GLOBAL HEALTH 2035

THE LANCET

Global health 2035: a world converging within a generation

Dean T Jamison, Lawrence H Summers*, George Alleyne, Kenneth J Arrow, Seth Berkley, Agnes Binagwaho, Flavia Bustreo, David Evans, Richard G A Feachem, Julio Frenk, Gargee Ghosh, Sue J Goldie, Yan Guo, Sanjeev Gupta, Richard Horton, Margaret E Kruk, Adel Mahmoud, Linah K Mohohlo, Mthuli Ncube, Ariel Pablos-Mendez, K Srinath Reddy, Helen Saxenian, Agnes Soucat, Karen H Ulltveit-Moe, Gavin Yamey*

Lancet 2013; 382: 1898–955

Published **Online** December 3, 2013 http://dx.doi.org/10.1016/S0140-6736(13)62105-4

This online publication has been corrected. The corrected version first appeared at thelancet.com on Jan 17, 2014

See **Comment** pages 1859, 1861, e33, e34, e36, and e38

*Denotes co-first authors

See **Online** for video infographic

Department of Global Health, University of Washington, Seattle, WA, USA (Prof D T Jamison PhD); **Harvard University, Cambridge, MA, USA** (Prof L H Summers PhD); **Harvard School of Public Health, Harvard University, Cambridge, MA, USA** (Prof J Frenk MD, Prof S J Goldie MD); **University of the West Indies, Kingston, Jamaica** (Prof G Alleyne MD); **Department of Economics and Center for Health Policy, Stanford University, Stanford, CA, USA** (Prof K J Arrow PhD); **Executive Office, GAVI Alliance, Geneva, Switzerland** (S Berkley MD); **Ministry of Health, Kigali, Rwanda** (A Binagwaho MD [Ped]); **Family, Women's, and Children's Health** (F Bustreo MD) **and Department of Health Systems Financing** (D Evans PhD), **World Health Organization, Geneva, Switzerland; Global Health Group, University of California, San Francisco, CA, USA** (Prof R G A Feachem DSc [Med], G Yamey MD); **Development Policy and Finance, Bill & Melinda Gates Foundation, Washington, DC, USA** (G Ghosh MSc); **Health Science Center, Peking University,**

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 assistance[3]—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?

Beijing, China (Prof Y Guo MPH); **Fiscal Affairs Department, International Monetary Fund, Washington, DC, USA** (S Gupta PhD); ***The Lancet*, London, UK** (R Horton FMedSci); **Department of Health Policy and Management, Mailman School of Public Health, Columbia University, New York, NY, USA** (M E Kruk MD); **Department of Molecular Biology and Woodrow Wilson School, Princeton University, Princeton, NJ, USA** (Prof A Mahmoud MD); **Bank of Botswana, Gaborone, Botswana** (L K Mohohlo MSc); **Chief Economist's Office** (Prof M Ncube PhD) **and Human Development Department** (A Soucat MD); **African Development Bank Group, Tunis, Tunisia; Bureau for Global Health, United States Agency for International Development, Washington, DC, USA** (A Pablos-Mendez MD); **Public Health Foundation of India, New Delhi, India** (Prof K S Reddy DM [Card]); **Results for Development Institute, Washington, DC, USA** (H Saxenian PhD); **and Department of Economics, University of Oslo, Oslo, Norway** (Prof K H Ulltveit-Moe PhD)

Correspondence to:
Dr Gavin Yamey, Evidence to Policy initiative, Global Health Group, 50 Beale Street, Suite 1200, Box 1224, San Francisco, CA 94105, USA
yameyg@globalhealth.ucsf.edu

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.

