 17, 2013).
- 142 Cousens S, Blencowe H, Stanton C, et al. National, regional, and worldwide estimates of stillbirth rates in 2009 with trends since 1995: a systematic analysis. *Lancet* 2011; **377**: 1319–30.
- 143 Taskforce on Innovative International Financing for Health Systems. *Constraints to scaling up and costs: working group 1 report*. Geneva: International Health Partnership, 2009.
- 144 Schwartländer B, Stover J, Hallett T, et al, and the Investment Framework Study Group. *Towards an improved investment approach for an effective response to HIV/AIDS*. *Lancet* 2011; **377**: 2031–41.
- 145 Bhutta ZA, Das JK, Walker N, et al. Interventions to address deaths from childhood pneumonia and diarrhoea equitably: what works and at what cost? *Lancet* 2013; **381**: 1417–29.
- 146 The International Health Partnership. *OneHealth Tool*. <http://www.internationalhealthpartnership.net/en/tools/one-health-tool/> (accessed April 25, 2013).
- 147 Futures Institute. *OneHealth Tool*. 2011. <http://www.futuresinstitute.org/onehealth.aspx> (accessed Oct 17, 2013).
- 148 WHO. *Essential interventions, commodities and guidelines for reproductive, maternal, newborn and child health*. World Health Organization, Aga Khan University, PMNCH, 2012. http://www.who.int/pmnch/topics/part_publications/essential_interventions_18_01_2012.pdf (accessed Oct 21, 2013).
- 149 Stenberg K, Axelson H, Sheehan P, et al. Advancing social and economic development by investing in women's and children's health: a new Global Investment Framework. *Lancet* 2013; published online Nov 19. DOI:10.1016/S0140-6736(13)62231-X.
- 150 Roll Back Malaria. *Global Malaria Action Plan*. 2011. <http://www.rbm.who.int/rbmgmap.html> (accessed Oct 17, 2013).
- 151 Seddoh A, Onyeze A, Gyapong JO, Holt J, Bundy D. Towards an investment case for neglected tropical diseases. Commission on Investing in Health Working Paper, 2013. <http://globalhealth2035.org> (accessed Oct 22, 2013).
- 152 Molyneux DH, Hotez PJ, Fenwick A. "Rapid-impact interventions": how a policy of integrated control for Africa's neglected tropical diseases could benefit the poor. *PLoS Med* 2005; **2**: e336.
- 153 Jamison DT, Evans JR, King T, Porter I. *China: the health sector*. Washington, DC: World Bank, 1984.
- 154 Pearson TA, Jamison DT, Trejo-Gutierrez J. Cardiovascular disease. In: Jamison DT, Mosley WH, Meashem AR, Bobadilla JL, eds. *Disease control priorities in developing countries*, 1st edn. New York: Oxford University Press, 1993: 577–94.
- 155 Jha P, Ramasundarahettige C, Landsman V, et al. 21st-century hazards of smoking and benefits of cessation in the United States. *N Engl J Med* 2013; **368**: 341–50.
- 156 Wen M, Gu D. Air pollution shortens life expectancy and health expectancy for older adults: the case of China. *J Gerontol A Biol Sci Med Sci* 2012; **67**: 1219–29.
- 157 Whitlock G, Lewington S, Sherliker P, et al, and the Prospective Studies Collaboration. Body-mass index and cause-specific mortality in 900 000 adults: collaborative analyses of 57 prospective studies. *Lancet* 2009; **373**: 1083–96.
- 158 Westphal SA. Obesity, abdominal obesity, and insulin resistance. *Clin Cornerstone* 2008; **9**: 23–29.
- 159 Reilly JJ, Kelly J. Long-term impact of overweight and obesity in childhood and adolescence on morbidity and premature mortality in adulthood: systematic review. *Int J Obes* 2011; **35**: 891–98.
- 160 Lim SS, Vos T, Flaxman AD, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2012; **380**: 2224–60.
- 161 Mozaffarian D, Capewell S. United Nations' dietary policies to prevent cardiovascular disease. *BMJ* 2011; **343**: d5747.
- 162 Chisholm D, Naci H, Hyder AA, Tran NT, Peden M. Cost effectiveness of strategies to combat road traffic injuries in sub-Saharan Africa and South East Asia: mathematical modelling study. *BMJ* 2012; **344**: e612.
