Advancing social and economic development by investing in women's and children's health: a new Global Investment Framework

*Karin Stenberg, Henrik Axelson, Peter Sheehan, Ian Anderson, A Metin Gülmezoglu, Marleen Temmerman, Elizabeth Mason, Howard S Friedman, Zulfiqar A Bhutta, Joy E Lawn, Kim Sweeny, Jim Tulloch, Peter Hansen, Mickey Chopra, Anuradha Gupta, Joshua P Vogel, Mikael Ostergren, Bruce Rasmussen, Carol Levin, Colin Boyle, Shyama Kuruvilla, Marjorie Koblinsky, Neff Walker, Andres de Francisco, Nebojsa Novcic, and Carole Presern, Dean Jamison, Flavia Bustreo, on behalf of the Study Group for the Global Investment Framework for Women's and Children's Health**

A new Global Investment Framework for Women's and Children's Health demonstrates how investment in women's and children's health will secure high health, social, and economic returns. We costed health systems strengthening and six investment packages for: maternal and newborn health, child health, immunisation, family planning, HIV/AIDS, and malaria. Nutrition is a cross-cutting theme. We then used simulation modelling to estimate the health and socioeconomic returns of these investments. Increasing health expenditure by just $5 per person per year up to 2035 in 74 high-burden countries could yield up to nine times that value in economic and social benefits. These returns include greater gross domestic product (GDP) growth through improved productivity, and prevention of the needless deaths of 147 million children, 32 million stillbirths, and 5 million women by 2035. These gains could be achieved by an additional investment of $30 billion per year, equivalent to a 2% increase above current spending.

Introduction

Substantial reductions in maternal and child deaths have been achieved worldwide in the last two decades. The global maternal mortality ratio reduced by 47% in 1990–2010 and the under-5 mortality reduced by 47% in 1990–2012.[1,2] However, this falls short of the rates of reduction needed by 2015 to achieve the Millennium Development Goals (MDGs) 4 and 5. Despite rapid economic growth in many Asian countries, south Asia still accounts for a third of child and maternal mortality (appendix). Communicable, maternal, neonatal, and nutritional causes account for 25% of deaths and remain dominant causes of premature mortality in sub-Saharan Africa.[3] Maternal causes are a significant cause of death for women aged 15–34 years, accounting for 11% of deaths in 2010.[3]

Sustained global and regional efforts are being made to support countries to accelerate progress, including the UN Secretary-General's Global Strategy for Women's and Children's Health, and the Campaign on Accelerated Reduction of Maternal, Newborn and Child Mortality in Africa.[4–7] As part of these initiatives, much work has been done to calculate where additional investment is needed to improve health systems and service delivery in low-income countries.[8,9] Our analysis builds on this work, with particular focus on the substantial social and economic benefits that can accrue when a country invests in the health of its women and children.

The investment gaps are well known: insufficiently resourced health systems[10] with low coverage of cost-effective interventions,[11] and poor health information and management systems,[12] making inefficient use of limited resources.[13] This in turn leads to unacceptably high rates of preventable maternal and child deaths with significant social and economic losses.

The leading causes of maternal mortality—obstetric haemorrhage, hypertensive disorders of pregnancy, sepsis, and unsafe abortion[14]—are, to a large extent, preventable in most high-burden countries. Death from these causes can usually be prevented by well equipped health facilities, the

Key messages

- Additional investments of US$5 per person per year in 74 countries, with 95% of the global maternal and child mortality burden, would yield high rates of return, producing up to nine times the economic and social benefit by 2035.
- Continuing historical trends of coverage increases is not sufficient. Accelerated investments are needed to bring health benefits to the majority of women and children.
- Compared with current trends, our accelerated investment scenario estimates that a total of 5 million maternal deaths, 147 million child deaths, and 32 million stillbirths can be prevented in 2013–35 in 74 high-burden countries.
- Expanding access to contraception will be a particularly cost-effective investment potentially accounting for half of all the deaths prevented in the accelerated investment scenario.
- More than a third of the additional costs required are health systems investments that are also required for services beyond those for reproductive, maternal, newborn, and child health. An ambitious scale-up would require an additional 675 000 nurses, doctors, and midwives in 2035, along with 544 000 community health workers.
- The new global investment framework could serve as a guide to countries to optimise investments in women's and children's health within national health and development plans over the next two decades.

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*Study Group members listed at the end of the paper

Department of Health Systems Financing (K Stenberg MSc), **Family, Women's and Children's Health** (F Bustreo MD), **Department of Reproductive Health and Research** (A M Gülmezoglu PhD, M Temmerman PhD, J P Vogel MBBS), **Department of Maternal, Newborn, Child and Adolescent Health** (Elizabeth Mason MSc, Mikael Ostergren MD), **World Health Organization, Geneva, Switzerland; World Health Organization, Phnom Penh, Cambodia** (H Axelson MSc); **The Partnership for Maternal, Newborn & Child Health, hosted by the World Health Organization** (A de Francisco MD, S Kuruvilla PhD, N Novcic MPhil, C Presern PhD); **SickKids Center for Global Child Health, Toronto, ON, Canada, and Center of Excellence in Women & Child Health, The Aga Khan University, Karachi, Pakistan** (Prof Z A Bhutta PhD); **The GAVI Alliance, Geneva, Switzerland** (P Hansen PhD); **Bloomberg School of Public Health, Johns Hopkins University, Baltimore, MD, USA** (N Walker PhD); **London School of Hygiene and Tropical Medicine, London, UK** (J E Lawn PhD); **The Ministry of Health and Family Welfare, Government of India, India** (A Gupta MBA); **Health Section, UNICEF, UN Plaza, New York, NY, USA** (M Chopra MD); **UN Population Fund, New York, NY, USA** (H S Friedman PhD); **US Agency for International Development, Washington DC, USA** (M Koblinsky PhD); **Victoria University, Melbourne, VIC, Australia** (B Rasmussen PhD,

P Sheehan DPhil, K Sweeny PhD); **Independent Consultant, Canberra, ACT, Australia** (I Anderson MSc); **Indendent Consultant, Cali, Colombia** (J Tulloch MBBS); **University of Washington, Seattle, WA, USA** (C Levin PhD, Prof D Jamison PhD); **University of California, San Francisco, CA, USA** (C Boyle MBA)

Correspondence to: Karin Stenberg, Department of Health Systems Governance and Financing, World Health Organization, Avenue Appia, 1211 Geneva, Switzerland **stenbergk@who.int**

See Online for appendix

presence of a skilled care provider (even at the lowest level of the health system), a functioning referral system, and a reliable supply of life-saving commodities. Some services are key interventions to prevent maternal deaths, such as contraception, antenatal care, skilled birth attendance, integrated reproductive health care in the postnatal phase, postnatal care, and a range of services for adolescents and women. However, access to them remains low, especially among the poorest in high-burden countries.[15]

Health systems investments are also required to prevent child mortality. WHO has estimated that 17% of deaths in children younger than 5 years are due to diseases that can be prevented by routine, cost-effective vaccination.[16] Although coverage rates of immunisation are high compared with other maternal and child health interventions, many children still die from easily preventable diseases, including pneumonia and diarrhoea.[17] New pneumococcal and rotavirus vaccines now exist to prevent these disorders. Coverage can be scaled up by strengthening existing supply chains and by training health workers to provide integrated care at facilities, and through outreach activities to rural communities. Robust health information systems and good management are also needed to ensure efficient and effective immunisation coverage.

