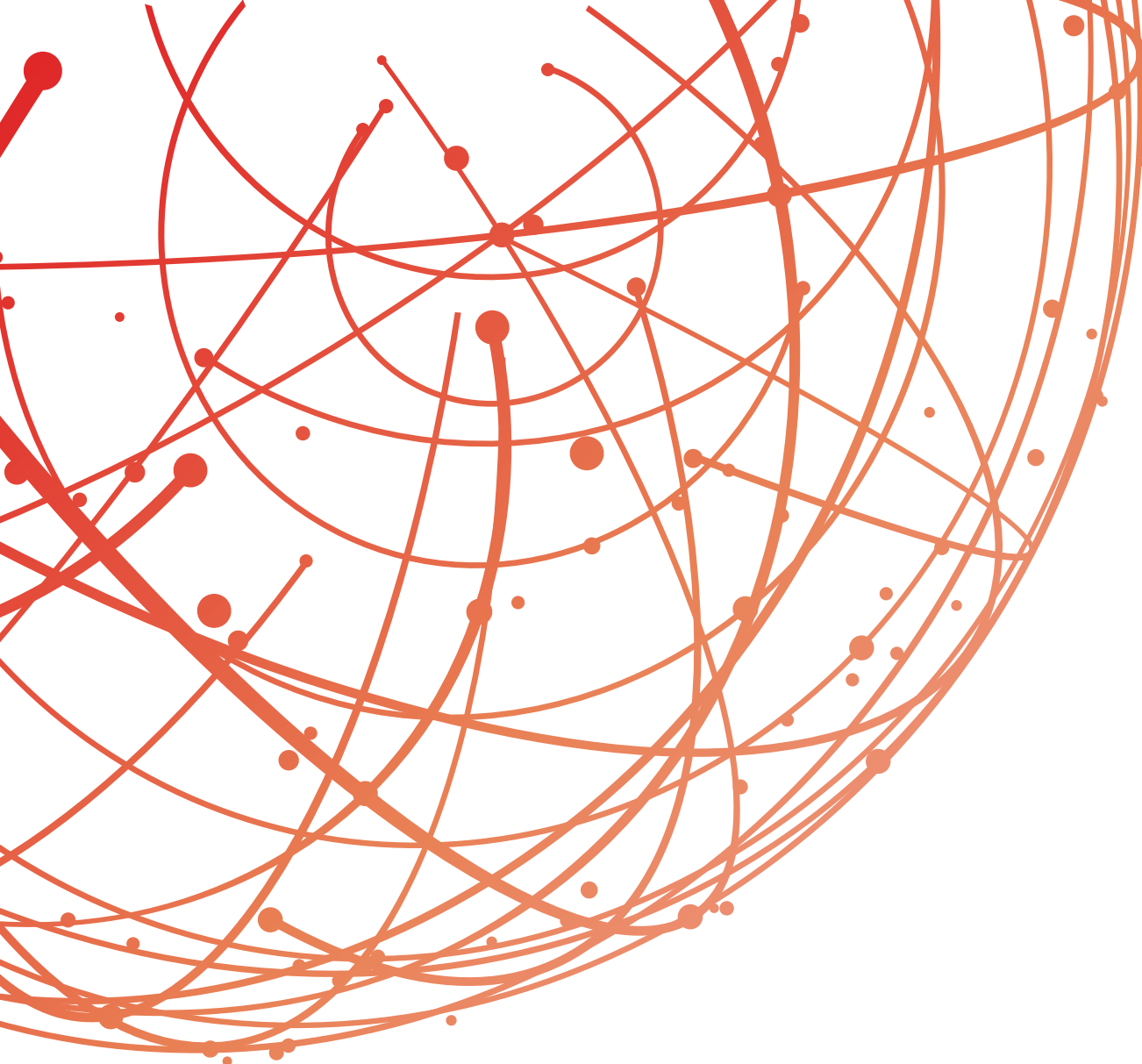




INVESTING IN HEALTH THE ECONOMIC CASE

Report of the WISH Investing in Health Forum 2016

Dean Jamison
Gavin Yamey
Naomi Beyeler
Hester Wadge



INVESTING IN HEALTH THE ECONOMIC CASE

Report of the WISH Investing in Health Forum 2016

CONTENTS

03	Foreword
04	Executive summary
07	Introduction
10	Section 1: Why invest in health – focused health sector investments yield impressive economic returns
18	Section 2: How to finance healthcare – through public financing
29	Section 3: What to invest in – a package of high-impact interventions
34	A concluding case study
35	Appendix: Evidence tables
39	Abbreviations and glossary
42	Acknowledgments
44	References

FOREWORD

Over the past few decades, national governments and aid agencies have made remarkable progress combatting the diseases that are the main cause of child mortality, as well as against HIV/AIDS, tuberculosis and malaria. This progress was mostly due to investments in scaling-up highly effective health interventions, such as malaria bed nets, childhood vaccinations and antiretroviral medicines to treat HIV infection.

Yet attention is now moving away from these successful investments. Our aim with this World Innovation Summit for Health (WISH) report is to step back and undertake a careful reconsideration of the benefits of continued investment in health.

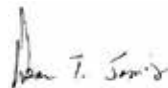
We call on finance ministries and aid agencies to be wary of complacency and maintain investments shown to have worked at large scale. In this report, decision-makers allocating resources will find the economic evidence they need to inform discussion concerning health investments in the coming decade.

In many parts of the world, the burden of maternal and child mortality, and deaths from infectious diseases remains stubbornly high. This burden is compounded by population aging and, in consequence, an explosion in the rate of non-communicable diseases that threaten the health and economies of developing countries. Medical expenditures continue to cause financial ruin for 150 million people each year and the recent outbreaks of the Zika and Ebola viruses have demonstrated all too clearly that the global health system still has weaknesses and vulnerabilities.

With the right health investments, we can meet these challenges. We can ensure that: life-saving medicines, vaccines and diagnostic tests are delivered to everyone who could benefit from them; we are investing in tomorrow's health technologies; and we are building a global system that is ready to tackle the next generation of health threats. With the right health investments, a transformation in global health is within our reach.

A handwritten signature in black ink, appearing to read 'A. V. Darzi'.

**Professor the Lord Darzi of Denham,
OM, KBE, PC, FRS**
Executive Chair, WISH, Qatar Foundation
Director, Institute of Global Health
Innovation, Imperial College London

A handwritten signature in black ink, appearing to read 'Dean T. Jamison'.

Professor Dean Jamison
Professor Emeritus,
University of California,
San Francisco

EXECUTIVE SUMMARY

Developing country governments and aid agencies face difficult decisions on how best to allocate their finite resources. Investments in many different sectors – including education, water and sanitation, transportation, and health – can all reap social and economic benefits. This report focuses specifically on the health sector. It presents compelling evidence of the value of scaling-up health investments. The economic case for increasing these investments in health has never been stronger.

Having made progress in reducing maternal and child mortality, and deaths from infectious diseases, it is essential that policymakers do not become complacent. These gains will be quickly reversed without sustained health investments. Scaled-up investments will be needed to tackle the emerging non-communicable disease (NCD) burden and to achieve universal health coverage (UHC).

This report addresses three key questions:

1. What is the economic rationale for investing in health?

Investing in health is an investment in economic prosperity through multiple pathways:

- **Education** – healthier, well-nourished children are more likely to go to school and stay there longer, which is linked to higher earnings in adulthood.
- **Productivity** – healthy people work harder and better, and are less likely to take days off.
- **Investment** – people are more likely to save money when they expect to live longer and businesses are more likely to invest in countries with healthier populations.
- **Resources** – access to natural resources is opened up when endemic diseases such as malaria or river blindness are tackled.
- **Demographics** – when mortality rates fall, women have fewer children, which temporarily increases the proportion of working-age people to their dependents.

Through these pathways, investing in health boosts individual and household incomes. These economic benefits are also seen at a national level, in the gross domestic product (GDP).

However, if policymakers only use the GDP to estimate these benefits, they will not see the full picture. When asked, people put a high monetary value on the additional years of life that health investments can bring – an inherent value to being alive for longer, unrelated to productivity. Policymakers need to do more to make sure health spending reflects people's priorities.

2. What is the best way to finance health?

To make sure services are accessible to all, governments have a clear role to play in financing health. Without public financing, there will be some who cannot afford the care they need, and they will be forced to choose sickness – perhaps even death – and financial ruin; a devastating choice that already pushes 150 million people into poverty every year.

In low-income countries (LICs) and middle-income countries (MICs), public financing should be used to achieve universal coverage with a package of highly cost-effective interventions ('best buys'). For this package, there should be zero or very low out-of-pocket payments, defined as fee-for-service charges at the point of care without the benefit of insurance (out-of-pocket payments exclude pre-payment in the form of taxes or insurance premiums). Domestic resource mobilization should be coupled with strategies to increase the efficiency of spending.

Public finance capacity at the outset will be limited and interventions outside the package will initially need to be privately financed. As a country's resources grow, the package of publicly financed interventions can expand over time.

Governments failing to protect the health and wealth of their people in this way will be unable to reap the benefits of long-term economic prosperity and growth. Public financing has the benefit of being more efficient and better at controlling costs than private financing and is the only sustainable way to reach UHC. In addition, people put a high economic value on the protection against financial risk that public financing provides.

In many developing countries, domestic public financing will need to be supplemented by external health aid from donor governments, multilateral agencies and foundations. Health aid has a proven history of success within countries tackling the diseases of poverty, but also globally, with the development of a substantial harvest of new innovations.

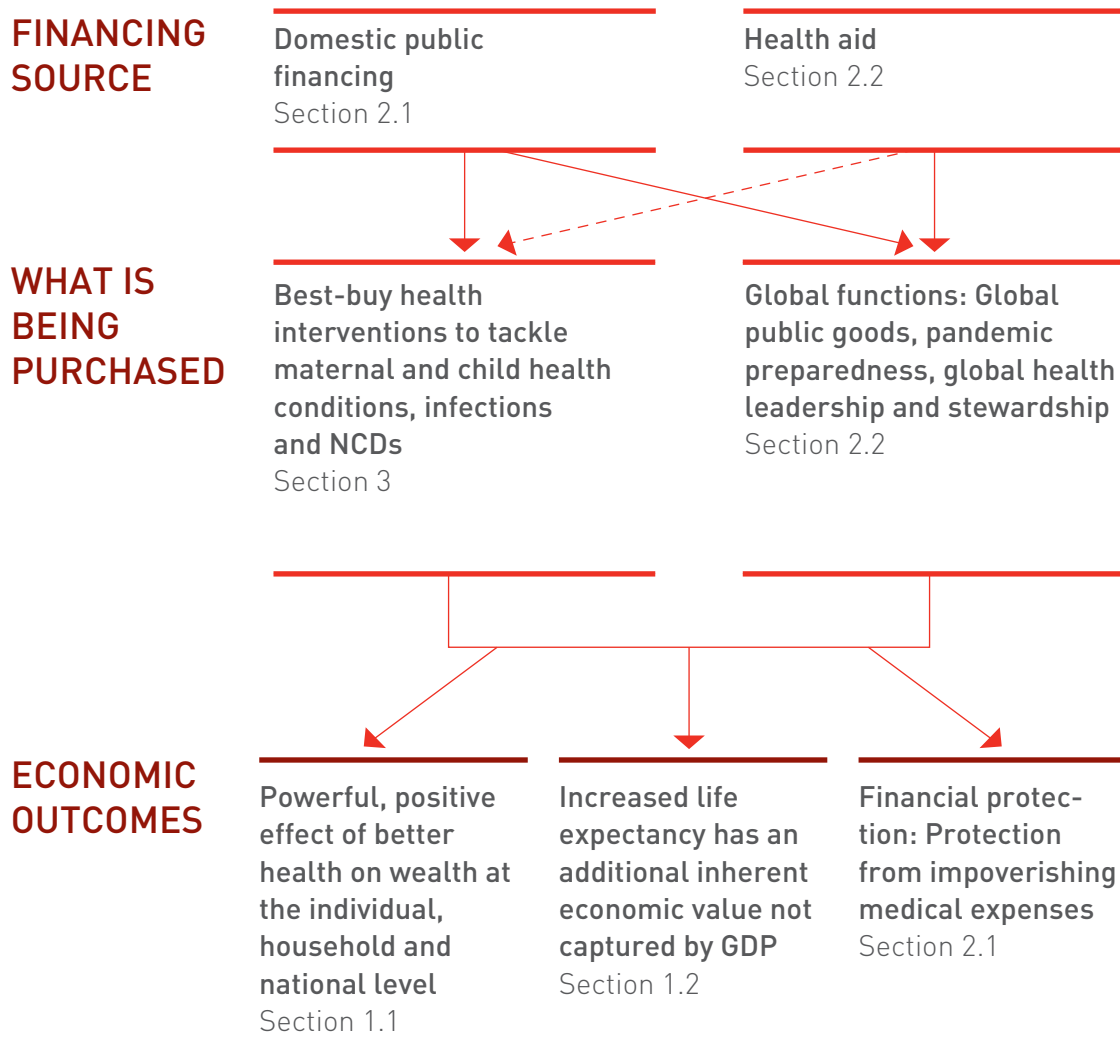
Just as GDP fails to capture the inherent value of extra life years, there has also been a failure to capture the full economic value of publicly financed insurance and donor investments in health.

3. Which interventions should be prioritized?

Investing in best-buy interventions that are targeted to local need, such as vaccinations, family planning and antiretroviral medicines to treat HIV, is the fastest and most effective way to reduce mortality. Dramatic health improvements are possible through scaling-up best buys, even when social and economic conditions are poor. These interventions provide high levels of health and financial protection with impressive economic returns.

Figure 1 shows an organizing framework for this report, summarizing the key arguments.

Figure 1: How investing in health boosts wealth – an organizing framework for the report



INTRODUCTION

Why policymakers should prioritize health

This generation has seen a remarkable transformation in health. Almost seven million fewer children are dying today than in 1990.¹ Average global life expectancy has been extended by six years since 1990, such that a child born today can expect to live to 71 years of age.²

It is health that is real wealth and not pieces of gold and silver.

Mahatma Gandhi

Based on these successes, which were largely due to health sector investments,³ it would be tempting for policymakers to conclude that the time is right to shift their investments away from the health sector and toward other sectors, such as climate or agriculture. This report argues that this shift could threaten recent progress and cause a sharp rise in avoidable deaths.

After a so-called 'golden decade' for health in which health aid tripled,^{4,5} health is now slipping down the development agenda.⁶ This demotion is of grave concern. Health has arguably made the largest contribution to sustainable development.

For example, Arrow and colleagues estimated the contribution of five sectors – education, natural resources, climate (carbon damages), physical capital (machines, buildings, etc.) and health – to wealth in five countries over the time period 1995–2000. They found that improved health contributes more to wealth than the other sectors combined.⁷

The governments of developing countries face difficult choices given that their economic growth has slowed in recent years. Sub-Saharan Africa, for example, grew at a rate of just 3.4 percent in 2015 and is projected to grow by three percent in 2016,⁸ lower than its growth from 2004 to 2013. In this context, governments should be guided by the best available evidence when it comes to allocating resources across different sectors. This report shows that the economic returns for investing in health are very large and that health spending is an efficient form of resource allocation.

Targeted health spending on highly cost-effective health interventions is a positive investment that promotes wellbeing and economic prosperity. The right health investments are not a drain on the economy; they have the opposite effect.^{9,10} An objective review of the evidence on investing in health would suggest that, instead of retreating from health, finance ministers of LICs and MICs and aid agencies should scale-up their health investments.