- 163 WHO. *Scaling up action against noncommunicable diseases: how much will it cost?* 2011. http://www.who.int/nmh/publications/cost_of_inaction/en/ (accessed Oct 3, 2013).
- 164 WHO. *Prevention and control of NCDs: priorities for investment*. Discussion paper for the First Global Ministerial Conference on Healthy Lifestyles and Noncommunicable Disease Control. Geneva: World Health Organization, 2011.
- 165 Chaloupka FJ, Yurekli A, Fong GT. Tobacco taxes as a tobacco control strategy. *Tob Control* 2012; **21**: 172–80.
- 166 Guindon GE, Tobin S, Yach D. Trends and affordability of cigarette prices: ample room for tax increases and related health gains. *Tob Control* 2002; **11**: 35–43.
- 167 Jha P, Joseph R, Li D, et al. *Tobacco taxes: a win-win measure for fiscal space and health*. Mandaluyong City, Philippines: Asian Development Bank, 2012.
- 168 Nelson TF, Xuan Z, Babor TF, et al. Efficacy and the strength of evidence of U.S. alcohol control policies. *Am J Prev Med* 2013; **45**: 19–28.

- 169 Verguet S, Gauvreau C, Mishra S, et al. Tobacco taxation in China: an extended cost-effectiveness analysis. Disease Control Priorities in Developing Countries, 3rd edn. Working Paper no. 4. Seattle: University of Washington, 2013. <http://www.dcp-3.org/resources/tobacco-taxation-china-extended-cost-effectiveness-analysis> (accessed Oct 17, 2013).
- 170 Mozaffarian D, Appel LJ, Van Horn L. Components of a cardioprotective diet: new insights. *Circulation* 2011; **123**: 2870–91.
- 171 Mozaffarian D, Hao T, Rimm EB, Willett WC, Hu FB. Changes in diet and lifestyle and long-term weight gain in women and men. *N Engl J Med* 2011; **364**: 2392–404.
- 172 Jou J, Techakehakij W. International application of sugar-sweetened beverage (SSB) taxation in obesity reduction: factors that may influence policy effectiveness in country-specific contexts. *Health Policy* 2012; **107**: 83–90.
- 173 Jamison DT, Leslie J, Musgrove P. Malnutrition and dietary protein: evidence from China and from international comparisons. *Food Nutr Bull* 2003; **24**: 145–54.
- 174 Mytton OT, Clarke D, Rayner M. Taxing unhealthy food and drinks to improve health. *BMJ* 2012; **344**: e2931.
- 175 International Monetary Fund. Energy subsidy reform: lessons and implications. Washington, DC: International Monetary Fund, 2013.
- 176 Aldy JE. Designing energy and environmental fiscal instruments to improve public health. Commission on Investing in Health Working Paper, 2013. <http://globalhealth2035.org> (accessed Oct 22, 2013).
- 177 Rivera J, Cordero S. Mexico: healthy food in schools—by law. World Nutrition volume 3, number 11, November 2012. http://www.wphna.org/2012_nov_wn3_legislation_obesity.htm (accessed Oct 17, 2013).
- 178 Clancy L, Goodman P, Sinclair H, Dockery DW. Effect of air-pollution control on death rates in Dublin, Ireland: an intervention study. *Lancet* 2002; **360**: 1210–14.
- 179 WHO. World report on road traffic injury prevention, 2004. Geneva: World Health Organization, 2004.
- 180 Mann JJ, Apter A, Bertolote J, et al. Suicide prevention strategies: a systematic review. *JAMA* 2005; **294**: 2064–74.
- 181 Baumgartner J, Smith KR, Chockalingam A. Reducing cardiovascular diseases through improvements in household energy: implications for policy-relevant research. *Global Heart* 2012; **7**: 243–47.
- 182 Institute of Medicine. Accelerating progress in obesity prevention: solving the weight of the nation, 2011. <http://www.iom.edu/Reports/2012/Accelerating-Progress-in-ObesityPrevention.aspx> (accessed Oct 17, 2013).
- 183 Sandy LG, Tuckson RV, Stevens SL. UnitedHealthcare experience illustrates how payers can enable patient engagement. *Health Aff* 2013; **32**: 1440–45.