High rates of malnutrition underlie more than 45% of all deaths in children younger than 5 years and are a significant factor in maternal mortality. For those children who survive, malnutrition jeopardises their potential for optimum growth and development, with important consequences later in life.[18,19]

The economic and social consequences of poor health services coverage and outcomes to families and communities are substantial, particularly for the poor and other vulnerable groups.[20,21] Unexpected illness and associated health-care costs are leading causes of impoverishment in many low-income and middle-income countries.[22] Poor health has a detrimental effect on school attendance and performance and future earnings.[23] Children—not just newborn babies—whose mothers die, are, on average, more likely to die before the age of 2 years than children with mothers.[24] If they do survive, they are also disadvantaged socially and economically.[25]

The analysis in this study estimates the costs and benefits of addressing the remaining gaps through health sector interventions. We show the potential effect on the economy and outline benefits for overall development.

In response to a recommendation in 2012 by the UN independent Expert Review Group on information and accountability for women's and children's health (iERG), WHO, the Partnership for Maternal, Newborn & Child Health (PMNCH), and *The Lancet* Commission on Investing in Health[26] coordinated the development of a global investment framework for women's and children's health ("the investment framework").[27] This builds on the HIV/AIDS investment framework and previous investment cases for reproductive, maternal, newborn, and child health (RMNCH) and other initiatives.[9,28–31] (appendix).

We have undertaken a new analysis that extends the earlier work by estimating the effects of investment on RMNCH across the continuum of care, including family planning, stillbirths, and newborn health (which have not always been included in previous studies). It also extends the timeframe to 2035 (this end date was chosen to align our analysis with the *The Lancet* Commission on Investing in Health) and analyses the economic and social returns on investment. The findings of this analysis will contribute to broader policy dialogue on effective health investments, including by being an input to *The Lancet* Commission on Investing in Health, which is expected to publish its report in December, 2013.

The analysis provides an updated estimate of the health, social, and economic benefits of investing in strengthening health systems to deliver RMNCH interventions in 74 low-income and middle-income countries that account for more than 95% of maternal and child deaths. It provides a global cost estimate of the level of investment required for the integrated delivery of a set of evidence-based RMNCH interventions. In modelling investment needs and health outcomes, the analysis supports an implementation approach that factors in equity and the social determinants of health—ie, by considering the effect of conditional cash transfers on increasing the proportion of women giving birth in health facilities. While recognising the intrinsic value of health and its role in meeting basic human rights, it also attempts to estimate the economic benefits of averting morbidity and mortality. This study analyses the broader, long-term health and nutrition gains to human capital development, and the substantial benefits of family planning for both health outcomes and socioeconomic development. The framework also emphasises the broader links to, and need for, health systems strengthening.

Methods

Conceptual framework

We first developed a conceptual framework that underpins the development of the Global Investment Framework for Women's and Children's Health (figure 1). This starts with the overall health and development context, and within it identifies four broad dimensions or "key enablers" that drive health outcomes: policy, health system, community engagement, and innovation. These enablers are key to scaling up essential interventions in a way that is politically, financially, technically, and socially sustainable. We then defined a package of evidence-based RMNCH interventions, on which there is consensus about the beneficial effects for the health of women and adolescent girls; mothers and newborn babies; and infants and children younger than 5 years.[32] We acknowledge that the health needs of those groups overlap, and recognise the crucial importance of the first thousand days from conception to 2 years of age in the prevention of maternal and child mortality.[33,34]

The conceptual framework outlines the importance of considering costs related to both the key enablers and

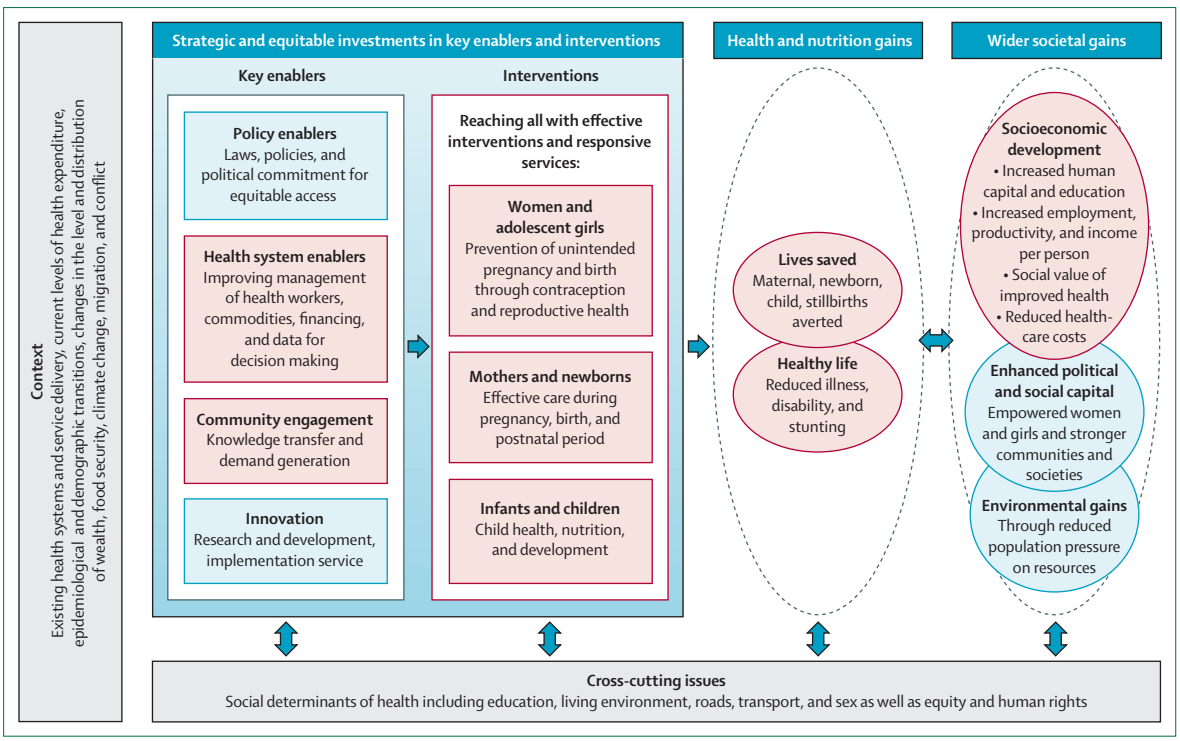

Figure 1: **Conceptual framework**
Areas shaded in red are those included in the quantitative analysis.

high-impact interventions, and acknowledges that an investment framework should estimate the health gains in terms of mortality reductions (lives saved) and morbidity averted (healthy life; third column in figure 1). The investment framework also addresses related societal gains (fourth column) such as socioeconomic development and enhanced political and social capital. It recognises that health gains can lead to wider societal gains in areas such as education, environment, gender equality, and human rights, and that these can in turn lead to health benefits (hence the arrows of causality run both ways).

Scope of the investment framework analysis

To estimate the potential social, economic, and health effect of a new global investment framework for women's and children's health, we used the conceptual framework to focus the analysis on 74 of the 75 Countdown to 2015 countries (we excluded South Sudan because of poor data availability). The 74 countries include: 35 low-income countries; 27 lower middle-income countries; 11 upper-middle-income countries; and one high-income country (appendix). These countries are estimated to have a total population of 4·9 billion in 2013,[35] and jointly account for more than 95% of maternal and child deaths.[15] Only 23 of the 74 countries are on track for MDG 4, and nine countries for MDG 5a.[36]

Our quantitative analysis did not cover all components of the conceptual framework, because of challenges related to modelling some of the components. For example, we assumed the development and adoption of appropriate policies across the health system to enable scale-up of effective interventions, but we did not specifically estimate the cost of developing and adopting these policies. We did not estimate the costs and benefits of innovation and research, in view of the many types of research and innovation and channels by which these influence health, and challenges related to predicting their effect. Moreover, enhanced political and social capital and environmental gains are highlighted, but not analysed because of conceptual and methodological challenges and absence of related data.