The context

Beyond the economic arguments, three profound changes in the international health landscape offer further rationale for prioritizing focused health investments:

- **The transition from the 2015 Millennium Development Goals to the 2030 Sustainable Development Goals (SDGs).** The adoption of 17 SDGs by United Nations member states in September 2015 greatly expanded the list of health challenges countries have now promised to tackle. The SDGs include targets for maternal and child health, infections, NCDs, injuries, mental health and substance misuse.
- **The explosion of NCDs.** The developing world is seeing a slow but relentless transition from predominantly youthful demographics to aging populations. One consequence is a shift in the burden of disease from infections to NCDs. Many LICs and MICs are now struggling with rising rates of NCDs such as cancer, cardiovascular disease and diabetes, with a dual health and economic burden.
- **The stagnation of aid for health.** In recent years, health aid has stagnated and even appeared to decline from 2013 to 2014.¹¹ Given the tremendous pay-offs of health aid, including impressive health progress and large economic returns, there is a strong case for donors to increase the proportion of their aid that is directed at health investments.

In this era of unprecedented transitions, the health and economic case for scaling-up focused health investments – both domestically and from aid agencies – has never been stronger. The national and global impacts could be transformative.

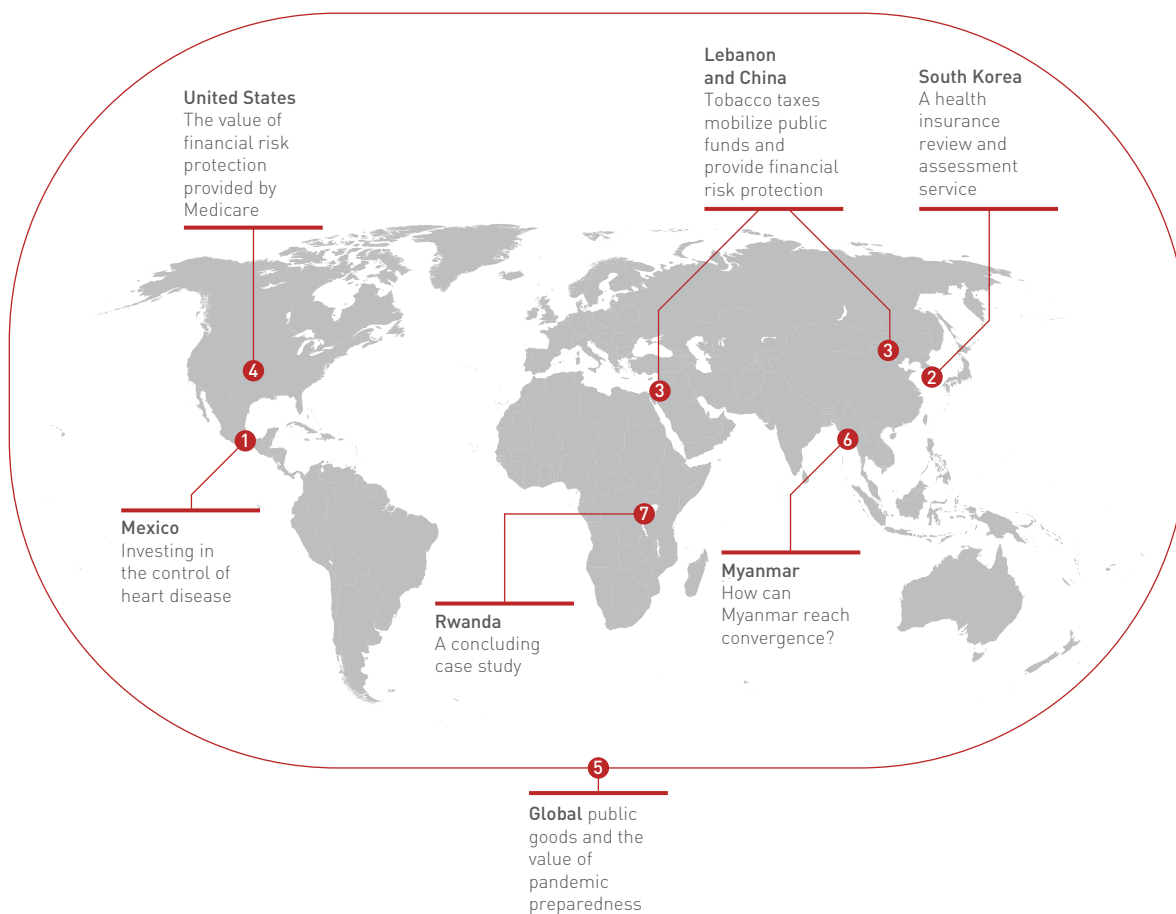
A child born today in a poor country has a staggering one in 10 risk of dying before her fifth birthday. In Spain, her risk is just one in 300.¹² With the right health investments, this dramatic gap can be closed – a ‘grand convergence in health’ – saving millions of lives every year, while reaping tremendous economic returns. There is no better way to improve human welfare over the next generation.

Who is this report for?

This report builds on the work of the Lancet Commission on Investing in Health,¹³ synthesizing the evidence and highlighting seven compelling new case studies (see Figure 2). Widely accessible to those without a health or economics background, it brings together the best available evidence in one place. It is aimed primarily at finance ministers in LICs and MICs, as well as donors who finance health programs in these countries. The report provides a synthesis of the research on the economic benefits of investing in health compared to the returns from investing in other sectors. For policymakers who want to promote development, we hope the report provides a valuable input into their resource allocation decisions by showing the very large returns from investing in health.

While the levels and patterns of mortality are different in high-income countries (HICs), even in these countries, there is a need for public financing and prioritization of interventions. The arguments for continued investment in health are just as important for HICs that might feel under pressure to put health spending on the back burner in times of financial difficulty.

Figure 2: Case study map



SECTION 1: WHY INVEST IN HEALTH – FOCUSED HEALTH SECTOR INVESTMENTS YIELD IMPRESSIVE ECONOMIC RETURNS

Key policy messages

- Better health has a powerful, positive effect on wealth.
 - Healthier children go on to have higher employment rates and wages in adulthood and healthier adults are more productive.
 - The economic benefits of improved health are even more impressive when viewed at a national level, measured by a country's GDP, than at an individual level.
 - GDP alone fails to capture the full economic value of improved health. When asked, people put a high monetary value on the additional years of life that health investments can bring – a value that is unrelated to productivity and not captured in the GDP. This rarely gets recognized, but it is another powerful argument for investing in health.
 - Policymakers should do more to make sure health spending reflects people's priorities. Taking the intrinsic value of additional life years into account points to large benefits – not captured in GDP measurements – of focused health sector investments.
-

1.1 Health investment can boost personal and national income

In 1993, the World Bank's *World Development Report* "showed finance ministers that well-chosen health expenditures were not an economic drain but an investment in economic prosperity and individual wellbeing".¹⁴

Over the subsequent two decades, the evidence on the relationship between health and wealth has grown steadily. It has sometimes been hard for researchers to pin down exactly how strong the link is, and to tease out its direction – in other words, does better health lead to increased wealth or vice versa? But, taken as a whole, the evidence shows that:

- the link between health and wealth goes in both directions;
- there is a powerful, positive effect of better health on wealth at the individual, household and national levels – these economic returns may not be immediate; and

- improved health boosts personal and national income through its positive effects on:
 - education;
 - productivity;
 - investment;
 - availability of resources; and
 - demographics.

Individual and family evidence

Health and wealth go together throughout our lives: in the womb and early childhood, in adulthood and across generations.

(a) In the womb and early childhood (Appendix, Tables A1 and A2)

We know that, starting in the womb, children with poor health do less well than those with better health. Malnutrition, exposure to air pollution and malaria are all linked to worse academic performance at school. The effects last, with those sick children growing up to have worse economic outcomes in adulthood.^{15–25}

Conversely, babies who are healthier than their peers will go on to earn more as adults. Using metrics such as birth weight, height-for-age and weight-for-age, children with a healthier start in life grow up to be healthier adults. Health translates into better cognitive development and children staying in school longer. All of this contributes to economic success in later life, with a better chance at employment and higher wages.^{26–32} Healthy, well-nourished children also grow up to be taller adults and the evidence from Indonesia suggests that height is linked to achieving better pay in later life.³³

The link between healthier children and better economic outcomes is clear and the evidence points to certain targeted programs that deliver the best outcomes. Cost-effective interventions, such as immunization and nutrition supplements, can improve children's longer-term economic and educational outcomes and improve the economic status of adults and their families.^{34–52}

(b) In adulthood (Appendix, Tables A3 and A4)

There is also compelling evidence that poor health in adults can lead to lost wages and reduced household income. Sick adults are absent from work more often and are less productive when they are in work. This means they could lose out on wages. It is also bad for the economy as a whole. The costs of seeking healthcare, combined with reduced earnings, represent a significant economic burden for many households in LICs and MICs.^{53–68} This burden can often result in households cutting back on essentials, such as food.⁶⁹ Poorer and female-headed households are more vulnerable to economic catastrophe as a result of health shocks.⁷⁰

Conventional estimates of poverty rates in developing countries often do not take account of these out-of-pocket payments for healthcare. In one study of poverty in 11 Asian LICs and MICs, when these payments were taken into account, poverty rates were 14 percent higher than previously thought.⁷¹

Just as poor health is indisputably linked to worse economic outcomes, the evidence in favor of investing in adult health is very persuasive. High-impact, cost-effective interventions, such as HIV treatment, iron supplements and air pollution reduction can yield high returns. The benefits are visible in productivity and earnings.⁷²⁻⁷⁷

(c) Across generations

Children born to parents who were undernourished in childhood, or who are infected with HIV, have poorer health and education outcomes,^{78, 79, 80} even when education and income levels are taken into account. Parental illness or death due to HIV/AIDS threatens household economic security, with implications for a child's nutrition and education. It can also result in a child needing to begin work at a young age, cutting short her education.

Interventions to improve early childhood nutrition also have intergenerational benefits. In Guatemala, for example, children born to parents who received nutritional supplements in childhood had a higher birth weight, height-for-age, and weight-for-age than children born to parents who did not.^{81, 82}

National and international evidence

The effects of mortality reduction and child and maternal health investments can also be seen clearly in the GDP (Appendix, Table A5):

- **Reducing adult mortality:** In a new macroeconomic modeling study, using data from 100 countries over the period 1990 to 2011, Liu and colleagues found that a one-year increase in life expectancy raises the productivity of workers and is correlated with a 1.43 percentage point increase in economic growth rate.⁸³ Another analysis estimated that about 12 percent of economic growth in LICs and MICs from 1970 to 2000 was due to a reduction in the rates of adult mortality.⁸⁴
- **Investments in maternal and child health:** Health conditions in childhood and pregnancy can curtail GDP growth; tackling these conditions can reverse this.⁸⁵⁻⁸⁹

There is an ongoing debate on the macroeconomic impact of increasing the number of people working in the health sector. Some research suggests it harms the economy (if rising wages outpace productivity), some research shows no effect, and some suggests it might even stimulate the economy.⁹⁰⁻⁹⁶ Given these conflicting results, the High-Level Commission on Health Employment and Economic Growth, chaired by the presidents of France and South Africa, is examining this evidence further.⁹⁷

The benefits of improved health are even more impressive when viewed at a national level than at an individual level.⁹⁸ What explains this robust link between health and national wealth? On top of the combined collective benefits of improved education and greater productivity among the workforce, four additional factors become relevant:^{99, 100}

1. When people live longer, they have an incentive to save for their retirement, which can boost investment and economic growth.
2. When disease control efforts are successful, there is an increase in investment from abroad in business and infrastructure.¹⁰¹
3. When diseases such as malaria and river blindness are brought under control, areas of land and natural resources that were previously off-limits become accessible.
4. When infant and child mortality rates fall, women tend to have fewer children. The result is a phenomenon known as 'the demographic dividend' – the potential for economic growth that results from an increased ratio of working age people to their dependents.¹⁰²

We have demonstrated how the benefits of better health can be seen throughout life, in particular on **education** and **productivity**. We have shown how this can lead to more **investment**, by individuals and businesses alike, as well as in the health sector itself. Safer environments allow for increased access to natural **resources**. Finally, we have considered how the **demographic** changes brought about by having fewer children in households can boost economies.

A note of caution: LICs and MICs are now undergoing a demographic transition from young to aging populations and a shift in their burden of disease from infections to NCDs. If countries do not take steps to mitigate these risks, NCDs could cause an economic downturn because the ratio of working age people to their dependents is reduced – a 'demographic tax'. For example, Bloom and colleagues estimate that, if China and India do not tackle their NCD crises, the economic losses from NCDs between 2010 and 2030 will amount to \$4.5 trillion in India and \$23 trillion in China.¹⁰³

1.2 People put a high value on living longer

In the past three decades, China's extraordinary economic growth has been very unevenly distributed. However, recent studies have shown that this inequality is mitigated by stronger health gains in the less wealthy areas.¹⁰⁴ This represents a new way of considering the benefits of health and its link with economic growth and prosperity.

Valuing health by going beyond GDP

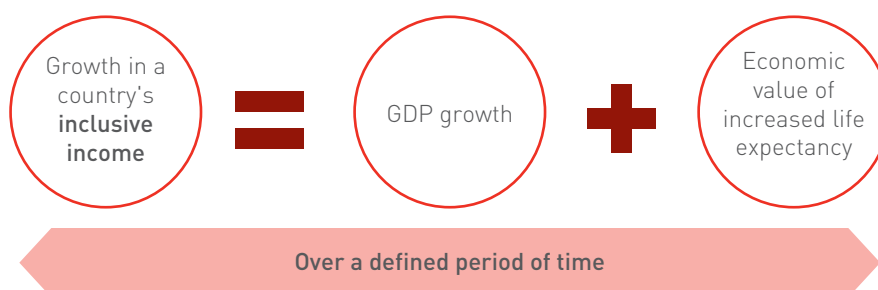
People place a very high value on living a longer, healthier life – a personal, intrinsic value that is unrelated to productivity. When asked, they put a high monetary value on the additional years of life that health investments can bring, a value that is not captured in the GDP. This rarely gets recognized, but it is another powerful argument for

investing in health. Figures 3, 4 and 5 illustrate how the economic value of increased life expectancy can be understood.

Inclusive income

The benefits of living longer are captured in the notion of increased 'inclusive income', the sum of increased GDP and the value of increased healthy life expectancy (see Figure 3).¹⁰⁵

Figure 3: Calculating inclusive income

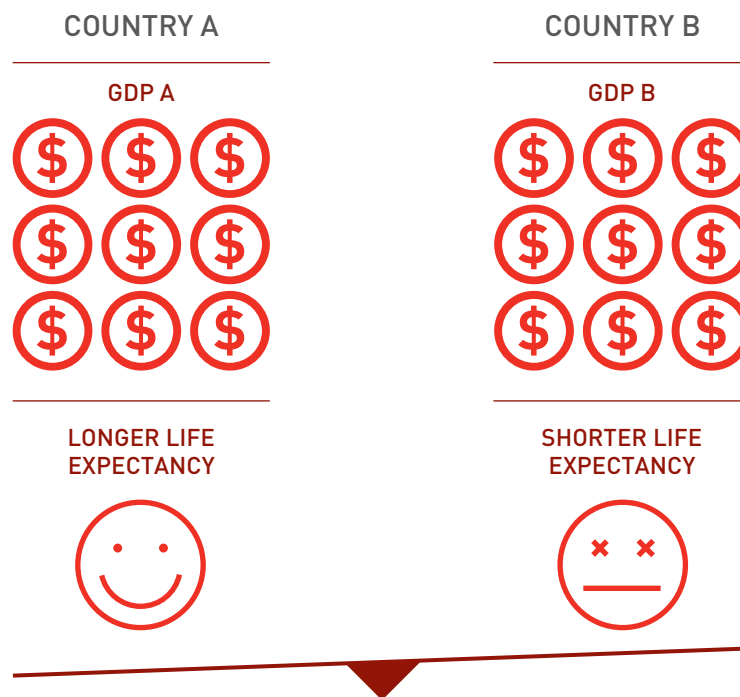


The Lancet Commission on Investing in Health argued that inclusive income gives “a more accurate and complete picture of health’s contribution to a nation’s economic wellbeing”, compared with using GDP alone.¹⁰⁶ The Commission proposed calling the economic value of one additional year of life a VLY (value of a life year).