- 184 Sacks G, Rayner M, Swinburn B. Impact of front-of-pack 'traffic-light' nutrition labelling on consumer food purchases in the UK. *Health Promot Int* 2009; **24**: 344–52.
- 185 Elbel B, Kersh R, Brescoll VL, Dixon LB. Calorie labeling and food choices: a first look at the effects on low-income people in New York City. *Health Aff* 2009; **28**: w1110–21.
- 186 Mozaffarian D, Stampfer MJ. Removing industrial trans fat from foods. *BMJ* 2010; **340**: c1826.
- 187 Larson N, Story M. Menu labeling: does providing nutrition information at the point of purchase affect consumer behavior? A research synthesis. Healthy Eating Research, Robert Wood Johnson Foundation, June 2009. http://www.healthyeatingresearch.org/images/stories/her_research_briefs/her_menu_labeling_brief_06_29_09_final.pdf (accessed Oct 17, 2013).
- 188 Rodgers A, Patel A, Berwanger O, et al, and the PILL Collaborative Group. An international randomised placebo-controlled trial of a four-component combination pill ("polypill") in people with raised cardiovascular risk. *PLoS One* 2011; **6**: e19857.
- 189 WHO. Investing in mental health: evidence for action. Geneva: World Health Organization, 2013.
- 190 Debas HT, Gosselin R, McCord C, Thind A. 2006. Surgery. In: Jamison DT, Breman JG, Measham AR, et al, eds. Disease control priorities in developing countries, 2nd edn. New York: Oxford University Press, 2006: 1245–59.
- 191 Norton R, Kobusingye O. Injuries. *N Engl J Med* 2013; **368**: 1723–30.
- 192 Gaziano T, Reddy KS, Paccaud F, Horton S, Chatuverdi V. Cardiovascular disease. In: Jamison DT, Breman JG, Measham AR, Alleyne G, et al, eds. Disease control priorities in developing countries, 2nd edn. New York: Oxford University Press, 2006: 645–62.
- 193 Bukhman G, Kidder A, eds. The PIH guide to chronic care integration for endemic non-communicable diseases. Partners in Health, Harvard Medical School, Brigham and Women's Hospital, 2011. <http://www.pih.org/library/the-pih-guide-to-chronic-care-integration-for-endemic-non-communicable-dise> (accessed Oct 17, 2013).
- 194 Gupta S, Clements B, Coady D. The challenge of health care reform in advanced and emerging economies. In: Clements B, Coady D, Gupta S, eds. The economics of public health care reform in advanced and emerging economies. Washington, DC: International Monetary Fund, 2012: 3–21.
- 195 World Bank. World Development Indicators 2012. Washington, DC: World Bank, 2012.
- 196 Africa Progress Panel. 2013 Africa Progress Report—equity in extractives: stewarding Africa's natural resources for all. 2013. <http://www.africaprogresspanel.org/en/publications/africa-progress-report-2013/apr-documents/> (accessed Oct 17, 2013).
- 197 Pablos-Méndez A, Tabish H, de Ferranti D. The cost disease and global health. In: Baumol W, ed. The cost disease: why computers get cheaper and health care doesn't. New Haven: Yale University Press, 2012: 94–108.
- 198 WHO. Health systems financing: the path to universal coverage. 2010. <http://www.who.int/whr/2010/en/index.html> (accessed Feb 4, 2013).
- 199 Bobadilla JL, Cowley P, Musgrove P, Saxenian H. Design, content and financing of an essential national package of health services. *Bull World Health Organ* 1994; **72**: 653–62.
- 200 Wagstaff A. Measuring financial protection in health. In: Smith, PC, Mossialos E, Papanicolas I, Leatherman S, eds. Performance measurement for health system improvement. Cambridge: Cambridge University Press, 2010: 114–37.
- 201 Central Office of Information. The new National Health Service. Leaflet prepared for the Ministry of Health. London: Central Office of Information, 1948.
- 202 Moreno-Serra R, Millett C, Smith PC. Towards improved measurement of financial protection in health. *PLoS Med* 2011; **8**: e1001087.
- 203 Finkelstein A, McKnight R. What did Medicare do (and was it worth it)? NBER Working Paper Series no. 11609. September, 2005. <http://www.nber.org/papers/w11609> (accessed Oct 17, 2013).