The period of analysis was aligned with *The Lancet* Commission on Investing in Health and covers 2013–35, to show what could be achieved within a generation. The focus of the analysis, especially in terms of potential effect, was society as a whole, because although most of the costs will be borne within the health sector, many of the benefits accrue to society more broadly, such as overall productivity and economic growth.

Costing of interventions and delivery mechanisms

Our analysis included health sector interventions known to directly improve reproductive health and to reduce maternal, newborn, and child mortality, as identified through a previous review.[32] It focused on interventions for which methods and data on effectiveness are available, so that outcomes can be modelled. On that basis, we selected 50 evidence-based interventions and

	Delivery channels (from OneHealth Tool)				Average coverage attained by 2035 in modelled scenario		
	Community*	Outreach†	First level facility‡	Hospital§	Low (baseline)	Medium	High
Package 1: Family planning							
Modern family planning methods (pill, condom, injectable, IUD, implant, female sterilisation, male sterilisation, LAM, vaginal barrier method, vaginal tablets, and other contraceptives)	x	x	x	x	30·41	41·90	49·87
Package 2: Maternal and newborn health							
Safe abortion¶	..	..	x	x	41·49	57·68	64·06
Post-abortion case management	..	..	x	x	42·72	76·05	99·70
Ectopic pregnancy case management	..	..	..	x	34·48	71·15	99·72
Syphilis detection and treatment in pregnant women	..	..	x	x	31·78	61·72	99·68
Multiple micronutrient supplementation	..	x	..	..		39·06	94·80
Balanced energy supplementation‖	NA	NA	NA	NA		32·03	97·86
Management of pre-eclampsia (magnesium sulphate)	..	..	x	x	3·09	4·02	4·99
Detection and management of diabetes in pregnancy‖	NA	NA	NA	NA	98·54	33·02	98·54
Detection and management of fetal growth restriction‖	NA	NA	NA	NA	3·09	4·02	4·99
Skilled birth assistance during labour	..	..	x	x	65·06	88·21	99·00
Active management of the third stage of labour	..	..	x	x	43·10	74·33	93·73
Management of eclampsia with magnesium sulphate	..	..	x	x	43·58	73·97	93·50
Neonatal resuscitation	..	..	x	x	27·91	53·33	84·28
Kangaroo mother care	..	..	x	x	4·30	9·73	94·89
Clean practices and immediate essential newborn care	x	..	..	..	52·86	78·95	93·77
Antenatal corticosteroids for preterm labour	..	..	..	x	43·58	73·97	93·50
Antibiotics for preterm premature rupture of membranes	..	..	x	x	43·58	73·97	93·50
Induction of labour (beyond 41 weeks)	..	..	..	x	6·92	14·35	19·62
Neonatal infections or newborn sepsis—full supportive care	..	..	..	x	22·69	56·31	86·53
Preventive postnatal care	..	..	x	x	17·94	35·94	96·08
Periconceptional folic acid supplementation	x	x	x	..	5·01	6·61	95·13
Calcium supplementation for prevention and treatment of pre-eclampsia and eclampsia	..	..	x	..	5·24	6·98	94·89
Package 3: Malaria							
Insecticide-treated materials	x	..	..	..	27·95	62·39	98·64
Pregnant women sleeping under an insecticide-treated bednet	x	..	..	..	26·18	100·00	100·00
Intermittent preventive treatment—for pregnant women	..	..	x	..	36·14	100·00	100·00
Malaria treatment in children 0–4 years	..	..	x	..	5·74	13·01	98·57
Treatment of malaria in pregnant women	..	..	x	..	54·71	80·42	99·99
Package 4: HIV							
Prevention of mother to child transmission	..	..	x	x	36·93	82·04	82·04
ART (first-line treatment) for pregnant women	..	..	x	x	38·87	73·84	73·84
Cotrimoxazole for children	x	..	x	x		39·62	95·86
Paediatric ART	..	..	x	x	18·39	63·09	95·97
Package 5: Immunisation							
Tetanus toxoid vaccine (pregnant women)	..	x	x	x	74·27	85·93	93·04
Rotavirus vaccine	..	..	x	..	5·52	90·66	90·66
Measles vaccine	..	x	x	..	79·45	89·84	99·94
DPT vaccine	..	..	x	..	80·62	91·72	99·94
Haemophilus influenzae type b vaccine (Hib) vaccine	..	..	x	..	62·46	91·52	91·52
Polio vaccine	..	x	x	..	81·20	81·57	81·57
BCG vaccine	..	..	x	..	87·59	87·89	87·89
Pneumococcal vaccine	..	..	x	..	4·85	88·80	88·80
Meningitis vaccine‖	NA	NA	NA	NA	100·00	100·00	100·00

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	Delivery channels (from OneHealth Tool)				Average coverage attained by 2035 in modelled scenario		
	Community*	Outreach†	First level facility‡	Hospital§	Low (baseline)	Medium	High
(Continued from previous page)							
Package 6: Child health							
Oral rehydration therapy	x	..	x	..	39·65	51·68	98·58
Zinc for diarrhoea treatment	x	..	x	..	1·23	51·70	98·58
Antibiotics for treatment of dysentery	..	..	x	x	31·93	52·77	98·43
Pneumonia treatment in children 0–4 years	x	..	x	..	45·46	74·46	99·47
Vitamin A for measles treatment in children 0–4 years	..	..	x	..	66·45	75·80	98·84
Breastfeeding counselling and support	..	x	x	..	Rates of breastfeeding were scaled up as below		
Rates of exclusive breastfeeding modelled: 1–5 months	..	..	..	..	30	54	90
Complementary feeding counselling and support	x	..	x	..	40·61	61·23	99·41
Management of severe malnutrition in children 0–4 years	x	..	x	x	4·30	9·60	94·89
Vitamin A supplementation in infants and children 6–59 months	x	x	..	..	66·18	78·13	98·83
All interventions							
Average coverage across 50 interventions	..	..	..	..	38·78	60·10	88·12

IUD=intrauterine device. LAM= lactational amenorrhoea method. ART=antiretroviral therapy. DPT=diphtheria, pertussis, tetanus. BCG=Bacillus Calmette–Guérin. NA=not applicable (only impact was included for this intervention, and no costs). *The intervention is delivered by a family member advised by a community health worker (eg, oral rehydration therapy) or directly by a community health worker. †The intervention is delivered by a health worker travelling from a health facility into the community to provide services for a few hours per day, either at a health post, or through a mobile vehicle. ‡The intervention is delivered at a primary level health facility with mainly outpatient services. §The intervention is delivered at a hospital which might include district, regional, or national level hospital. Both outpatient and inpatient services are planned for and costed at this level. ¶In 11 countries where abortion is legal. ||Current analysis includes impact only, not cost.

Table 1: **List of interventions included in the analysis**

grouped them into six broad packages that follow programme structures in many national ministries of health: family planning, maternal and newborn health, malaria, HIV, immunisation, and child health. We included improved nutrition in several packages (table 1). We assumed that interventions were delivered at four delivery points: hospital, first-level facility, outreach, and the community (table 1). The distribution of interventions across these four delivery points was based on existing best practice, as outlined in WHO treatment guidelines and judgments applied by WHO experts in areas where guidelines were not available. We assumed the distribution to remain constant during the scale-up period. We did not factor "task-shifting" across different delivery points in the analysis.