Calculations by the Commission suggest that, in LICs and MICs, one VLY is about 2.3 times the per person GDP, although other researchers have found lower values.¹⁰⁷ Estimates come from: (a) asking people how much they would be willing to pay to reduce their risk of dying; and (b) observing how much money people actually get paid for risky occupations.

The Commission used this approach to estimate the returns on investing in what they called a ‘grand convergence in health’. Grand convergence means a global reduction in avertable maternal and child mortality, and deaths from infectious diseases down to universally low levels. The Commission found that every \$1 invested in this goal from now to 2035 would yield \$9 to \$20, an extraordinary rate of return. Even with much more conservative estimates, there are still great opportunities for significant returns on investment.

Figure 4: A story of two countries



GDP is not a good enough measure to assess economic performance

"A country whose citizens enjoy long and healthy lives clearly outperforms another with the same GDP per capita but whose citizens suffer much illness and die sooner."

Bloom et al. (2004)¹⁰⁸

Why the value of a life year should matter to policymakers

Economists make an important distinction between market and non-market goods and services. As the name suggests, market goods and services are traded at a price that reflects how much people are willing to pay – this price is their economic value. However, non-market goods, such as clean air and healthy oceans, cannot be traded in the same way. Their economic value is not revealed by market prices, but they are nonetheless valuable.

Figure 5: An economist's question

Imagine you have to make a choice between the improvements in material goods since the 1950s and the improvements in health during the same period. Better televisions, cars, roads, planes, computers and phones or an extra 11 years of life expectancy. Which would you choose? Very few people choose the first option.



Extra years of healthy life – value of a life year (VLY) – are not traded in markets, so it is harder to put a value on them. Using a VLY approach is essential, or we risk undervaluing health. Using GDP alone can lead policymakers to make bad decisions about how best to allocate resources. By definition, VLYs are not dollars that can be used to buy other things. Why they matter so much is that they give policymakers a fuller picture of the benefits of health investments, as shown in Case study 1.

Case study 1: The economic value of reducing deaths from heart disease in Mexico

Life expectancy at birth in Mexico increased by 5.4 years from 1990 to 2014.¹⁰⁹ These health gains, however, were not evenly distributed. While mortality fell by two-thirds for children up to four years of age, for older adults aged 50 to 69 years, it fell by only one-fifth. Reducing adult mortality, especially from NCDs, has been a neglected agenda throughout the Millennium Development Goals era of 1990 to 2015. Aptly, the SDG for health recommends reducing premature mortality – deaths before the age of 70 – from NCDs by one-third by 2030.

Since 1990, cardiovascular disease (CVD) has been the single largest cause of death in Mexico.¹¹⁰ While in Organisation for Economic Co-operation and Development (OECD) countries death rates for CVD have dropped by 45 percent since 1990, age-standardized death rates for Mexico have remained constant.¹¹¹ If this trend were to persist until 2030, the share of premature deaths associated with CVD would increase from 8.1 percent to 17.3 percent.

Is increased expenditure on prevention and treatment for CVD warranted? Using a VLY approach, investing in CVD control to avoid one-third of the current projected deaths from CVD would yield \$8.4 billion in the year 2030.

In 2014, the Mexican healthcare system accounted for 6.1 percent of the GDP.¹¹² Estimates of healthcare cost by disease category place CVD at 3.8 percent of total health spending; close to \$3 billion.¹¹³ The benefits of a one-third reduction in premature mortality from CVD could justify an almost two-fold increase in current CVD spending. Tackling CVD is a complex task, requiring more responsive primary care, better performing hospitals and better control of risk factors such as smoking. The benefits would be well worth the investment.

SECTION 2: HOW TO FINANCE HEALTHCARE – THROUGH PUBLIC FINANCING

Key policy messages

- Expecting people to cover out-of-pocket medical costs deters them from using important health services and encourages them to discontinue life-saving treatments. These costs push 150 million people into poverty each year.
 - A superior approach to financing healthcare is to use public financing to cover a defined package of best-buy interventions, with zero out-of-pocket costs. Public financing is the purchase of health services for a population using general revenue taxation or mandatory contributions such as payroll taxes.
 - Public financing is more efficient and controls costs better than private financing. It provides greater protection against medical impoverishment and it is the only real option for countries hoping to provide a sustainable healthcare system.
 - Public financing should be coupled with strategies to increase efficiency, such as health technology assessment, using medicines more appropriately and fostering accountable care.
 - Some developing countries need to supplement public spending on health with aid. Based on past success and large economic returns, donor governments should spend a greater proportion of their total aid on health. There is a particularly important role for health aid in supporting global health research and development (R&D) and tackling pandemics and antimicrobial resistance.
-

2.1 The case for public financing as the best choice for governments

Making the right financing choice

What is the best way to pay for healthcare? It is a question high on the agenda of ministers of health and finance in LICs and MICs.

Policymakers might look to private voluntary insurance as a way to curtail public financing of health. On the face of it, this strategy seems to make sense: if costs can be transferred from the government to citizens, surely public costs will be constrained?

The reality is rather different. The Lancet Commission on Investing in Health showed that trying to encourage citizens into private voluntary insurance does little to curtail

demand on public financing for health.¹¹⁴ What is more, expecting people to pay for health costs is pushing 150 million people into poverty every year.¹¹⁵ Expecting people to pay out-of-pocket medical costs:

- deters them from using important health services, which in turn risks the spread of communicable diseases such as tuberculosis (TB) and HIV;¹¹⁶
- encourages them to discontinue life-saving treatments; and
- forces them to cut spending on food, clothes and other essential items to pay for healthcare.¹¹⁷

A superior approach, which this report strongly endorses, is to use public financing to cover a defined package of highly cost-effective best-buy interventions, such as vaccinations, family planning, TB treatment and antiretroviral drugs for HIV (this package is discussed in Section 3). There should be zero or very low (that is, highly affordable) out-of-pocket costs for this package. By public financing, we mean the purchase of health services for a population using general revenue taxation or mandatory contributions, such as payroll taxes or other mandatory public or private insurance schemes.

Both the Lancet Commission on Investing in Health¹¹⁸ and the **WISH 2015 Universal Health Coverage report**¹¹⁹ recognized the importance of prioritizing full population coverage with an essential package of cost-effective interventions. As noted by the WISH Forum: “UHC can only be achieved through publicly governed, mandatory financing mechanisms (general taxation and social health insurance contributions) that compel wealthier and healthier members of society to subsidize the poor and the vulnerable.”

See WISH 2015
Universal Health
Coverage report

In countries with limited resources that are moving toward UHC, public financing should be used to achieve universal coverage of an essential package of best buys. Public finance capacity at the outset will be limited and interventions outside the package will initially need to be privately financed. As a country’s resources grow, the package of publicly financed interventions can expand, as has been seen in Mexico’s move toward UHC.

The Lancet Commission on Investing in Health endorsed two pathways to UHC that would protect the poor:

1. The first is to use public funds from general taxation and payroll taxes to cover an essential package for conditions that disproportionately affect the poor – especially infections and maternal health conditions. Everybody receives the package, with zero or low out-of-pocket payments. The government does not have to incur costs trying to identify who is poor – the package covers everyone. The benefits package would be relatively narrow, made up of the most cost-effective interventions. Interventions outside the package would need to be privately financed.
2. The second, for governments that wish to provide a much broader package, is to use a wider range of financing mechanisms. These could include general taxation, payroll taxes, mandatory premiums and co-payments, with the

poorest given exemptions from premiums and co-payments. A wider range of services can be offered, though it does mean that the poor need to be identified so that they can be exempted from payments.

The many benefits of public financing

(a) Efficiency

Evidence shows that public financing is often more efficient and controls costs better than private financing.¹²⁰ Administrative costs in the United States (US) Medicare system account for less than two percent of all costs,¹²¹ compared with about 14 to 15 percent for private health plans.^{122, 123} Private health plans can encourage excessive or inappropriate use of services if providers are rewarded for the quantity and not the quality of services. Furthermore, there are few incentives in privately funded healthcare to promote health prevention, education and early treatment.

Nevertheless, publicly financed UHC could result in cost escalation unless steps are taken to curb the risks and promote efficiency (see Section 2.1, point (c) for more information). Case study 2 gives the example of a strategy adopted by South Korea to curb costs in its publicly financed health sector.

Strategies to curb unproductive cost escalation

The Lancet Commission on Investing in Health examined the evidence on strategies that can curb unproductive cost escalation in publicly financed UHC programs.¹²⁴ The Commission concluded that the three most important strategies are:

1. Ensuring hard budget constraints.
2. Minimizing fee-for-service payments.
3. Paying providers on a salaried basis or by capitation, especially for treatment of chronic illnesses.

Other important strategies include:

- having a single payer to reduce administrative costs;
- gatekeeping strategies;
- using integrated IT platforms; and
- increasing the use of generic drugs.

Case study 2: South Korea's health insurance review and assessment service

In South Korea, people pay a premium in exchange for health coverage. This is calculated using a sliding scale based on income, with the average fee being only \$34 per month. With 50 million people insured, premiums account for \$36 billion of the annual public health expenditure of \$37.5 billion. To keep health costs down and premiums affordable, the government has established the Health Insurance Review and Assessment Service (HIRA). The service assesses claims, service provision patterns and the cost-effectiveness of medical services and technologies. In 2012, HIRA saved about \$1.95 billion through claims assessments and, as a result of HIRA's assessment of pharmaceutical prescribing, the antibiotic prescription rate fell from 73 percent to 44 percent between 2002 and 2014.

While South Korea has achieved UHC, it has prioritized *population* coverage over expanding the *benefits* package. This is exacerbated by a strong private sector, which encourages demand for cutting-edge services and technologies. In 2013, out-of-pocket spending accounted for 37 percent, compared to the OECD average of 19.5 percent. South Korea will need to continuously expand UHC to cover all essential medical services, set a limit on out-of-pocket spending and establish a review system for private expenditure.

(b) Financial protection

Being ill or injured is a source of enormous distress and, at these times, people should not have to have the additional anxiety of being unable to pay for medical care. Relieving this stress was a key motivation for one of the earliest public financing schemes – Britain's National Health Service. The front page of a 1948 leaflet assures readers that the service “will relieve your money worries in times of illness”.¹²⁵

Studies in LICs and MICs have shown that public financing can reduce out-of-pocket spending^{126, 127} and highlight two important considerations:

1. In countries such as Ethiopia that have high non-medical costs of care – for example, transport to clinics – there must be public support for these costs or the risks of medical impoverishment remain.¹²⁸
2. Levying high co-payments as a way for the government to recoup some costs is also risky. Recent research on China's unprecedented expansion of publicly financed insurance has shown that, while coverage rates are now close to 100 percent, high co-payments have limited financial protection.¹³⁰

No longer will illness crush and destroy the savings that they [seniors] have so carefully put away over a lifetime so that they might enjoy dignity in their later years. No longer will young families see their own incomes, and their own hopes, eaten away simply because they are carrying out their deep moral obligations to their parents, and to their uncles, and their aunts.¹²⁹

Lyndon B Johnson, US President at the signing of Medicare into law in 1965

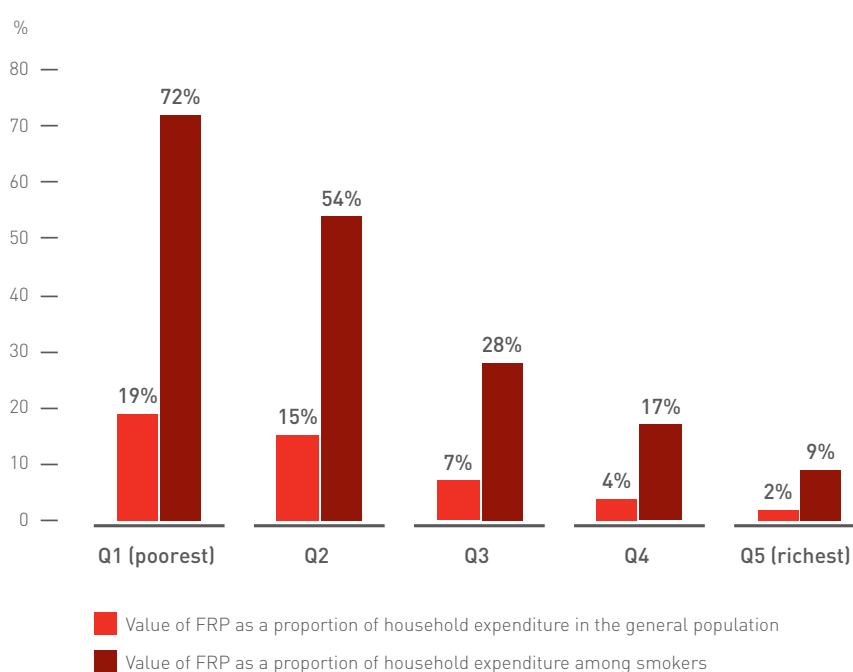
A new area of research that links public financing of health with financial protection is the study of tobacco taxation. Such taxes can mobilize public revenues, improve public health outcomes by curbing unhealthy behavior and provide financial protection by reducing health-related medical expenses (see Case study 3).

Case study 3: Tobacco taxes mobilize public funds and provide financial risk protection

Many LICs and MICs are facing a growing burden of NCDs, partly driven by smoking. Tobacco taxes are an effective strategy for reducing this burden while raising substantial public revenues and providing financial risk protection.¹³¹ These effects have been seen in a variety of countries, from small to large economies – as shown below in the examples of Lebanon and China.

In **Lebanon**, smoking prevalence rates are among the highest in the Middle East.¹³² Salti and colleagues found that levying a tobacco tax to raise the price of tobacco by 50 percent would reduce consumption, curb illness and deaths from NCDs and increase government revenues.¹³³ Figure 6 shows the value of risk protection, presented as a percentage of total household expenditure across five income quintiles, resulting from a 50 percent increase in the price of cigarettes from higher taxes. There would be much greater benefits for the poorest households.

Figure 6: Estimated value of financial risk protection (FRP) in Lebanon



(Case study 3 continued)

Tobacco taxation in **China**, where there are more than 300 million male smokers, would have similar benefits. A modeling study found that a 50 percent increase in price would lead to 231 million years of life gained over the next 50 years among men, with a third of these being in the poorest group. The government could raise \$703 billion from tax revenues. The tax would reduce spending on tobacco-related disease by \$24 billion, about a third of which would be in the poorest group. Financial protection in the order of \$1.8 billion would be mainly concentrated (74 percent) in the poorest households.¹³⁴

In the same way that people put a high monetary value on the additional years of life that health investments buy, they also put a high value on the protection against financial risk that publicly financed insurance provides. Knowing that key health services have been pre-paid by the government gives people peace of mind. It allows them to sleep at night knowing that they will not suffer financial ruin if they get sick or injured. This peace of mind has an economic worth we have been failing to fully acknowledge.

Case study 4, on the US Medicare system, gives an example of people valuing the reduction in their financial risk.

Case study 4: The value of financial risk protection provided by Medicare

For most people, the value of health insurance is obvious – it allows access to healthcare, such as medical care for a sick child, or hospital-based intensive cancer treatments. There is another, less obvious benefit of health insurance – protection against financial ruin arising from catastrophic healthcare costs. Previous studies suggest that insurance coverage yields large benefits for low-income households most at risk from the expenses associated with serious illness. For example, in Thailand, very high out-of-pocket medical spending was cut by 50 percent following the introduction of national health insurance.¹³⁵ Importantly, health insurance is valuable even for those who never need to use it. In the Oregon randomized trial of health insurance (Medicare) in the US,¹³⁶ the largest impact of coverage was a reduction in depression (rather than better blood pressure or glucose control), leading one of the investigators to state: “I didn’t realize what a mental health toll being uninsured was taking on people.”¹³⁷ Thus health insurance provides a triple dividend:

- Better access to healthcare.
- A cushion to the financial blow of a serious and prolonged illness.
- A reduction in stress and depression among those who worry that they won’t be able to seek care when they need it most.