- 204 Enthoven A, Kronick R. A consumer-choice health plan for the 1990s. Universal health insurance in a system designed to promote quality and economy (1). *N Engl J Med* 1989; **320**: 29–37.
- 205 Roberts MJ, Hsiao W, Berman P, Reich MR. Getting health reform right: a guide to improving performance and equity. New York: Oxford University Press, 2004.
- 206 WHO. The world health report 2000 – health systems: improving performance. Geneva: World Health Organization, 2000.
- 207 WHO. The world health report 2010 – health systems financing: the path to universal coverage. Geneva: World Health Organization, 2010.
- 208 Verguet S, Laxminarayan R, Jamison DT. Universal public finance of tuberculosis treatment in India: an extended cost-effectiveness analysis. *Health Econ* (in press).
- 209 Smith PC. Incorporating financial protection into decision rules for publicly financed healthcare treatments. *Health Econ* 2013; **22**: 180–93.
- 210 Giedion U, Alfonso EA, Díaz Y. The impact of universal coverage schemes in the developing world: a review of the existing evidence. Washington, DC: World Bank, 2013.
- 211 Hernández-Torres J, Avila-Burgos L, Valencia-Mendoza A, Poblano-Verástegui O. [Seguro Popular's initial evaluation of household catastrophic health spending in Mexico]. *Rev Salud Publica* 2008; **10**: 18–32 [in Spanish].
- 212 Evans TG, Chowdhury AMR, Evans DB, et al. Thailand's universal coverage scheme: achievements and challenges. Bangkok: Health Insurance System Research Office, 2012.
- 213 Limwattananon S, Tangcharoensathien V, Prakongsai P. Catastrophic and poverty impacts of health payments: results from national household surveys in Thailand. *Bull World Health Organ* 2007; **85**: 600–06.

- 214 Wagstaff A, Yu S. Do health sector reforms have their intended impacts? The World Bank's Health VIII Project in Gansu Province, China. *J Health Econ* 2007; **26**: 505–35.
- 215 Gwatkin DR, Ergo A. Universal health coverage: friend or foe of equity? *Lancet* 2011; **377**: 2160–61.
- 216 Brundtland GH. Message from the Director General. World Health Report, World Health Organization, 1999. http://www.who.int/whr/1999/en/whr99_dgmessage_en.pdf (accessed Oct 17, 2013).
- 217 Bosch M, Cobacho MB, Pages C. Taking stock of nine years of implementation of Seguro Popular in Mexico: lessons for developing countries. 2012. <http://siteresources.worldbank.org/EXTLACOFFICEOFCE/Resourses/870892-1265238560114/CPagesPaper.pdf> (accessed Oct 17, 2013).
- 218 World Bank. Mexico's system for social protection in health and the formal sector. A literature review. Human Development Department, Latin America and the Caribbean Regional Office. Washington, DC: The World Bank, 2012.
- 219 Towse A, Mills A, Tangcharoensathien V. Learning from Thailand's health reforms. *BMJ* 2004; **328**: 103–05.
- 220 Limwattananon S, Tangcharoensathien V, Tisayaticom K, Boonyapaisarncharoen T, Prakongsai P. Why has the Universal Coverage Scheme in Thailand achieved a pro-poor public subsidy for health care? *BMC Public Health* 2012; **12** (suppl 1): S6.
- 221 Sekhri N, Savedoff W. Regulating private health insurance to serve the public interest: policy issues for developing countries. *Int J Health Plann Manage* 2006; **21**: 357–92.
- 222 Frakt A. Almost any cost is catastrophic if you are poor. 2013. <http://www.nytimes.com/roomfordebate/2013/05/06/more-medicaid-more-health/almost-any-cost-is-catastrophic-if-you-are-poor> (accessed Oct 17, 2013).
- 223 Organisation for Economic Co-operation and Development. Health status. 2013. http://stats.oecd.org/index.aspx?DataSetCode=HEALTH_STAT (accessed Oct 17, 2013).
- 224 Cheng T-M. Taiwan Province of China's experience with universal health coverage. In: Clements B, Coody D, Gupta S, eds. The economics of public health care reform in advanced and emerging economies. Washington, DC: International Monetary Fund, 2012: 253–79.