Estimation of costs and health impact

A range of methods has been used in recent years to estimate costs and benefits of RMNCH interventions to address maternal,[37] newborn[38] and child[39,40] deaths, stillbirths,[41] deaths due to pneumonia and diarrhoea,[42] and nutrition-related mortality.[18] However, few have looked at a more complete range of interventions along the RMNCH continuum of care. Recent efforts to estimate costs for a comprehensive set of health interventions, and the related health systems requirements, indicated the overall resource envelope required until 2015 but only included low-income countries, thereby excluding many high-burden countries for child and maternal mortality.[9] Our analysis attempts to address these gaps, as explained below.

Our analysis estimates the costs of six packages of high-impact interventions, along with the programme and systems costs needed to deliver these interventions, and the potential effects of these interventions. We used the OneHealth Tool, which takes an integrated approach to the assessment of costs and health benefits[43] and incorporates interlinked epidemiological reference models such as the Lives Saved Tool (LiST),[44] the AIDS Impact Model for HIV/AIDS interventions,[45–47] and the FamPlan model which computes the relation between contraceptive use and the total fertility rate.[48,49] The OneHealth Tool uses these epidemiological resources to model the estimated need for health services dynamically over time—taking into account population growth, reduced mortality, and reduced incidence or prevalence of disorders as interventions are scaled up.

The levels of coverage in the 74 high-burden countries drove our analysis of intervention costs and impact. We included three scenarios: low, medium, and high coverage (panel 1). Coverage projections drew on previous analysis,[50] but with adjustments to align the analysis with the set of identified interventions and with global targets set for malaria and HIV (appendix). We did the modelling country by country for each of the three scenarios. Our objective of using the three scenarios was to model or estimate the incremental effect of an investment strategy for women's and children's health (medium or high) compared with maintaining current coverage without strengthening the health system (low). Our analysis was thus centred on the comparison between scenarios,

Panel 1: **Definition of scenarios used in the analysis**

Low: maintaining present coverage

- This scenario assumes that coverage is maintained at present levels.
- Coverage of existing interventions across the continuum of care, including use of contraceptives, is maintained at predicted present levels (2012).
- Population growth is as would occur with present contraceptive use, fertility, and mortality profiles of the 74 countries. This means that the total population will continue to increase over time, along with the cost of providing services. The absolute number of deaths will therefore increase.
- The LiST model assumes that mortality rates will not change unless coverage changes. For this reason, because the low scenario assumes constant coverage rates from 2013 onwards, mortality rates do not change over time.

Medium: continuing historical trends

- This scenario assumes scale-up according to currently available historic trends for expanding coverage in every country based on data for years 1990–2010. Rates of coverage increase according to model predictions based on country-specific and intervention-specific historical data.
- Family planning or contraceptive use increases based on trend model data, the total fertility rate was capped at a minimum of 2·1 children per woman, except in the four cases for which the present total fertility rate was already lower than this.
- For newer vaccines (rotavirus, *Haemophilus influenzae* type b (Hib), and pneumococcal vaccines), we used predictions of rollouts by the GAVI Alliance.
- For predictions of HIV incidence, prevention of mother-to-child transmission (PMTCT), antiretroviral therapy for children and adults, and treatment with cotrimoxazole, we used projections of UNAIDS data directly.
- Coverage across the 50 interventions reaches on average 60% by 2035.

High: accelerated scale-up

- This is a more ambitious scenario in which scale-up coverage is based on accelerating present trends using a best performer approach.
- Projected coverage values derived from historical trends, using the fastest rate of change achieved by countries at specific coverage levels.
- Rates of coverage increase to reach on average 88% for the 50 interventions by 2035.
- Family planning or contraceptive use increases also based on best performer trends, with total fertility rate capped at 2·1 children per woman.
- For newer vaccines, predictions are the same as for the medium scenario.
- For predictions of HIV incidence, PMTCT, antiretroviral therapy for children, and adults and treatment with cotrimoxazole, we applied global targets for all countries to reach 80% by 2015, and extended the projections linearly to reach 95% by 2035.
- The appendix shows more details of the different scenarios.

where the main counterfactual was the low scenario with constant coverage levels and a growing population. We estimated incremental costs and health impact as the difference in total cost and outcomes for the high or medium investment scenarios compared with the low investment scenario. Our cost estimates should therefore not be interpreted as additional spending above current spending levels, but rather what would be the cost and effect of bending the curve and accelerating progress compared with a scenario where coverage remains at the 2012 level while population increases.

The difference in deaths between any two scenarios portrays both the reduction in births arising from enhanced access to contraceptives (avoidance of unintended pregnancies or deaths averted) and the effect of the health interventions on those who are born (lives saved). Modelled health outcomes include maternal, newborn, and child mortality (including stillbirths), stunting and wasting, and fertility rates.

The costing used a so-called ingredients approach, in which needs-based quantities are multiplied by country-specific prices. The number of services by delivery platform was multiplied by country-specific estimated service delivery costs from WHO-CHOICE updated to year 2011.[51] Estimates of health services provided by country, by year, allowed us to estimate the additional number of trained health workers needed.

Evidence shows that the availability of proven, technical interventions is not sufficient in itself to improve health outcomes:[52] strong functional health systems and community engagement are essential enablers for integrated effective delivery of quality health care. The analysis presented here drew on estimates of the Taskforce on Innovative International Financing for Health Systems regarding additional investments for health systems strengthening that are needed to bring health systems to at least a minimum degree of functionality in terms of availability of hospital beds and health workers.[53,54] Strategies modelled included both the supply side (eg, construction of new hospitals and facilities) and the demand side (eg, mass media campaigns to encourage breastfeeding and care seeking for childhood illnesses). We specifically incorporated additional investment needs for training and supervising health workers, increasing the functionality of health information systems, ensuring that drugs get to rural populations by strengthening the supply chain, allocating resources to supporting good governance through informed and transparent decision making, and by investing in extension of social health insurance to provide financial risk protection and enhance equity in access and health financing. Capital investments in infrastructure are frontloaded to ensure that facilities and hospitals are constructed such that physical access is increased, particularly for rural populations. Acknowledging that RMNCH interventions should only be allocated a proportion of the shared health systems' investment needs, we followed the same route as previous analysis[55] and assumed that 50% of incremental health system costs were allocated towards RMNCH (the allocation in past analysis was based on the estimated share of additional costs for RMNCH services as part of a broader package). To combat current trends in which early pregnancy and HIV disproportionately affect adolescents compared with other age groups,[56] the high scenario included specific investments to reduce barriers to care for pregnant women and adolescents[57] and strengthen the quality of maternity care to improve acceptability and effectiveness.