(c) A long-term solution: Domestic resource mobilization and efficient spending

A robust domestic financing system is the only real option for countries hoping to provide a sustainable healthcare system. Such domestic resource mobilization should be coupled with efficient spending.

One way to increase efficiency is to ensure that money is targeted at best-buy health interventions. Other strategies include:

- **Health technology assessment** – such as Thailand’s Health Intervention and Technology Assessment Program. Such assessment leads to more efficient use of healthcare resources.¹³⁸
- **Accountable care** – an arrangement in which a group of health providers is held jointly accountable for achieving a set of outcomes for a prospectively defined population over a period of time and for an agreed cost. The **WISH 2016 Accountable Care report** gives a range of case studies from LICs and MICs, including India, Mexico, Nepal and Rwanda, showing how this arrangement can lead to higher-quality care at lower cost.
- **Using medicines more appropriately** – reducing unnecessary expenditures on inappropriate medicines, especially antibiotics, and instituting quality controls to stamp out counterfeit or substandard drugs.¹³⁹
- **Using incentives to motivate health workers and reduce inappropriate or lengthy hospital stays** – such incentives include performance-related pay as well as professional incentives (for example, providing flexible working time and work autonomy, and recognizing good work).¹⁴⁰
- **Reducing public sector spending inefficiencies, such as fossil fuel subsidies** – the International Monetary Fund (IMF) estimates that the revenue gain from eliminating such subsidies would have amounted to \$2.9 trillion (3.6 percent of global GDP) in 2015 that could have been used for “growth-enhancing tax cuts on labor and capital or badly needed investments in basic education and health”.¹⁴¹

See WISH 2016
Accountable
Care report

However, even with domestic resource mobilization and gains in spending efficiency, many developing countries are not in a position to independently fund their health services, relying instead on health aid. In the next sub-section, we explore how health aid can best be mobilized to complement developing publicly financed systems.

2.2 The case for increased health aid: Past investments brought health and economic progress

After a decade of rising investment from 2000 to 2010, health aid has stagnated. Preliminary estimates even suggest that there may have been a decline from 2013 to 2014; a very worrying trend.¹⁴² Without this downturn, the Institute for Health Metrics and Evaluation estimates that an additional \$38.4 billion of health aid would have been disbursed between 2011 and 2014.¹⁴³

This should be a wake-up call for donors. These trends could imperil recent progress in global health and lead to thousands of avertable deaths. Rather than retreating from health investment, we argue that donors should spend a greater proportion of their total aid on health.

As described further below, in developing countries, aid can complement domestic financing in several important ways:

- **Scale-up:** Aid supports countries in scaling-up critical health tools.
- **Sharing best practices:** Aid can serve as a vehicle or mechanism for the diffusion of knowledge and information between countries on preventing and treating disease.
- **Reaching marginalized people:** Aid can finance health services for people – such as refugees, scheduled castes or women – who may suffer discrimination when it comes to receiving domestically funded services.
- **Delivering stigmatized services:** Aid can finance services that the government finds politically problematic to provide, such as safe abortion, post-abortion care and other aspects of reproductive health.

A history of success

The question of whether aid works has been the subject of a great deal of debate.^{144, 145, 146} Yet even the critics admit that health aid has shown much greater success than other kinds of aid.

The economist and Nobel Laureate, Angus Deaton, a very vocal aid skeptic, acknowledges that “external aid has saved millions of lives in poor countries”.¹⁴⁷ Since 2000, most health aid has been targeted at HIV/AIDS, malaria, TB and maternal and child health. Research has shown that the mobilization of aid in this way was linked to large declines in mortality, for example:

- **Malaria:** Prior to 1998, less than \$40 million of health aid was disbursed annually to malaria control. By 2007, the amount had increased to \$724 million. Much of this was spent on mosquito bed nets. Flaxman and colleagues showed that every dollar of malaria aid per capita was linked with roughly a five percent increase in the proportion of children sleeping under a net at night.¹⁴⁸ In households that

had at least one bed net, child mortality was reduced by 23 percent.¹⁴⁹ Mills and Shillcutt estimate that every dollar spent on malaria control has brought a return of \$2 to \$5.¹⁵⁰

- **HIV:** From 2003 to 2008, the US President's Emergency Plan for AIDS Relief (PEPFAR) mobilized \$20.4 billion for HIV control in developing countries and, by the end of 2008, two million people were receiving antiretroviral drugs through PEPFAR funding. A study by Bendavid and colleagues found that "PEPFAR has been associated with a decline in all-cause adult mortality."¹⁵¹
- **Measles:** Since 2000, two billion children worldwide have received a supplemental measles vaccination, which has resulted in at least 15.6 million lives saved.¹⁵²

Since these diseases require constant control efforts, abruptly cutting aid will lead to disease resurgence and avoidable deaths. These programs face a paradox – the more successful they are, the more invisible the disease becomes to policymakers, increasing the risk that financing will be withdrawn. It is fundamentally important that researchers reach policymakers with this kind of evidence at the right time.

Taken as a whole, the evidence shows that health aid has had a direct, causal effect in saving lives. Countries that have received more health aid have experienced a more rapid rise in life expectancy and a much greater fall in their child mortality rates than countries that have received less aid.¹⁵³ Health aid has worked when countries have used the external financing to scale-up highly focused and technically sound programs, with clear goals and strong managerial authority and responsibility. A set of case studies published by the Center for Global Development called the Millions Saved project has documented a range of impressive success stories showing the impact of health aid, including the control of river blindness and guinea worm in Sub-Saharan Africa.¹⁵⁴

A fuller picture

Using changes in the GDP as the sole measure of the economic value of health aid gives a very narrow picture. For example, based on GDP alone, every dollar invested in childhood vaccinations from 2011 to 2020 would yield \$16 in return. Using an inclusive income approach, each dollar would yield \$44 over the same period.¹⁵⁵

The Copenhagen Consensus Center, a think tank that works on global development, is the only organization to our knowledge that uses inclusive income approaches to estimate the returns on investing in different development sectors. The Center's analyses have found that, based on these returns, health is one of the best of all investments. Its 2012 analysis found that eight out of the top 10 investments were health investments – micronutrients (vitamins and minerals essential to health and needed in small amounts); subsidizing malaria drugs; childhood vaccines; de-worming school children; expanding TB treatment; strengthening surgical capacity; hepatitis B vaccination and low-cost heart attack drugs.¹⁵⁶

The future of aid

Country-specific health aid (that is, aid given directly to countries) will certainly be crucial for decades to come. LICs will continue to need aid to support their health programs. Donors should also provide targeted health aid to MICs on a case-by-case basis to vulnerable populations, such as refugees or groups that suffer discrimination, and to fund politically charged services such as family planning. However, the need for country-specific aid is likely to fall in coming years, given the rapid economic growth of many developing countries. Rather than cutting funding, donors should instead invest in the global functions of health aid.

Global functions of health aid

Beyond country-specific programs, health aid has a further important role to play – supporting a co-ordinated global response to immediate and long-term threats.¹⁵⁷ This is achieved through:

- developing new health technologies to tackle diseases of poverty;
- managing cross-border threats, such as **antimicrobial resistance**;¹⁵⁸ and
- fostering global health leadership and stewardship.

See WISH 2013
Antimicrobial
Resistance report

Currently, only \$4.7 billion is being directed at these crucial functions, representing just one-fifth of all health aid.¹⁵⁹ While there should be an increase in the overall amount of health aid, the proportion of aid directed to global functions should increase. Using an inclusive income approach, Case study 5 demonstrates why.

The World Health Organization (WHO) estimates that \$6 billion a year is needed to support R&D on the diseases of poverty – yet currently, only half that amount is being spent. Inclusive income approaches show the large economic returns of investing in R&D. Hecht and Jamison, for example, used this approach to show the very large returns on investing in a HIV vaccine.¹⁶⁰ Every dollar invested in HIV vaccine development would return between \$2 and \$67, assuming that the R&D costs are about \$900 million annually and that a vaccine of 50 percent efficacy becomes available by 2030. Standard ways of valuing innovation have also ignored the large insurance value of new health interventions – that is, the economic value resulting from the fact that the new intervention lowers a person's risk of illness or reduces the severity of an illness.¹⁶¹

In 2013, donors invested less than \$1 billion on managing cross-border threats, such as preparing for outbreaks, and yet the World Bank estimates that it would cost about \$3.4 billion to build a global pandemic preparedness system.¹⁶² This leaves the world extremely vulnerable.

Underinvestment in these functions led to the very slow global response to the Ebola crisis in West Africa – there was no treatment, vaccine or rapid diagnostic test. The outbreak preparedness and response system was exceptionally weak; the WHO's leadership lacking.

The 'middle income dilemma' refers to the fact that most of the world's poor now live in MICs and yet many MICs are becoming too rich to qualify for aid. However, increased support for global functions would help solve this dilemma. For example, China and India would benefit greatly from collective purchasing of medicines and other health products, market shaping to reduce drug prices and increased international efforts to control multidrug-resistant TB.¹⁶³

Case study 5: Global public goods and the value of pandemic preparedness

The 21st century has witnessed a remarkable, and remarkably productive, commitment of global resources to health investments for LICs and MICs. Yet easily achieved health goals remain. The lack of pandemic influenza preparedness provides a compelling example.¹⁶⁴

In any given year, there is a small likelihood that the world will again suffer a very severe flu pandemic, akin to the one in 1918 that killed many tens of millions of people. Even a moderately severe pandemic, of which at least six have occurred since 1700, could lead to two million or more deaths. A recent study using reasonable (although admittedly uncertain) estimates of the annual probabilities of pandemics found that a reasonable estimate of expected pandemic deaths exceeds 700,000 per year worldwide, with an associated annual mortality cost estimated at \$490 billion.¹⁶⁵ Adding on an expected income loss of \$80 billion per year, the cost comes to \$570 billion per year, or 0.7 percent of global income (range: 0.4 to 1.0 percent). Failing to consider the intrinsic cost of elevated mortality risk would seriously underestimate the value of investments to control pandemics.

While all countries benefit from pandemic preparedness, the cost of pandemics in LICs is twice the global average. Therefore, being prepared would have its greatest impact in the most vulnerable parts of the world.

SECTION 3: WHAT TO INVEST IN – A PACKAGE OF HIGH-IMPACT INTERVENTIONS

Key policy messages

- About 80 percent of the fall in child mortality in developing countries from 1970 to 2000 was due to the adoption of life-saving health interventions.
 - Public financing and health aid should be focused on delivering packages of highly cost-effective best-buy interventions to tackle infections, maternal and child health conditions, NCDs and injuries, all targeted to local need.
 - The returns on investing in these packages are enormous – for example, every dollar invested in delivering a package of childhood vaccines over the period 2011 to 2020 would yield up to \$44 in return.
 - Aggressive scale-up of best buys in LICs and MICs could lead to a grand convergence in global health within a generation.
-

The best way to improve health is to deliver cheap, powerful health interventions

Sixty years ago, Kingsley Davis, the internationally renowned sociologist and demographer, challenged prevailing views on why death rates were falling, finding that economic progress was not the explanation. In fact, it was not even a precondition for rapid mortality decline. Instead, the decline was explained mostly by low-cost health interventions.

“The great reduction of mortality in underdeveloped areas ... has been brought about mainly by the discovery of new methods of disease treatment applicable at reasonable cost ... The reduction could be rapid because it did not depend on general economic development or social modernization ... there is still great lip service paid to the necessity of general economic improvement and community welfare in the control of disease ... the truth is that many scourges can be stamped out with none of this...”¹⁶⁶

If services are to be provided for all, then not all services can be provided. The most cost-effective services should be provided first.

**Gro Harlem Brundtland,
WHO, 1999**

From 1991 to 2000, four low-income countries – Bangladesh, Ecuador, Egypt and Indonesia – successfully reduced their child mortality by at least 40 percent, a rate far greater than would have been expected.¹⁶⁷ Economic growth, poverty reduction and reducing inequalities did not consistently contribute to the fall. Even when there was poor governance, corruption, upheaval and low participation in the political process, what mattered most was:

- targeting packages of selected health interventions to those who needed them the most; and
- financial and technical assistance, especially in disease surveillance.

The importance of targeting health interventions to the conditions and the populations that need them the most is discussed further in the **WISH 2016 Precision Medicine report**.¹⁶⁸

Research into child mortality decline from 1970 to 2000 across 95 developing countries confirms the importance of adopting health interventions.¹⁶⁹ The most important factor in reducing child mortality is whether countries quickly adopt the latest cheap, effective life-saving interventions; early adopter countries saw an additional two percent annual decline in their child mortality and 80 percent of mortality improvement was explained by the adoption of health technologies, compared to only three percent due to income growth, eight percent due to expanding the medical workforce, and nine percent due to the education of girls.

How to prioritize

If you had \$1 million to spend on health, what would be the best purchases? Which would save the most lives?

These questions have been addressed through a wide range of research,^{170–173} showing which health interventions are the most cost effective – known as the ‘best buys’ (see Table 1).¹⁷⁴

Table 1: The benefit to cost ratios of investing in different packages of best-buy interventions

Health focus	Intervention packages	Benefit for every dollar spent	References
Immunization	Package of vaccines: DPT-Hep B-Hib ⁱ or pentavalent vaccine; ⁱⁱ human papillomavirus; Japanese encephalitis; measles, mumps and rubella; rotavirus; pneumococcal conjugate vaccine; yellow fever.	\$16–44	175
Nutrition	Stunting reduction interventions including: micronutrient supplementation; universal salt iodization; calcium supplementation; folate and iron fortification and supplementation; breastfeeding and complementary feeding education; zinc and vitamin A supplementation; community-based management of acute malnutrition.	\$3–48	176
Maternal and child health	Intervention packages for: maternal and newborn health; child health; immunization; family planning; HIV/AIDS; malaria.	\$9–20	177, 178
Malaria	Malaria control in Sub-Saharan Africa.	\$5	179
NCDs (e.g. stroke, chronic lung disease, ischemic heart disease)	Aspirin therapy at onset of acute heart attack; management of chronic hypertension; 30% salt reduction in manufactured foods; 125% increase in tobacco price; secondary prevention of CVD with polypill. ⁱⁱⁱ	\$9	180

ⁱ DPT-Hep B-Hib: diphtheria-pertussis-tetanus-polio, hepatitis B and Haemophilus influenzae type B

ⁱⁱ Pentavalent vaccine protects against Haemophilus influenzae type B, pertussis, tetanus, hepatitis B and diphtheria

ⁱⁱⁱ Polypills typically include aspirin, a beta-blocker, a statin and an angiotensin-converting enzyme inhibitor

It is important to consider not only which treatments deliver the best results for the least money, but also how much financial protection they offer. Economists call this an 'extended cost-effectiveness analysis'.¹⁸¹ Such studies are illuminating how effective certain interventions, such as rotavirus vaccinations, are at preventing financial impoverishment, often through preventing costly hospitalization.^{182, 183} Each country will have its own challenges and context, however the intervention package set out in Figure 7 could help achieve a grand convergence in global health, as well as tackling some of the most problematic NCDs if scaled-up to high coverage levels where needed in LICs and MICs.

Figure 7: An investment package



Source: Adapted from the Lancet Commission on Investing in Health and the WHO's recommended best-buy interventions^{184, 185}

Many LICs and MICs are already on a pathway to introducing packages of best buys for a variety of conditions, including NCDs, targeted to local need. For example, Ethiopia is scaling-up a package for mental health and neurological conditions, comprising basic psychosocial treatment and low-cost generic drugs for bipolar disorder, depression, epilepsy and psychosis.¹⁸⁶ The package costs just \$3 to \$4 per person and can be delivered in primary care. Packages for CVD are discussed further in the **WISH 2016 Cardiovascular Disease report**.¹⁸⁷

See WISH 2016
Cardiovascular
Disease report

Aggressive scale-up of best-buy interventions in LICs and MICs could lead to a grand convergence in global health. Case study 6 shows what it would take for Myanmar to reach convergence – that is, to achieve the mortality levels seen today in the top performing MICs – through the scale-up of these interventions.