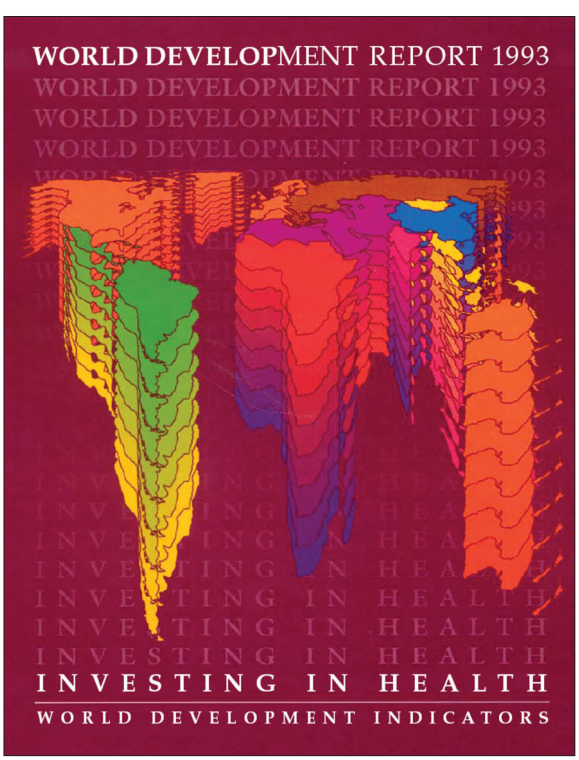

Figure 1: **The World Development Report 1993**

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

***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.

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 system[21] (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 Project[24] 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.

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

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

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.

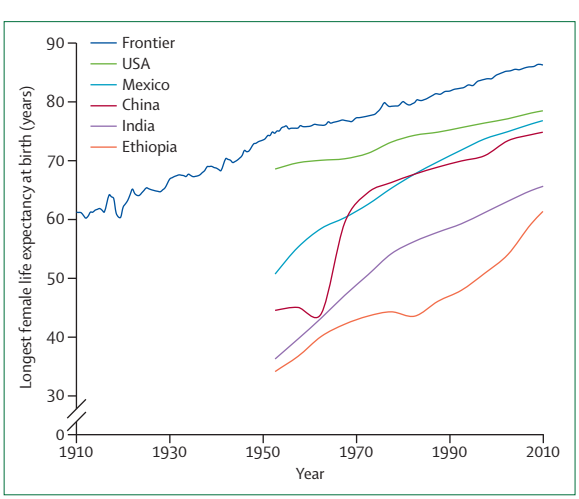

Figure 2: **Female life expectancy at birth for selected countries compared with the frontier**

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.

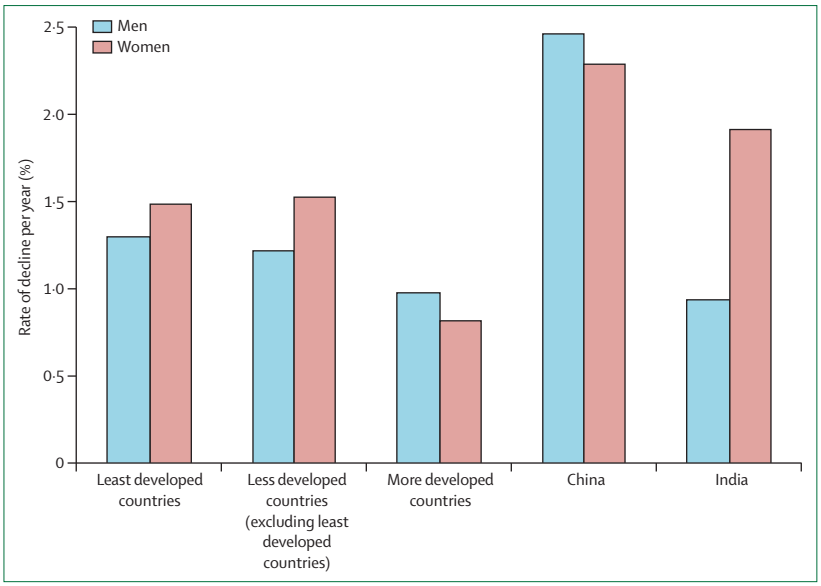

Figure 3: **Annual rates of decrease in adult mortality by sex and income group, 1992–2012**
Adult mortality rates are defined as the probability of dying between the ages of 15 and 60 years at the age-specific mortality rates of the indicated year (denoted by demographers as 45q15). The bars show the 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.