In view of the uncertainty around estimates of service delivery costs and the appropriate allocation share of health systems towards RMNCH interventions, we varied

Panel 2: **Cost components included under each cost category**

RMNCH specific costs

Commodities
Drugs, vaccines, laboratory tests, and medical supplies based on treatment guidelines
Included in scenario: low, medium, high
Included in intervention-specific package costs: yes

RMNCH programme management costs
In-service training activities, development of pre-service training materials, distribution of printed information materials, mass media campaigns, supervision of community health workers, routine programme management
Included in scenario: medium, high
Included in intervention-specific package costs: no

Improving adolescents' accessibility to health services
General programme coordination at national and district level, development and distribution of national standards for Adolescent Friendly Health Services (AFHS), in-service training on AFHS, information and communication activities, upgrade of infrastructure and equipment to adolescent friendly standards
Included in scenario: high
Included in intervention-specific package costs: no

Conditional cash transfers
Financial incentives provided to women delivering in health facilities (included for selected countries only)
Included in scenario: high
Included in intervention-specific package costs: no

Service delivery costs

Inpatient care
Inpatient care, including the running costs of the inpatient facilities such as infrastructure operations and maintenance, and health worker costs, but excluding drugs, vaccines, laboratory tests, and food/food supplements
Included in scenario: low, medium, high
Included in intervention-specific package costs: yes

Outpatient care vs community and outreach
Outpatient care, where a proxy amount intends to cover the running costs of the community-based care and outreach activities, including transport operations and maintenance, and health-worker-related costs
Included in scenario: low, medium, high
Included in intervention-specific package costs: yes

Outpatient care—primary level facilities
Outpatient care, including the running costs of the inpatient facilities such as infrastructure operations and maintenance, and health worker costs, but excluding drugs, vaccines, laboratory tests, and food supplements.
Included in scenario: low, medium, high
Included in intervention-specific package costs: yes

Outpatient care—hospital level
Outpatient care, including the running costs of the inpatient facilities such as infrastructure operations and maintenance, and health worker costs, but excluding drugs, vaccines, laboratory tests, and food supplements.
Included in scenario: low, medium, high
Included in intervention-specific package costs: yes

Health system investments

Infrastructure investments
Capital investments in infrastructure, primarily related to construction of hospitals, facilities and health posts. Capital investments are assumed to take place during the first 12 years only (2013–24) to accommodate for expansion in service delivery.
Included in scenario: medium, high
Included in intervention-specific package costs: no

Supply chain
Operational costs for transporting additional RMNCH commodities throughout the supply chain
Included in scenario: low, medium, high
Included in intervention-specific package costs: no

Health information systems
Investments in equipment and procedures for better health information management
Included in scenario: medium, high
Included in intervention-specific package costs: no

Health financing policy
Administration of social health insurance in selected countries
Included in scenario: medium, high
Included in intervention-specific package costs: no

Governance
Investments in procedures for improved governance and management of resources
Included in scenario: medium, high
Included in intervention-specific package costs: no

RMNCH= reproductive, maternal, newborn and child health.

three variables that drove the costs: the allocation of health systems costs to RMNCH (varied from 40% to 60%), commodity costs (varied by ±25%), and estimated service delivery costs (varied by ±25%). This analysis provided us with an uncertainty range for the cost estimates.

Panel 2 provides an overview of the costs included, with more details on the approach provided in the appendix. All costs are presented in constant 2011 US$ excluding inflation.

Estimation of the economic and social returns on investment

We estimated the economic and social benefits arising from scaling up RMNCH interventions in the high and medium scenarios, in both cases relative to the low scenario. We identified three broad types of benefits for the high and medium scenarios. First, some had the benefit of life because their lives were saved through the interventions. Second, others were in better health

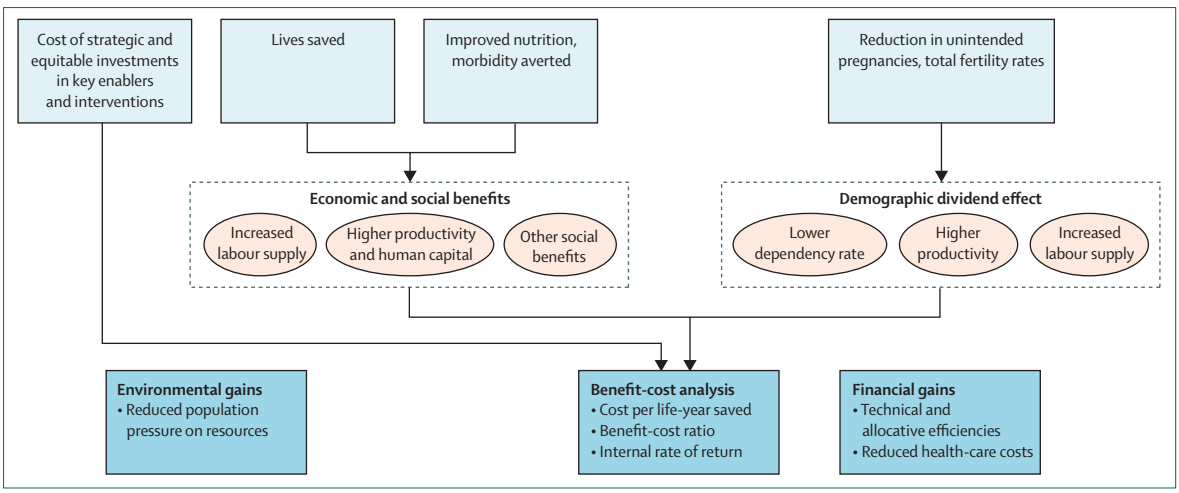

Figure 2: **Links between cost/impact and socioeconomic returns analyses**

Panel 3: Estimation of economic and social benefits

The first benefit we estimated was the additional mortality averted through the scaled-up interventions. Putting a value on a life or year of life saved is a common, but problematic and contentious approach, and we took a conservative approach that is consistent with international scientific literature.[58–60] The value of a statistical life has two components: (1) direct contribution to the economy through the production of goods and services, and (2) the social value of a human life—ie, as a woman, mother, child, and family and community member. The literature about the value of a statistical life suggests that a value of 1·5–2·0 times the gross domestic product (GDP) per person would be appropriate for the value of a life-year saved in a low-income country. We measured the economic benefits directly, in terms of increased labour supply and productivity in national values, and generated an average benefit of 1·0 times the GDP per capita. We then set the social value of a life-year saved at 0·5 times the GDP per capita for the full sample. These two components together gave a total value of 1·5 times the GDP per capita for a life-year saved, which is at the lower end of the range used in the literature.

The second benefit we estimated was for morbidity averted—ie, women, mothers, and children who had improved health because of the scaled-up interventions. Many women and children who survive adverse events have serious and sustained disabilities.[61–63] Little study has been done of either the health burden or the economic and social cost of such morbidities, and hence, of the benefits of their aversion. We provide some preliminary estimates of the benefits of morbidity averted for four causes for children (pre-term birth complications, birth injury, congenital abnormalities, and nutritional deficiencies) and two for mothers (obstructed labour and other maternal disorders). These six morbidities are chosen as most likely to give rise to serious and sustained disabilities, in the sense that serious disability is evident well after the originating adverse event.[64] With the exception of nutrition, we estimated the morbidity averted by using a morbidity to mortality ratio and estimates of severity drawn from the literature.[61,65] We measured the economic benefits in terms of increased participation and productivity of workforces, and on the basis of social benefits, by application of disability weights to the social value of a life-year saved. For wasting and stunting averted, we used direct estimates from the OneHealth Tool on the health benefits, and identified variables from the literature to assess the effect on long-term earnings (appendix).