Case study 6: How can Myanmar reach convergence?

Over the past five years, Myanmar has undergone significant political reforms. Pursuing major changes in the health sector has been a part of this, committing to increasing investments and reaching UHC by 2030.

Despite progress, there is still much to do. Myanmar's public health spending per capita is among the lowest in the world, accounting for only 1.5 percent of government expenditure in 2013.¹⁸⁸ As a result, health infrastructure is limited, out-of-pocket expenditures on health are among the world's highest and maternal and child mortality rates are comparatively high.

To achieve convergence with today's best-performing MICs, Myanmar would need to invest about \$1.3 billion annually over the next 20 years, over and above current spending levels. Two-thirds of this is needed to build capacity in the system. The largest programmatic investments should target malaria, HIV and child health, especially among the rural poor who have the highest disease burden.

Such scaled-up, strategic investments could result in significant mortality reductions. For example, the mortality rate for children younger than five years old could fall by half – from 66 deaths per 1,000 live births in 2011 to 31 deaths per 1,000 in 2035.

To meet these targets, Myanmar will need increased aid and domestic investment. The estimated costs to achieve convergence represent a tripling of current spending. This should be feasible over the coming 20 years: the IMF projects that the country's GDP will grow seven to eight percent, in real terms, from 2015 to 2020.¹⁸⁹

These investments have the potential to generate large economic returns. Using an inclusive income approach, each dollar invested in achieving convergence in Myanmar would return around \$6 from 2015 to 2035.

A CONCLUDING CASE STUDY

The purpose of this report has been to inform policymakers of the impressive economic returns to investing in health. The report has provided an economic rationale for such investments and it has argued that public financing of a defined set of best-buy interventions provides very high levels of health and financial protection. It has also made the case for the value of targeted health aid. We conclude with a short case study that illustrates these key messages.

Following the 1994 genocide, Rwanda was one of the world's poorest countries. The health system had collapsed and infectious diseases such as HIV/AIDS, malaria and TB were on the rise. Rwanda was "a failed state mired in poverty and chaos".¹⁹⁰

In the aftermath, the Rwandan government adopted an ambitious plan to rapidly scale-up best-buy health interventions, such as treatments for childhood illnesses, vaccinations, pregnancy care and control programs for malaria and HIV/AIDS.

Increased public funding and substantial amounts of health aid were targeted to expand coverage, beginning a pathway to UHC through a community-based insurance scheme, with the poor exempted, that now covers about 98 percent of the population.¹⁹¹ A group of 45,000 community health workers were trained to provide basic primary care services.

The result has been a "spectacular public health story".¹⁹² Life expectancy increased from just 28 years in 1994 to 56 years in 2012.¹⁹³ In 1994, more than one in four children died before their fifth birthday; now the rate is about one in 25, representing the fastest fall in child mortality in recorded history.¹⁹⁴ From 2005 to 2011, malaria deaths fell by almost 90 percent.¹⁹⁵

Rwanda's transformation demonstrates the comprehensive benefits of investing in health: lifting many out of the poverty caused by medical expenses; boosting productivity and income; and, perhaps most fundamentally – improved health and longer lives for its people.

APPENDIX: EVIDENCE TABLES

Table A1: The economic impacts of poor health in utero and in early childhood

Health risk or health status	Outcome of interest	Key findings	References
Undernutrition in early childhood	Schooling	Children in Ethiopia, India, Peru and Vietnam with stunted growth due to undernutrition in early childhood complete fewer years of schooling.	196
Famine	Educational attainment in adults and labor market outcomes	Exposure to famine in China and Uganda in the womb or infancy has a strong negative impact on the educational attainment of adults; in China, famine was also linked to lower earnings.	197, 198, 199
Poor nutrition in childhood and stunting	Schooling and adult labor market outcomes	Being stunted at two years old in Guatemala was associated with less schooling, lower test performance, lower household per capita expenditure and increased probability of living in poverty. Similar results were found in Brazil and India.	200, 201, 202
Exposure to malaria in utero and early childhood	Academic performance	Exposure to malaria can lead to poorer academic performance, which in turn can have long-term effects on an individual's economic status in adulthood; most studies were done in Sub-Saharan Africa, but there are also data from Latin America and Asia.	203, 204, 205
Air pollution exposure in utero and early childhood	Academic performance	Air pollution exposure in utero and early childhood can reduce birth weight and increase infant mortality; it is associated with school absenteeism and poorer academic performance.	206, 207
Better nutritional status in early childhood	Childhood cognition and school performance	Studies conducted in developing countries and rich nations have shown that children with better nutritional status have improved early childhood cognitive development and do better in school.	208, 209, 210
Better nutritional status in early childhood	School performance	In the Philippines, taller children were more likely to enroll in school earlier, less likely to repeat grades, and less likely to drop out during grade school. In rural Zimbabwe, they were more likely to complete more grades and start school earlier.	211, 212
Better nutritional status in utero and early childhood	Economic outcomes in adulthood	Long-term studies that track how the health of the fetus and young child relates to outcomes in adulthood have shown that in LICs and lower MICs, better nutritional status in the womb and early childhood is associated with higher earnings later in life.	213, 214

Table A2: The economic benefits of investments in child health

Health investment	Outcome of interest	Key findings	References
Iodine supplementation in utero	Educational attainment	In Tanzania, treated children attain an estimated 0.35 to 0.56 years of additional schooling relative to siblings and older and younger peers; the effect appears to be much larger for girls.	215
Nutritional supplementation in childhood	Cognitive and adult economic outcomes	In Guatemala, children who received nutritional supplements had better cognitive function in adulthood, higher hourly wage rates and a 10% lower probability of living in poverty. Evidence from Ethiopia, India, Peru and Vietnam has also shown how supplements can help children overcome the effects of malnutrition, in some cases catching up with their peers.	216–221
Malaria control	Schooling, adult wages and labor market productivity	A malaria eradication program in Uganda was associated with a half-year increase in years of schooling and a 40% increase in the likelihood of waged work in males; overall, the effect of treating malaria yielded an annual income gain of 5–20%, a very large effect. In India, eradication efforts also had a significant positive impact on productivity and wages among men.	222, 223
Maternal tetanus immunization	Schooling	In Bangladesh, the maternal tetanus vaccination was linked to significant schooling gains for children whose parents had no schooling.	224
Childhood vaccination	Household economic status and childhood cognition	Multiple studies have shown that vaccination can improve household economic status by reducing time off work and money spent caring for sick children. Furthermore, in the Philippines, full childhood vaccination significantly increased cognitive test scores relative to matched children who received no vaccinations.	225–228
Measles vaccination	Schooling	A measles vaccination program in Bangladesh resulted in a 7.4% increase in school enrollment among boys; in South Africa, one additional year of schooling was completed for every five to seven vaccinated children.	229, 230
Hookworm eradication	Schooling	Prior to an eradication campaign, 40% of schoolchildren in the American South in the 1900s were infested with hookworm. After the campaign, counties that had higher levels of infection before the campaign saw greater increases in school attendance and literacy. Eradication among affected schoolchildren was associated with increased earnings later in life. More recent studies have been less conclusive about the link between deworming and education outcomes.	231, 232, 233
Reducing exposure to air pollution	School test scores	Decreasing prenatal exposure to air pollution increases high school test scores.	234

Table A3: The economic impacts of adult illness

Adult illness	Outcome of interest	Key findings	References
HIV/AIDS	Productivity, employment and income	Employees with HIV/AIDS take more sick leave days and have reduced productivity at work. Income of HIV-affected households is about 35–50% lower than that of non-affected households; in South Africa, HIV/AIDS is associated with a 6% increase in the likelihood of unemployment.	235–238
Malaria	Household income	Direct and indirect costs associated with malaria – including lost work days due to illness or caretaking for sick family members, reduced productivity and costs of healthcare – accounted for 32% of annual household income among the poorest Malawian households in 1992.	239
NCDs and injuries	Indirect and out-of-pocket expenses	There are large indirect costs associated with chronic illness, including income and productivity losses among patients and family carers. In India, out-of-pocket spending on NCDs increased as a proportion of all out-of-pocket spending from 32% in 1995–1996 to 47% in 2004; the odds of catastrophic hospitalization expenditures for cancer was nearly 170% greater; and for CVD and injuries was 22% greater than the odds of hospitalization due to communicable diseases.	240, 241, 242
CVD	Out-of-pocket expenses and employment	Households affected by CVD in India have higher health spending, rely more on selling assets and borrowing to pay for healthcare, and have lower employment rates than households unaffected by the disease.	243

Table A4: The economic benefits of investing in adult health

Health investment	Outcome of interest	Key findings	References
Antiretroviral therapy for HIV	Productivity	There is strong evidence that HIV treatment yields great economic returns, mostly through increasing participation in the labor force. People with HIV who begin and continue with antiretroviral therapy show immediate and long-term improvements in productivity.	244, 245
Iron supplementation for anemia	Productivity	Among male rubber workers in Indonesia, anemic workers were 20% less productive than non-anemic workers. When the anemic workers were treated with iron supplements, their productivity rose to the same level as the non-anemic workers.	246, 247
Curbing air pollution	Labor outcomes	Reducing pollution levels is associated with increased labor force participation and earnings. For example, in the US, a decrease in ozone concentration of 10 parts per billion was associated with a 4.2% increase in productivity among agricultural sector workers.	248, 249

Table A5: The national economic impact of health

Illness or health investment	Outcome of interest	Key findings	References
Malaria	Loss of GDP growth	A study of six countries in Sub-Saharan Africa found that malaria led to a loss in GDP growth ranging from 0.4% of GDP in Ghana to 9% of GDP in Chad.	250
Malaria reduction and elimination	Global economic output	A study that modeled the impact of global malaria reduction and elimination from 2013 to 2035 found that the gains in economic output would be worth about \$208.6 billion.	251
Childhood vaccination	Treatment costs averted and productivity losses averted	Scaling-up vaccination against six childhood diseases from 2011 to 2020 in 72 developing countries could avert \$6.2 billion in treatment costs and \$145 billion in productivity losses.	252

ABBREVIATIONS AND GLOSSARY

Abbreviations

CVD	Cardiovascular disease
GDP	Gross domestic product
HICs	High-income countries
IMF	International Monetary Fund
LICs	Low-income countries
MICs	Middle-income countries
NCDs	Non-communicable diseases
R&D	Research and development
SDG	Sustainable development goal
TB	Tuberculosis
UHC	Universal health coverage
VLY	Value of a life year
WHO	World Health Organization

Glossary

Best buys

Highly cost-effective health interventions that are feasible and culturally acceptable to implement. A highly cost-effective intervention is one that, on average, provides an extra year of healthy life for less than the country's average annual income per person.

Capitation

Paying healthcare providers a fixed amount in advance to provide a defined set of services over a fixed period of time for a specific population.

Co-payment

A fixed payment for a specific health service paid by an insured individual at the time they receive the service.

Fee-for-service

Paying healthcare providers for each individual service provided – such as a diagnostic test, a clinic visit, or a medical procedure. In a fee-for-service model, providers are incentivized to provide more treatments because payment is dependent on the quantity rather than the quality of care.

Financial protection

Protection from financial risk. A key aim of publicly financed insurance is to provide citizens with financial protection to ensure they will not suffer financial ruin if they get sick or injured.

Financial risk

Impoverishment or other adverse financial consequences that result from paying for healthcare services out-of-pocket.

Grand convergence

A reduction in the rates of maternal and child mortality, and deaths from infectious diseases to universally low levels – the levels that are seen today in high-performing MICs (for example, China, Costa Rica and Turkey).

Household income

The combined income of all individuals in a household, including all forms of income such as salaries, wages and government transfers.

Inclusive income

A measure of a country's wealth that goes beyond the GDP alone. The growth in a country's inclusive income over time is the sum of the growth in GDP and the economic value of increased life expectancy.

Individual income

The total income of a single individual, including all forms of income such as salaries, wages and government transfers.

Interventions

Medicines, vaccines, diagnostic tests, surgical operations, promotion of healthy behaviors and other ways to prevent or treat illness and promote health.

Monetary value

The value in currency that individuals or markets place on an item, service or resource.

National income

The total value of all goods and services produced annually in a country. Gross domestic product (GDP) is one measure of a country's national income.

Out-of-pocket payments

Fee-for-service charges at the point of care without the benefit of insurance. Out-of-pocket payments exclude prepayment in the form of taxes or insurance premiums.

Pooling

Also known as health insurance, in risk pooling a group of people contribute to a common pool, usually run by a third party – funds from the pool are then used to pay part or all of the costs of a defined set of health services for members of the pool.

Public financing

The purchase of health services for a population using general revenue taxation or mandatory contributions (such as payroll taxes or other mandatory public or private insurance schemes).

Value of a life year (VLY)

The economic value of one additional year of life – it represents the personal, intrinsic value of this extra year, unrelated to a person's productivity.

ACKNOWLEDGMENTS

The Forum advisory board for this paper was chaired by Dean Jamison, Professor Emeritus at the University of California, San Francisco. *Investing in Health* was written by Gavin Yamey (Duke Global Health Institute, Duke University), in collaboration with Naomi Beyeler (University of California, San Francisco), Hester Wadge (Imperial College London) and Dean Jamison.

Sincere thanks are extended to the members of the advisory board who contributed their unique insights to this paper:

Faleh Mohamed Hussain Ali | Acting Chief Executive Officer, National Health Insurance Company, Qatar

Ala Alwan | Regional Director for the Eastern Mediterranean, World Health Organization

Sir Richard Feachem | Director, The Global Health Group and Professor of Global Health, University of California, San Francisco, US

Eduardo González Pier | Senior Research Fellow, FUNSALUD and former Deputy Minister of Health, Mexico

Sanjeev Gupta | Deputy Director, Fiscal Affairs Department, International Monetary Fund

Richard Horton | Editor-in-Chief, The Lancet, UK

Gordon Liu | Director, PKU Yangtze River Scholar Professor of Economics, Peking University National School of Development, China

Mark McClellan | Director, Duke-Robert J. Margolis Center for Health Policy and Robert J. Margolis Professor of Business, Medicine and Health Policy, Duke University, US

Elias Mossialos | Professor of Health Policy, Imperial College London, UK

Sir David Nicholson | Adjunct Professor, Imperial College London, UK

Nisreen Salti | Associate Professor, Department of Economics, American University of Beirut, Lebanon

Jon Skinner | James O. Freedman Presidential Professor, Dartmouth College and Geisel School of Medicine, US

Agnes Soucat | Director, Health Systems, Governance and Financing, World Health Organization

Lawrence Summers | Charles W. Eliot University Professor and President Emeritus, Harvard University, US

Duncan Thomas | Norb F. Schaefer Professor of International Studies and Professor of Economics, Global Health and Public Policy, Department of Economics, Duke University, US

The interviews that informed this report were conducted by Gavin Yamey and Naomi Beyeler. The chair and authors thank all who contributed, including Amelia Cheatham, Sara Fewer, Gianluca Fontana, Orsida Gjebrea, Jungyeon Kim, Natalie Lubin, Jennifer Nguyen, Emily Partner, Sarah Salvest and David Soled.

Any errors or omissions remain the responsibility of the authors.