- 225 Stabile M, Thomson S, Allin S, et al. Health care cost containment strategies used in four other high-income countries hold lessons for the United States. *Health Aff* 2013; **32**: 643–52.
- 226 Figueras J, Robinson R, Jakubowski E. Purchasing to improve health systems performance. Maidenhead: Open University Press, 2005. http://www.euro.who.int/__data/assets/pdf_file/0004/98428/E86300.pdf.
- 227 Loevinsohn B, Harding A. Buying results? Contracting for health service delivery in developing countries. *Lancet* 2005; **366**: 676–81.
- 228 Evans D. Contracting and health. *Bull World Health Organ* 2006; **84**: 850–51.
- 229 House of Commons Health Committee. Commission. 2010. <http://www.publications.parliament.uk/pa/cm200910/cmselect/cmhealth/268/268i.pdf#page=10> (accessed Oct 17, 2013).
- 230 Oxley H. Improving health care system performance through better coordination of care. In: Achieving better value for money in health care. Paris: Organisation for Economic Co-operation and Development, 2009: 79–100.
- 231 Bloom D, Cafiero E, Jané-Llopis E, et al. The global burden of noncommunicable diseases. Geneva: World Economic Forum, 2011.
- 232 Colombo F, Tapay N. Private health insurance in OECD countries: the benefits and costs for individuals and health systems. Organisation for Economic Co-operation and Development, 2004. <http://www.oecd.org/els/health-systems/33698043.pdf> (accessed Oct 17, 2013).
- 233 WHO. National health accounts database. <http://apps.who.int/nha/database/DataExplorerRegime.aspx> (accessed Oct 17, 2013).
- 234 Baicker K, Goldman D. Patient cost-sharing and healthcare spending growth. *J Econ Perspect* 2011; **25**: 47–68.
- 235 Krivelli E, Leive A, Stratmann T. Subnational health spending and soft budget constraints in OECD countries. IMF Working paper 2010. <http://www.imf.org/external/pubs/ft/wp/2010/wp10147.pdf> (accessed Oct 3, 2013).
- 236 Calsyn M, Lee EO. Alternatives to fee-for-service payments in health care. 2012. <http://www.americanprogress.org/wp-content/uploads/2012/09/FeeforService-1.pdf> (accessed Oct 17, 2013).
- 237 Feachem RGA, Sekhri NK, White KL. Getting more for their dollar: a comparison of the NHS with California's Kaiser Permanente. *BMJ* 2002; **324**: 135–41.
- 238 Chen JY, Tian H, Taira Juarez D, et al. The effect of a PPO pay-for-performance program on patients with diabetes. *Am J Manag Care* 2010; **16**: e11–19.
- 239 Basinga P, Gertler PJ, Binagwaho A, Soucat ALB, Sturdy J, Vermeersch CMJ. Effect on maternal and child health services in Rwanda of payment to primary health-care providers for performance: an impact evaluation. *Lancet* 2011; **377**: 1421–28.
- 240 Bonfrer I, Soeters R, van de Poel E, et al. The effects of performance-based financing on the use and quality of health care in Burundi: an impact evaluation. *Lancet* 2013; **381**: S19.
- 241 Witter S, Fretheim A, Kessy FL, Lindahl AK. Paying for performance to improve the delivery of health interventions in low- and middle-income countries. *Cochrane Database Syst Rev* 2012; **2**: CD007899.
- 242 Lee JL, Fischer MA, Shrank WH, Polinski JM, Choudhry NK. A systematic review of reference pricing: implications for US prescription drug spending. *Am J Manag Care* 2012; **18**: e429–37.
- 243 United Nations Development Programme. Human Development Report 1994. New Dimensions of Human Security. New York and Oxford: Oxford University Press, 1994.
- 244 Brundtland GH, Sachs J, Feachem RGA. World Health Organization and Commission on Macroeconomics and Health. Working Group 2. Global public goods for health: The report of Working Group 2 of the Commission on Macroeconomics and Health. Geneva: World Health Organization, 2002.
- 245 WHO. Eleventh General Programme of Work. Geneva: World Health Organization, 2010. http://apps.who.int/gb/ebwha/pdf_files/WHA63/A63_30-en.pdf (accessed Oct 17, 2013).
- 246 Jamison DT, Frenk J, Knaul F. International collective action in health: objectives, functions, and rationale. *Lancet* 1998; **351**: 514–17.