The third benefit we identified is the positive economic and social consequences of decreases in fertility and reductions in unintended pregnancies. A sustained reduction in fertility reduces the dependency ratio (the proportion of young and old people compared with those of a working age) for a substantial period. With total GDP produced by people of a working age, a reduced dependency ratio leads to an increase in GDP per person. Reduced births will increase the ability of mothers and other caregivers to enter the labour force or provide better care for their children, leading to increased labour supply and higher GDP per person. When fertility rates fall, several other factors should lead to an increase in national and household productivity in the long term: higher saving by households, leading to higher investment in schooling and in areas, and an increased ability to devote capital resources to make existing activities more capital intensive and therefore increase productivity. We draw on the methods of Ashraf and colleagues (2013) to quantify these elements of the demographic dividend.[66]

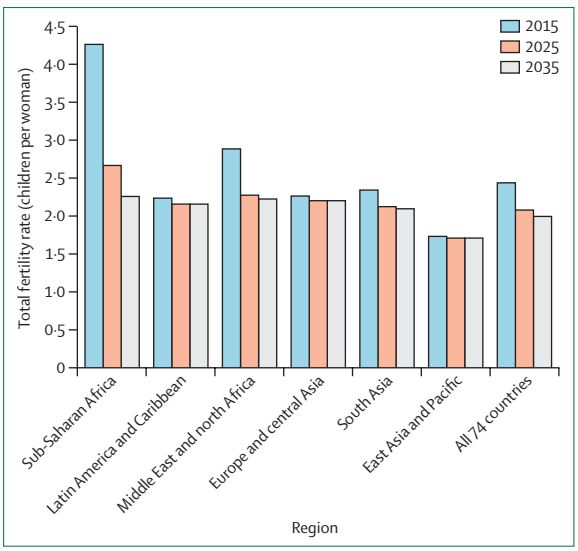

Figure 3: **Population weighted average total fertility rate by region for selected years, 74 countries**

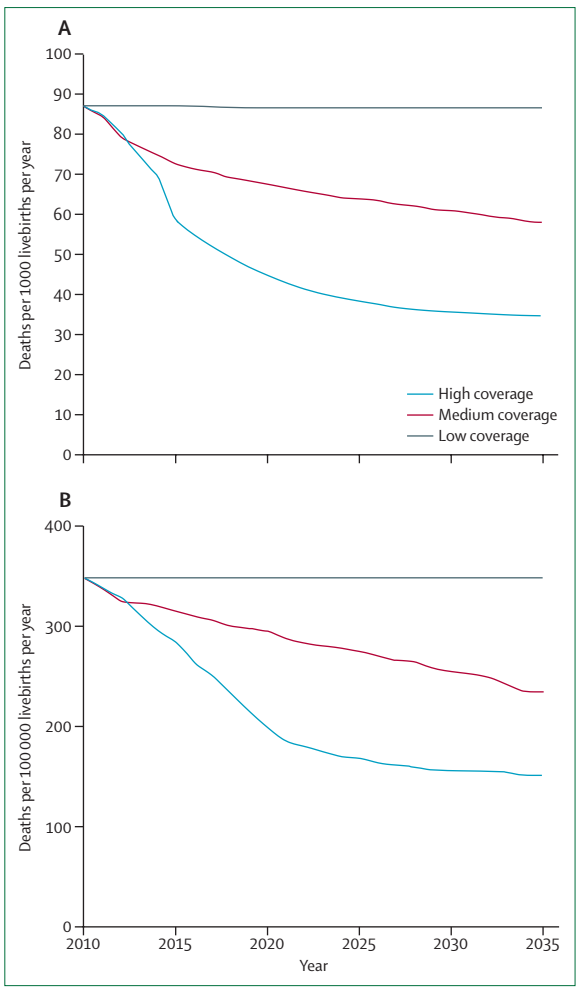

Figure 4: **Average under-5 mortality and maternal mortality for 74 countries**
(A) Under-5 mortality (number of deaths in children younger than 5 years per 1000 livebirths), average for 74 countries. (B) Maternal mortality ratio (number of maternal deaths per 100 000 livebirths), average for 74 countries.

because of the morbidity averted. The reduction in mortality and morbidity results in the potential for increased labour force participation and productivity. Third, the whole community has the benefit of higher per-capita incomes arising from the reduction in unintended pregnancies which, among other things, increases rates of saving.

We did the analysis of economic and social impact in a simulation modelling framework for the 74 countries at the individual country level. That is, we specified a set of relations between health outcomes and various economic and social variables, and drew on a wide range of medical literature to determine the key variables in these relations. Regarding the benefit-cost estimates, we undertook uncertainty analysis by increasing and decreasing total costs and benefits by 25%. Moreover, we applied a range of discount rates. Figure 2 summarises the model structure. Panel 3 describes the approach taken to estimate and value benefits of the interventions. The appendix provides more detail of the methods employed and the parameter values used.

Results

Health impact of additional investments

The modelling suggests that increased and improved coverage of essential RMNCH interventions, through additional investments, could significantly reduce mortality in the 74 countries. The high coverage scenario would result in 147 million fewer child deaths, 32 million fewer stillbirths, and 5 million fewer maternal deaths between 2013 and 2035 (appendix). Substantial reductions in the total fertility rate (figure 3), under-5 mortality (figure 4A), maternal mortality ratio (figure 4B) and number of deaths overall (figures 5 and 6) would be achieved, along with decreases in numbers of unintended pregnancies and improved nutritional status of children (appendix). For example, the (simple average) under-5 mortality rate would be reduced from 87 deaths per 1000 livebirths in 2010 to 35 in 2035 (figure 4A). The population-weighted measure of the same indicator would decrease from 53 deaths per 1000 livebirths to 22 (appendix). Four of ten child deaths prevented in this model are newborn deaths, whereas 17 million (11%) are malaria deaths (appendix).

Nearly all (95%) of maternal deaths averted would be in low-income or lower-middle-income countries (figure 5). Two-thirds of the reduction in deaths would be in sub-Saharan Africa. Most of the child deaths averted (61%) would also be in sub-Saharan Africa, where under-5 mortality rates are highest, and in south Asia (31%), where absolute numbers of deaths are highest (figure 6). We estimate that 47% of the reduction

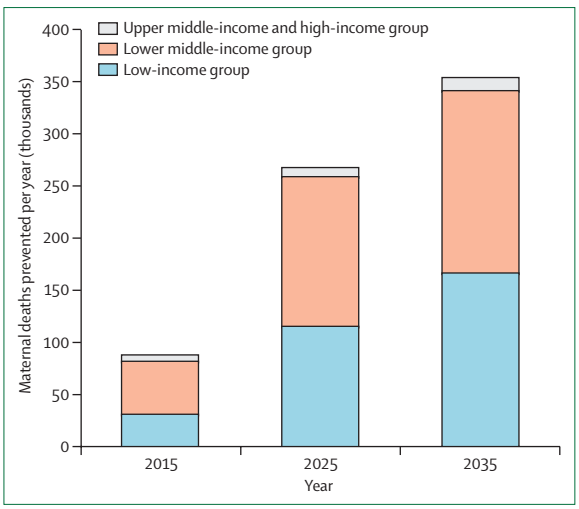

Figure 5: **Maternal deaths prevented, high scenario compared with low scenario, by country income group for selected years**
The estimation of the number of deaths prevented is based on a comparison with the low scenario which has a growing population. This means that the number of deaths prevented in 2035 is greater than the current number of maternal deaths.