WISH Forum team

Forum Director: Jessica Prestt

Head of Forum Development: Hannah Patel

Investing in Health Forum Fellow: Hester Wadge

REFERENCES

- 01.** UN Inter-agency Group for Child Mortality Estimation. Levels and trends in child mortality. United Nations Children's Fund, 2015; Available at: www.childmortality.org/files_v20/download/IGME%20report%202015%20child%20mortality%20final.pdf
- 02.** World Health Organization. Global Health Observatory: Life expectancy data. Geneva: 2015; Available at: www.who.int/gho/mortality_burden_disease/life_tables/en/
- 03.** Jamison DT, Summers LH, Alleyne G *et al.* Global health 2035: A world converging within a generation. *The Lancet*, 2013; 382(9908): 1898–955.
- 04.** Institute for Health Metrics and Evaluation. Financing global health 2014: Shifts in funding as the MDG era closes. Seattle, WA: 2015; Available at: www.healthdata.org/policy-report/financing-global-health-2014-shifts-funding-mdg-era-closes
- 05.** Von Schoen-Angerer T, Ford N, Arkinstall J. Access to medicines in resource-limited settings: The end of a golden decade? *Global Advances in Health and Medicine*, 2012; 1(1): 52–9.
- 06.** *The Lancet*. Global health in 2012: Development to sustainability. *The Lancet*, 2012; 379(9812): 193.
- 07.** Arrow KJ *et al.* Sustainability and the measurement of wealth. National Bureau of Economic Research, 2010; Available at: www.nber.org/papers/w16599
- 08.** International Monetary Fund. World economic outlook: Too slow for too long. Washington, DC: 2016; Available at: www.imf.org/external/pubs/ft/weo/2016/01/pdf/text.pdf
- 09.** Jamison DT, Summers LH, Alleyne G *et al.* Global health 2035: A world converging within a generation. *The Lancet*, 2013; 382(9908): 1898–955.
- 10.** World Bank. World development report 1993: Investing in health. New York: Oxford University Press, 1993.
- 11.** Institute for Health Metrics and Evaluation. Financing global health 2014: Shifts in funding as the MDG era closes. Seattle, WA: 2015; Available at: www.healthdata.org/policy-report/financing-global-health-2014-shifts-funding-mdg-era-closes
- 12.** United Nations Department of Economic and Social Affairs Population Division. World population prospects, the 2015 revision. 2015; Available at: <http://esa.un.org/unpd/wpp/unpp>
- 13.** Jamison DT, Summers LH, Alleyne G *et al.* Global health 2035: A world converging within a generation. *The Lancet*, 2013; 382(9908): 1898–955.
- 14.** Jamison DT, Summers LH, Alleyne G *et al.* Global health 2035: A world converging within a generation. *The Lancet*, 2013; 382(9908): 1898–955.

15. Fink G, Rockers PC. Childhood growth, schooling, and cognitive development: Further evidence from the Young Lives study. *The American Journal of Clinical Nutrition*, 2014; 100(1): 182–8.
16. Meng X, Qian N. The long term consequences of famine on survivors: Evidence from a unique natural experiment using China's great famine. National Bureau of Economic Research, 2009; Available at: www.nber.org/papers/w14917
17. Umana-Aponte M. Long-term effects of a nutritional shock: The 1980 famine of Karamoja, Uganda. Department of Economics at University of Bristol, 2011; Available at: <https://ideas.repec.org/p/bri/cmpowp/11-258.html>
18. Hoddinott J, Behrman JR, Maluccio JA et al. Adult consequences of growth failure in early childhood. *The American Journal of Clinical Nutrition*, 2013; 98(5): 1170–8.
19. Victora CG, Adair L, Fall C et al. Maternal and child undernutrition: Consequences for adult health and human capital. *The Lancet*, 2008; 371(9609): 340–57.
20. Chen Y, Zhou L-A. The long-term health and economic consequences of the 1959–1961 famine in China. *Journal of Health Economics*, 2007; 26(4): 659–81.
21. Fernando SD, Rodrigo C, Rajapakse S. The 'hidden' burden of malaria: Cognitive impairment following infection. *Malaria Journal*, 2010; 9(1): 1–11.
22. Venkataramani AS. Early life exposure to malaria and cognition in adulthood: Evidence from Mexico. *Journal of Health Economics*, 2012; 31(5): 767–80.
23. Barofsky J, Anekwe TD, Chase C. Malaria eradication and economic outcomes in Sub-Saharan Africa: Evidence from Uganda. *Journal of Health Economics*, 2015; 44: 118–36.
24. Currie J, Vogl T. Early-life health and adult circumstance in developing countries. *Annual Review of Economics*, 2013; 5: 1–36.
25. Currie J, Zivin JSG, Mullins J, Neidell MJ. What do we know about short and long term effects of early life exposure to pollution? National Bureau of Economic Research, 2013; Available at: www.nber.org/papers/w19571
26. Currie J, Vogl T. Early-life health and adult circumstance in developing countries. *Annual Review of Economics*, 2013; 5: 1–36.
27. Currie J, Zivin JSG, Mullins J, Neidell MJ. What do we know about short and long term effects of early life exposure to pollution? National Bureau of Economic Research, 2013; Available at: www.nber.org/papers/w19571
28. Walker SP, Wachs TD, Grantham-McGregor S et al. Inequality in early childhood: Risk and protective factors for early child development. *The Lancet*, 2011; 378(9799): 1325–38.
29. Vogl T. Education and health in developing economies. New Jersey: Princeton University and NBER, 2012; Available at: www.princeton.edu/~t-vogl/vogl_ed_health_review.pdf

30. Daniels MC, Adair LS. Growth in young Filipino children predicts schooling trajectories through high school. *Journal of Nutrition*, 2004; 134(6): 1439–46.
31. Alderman H, Hoddinott J, Kinsey B. Long term consequences of early childhood malnutrition. *Oxford Economic Papers*, 2006; 58(3): 450–74.
32. Almond D, Currie J. Killing me softly: The fetal origins hypothesis. *Journal of Economic Perspectives*, 2011; 25(3): 153–72.
33. Thomas D, Frankenberg E. Health, nutrition and prosperity: A microeconomic perspective. *Bulletin of the World Health Organization*, 2002; 80(2): 106–13.
34. Fink G, Rockers PC. Childhood growth, schooling, and cognitive development: Further evidence from the Young Lives study. *The American Journal of Clinical Nutrition*, 2014; 100(1): 182–8.
35. Hoddinott J, Behrman JR, Maluccio JA *et al.* Adult consequences of growth failure in early childhood. *The American Journal of Clinical Nutrition*, 2013; 98(5): 1170–8.
36. Barofsky J, Anekwe TD, Chase C. Malaria eradication and economic outcomes in Sub-Saharan Africa: Evidence from Uganda. *Journal of Health Economics*, 2015; 44: 118–36.
37. Field E, Robles O, Torero M. Iodine deficiency and schooling attainment in Tanzania. *American Economic Journal: Applied Economics*, 2009; 1(4): 140–69.
38. Stein AD, Wang M, DiGirolamo A *et al.* Nutritional supplementation in early childhood, schooling, and intellectual functioning in adulthood: A prospective study in Guatemala. *Archives of Pediatrics and Adolescent Medicine*, 2008; 162(7): 612–18.
39. Hoddinott J, Maluccio JA, Behrman JR, Flores R, Martorell R. Effect of a nutrition intervention during early childhood on economic productivity in Guatemalan adults. *The Lancet*, 2008; 371(9610): 411–16.
40. Maluccio JA, Hoddinott J, Behrman JR, Martorell R, Quisumbing AR, Stein AD. The impact of improving nutrition during early childhood on education among Guatemalan adults. *The Economic Journal*, 2009; 119(537): 734–63.
41. Crookston BT, Penny ME, Alder SC *et al.* Children who recover from early stunting and children who are not stunted demonstrate similar levels of cognition. *Journal of Nutrition*, 2010; 140(11): 1996–2001.
42. Cutler D, Fung W, Kremer M, Singhal M, Vogl T. Mosquitoes: The long-term effects of malaria eradication in India. National Bureau of Economic Research, 2007; Available at: www.nber.org/papers/w13539
43. Canning D, Razzaque A, Driessen J, Walker DG, Streatfield PK, Yunus M. The effect of maternal tetanus immunization on children's schooling attainment in Matlab, Bangladesh: Follow-up of a randomized trial. *Social Science & Medicine*, 2011; 72(9): 1429–36.

44. Bloom DE, Canning D, Shenoy ES. The effect of vaccination on children's physical and cognitive development in the Philippines. *Applied Economics*, 2012; 44(21): 2777–83.
45. Deogaonkar R, Hutubessy R, van der Putten I, Evers S, Jit M. Systematic review of studies evaluating the broader economic impact of vaccination in low and middle income countries. *BMC Public Health*, 2012; 12(1): 878.
46. Jit M, Hutubessy R, Png ME *et al*. The broader economic impact of vaccination: Reviewing and appraising the strength of evidence. *BMC Medicine*, 2015; 13(1): 209.
47. Driessen J, Razzaque A, Walker D, Canning D. The effect of childhood measles vaccination on school enrolment in Matlab, Bangladesh. *Applied Economics*, 2015; 47(55): 6019–40.
48. Anekwe TD, Newell M-L, Tanser F, Pillay D, Bärnighausen T. The causal effect of childhood measles vaccination on educational attainment: A mother fixed-effects study in rural South Africa. *Vaccine*, 2015; 33(38): 5020–6.
49. Bleakley H. Disease and development: Evidence from hookworm eradication in the American South. *Quarterly Journal of Economics*, 2007; 122(1): 73–117.
50. Taylor-Robinson DC, Maayan N, Soares-Weiser K, Donegan S, Garner P. Deworming drugs for soil-transmitted intestinal worms in children: Effects on nutritional indicators, haemoglobin and school performance. *Cochrane Database of Systematic Reviews*, 2012; 7: CD000371.
51. Davey C, Aiken AM, Hayes RJ, Hargreaves JR. Re-analysis of health and educational impacts of a school-based deworming programme in western Kenya: A statistical replication of a cluster quasi-randomized stepped-wedge trial. *International Journal of Epidemiology*, 2015; 44: 1581–92.
52. Zivin JSG, Neidell MJ. The impact of pollution on worker productivity. National Bureau of Economic Research, 2011; Available at: www.nber.org/papers/w17004
53. Fox MP, Rosen S, MacLeod WB *et al*. The impact of HIV/AIDS on labour productivity in Kenya. *Tropical Medicine and International Health*, 2004; 9(3): 318–24.
54. Habyarimana J, Mbakile B, Pop-Eleches C. The impact of HIV/AIDS and ARV treatment on worker absenteeism implications for African firms. *Journal of Human Resources*, 2010; 45(4): 809–39.
55. Levinsohn JA, McLaren Z, Shisana O, Zuma K. HIV status and labor market participation in South Africa. National Bureau of Economic Research, 2011; Available at: www.nber.org/papers/w16901
56. Chima RI, Goodman CA, Mills A. The economic impact of malaria in Africa: A critical review of the evidence. *Health Policy*, 2003; 63(1): 17–36.

57. Alam K, Mahal A. Economic impacts of health shocks on households in low and middle income countries: A review of the literature. *Global Health*, 2014; 10(1): 21.
58. Xu K, Evans DB, Carrin G, Aguilar-Rivera AM, Musgrove P, Evans T. Protecting households from catastrophic health spending. *Health Affairs*, 2007; 26(4): 972–83.
59. Bachmann MO, Booysen FL. Health and economic impact of HIV/AIDS on South African households: A cohort study. *BMC Public Health*, 2003; 3(1): 14.
60. Ettling M, McFarland DA, Schultz LJ, Chitsulo L. Economic impact of malaria in Malawian households. *Tropical Medicine and Parasitology*, 1994; 45(1): 74–9.
61. Jaspers L, Colpani V, Chaker L, Ven der Lee S, Muka T, Imo D. The global impact of non-communicable diseases on households and impoverishment: A systematic review. *European Journal of Epidemiology*, 2015; 30(3): 163–88.
62. Engelgau MM, Karan A, Mahal A. The Economic impact of non-communicable diseases on households in India. *Global Health*, 2012; 8(1): 9.
63. Karan A, Engelgau M, Mahal A. The household-level economic burden of heart disease in India. *Tropical Medicine and International Health*, 2014; 19(5): 581–91.
64. Counts CJ, Skordis-Worrall J. Recognizing the importance of chronic disease in driving healthcare expenditure in Tanzania: Analysis of panel data from 1991 to 2010. *Health Policy Plan*, 2015; czv081.
65. Kankeu H, Saksena P, Xu K, Evans D. The financial burden from non-communicable diseases in low- and middle-income countries: A literature review. *Health Research Policy and Systems*, 2013; 11(1): 31.
66. Heltberg R, Oviedo AM, Talukdar F. What do household surveys really tell us about risk, shocks and risk management in the developing world? *Journal of Development Studies*, 2015; 51(3): 209–25.
67. Dhanaraj S. Economic vulnerability to health shocks and coping strategies: Evidence from Andhra Pradesh, India. *Health Policy Plan*, 2016; czv127.
68. van Doorslaer E, O'Donnell O, Rannan-Eliya RP et al. Effect of payments for health care on poverty estimates in 11 countries in Asia: An analysis of household survey data. *The Lancet*, 2006; 368(9544): 1357–64.
69. Heltberg R, Oviedo AM, Talukdar F. What do household surveys really tell us about risk, shocks and risk management in the developing world? *Journal of Development Studies*, 2015; 51(3): 209–25.
70. Dhanaraj S. Economic vulnerability to health shocks and coping strategies: Evidence from Andhra Pradesh, India. *Health Policy Plan*, 2016; czv127.
71. van Doorslaer E, O'Donnell O, Rannan-Eliya RP et al. Effect of payments for health care on poverty estimates in 11 countries in Asia: An analysis of household survey data. *The Lancet*, 2006; 368(9544): 1357–64.

72. Thomas D, Frankenberg E. Health, nutrition and prosperity: A microeconomic perspective. *Bulletin of the World Health Organization*, 2002; 80(2): 106–13.
73. Zivin JSG, Neidell MJ. The impact of pollution on worker productivity. National Bureau of Economic Research, 2011; Available at: www.nber.org/papers/w17004
74. Thirumurthy H, Galárraga O, Larson B, Rosen S. HIV treatment produces economic returns through increased work and education, and warrants continued US support. *Health Affairs*, 2012; 31(7): 1470–7.
75. Rosen S, Larson B, Rohr J et al. Effect of antiretroviral therapy on patients' economic well being: Five-year follow-up. *AIDS*, 2014; 28(3): 417–24.
76. Basta SS, Soekirman, Karyadi D, Scrimshaw NS. Iron deficiency anemia and the productivity of adult males in Indonesia. *American Journal of Clinical Nutrition*, 1979; 32(4): 916–25.
77. Isen A, Rossin-Slater M, Walker R. Every breath you take – every dollar you'll make: The long-term consequences for the Clean Air Act of 1970. NBER Working Paper No. 19858, 2014.
78. Victora CG, Adair L, Fall C et al. Maternal and child undernutrition: Consequences for adult health and human capital. *The Lancet*, 2008; 371(9609): 340–57.
79. Thirumurthy H, Galárraga O, Larson B, Rosen S. HIV treatment produces economic returns through increased work and education, and warrants continued US support. *Health Affairs*, 2012; 31(7): 1470–7.
80. Walker SP, Chang SM, Wright A, Osmond C, Grantham-McGregor SM. Early childhood stunting is associated with lower developmental levels in the subsequent generation of children. *Journal of Nutrition*, 2015; 145(4): 823–8.
81. Stein AD, Barnhart HX, Hickey M, Ramakrishnan U, Schroeder DG, Martorell R. Prospective study of protein-energy supplementation early in life and of growth in the subsequent generation in Guatemala. *American Journal of Clinical Nutrition*, 2003; 78(1): 162–7.
82. Behrman JR, Calderon MC, Preston SH, Hoddinott J, Martorell R, Stein AD. Nutritional supplementation in girls influences the growth of their children: Prospective study in Guatemala. *American Journal of Clinical Nutrition*, 2009; 90(1): 1372–9.
83. Liu G, Hackney C, Yao Y. Health and wealth: The role of health in economic growth. Working Paper, China Center for Health Economics Research, Peking University, 2016.
84. Jamison DT, Lau L, Wang J. Health's contribution to economic growth in an environment of partially endogenous technical progress. In López-Casasnovas G, Rivera B, Currais L (eds.). *Health and economic growth: Findings and policy implications*. Cambridge, MA: MIT Press, 2005: 67–91.