- 247 Frenk J, Moon S. Governance challenges in global health. *N Engl J Med* 2013; **368**: 936–42.
- 248 IJsselmuiden CI, Matlin. Why health research? 2006. http://whqlibdoc.who.int/publications/2006/2940286477_eng.pdf (accessed Oct 17, 2013).
- 249 Hecht R, Jamison DT. Vaccine research and development assessment paper. In: Lomborg B, ed. Rethink HIV: smarter ways to invest in ending HIV in sub-Saharan Africa. New York: Cambridge University Press, 2012: 299–320.
- 250 Goldie SJ, Sweet S. Research and development. Commission on Investing in Health Working Paper. 2013. <http://globalhealth2035.org> (accessed Oct 22, 2013).
- 251 Torjesen I. Antimicrobial resistance presents an "apocalyptic" threat similar to that of climate change, CMO warns. *BMJ* 2013; **346**: f1597.
- 252 Global Alliance for TB Drug Development. MDR-TB/XDR-TB. 2013. <http://www.tballiance.org/why/mdr-xdr.php> (accessed Aug 10, 2013).
- 253 Lightfoot N, Rweyemamu M, Heymann DL. Preparing for the next pandemic. *BMJ* 2013; **346**: f364.
- 254 Jamison DT, Jha P, Malhotra V, Verguet S. Human health: the twentieth century transformation of human health—its magnitude and value. In: Lomborg B, ed. How much have global problems cost the world? A scorecard from 1900 to 2050. Cambridge: Cambridge University Press, 2013: 207–46.
- 255 Liu J, Modrek S, Gosling RD, Feachem RGA. Malaria eradication: is it possible? Is it worth it? Should we do it? *Lancet Glob Health* 2013; **1**: e2–3.
- 256 The Global Health Group. Maintaining the gains in global malaria control: the health and economic benefits of sustaining control measures. October, 2011. <http://MaintainTheGains.org> (accessed Aug 8, 2013).
- 257 Ebrahim S, Pearce N, Smeeth L, Casas JP, Jaffar S, Piot P. Tackling non-communicable diseases in low- and middle-income countries: is the evidence from high-income countries all we need? *PLoS Med* 2013; **10**: e1001377.
- 258 Yamey G. Scaling up global health interventions: a proposed framework for success. *PLoS Med* 2011; **8**: e1001049.
- 259 Black AD, Car J, Pagliari C, et al. The impact of eHealth on the quality and safety of health care: a systematic overview. *PLoS Med* 2011; **8**: e1000387.

- 260 Free C, Phillips G, Watson L, et al. The effectiveness of mobile-health technologies to improve health care service delivery processes: a systematic review and meta-analysis. *PLoS Med* 2013; **10**: e1001363.
- 261 Downs S, Montagu D, Da Rita P, Brashers E, Feachem RGA. Health system innovation in Lesotho: design and early operations of the Maseru public-private integrated partnership. Healthcare public-private partnerships series, no. 1. San Francisco: The Global Health Group, Global Health Sciences, University of California, San Francisco, and PwC, 2013.
- 262 Bloomberg MR. Why is Obama caving on tobacco? *New York Times* (New York), August 22, 2013.
- 263 Lee K, Collin J. "Key to the future": British American tobacco and cigarette smuggling in China. *PLoS Med* 2006; **3**: e228.
- 264 Lagomarsino G, Garabrant A, Adyas A, Muga R, Otoo N. Moving towards universal health coverage: health insurance reforms in nine developing countries in Africa and Asia. *Lancet* 2012; **380**: 933–43.
- 265 Berman P, Bitran R. Health systems analysis for better health systems strengthening. World Bank HNP Discussion Paper. Washington, DC: The World Bank, 2011.
- 266 Barrett S. Economic considerations for the eradication endgame. *Philos Trans R Soc Lond B Biol Sci* 2013; **368**: 20120149.
- 267 Röttingen J-A, Chamas C. A new deal for global health R&D? The recommendations of the Consultative Expert Working Group on Research and Development (CEWG). *PLoS Med* 2012; **9**: e1001219.
- 268 WHO Ad Hoc Committee on Health Research Relating to Future Intervention Options. Investing in health research and development. Geneva: World Health Organization, 1996.