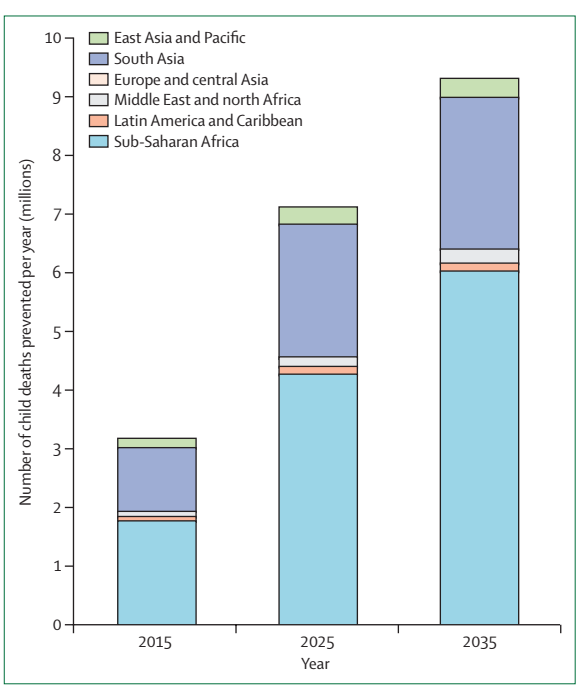

Figure 6: **Child deaths prevented, high scenario compared with low scenario, by region for selected years**
The estimation of the number of deaths prevented is based on a comparison with the low scenario that has a growing population. This means that the number of deaths prevented in 2035 is greater than the current number of child deaths.

in child deaths and 53% of the reduction in maternal deaths would be due to fewer births (appendix). The analysis therefore highlights the substantial contribution from greater access to contraceptives for effective family planning. The total fertility rate—in

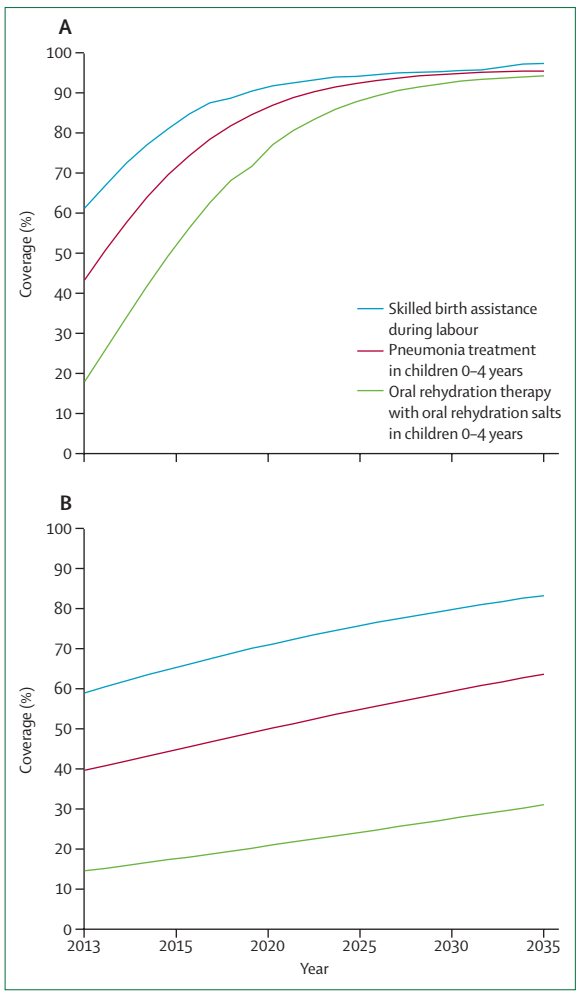

Figure 7: **Coverage scale-up trajectory, high and medium scenario, selected interventions**
(A) High scenario. (B) Medium scenario.

2010 estimated at 2·7 children per woman—would approach 2·0 for the 74 countries by 2035 (population weighted average), with country variations from 1·6 to 3·1 (figure 3).

We included the medium scenario to provide a comparison that showed continuation of historic trends, and to illustrate the potential effect of accelerating investment plans beyond past trends. The comparison of figure 4 with figure 7 shows the link between coverage trajectories and mortality reduction over time. Coverage would increase less rapidly after 2025 in the high scenario, which would also be when mortality becomes flatter. Our analysis showed substantial differences between the medium and high scenarios. The medium scenario would prevent 38% of child deaths, 33% of maternal deaths, and 25% of stillbirths, whereas the high scenario would prevent 65% of child deaths, 62% of maternal deaths, and 46% of stillbirths compared with the low scenario (appendix).

Additional investment requirements for the low, medium, and high coverage scenarios

Table 2 shows the additional investment needs for the 74 countries, by region and income group. The additional investment for the high-coverage scenario compared with the low-coverage scenario would reach $30 billion per year in year 2035, with a cumulative total of $678 billion in 2013–35 (constant 2011 US$). $174 billion (18%) of the total investment would be needed in low-income countries where substantial health gains can be made (table 2; appendix). The exclusion of China and India reduces the total cost estimate for 2013–35 by a third (China and India together account for 21·6% of the global number of maternal deaths and 27·6% of the

	Costs in US$ billion			Cost per person, US$			Uncertainty analysis, cost in US$ billion	
	2013–35	2025	2035	Average 2013–35	2025	2035	2013–35	2035
High scenario compared with low scenario								
74 countries	678·1	29·1	30·0	4·81	4·68	4·48	552–805	24·3–35·8
72 countries (excluding China and India)	448·1	17·7	18·4	6·49	5·74	5·36	372–524	15·2–21·6
Low-income countries (n=35)	173·6	5·9	6·2	7·16	5·40	4·97	146–201	5·2–7·1
Lower middle-income countries (n=27)	316·3	14·1	14·8	4·74	4·81	4·60	255–378	11·8–17·7
Upper middle-income and high-income countries (n=12)	188·3	9·1	9·1	5·12	3·10	2·83	150–226	7·2–11·0
Sub-Saharan Africa (n=43)	233·3	9·0	9·0	9·05	7·69	6·79	197–270	7·6–10·4
South Asia (n=5)	226·4	10·1	226·4	3·58	4·64	4·56	178–274	7·9–12·3
Medium scenario compared with low scenario								
74 countries	428·2	16·3	17·3	3·02	2·59	2·50	347–510	14·0–20·7
72 countries (excluding China and India)	348·2	11·0	11·3	4·31	3·47	3·09	285–411	9·3–13·3
Low-income countries (n=35)	134·3	4·1	4·4	5·41	3·61	3·24	112–157	3·7–5·2
Lower middle-income countries (n=27)	198·1	7·8	8·5	2·94	2·62	2·56	161–235	6·8–10·1
Upper middle-income and high-income countries (n=12)	95·8	4·4	4·4	3·39	1·50	1·38	74–117	3·4–5·4
Sub-Saharan Africa (n=43)	178·3	6·4	7·0	6·62	5·21	4·62	148–208	5·8–8·2
South Asia (n=5)	157·4	5·5	6·1	2·09	2·70	2·72	125–190	4·9–7·4

The appendix shows details of cost components.

Table 2: **Additional estimated costs for high and medium scenario compared to low scenario (US$, 2011)**