85. Okorosobo T, Okorosobo F, Mwabu G, Orem J, Kirigia J. Economic burden of malaria in six countries of Africa. *European Journal of Business Management*, 2011; 3.
86. Purdy M, Robinson M, Wei K, Rublin D. The economic case for combating malaria. *American Journal of Tropical Medicine and Hygiene*, 2013; 89(5): 819–23.
87. Roll Back Malaria. Global malaria action plan for a malaria-free world. 2008; Available at: www.rollbackmalaria.org/microsites/gmap/toc.html
88. Stack ML, Ozawa S, Bishai DM et al. Estimated economic benefits during the 'Decade of vaccines' include treatment savings, gains in labor productivity. *Health Affairs*, 2011; 30(6): 1021–8.
89. 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. *The Lancet*, 2014; 383(9925): 1333–54.
90. Baicker K and Chandra A. The health care jobs fallacy. *The New England Journal of Medicine*, 2012; 366(26):2433–5.
91. Baumol W. The cost disease: Why computers get cheaper and health care doesn't. New Haven: Yale University Press, 2012.
92. Baumol WJ. Macroeconomics of unbalanced growth: The anatomy of urban crisis. *American Economic Review*, 1967; 57(3): 415–26.
93. Evans T, Soucat A. Economic, demographic, and epidemiological transitions and the future of health labor markets. Global Health Workforce Alliance, Working Group Paper, 2015.
94. Hartwig J. What drives health care expenditure? – Baumol's model of 'unbalanced growth' revisited. *Journal of Health Economics*, 2008; 27(3): 603–23.
95. Hartwig J. Can Baumol's model of unbalanced growth contribute to explaining the secular rise in health care expenditure? An alternative test. *Applied Economics*, 2011; 43(2): 173–84.
96. Evans T, Soucat A. Economic, demographic, and epidemiological transitions and the future of health labor markets. Global Health Workforce Alliance, Working Group Paper, 2015.
97. World Health Organization. Health workforce: Presidents Hollande and Zuma chair the first meeting of the High-Level Commission on Health Employment and Economic Growth. 2016; Available at: www.who.int/hrh/com-heeg/com-heeg-meeting-chair/en/
98. Bloom DE, Canning D, Jamison DT. Health, wealth, and welfare. *Finance Development*, 2004; 41: 10–115.
99. Bloom DE, Canning D, Jamison DT. Health, wealth, and welfare. *Finance Development*, 2004; 41: 10–115.
100. Bloom DE, Canning D. Policy forum: Public health. The health and wealth of nations. *Science*, 2000; 287(5456): 1207, 1209.

101. Gallup JL, Sachs JD. The economic burden of malaria. *American Journal of Tropical Medicine and Hygiene*, 2001; 64(1 suppl): 85–96.
102. Lee R, Mason A. What is the demographic dividend? *Finance and Development*, 2006; 43(3).
103. Bloom D, Cafiero-Fonseca ET, McGovern M *et al.* The macroeconomic impact of non-communicable diseases in China and India: Estimates, projections, and comparisons. *Journal of the Economics of Ageing*, 2014; 4: 100–11.
104. Chi S, Lee S, Liu G, Jamison DT. Evolution of the value of longevity in China. Working Paper, 2016.
105. Becker GS, Philipson TJ, Soares RR. The quantity and quality of life and the evolution of world inequality. *American Economic Review*, 2005; 95(1): 277–91.
106. Jamison DT, Summers LH, Alleyne G *et al.* Global health 2035: A world converging within a generation. *The Lancet*, 2013; 382(9908): 1898–955.
107. Chang A. What is a life year worth? Sensitivity of the Lancet Commission on Investing in Health estimates to underlying assumptions and implications. Washington, DC: 2016.
108. Bloom DE, Canning D, Jamison DT. Health, wealth, and welfare. *Finance Development*, 2004; 41: 10–115.
109. National Population Council (CONAPO). Mexican population projections 2010–2050. 2014; Available at: www.conapo.gob.mx/es/CONAPO/Proyecciones
110. National Institute of Statistics and Geography (INEGI). Statistics of mortality 1990–2014. 2016; Available at: www.inegi.org.mx/est/lista_cubos/consulta.aspx?p=adm&c=4
111. OECD. Health at a glance 2015: OECD indicators. Paris: 2015; Available at: http://dx.doi.org/10.1787/health_glance-2015-en
112. Ministry of Health, Mexico. Directorate General of Information in Health. 2015; Available at: www.dgjs.salud.gob.mx/contenidos/sinais/s_index.html
113. Sansores D, Gutierrez D. Financing impact of overweight and obesity in Mexico, 1999–2023. Mexico: Economic Analysis Unit, Ministry of Health, 2015.
114. Jamison DT, Summers LH, Alleyne G *et al.* Global health 2035: A world converging within a generation. *The Lancet*, 2013; 382(9908): 1898–955.
115. Xu K, Evans DB, Carrin G, Aguilar-Rivera AM, Musgrove P, Evans T. Protecting households from catastrophic health spending. *Health Affairs*, 2007; 26(4): 972–83.
116. Baicker K, Goldman D. Patient cost-sharing and healthcare spending growth. *Journal of Economic Perspectives*, 2011; 25(2): 47–68.

117. Kruk ME, Goldmann E, Galea S. Borrowing and selling to pay for health care in low- and middle-income countries. *Health Affairs*, 2009; 28(4): 1056–66.
118. Jamison DT, Summers LH, Alleyne G *et al.* Global health 2035: A world converging within a generation. *The Lancet*, 2013; 382(9908): 1898–955.
119. Nicholson D, Yates R, Warburton W, Fontana G. Delivering universal health coverage: A guide for policymakers. Report of the WISH Universal Health Coverage Forum, 2015.
120. Nicholson D, Yates R, Warburton W, Fontana G. Delivering universal health coverage: A guide for policymakers. Report of the WISH Universal Health Coverage Forum, 2015.
121. Potetz L, Cubanski J, Neuman T. Medicare spending and financing: A primer. The Henry J Kaiser Family Foundation, 2011; Available at: <https://kaiserfamilyfoundation.files.wordpress.com/2013/01/7731-03.pdf>
122. Merlis M. Simplifying administration of health insurance. National Academy of Social Insurance, National Academy of Public Administration, Robert Wood Johnson Foundation, 2009.
123. World Health Organization. Administrative costs of health insurance schemes: Exploring the reasons for their variability. Geneva: 2010.
124. Jamison DT, Summers LH, Alleyne G *et al.* (2013).
125. Central Office of Information. The new National Health Service. London: 1948.
126. Finkelstein A, McKnight R. What did Medicare do (and was it worth it)? National Bureau of Economic Research, 2005; Available at: www.nber.org/papers/w11609
127. Giedion U, Alfonso EA, Diaz Y. The impact of universal coverage schemes in the developing world: A review of the existing evidence. The World Bank, 2013.
128. Shrimpe M, Verguet S, Johansson K, Desalegn D, Jamison D, Kruk ME. Task-sharing or public finance for expanding surgical access in rural Ethiopia: An extended cost-effectiveness analysis. In: Debas HT, Donkor P, Gawande A *et al* (eds.). *Essential surgery: Disease control priorities*, Third Edition (Volume 1). Washington, DC: The International Bank for Reconstruction and Development/The World Bank, 2015: Chapter 19.
129. American Presidency Project. Remarks with President Truman at the signing in Independence of the Medicare Bill, 2016.; Available at: www.presidency.ucsb.edu/ws/?pid=27123
130. Yip WC-M, Hsiao WC, Chen W, Hu S, Ma J, Maynard A. Early appraisal of China's huge and complex health-care reforms. *The Lancet*, 2012; 379(9818): 833–42.

131. 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.
132. Salti N, Chaaban J, Naamani N. The economics of tobacco in Lebanon: An estimation of the social costs of tobacco consumption. *Substance Use & Misuse*, 2014; 49(6): 735–42.
133. Salti N. On the progressivity of increasing taxes on tobacco: An extended cost effectiveness analysis for Lebanon. American University of Beirut, 2014; Available at: bit.ly/1UgnMpL
134. Verguet S, Gauvreau CL, Mishra S *et al.* The consequences of tobacco tax on household health and finances in rich and poor smokers in China: An extended cost-effectiveness analysis. *Lancet Global Health*, 2015; 3(4): e206–16.
135. Limwattananon S, Neelsen S, O'Donnell OA *et al.* Universal coverage on a budget: Impacts on health care utilization and out-of-pocket expenditures in Thailand. Rochester, NY: Social Science Research Network, 2013; Available at: <http://papers.ssrn.com/abstract=2277437>
136. Finkelstein A, Hendren N, Luttmer EFP. The value of Medicaid: Interpreting results from the Oregon health insurance experiment. National Bureau of Economic Research, 2015; Available at: www.nber.org/papers/w21308
137. Neyfakh L. Is health insurance an antidepressant? *Boston Globe*, 23 June 2013; Available at: www.bostonglobe.com/ideas/2013/06/23/health-insurance-antidepressant/bn3cq4XTH67RMZ9b3i0R7M/story.html
138. 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 Affairs*, 2013; 32(4): 643–52.
139. World Health Organization. World Health Report 2010: Health systems financing – The path to universal coverage. Geneva: 2010.
140. World Health Organization. World Health Report 2010: Health systems financing – The path to universal coverage. Geneva: 2010.
141. Coady D, Parry I, Sears L, Shang B. How large are global energy subsidies? Washington, DC: International Monetary Fund, 2015.
142. Institute for Health Metrics and Evaluation. Financing global health 2014: Shifts in funding as the MDG era closes. Seattle, WA: 2015; Available at: www.healthdata.org/policy-report/financing-global-health-2014-shifts-funding-mdg-era-closes
143. Institute for Health Metrics and Evaluation. Financing global health 2014: Shifts in funding as the MDG era closes. Seattle, WA: 2015; Available at: www.healthdata.org/policy-report/financing-global-health-2014-shifts-funding-mdg-era-closes
144. Easterly W. The white man's burden: Why the West's efforts to aid the rest have done so much ill and so little good. New York: Penguin Press, 2006.

145. Moyo D. Dead aid: Why aid is not working and how there is a better way for Africa. New York: Farrar, Straus and Giroux, 2009.
146. Deaton A. The great escape: Health, wealth, and the origins of inequality. Princeton, NJ: Princeton University Press, 2013.
147. Deaton A. The great escape: Health, wealth, and the origins of inequality. Princeton, NJ: Princeton University Press, 2013.
148. Flaxman AD, Fullman N, Jr MWO *et al.* Rapid scaling up of insecticide-treated bed net coverage in Africa and its relationship with development assistance for health: A systematic synthesis of supply, distribution, and household survey data. *PLOS Medicine*, 2010; 7: e1000328.
149. Lim SS, Fullman N, Stokes A *et al.* Net benefits: A multi-country analysis of observational data examining associations between insecticide-treated mosquito nets and health outcomes. *PLOS Medicine*, 2011; 8: e1001091.
150. Mills A, Shillcutt S. The challenge of communicable disease. In Lomborg B (eds.). Global crises, global solutions. Cambridge, UK: Cambridge University Press, 2004.
151. Bendavid E, Holmes CB, Bhattacharya J, Miller G. HIV development assistance and adult mortality in Africa. *Journal of the American Medical Association*, 2012; 307(19): 2060–7.
152. Perry R, Murray J, Gacic-Dobo M *et al.* Progress toward regional measles elimination – worldwide, 2000–2014. *Morbidity and Mortality Weekly Report*, 2015; 64(44): 1246–51.
153. Bendavid E, Bhattacharya J. The relationship of health aid to population health improvements. *JAMA Internal Medicine*, 2014; 174(6): 881–7.
154. Center for Global Development. Millions Saved. Available at: <http://millionssaved.cgdev.org>
155. Stack ML, Ozawa S, Bishai DM *et al.* Estimated economic benefits during the ‘Decade of vaccines’ include treatment savings, gains in labor productivity. *Health Affairs*, 2011; 30(6): 1021–8.
156. Copenhagen Consensus. Outcome: Expert panel findings, Copenhagen Consensus outcome paper. 2012; Available at: www.copenhagenconsensus.com/copenhagen-consensus-iii/outcome
157. Schäferhoff M, Fewer S, Kraus J *et al.* How much donor financing for health is channelled to global versus country-specific aid functions? *The Lancet*, 2015; 386(10011): 2436–41.
158. Davies D, Verde E. Antimicrobial resistance: In search of a collaborative solution. Qatar: World Innovation Summit for Health (WISH), 2013; Available at: <http://cdn.wish.org.qa/app/media/385>
159. Schäferhoff M, Fewer S, Kraus J *et al.* How much donor financing for health is channelled to global versus country-specific aid functions? *The Lancet*, 2015; 386(10011): 2436–41.

160. Hecht R, Jamison DT. Vaccine research and development assessment paper. In Lomborg B (eds.). *Rethink HIV: Smarter ways to invest in ending HIV in Sub-Saharan Africa*. New York: Cambridge University Press, 2012: 299–320.
161. Lakdawalla D, Malani A, Reif J. The insurance value of medical innovation. NBER Working Paper, 2015.
162. World Bank. *Pandemic risk and One Health*. Washington, DC: 2013; Available at: www.worldbank.org/en/topic/health/brief/pandemic-risk-one-health
163. Schäferhoff M, Fewer S, Kraus J *et al*. How much donor financing for health is channelled to global versus country-specific aid functions? *The Lancet*, 2015; 386(10011): 2436–41.
164. Sands P. *The neglected dimension of global security: A framework to consider infectious disease crises*. Washington, DC: National Academies Press, 2016.
165. Fan V, Jamison DT, Summers LH. *The inclusive cost of pandemic influenza risk*. Cambridge, MA: National Bureau of Economic Research, 2016.
166. Davis K. The amazing decline of mortality in underdeveloped areas. *American Economic Review*, 1956; 46(2): 305–18.
167. Croghan TW, Beatty A, Ron A. Routes to better health for children in four developing countries. *Milbank Quarterly*, 2006; 84(2): 333–58.
168. World Innovation Summit for Health (WISH). WISH Forum on Precision Medicine. Press Release. Qatar: 2016; Available at: <http://wish-qatar.org/media-center/press-release-details?item=176&backArt=71>
169. Jamison DT, Murphy SM, Sandbu M. Why has under-5 mortality decreased at such different rates in different countries? *Journal of Health Economics*, in press.
170. Jamison DT, Summers LH, Alleyne G *et al*. Global health 2035: A world converging within a generation. *The Lancet*, 2013; 382(9908): 1898–955.
171. World Bank. *World development report 1993: Investing in health*. New York: Oxford University Press, 1993.
172. World Health Organization. *World health report 1999: Making a difference*. Geneva: 1999.
173. Disease Control Priorities (DCP3). Available at: www.dcp-3.org
174. Cleason M, Mawji T, Walker C. Investing in the best buys: A review of the health, nutrition, and population portfolio, FY 1993–1999. Health, Nutrition and Population Discussion Paper. Washington, DC: World Bank, 2000; Available at: <http://siteresources.worldbank.org/HEALTHNUTRITIONANDPOPULATION/Resources/281627-1095698140167/Claeson-InvestingInTheBest-whole.pdf>

175. Ozawa S, Mirelman A, Stack ML, Walker DG, Levine OS. Cost-effectiveness and economic benefits of vaccines in low- and middle-income countries: A systematic review. *Vaccine*, 2012; 31(1): 96–108.
176. Hoddinott J, Alderman H, Behrman JR, Haddad L, Horton S. The economic rationale for investing in stunting reduction. *Maternal and Child Nutrition*, 2013; 9(S2): 69–82.
177. Jamison DT, Summers LH, Alleyne G *et al.* Global health 2035: A world converging within a generation. *The Lancet*, 2013; 382(9908): 1898–955.
178. 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. *The Lancet*, 2014; 383(9925): 1333–54.
179. Roll Back Malaria. Global malaria action plan for a malaria-free world. 2008; Available at: www.rollbackmalaria.org/microsites/gmap/toc.html
180. Nugent RA. Benefits and costs of the non-communicable disease targets for the post-2015 development agenda. Post-2015 Consensus. Available at: <http://dcp-3.org/sites/default/files/resources/R%20Nugent%20CC%20Perspective%20Paper.pdf>
181. Jamison DT, Summers LH, Alleyne G *et al.* Global health 2035: A world converging within a generation. *The Lancet*, 2013; 382(9908): 1898–955.
182. Verguet S, Laxminarayan R, Jamison DT. Universal public finance of tuberculosis treatment in India: An extended cost-effectiveness analysis. *Health Economics*, 2015; 24(3): 318–32.
183. Verguet S, Murphy S, Anderson B, Johansson KA, Glass R, Rheingans R. Public finance of rotavirus vaccination in India and Ethiopia: An extended cost-effectiveness analysis. *Vaccine*, 2013; 31(42): 4902–10.
184. Jamison DT, Summers LH, Alleyne G *et al.* Global health 2035: A world converging within a generation. *The Lancet*, 2013; 382(9908): 1898–955.
185. Bloom DE, Chisholm D, Jané-Llopis E, Prettner K, Stein A, Feigl A. From burden to “best buys”: Reducing the economic impact of non-communicable diseases in low- and middle-income countries. Program on the Global Demography of Aging, 2011.
186. Ministry of Health: Federal Democratic Republic of Ethiopia. National mental health strategy 2012/13–2015/16. Ethiopia: 2012.
187. World Innovation Summit for Health (WISH). WISH Forum on Cardiovascular Disease. Qatar: 2016; Available at: <http://wish-qatar.org/media-center/press-release-details?item=180&backArt=71>
188. World Health Organization. Global health expenditure database, 2013. Geneva: 2013.
189. International Monetary Fund. World economic prospects. Washington, DC: 2015.