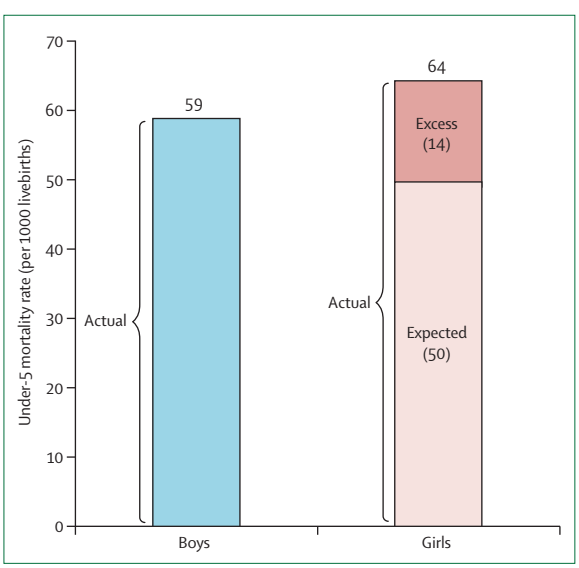

Figure 4: **Excess under-5 mortality rate in girls compared with boys in India, 2005**
In low-income and middle-income countries as a group, the under-5 mortality rate is 18% higher for boys. The expected under-5 mortality rate for girls in India shows what the female rate is expected to be, given the 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 susbstantially 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-based 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

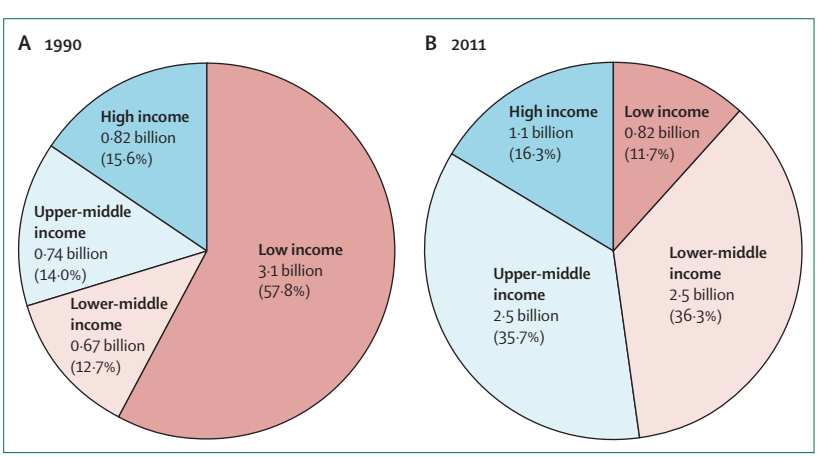

Figure 5: **Movement of populations from low income to higher income between 1990 and 2011**
Data refer to classifications based on (A) 1990 and (B) 2011 gross national income per head that were the basis for the World Bank's lending classifications for its financial year 1992 and financial year 2013, 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.