190. Emery N. Rwanda's historic health recovery: What the U.S. might learn. *The Atlantic*, 20 February 2013; Available at: www.theatlantic.com/health/archive/2013/02/rwandas-historic-health-recovery-what-the-us-might-learn/273226/
191. Farmer PE, Nutt CT, Wagner CM et al. Reduced premature mortality in Rwanda: Lessons from success. *British Medical Journal*, 2013; 346: f65.
192. McNeil Jr D. Rwanda's health care success story. *The New York Times*, 4 February 2013; Available at: www.nytimes.com/2013/02/05/science/rwandas-health-care-success-story.html?_r=0
193. National Institute of Statistics of Rwanda. Integrated household living conditions survey 3 (EICV 3). Rwanda: 2012; Available at: www.statistics.gov.rw/survey-period/integrated-household-living-conditions-survey-3-eicv-3
194. World Bank. World development indicators. Washington, DC: 2015; Available at: <http://data.worldbank.org/data-catalog/world-development-indicators>
195. World Health Organization. World malaria report: 2012. Geneva: 2012; Available at: www.who.int/malaria/publications/world_malaria_report_2012/wmr2012_no_profiles.pdf?ua=1
196. Fink G, Rockers PC. Childhood growth, schooling, and cognitive development: Further evidence from the Young Lives study. *The American Journal of Clinical Nutrition*, 2014; 100(1): 182–8.
197. Meng X, Qian N. The long term consequences of famine on survivors: Evidence from a unique natural experiment using China's great famine. National Bureau of Economic Research, 2009; Available at: www.nber.org/papers/w14917
198. Umana-Aponte M. Long-term effects of a nutritional shock: The 1980 famine of Karamoja, Uganda. Department of Economics at University of Bristol, 2011; Available at: <https://ideas.repec.org/p/bri/cmpowp/11-258.html>
199. Chen Y, Zhou L-A. The long-term health and economic consequences of the 1959–1961 famine in China. *Journal of Health Economics*, 2007; 26(4): 659–81.
200. Hoddinott J, Behrman JR, Maluccio JA et al. Adult consequences of growth failure in early childhood. *The American Journal of Clinical Nutrition*, 2013; 98(5): 1170–8.
201. Victora CG, Adair L, Fall C et al. Maternal and child undernutrition: Consequences for adult health and human capital. *The Lancet*, 2008; 371(9609): 340–57.
202. Hoddinott J, Maluccio JA, Behrman JR, Flores R, Martorell R. Effect of a nutrition intervention during early childhood on economic productivity in Guatemalan adults. *The Lancet*, 2008; 371(9610): 411–16.

203. Fernando SD, Rodrigo C, Rajapakse S. The 'hidden' burden of malaria: Cognitive impairment following infection. *Malaria Journal*, 2010; 9(1): 1–11.
204. Venkataramani AS. Early life exposure to malaria and cognition in adulthood: Evidence from Mexico. *Journal of Health Economics*, 2012; 31(5): 767–80.
205. Barofsky J, Anekwe TD, Chase C. Malaria eradication and economic outcomes in Sub-Saharan Africa: Evidence from Uganda. *Journal of Health Economics*, 2015; 44: 118–36.
206. Currie J, Vogl T. Early-life health and adult circumstance in developing countries. *Annual Review of Economics*, 2013; 5: 1–36.
207. Currie J, Zivin JSG, Mullins J, Neidell MJ. What do we know about short and long term effects of early life exposure to pollution? National Bureau of Economic Research, 2013; Available at: www.nber.org/papers/w19571
208. Currie J, Vogl T. Early-life health and adult circumstance in developing countries. *Annual Review of Economics*, 2013; 5: 1–36.
209. Walker SP, Wachs TD, Grantham-McGregor S et al. Inequality in early childhood: Risk and protective factors for early child development. *The Lancet*, 2011; 378(9799): 1325–38.
210. Vogl T. Education and health in developing economies. New Jersey: Princeton University and NBER, 2012; Available at: www.princeton.edu/~tvogl/vogl_ed_health_review.pdf
211. Daniels MC, Adair LS. Growth in young Filipino children predicts schooling trajectories through high school. *Journal of Nutrition*, 2004; 134(6): 1439–46.
212. Alderman H, Hoddinott J, Kinsey B. Long term consequences of early childhood malnutrition. *Oxford Economic Papers*, 2006; 58(3): 450–74.
213. Currie J, Vogl T. Early-life health and adult circumstance in developing countries. *Annual Review of Economics*, 2013; 5: 1–36.
214. Almond D, Currie J. Killing me softly: The fetal origins hypothesis. *Journal of Economic Perspectives*, 2011; 25(3): 153–72.
215. Field E, Robles O, Torero M. Iodine deficiency and schooling attainment in Tanzania. *American Economic Journal: Applied Economics*, 2009; 1(4): 140–69.
216. Fink G, Rockers PC. Childhood growth, schooling, and cognitive development: Further evidence from the Young Lives study. *The American Journal of Clinical Nutrition*, 2014; 100(1): 182–8.
217. Hoddinott J, Behrman JR, Maluccio JA et al. Adult consequences of growth failure in early childhood. *The American Journal of Clinical Nutrition*, 2013; 98(5): 1170–8.
218. Hoddinott J, Maluccio JA, Behrman JR, Flores R, Martorell R. Effect of a nutrition intervention during early childhood on economic productivity in Guatemalan adults. *The Lancet*, 2008; 371(9610): 411–16.

219. Maluccio JA, Hoddinott J, Behrman JR, Martorell R, Quisumbing AR, Stein AD. The impact of improving nutrition during early childhood on education among Guatemalan adults. *The Economic Journal*, 2009; 119(537): 734–63.
220. Crookston BT, Penny ME, Alder SC et al. Children who recover from early stunting and children who are not stunted demonstrate similar levels of cognition. *Journal of Nutrition*, 2010; 140(11): 1996–2001.
221. Stein AD, Barnhart HX, Hickey M, Ramakrishnan U, Schroeder DG, Martorell R. Prospective study of protein-energy supplementation early in life and of growth in the subsequent generation in Guatemala. *American Journal of Clinical Nutrition*, 2003; 78(1): 162–7.
222. Barofsky J, Anekwe TD, Chase C. Malaria eradication and economic outcomes in Sub-Saharan Africa: Evidence from Uganda. *Journal of Health Economics*, 2015; 44: 118–36.
223. Cutler D, Fung W, Kremer M, Singhal M, Vogl T. Mosquitoes: The long-term effects of malaria eradication in India. National Bureau of Economic Research, 2007; Available at: www.nber.org/papers/w13539
224. Canning D, Razzaque A, Driessen J, Walker DG, Streatfield PK, Yunus M. The effect of maternal tetanus immunization on children's schooling attainment in Matlab, Bangladesh: Follow-up of a randomized trial. *Social Science & Medicine*, 2011; 72(9): 1429–36.
225. Bloom DE, Canning D, Shenoy ES. The effect of vaccination on children's physical and cognitive development in the Philippines. *Applied Economics*, 2012; 44(21): 2777–83.
226. Ozawa S, Mirelman A, Stack ML, Walker DG, Levine OS. Cost-effectiveness and economic benefits of vaccines in low- and middle-income countries: A systematic review. *Vaccine*, 2012; 31(1): 96–108.
227. Bärnighausen T, Bloom DE, Canning D, O'Brien J. Accounting for the full benefits of childhood vaccination in South Africa. *South African Medical Journal*, 2008; 98(11): 842, 844–6.
228. Ozawa S, Clark S, Portnoy A, Grewal S, Brenzel L, Walker DG. Return on investment from childhood immunization in low- and middle-income countries, 2011–20. *Health Affairs*, 2016; 35(2): 199–207.
229. Driessen J, Razzaque A, Walker D, Canning D. The effect of childhood measles vaccination on school enrolment in Matlab, Bangladesh. *Applied Economics*, 2015; 47(55): 6019–40.
230. Anekwe TD, Newell M-L, Tanser F, Pillay D, Bärnighausen T. The causal effect of childhood measles vaccination on educational attainment: A mother fixed-effects study in rural South Africa. *Vaccine*, 2015; 33(38): 5020–6.
231. Bleakley H. Disease and development: Evidence from hookworm eradication in the American South. *Quarterly Journal of Economics*, 2007; 122(1): 73–117.

232. Taylor-Robinson DC, Maayan N, Soares-Weiser K, Donegan S, Garner P. Deworming drugs for soil-transmitted intestinal worms in children: Effects on nutritional indicators, haemoglobin and school performance. *Cochrane Database of Systematic Reviews*, 2012; 7: CD000371.
233. Davey C, Aiken AM, Hayes RJ, Hargreaves JR. Re-analysis of health and educational impacts of a school-based deworming programme in western Kenya: A statistical replication of a cluster quasi-randomized stepped-wedge trial. *International Journal of Epidemiology*, 2015; 44: 1581–92.
234. Currie J, Zivin JSG, Mullins J, Neidell MJ. What do we know about short and long term effects of early life exposure to pollution? National Bureau of Economic Research, 2013 Available at: www.nber.org/papers/w19571
235. Fox MP, Rosen S, MacLeod WB et al. The impact of HIV/AIDS on labour productivity in Kenya. *Tropical Medicine and International Health*, 2004; 9(3): 318–24.
236. Habyarimana J, Mbakile B, Pop-Eleches C. The impact of HIV/AIDS and ARV treatment on worker absenteeism implications for African firms. *Journal of Human Resources*, 2010; 45(4): 809–39.
237. Levinsohn JA, McLaren Z, Shisana O, Zuma K. HIV status and labor market participation in South Africa. National Bureau of Economic Research, 2011; Available at: www.nber.org/papers/w16901
238. Bachmann MO, Booyesen FL. Health and economic impact of HIV/AIDS on South African households: A cohort study. *BMC Public Health*, 2003; 3(1): 14.
239. Ettling M, McFarland DA, Schultz LJ, Chitsulo L. Economic impact of malaria in Malawian households. *Tropical Medicine and Parasitology*, 1994; 45(1): 74–9.
240. Engelgau MM, Karan A, Mahal A. The economic impact of non-communicable diseases on households in India. *Global Health*, 2012; 8(1): 9.
241. Karan A, Engelgau M, Mahal A. The household-level economic burden of heart disease in India. *Tropical Medicine and International Health*, 2014; 19(5): 581–91.
242. Counts CJ, Skordis-Worrall J. Recognizing the importance of chronic disease in driving healthcare expenditure in Tanzania: Analysis of panel data from 1991 to 2010. *Health Policy Plan*, 2015; czv081.
243. Karan A, Engelgau M, Mahal A. The household-level economic burden of heart disease in India. *Tropical Medicine and International Health*, 2014; 19(5): 581–91.
244. Thirumurthy H, Galárraga O, Larson B, Rosen S. HIV treatment produces economic returns through increased work and education, and warrants continued US support. *Health Affairs*, 2012; 31(7): 1470–7.
245. Rosen S, Larson B, Rohr J et al. Effect of antiretroviral therapy on patients' economic well being: Five-year follow-up. *AIDS*, 2014; 28(3): 417–24.

- 246.** Thomas D, Frankenberg E. Health, nutrition and prosperity: A microeconomic perspective. *Bulletin of the World Health Organization*, 2002; 80(2): 106–13.
- 247.** Basta SS, Soekirman, Karyadi D, Scrimshaw NS. Iron deficiency anemia and the productivity of adult males in Indonesia. *American Journal of Clinical Nutrition*, 1979; 32(4): 916–25.
- 248.** Zivin JSG, Neidell MJ. The impact of pollution on worker productivity. National Bureau of Economic Research, 2011; Available at: www.nber.org/papers/w17004
- 249.** Isen A, Rossin-Slater M, Walker R. Every breath you take – every dollar you’ll make: The long-term consequences for the Clean Air Act of 1970. NBER Working Paper No. 19858, 2014.
- 250.** Okorosobo T, Okorosobo F, Mwabu G, Orem J, Kirigia J. Economic burden of malaria in six countries of Africa. *European Journal of Business Management*, 2011; 3.
- 251.** Purdy M, Robinson M, Wei K, Rublin D. The economic case for combating malaria. *American Journal of Tropical Medicine and Hygiene*, 2013; 89(5): 819–23.
- 252.** Stack ML, Ozawa S, Bishai DM *et al.* Estimated economic benefits during the ‘Decade of vaccines’ include treatment savings, gains in labor productivity. *Health Affairs*, 2011; 30(6): 1021–8.

WISH PARTNERS



WISH gratefully acknowledges the support of the Ministry of Public Health



Duke-Margolis Center
for Health Policy



McKinsey&Company

MedStar Health
Institute for Quality and Safety

NATIONAL ACADEMY OF MEDICINE

NORTHWESTERN
UNIVERSITY
IN QATAR

مؤسسة الرعاية الصحية الأولية
PRIMARY HEALTH CARE CORPORATION

QATAR
AIRWAYS القطرية

كلية الصيدلة
College of Pharmacy
QATAR UNIVERSITY

أكاديمية ريناد
RENAD ACADEMY

مركز دراسات التشريع
الإسلامي والأخلاق
Research Center for Islamic
Legislation and Ethics
عضو في كلية الدراسات الإسلامية في قطر
Member of Qatar Faculty of Islamic Studies

السفارة
Sidra
مركز السفارة للطب والبحوث
Sidra Medical and Research Center
Member of Qatar Foundation

نجوم
العلم
من مبادرات مؤسسة قطر
An Initiative of Qatar Foundation

اللجنة العليا
للمشاريع والريث
Supreme Committee
for Delivery & Legacy

THE
BEHAVIOURAL
INSIGHTS TEAM.

THE
CARTER CENTER

TheKingsFund

جامعة كالغاري في قطر
UNIVERSITY OF CALGARY IN QATAR

UMASS
BOSTON

Weill Cornell
Medicine-Qatar

ويك
WEYAK
جمعية أصدقاء الصحة النفسية
MENTAL HEALTH FRIENDS ASSOCIATION

wise
world innovation summit for education
مؤتمر القمة العالمي للابتكار في التعليم
an initiative of
مؤسسة قطر
Qatar Foundation

WORLD BANK GROUP

NOTES