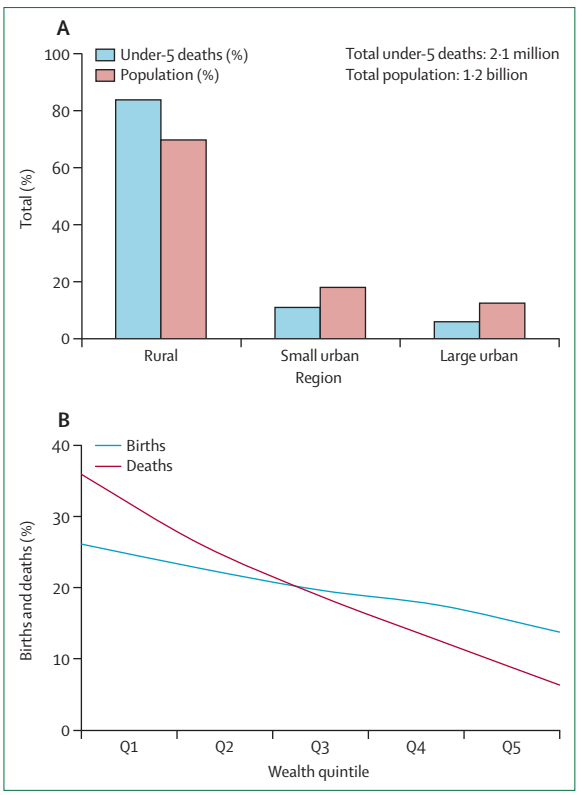

Figure 6: **Child deaths and births by region and wealth quintile in India, early 2000s**
(A) Under-5 deaths and total population in rural and urban India. (B) Births and under-5 deaths by wealth quintile in India. Data for (A) from reference 79; data for (B) from reference 40.

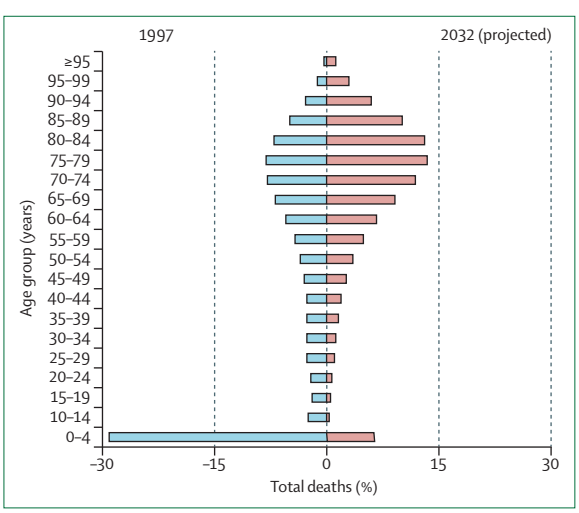

Figure 7: **Evolving age distribution of mortality in south Asia**
The 1997 side of the figure shows estimates averaged for the period 1995–2000 and the 2032 side shows the UN medium projections for 2030–35. Data from reference 37.

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 climactic 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.

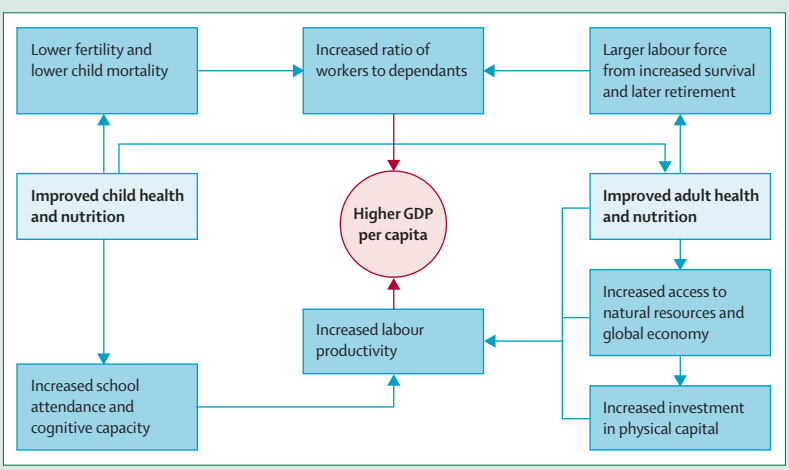

***Figure 8*: Links between health and GDP per person**
Adapted with permission from reference 101.

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.

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 Canning[98] 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 studies[103] 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