	Total and percentage share of costs per package (2013–2035) US$ 2011, billion				Cost per person, year 2035 (US$ 2011)			
	74 countries	35 low-income countries	27 lower middle-income countries	11 upper middle-income countries	74 countries	35 low-income countries	27 lower middle-income countries	11 upper middle-income countries
High compared with low scenario								
Family planning	12·8 (4%)	4·3 (9%)	6·8 (4%)	1·7 (1%)	0·08	0·12	0·10	0·03
Maternal and newborn health	72·1 (23%)	8·9 (19%)	38·0 (24%)	25·2 (23%)	0·48	0·25	0·55	0·38
Malaria	31·5 (10%)	9·3 (20%)	14·9 (9%)	7·3 (7%)	0·21	0·27	0·22	0·11
HIV	27·6 (9%)	11·4 (25%)	7·7 (5%)	8·5 (8%)	0·18	0·33	0·11	0·13
Immunisation	72·0 (23%)	4·7 (10%)	31·2 (20%)	36·1 (32%)	0·48	0·13	0·45	0·55
Child health	100·0 (32%)	7·8 (17%)	58·9 (37%)	33·1 (30%)	0·66	0·22	0·85	0·50
Total	316·1 (100%)	46·3 (100%)	157·5 (100%)	111·9 (100%)	2·09	1·33	2·28	1·70
Medium compared with low scenario								
Family planning	8·0 (5%)	2·2 (7%)	4·6 (7%)	1·2 (2%)	0·05	0·05	0·06	0·02
Maternal and newborn health	11·7 (8%)	2·0 (6%)	8·7 (14%)	0·8 (2%)	0·07	0·05	0·11	0·01
Malaria	5·8 (4%)	1·5 (5%)	2·9 (5%)	1·3 (3%)	0·03	0·03	0·04	0·02
HIV	28·3 (19%)	12·8 (40%)	6·1 (10%)	9·3 (18%)	0·16	0·29	0·08	0·13
Immunisation	87·0 (60%)	11·1 (35%)	38·4 (62%)	37·2 (73%)	0·49	0·25	0·50	0·50
Child health	5·2 (4%)	2·5 (8%)	1·6 (3%)	1·1 (2%)	0·03	0·06	0·02	0·01
Total	145·9 (100%)	32·0 (100%)	62·4 (100%)	51·0 (100%)	0·82	0·73	0·81	0·69

Table does not include costs for health systems strengthening, conditional cash transfers, or programme management.

Table 3: **Estimated direct cost per intervention package**

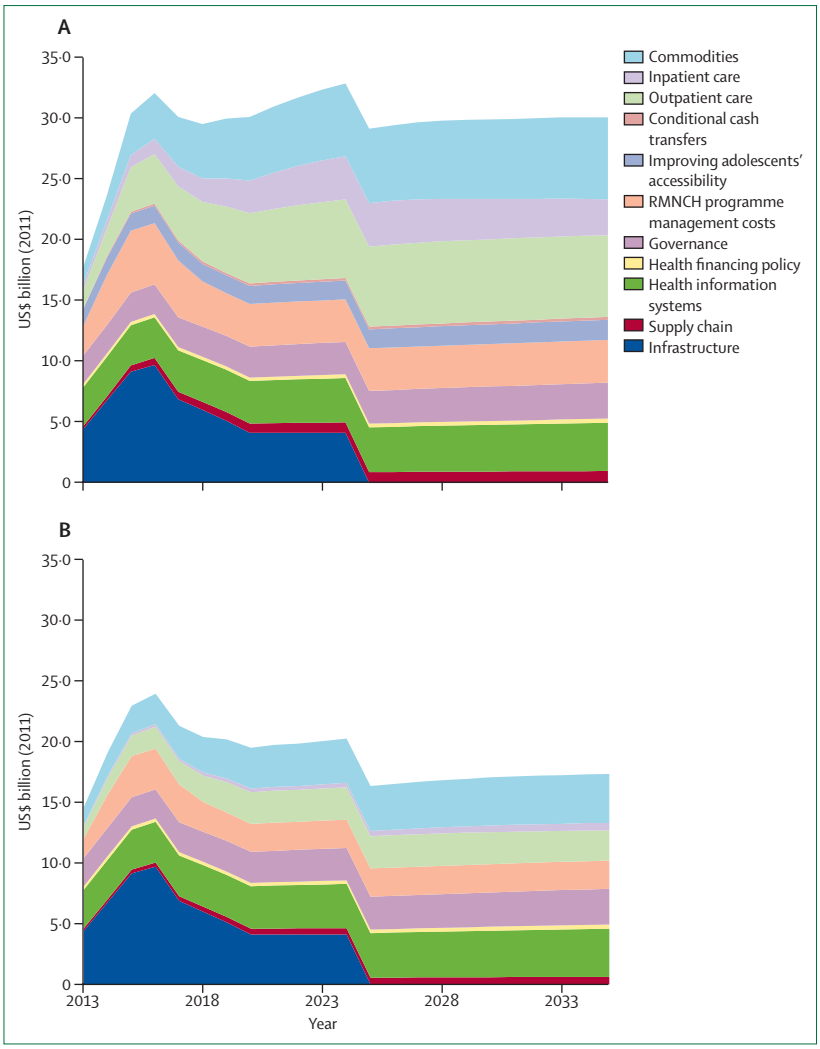

Figure 8: **Additional costs by cost category**
RMNCH=reproductive, maternal, newborn and child health. (A) High scenario compared with low scenario. (B) Medium scenario compared with low scenario.

global number of under-5 deaths, appendix). On average, an extra $4·48 per person would be needed in 2035, with a range across the 74 countries of $1·2–112·7). The average amount per year 2013–35 is $4·81, or a rounded estimate of $5 per person (table 2)

By comparison, the medium compared with the low scenario would need fewer resources but, as noted above, would also bring less impact as it would avert fewer deaths. Continuing current trends of scale-up would require an additional cumulative $428 billion 2013–35, equivalent to $2·50 per person in 2035 (country range $1·9–72·5). For some countries and years, we estimated lower costs in the medium than in the low scenario, since the scale-up of family planning in the medium scenario lowers population growth, which reduces overall costs. The reduction in population growth over time was also what brought a lower per person cost in 2035 than that in 2025 for many countries in high and medium scenarios (table 2).

The division of costs by total number of deaths prevented 2013–35 results in an estimated cost of $4053 (medium) and $3673 (high) per death prevented (including health systems investments).

It should be noted that maintaining the status quo in the low scenario also bears a cost. Simply maintaining current coverage levels with an increasing population would require an additional $1·27 per person by 2035 (data not shown). Our sensitivity analysis provides a range for overall additional costs, ranging from $552–805 billion for the high scenario, and $347–510 billion for the medium scenario, 2013–35.

Costing high-impact intervention packages for women's and children's health

Table 3 shows the additional direct cost for the six packages, across income groups and over time for high compared with low and medium compared with low. For the 74 countries, in the high scenario in which trends of coverage are accelerated across all six packages to attain the largest health effect, their cost is equivalent to an average $2·09 per person in 2035. The greatest share (32%) of incremental investment would be needed for child health interventions, with 23% required for immunisation and another 23% for maternal and newborn health. The additional immunisation costs reduce over time as population size decreases.

In the medium scenario, however, most (60%) of incremental investment in the 74 countries 2013–35 would be needed for vaccine scale-up as per GAVI predictions of rollout. Different groups of countries would see different degrees of overall investment and composition of investment in the various packages. In the 35 low-income countries, if investments continue as per current trends, HIV would be the package receiving the most investment, followed by immunisation.

Investment in health systems

Figure 8 shows the cost profile over time. During the first 5 years, half of the additional costs estimated for the high scenario were health systems investments shared with other health issues beyond RMNCH, with particular frontloading of capital investments in infrastructure to expand physical accessibility to quality health care. This profile is consistent with addressing the need for expanding access to skilled care at birth, including emergency obstetric care. Benefits of infrastructure investments will spill over to other areas beyond RMNCH. The shared health systems investment would decrease to a quarter of the costs in 2035, with outpatient care and commodities taking over the role as cost drivers. This result portrays increasing coverage of treatment of diarrhoea, pneumonia, and malaria in children, along with newborn care, immunisation, and nutrition counselling. The medium scenario showed a

smaller share of resources allocated to inpatient care than the high scenario.

Our analysis shows that cost drivers vary across regions and countries according to their investment needs (appendix), which depend on current gaps and country-specific prices of (local and imported) inputs. For example, commodities account for 21% of incremental costs in sub-Saharan Africa and programme management for 27%. Strengthening maternity care and access to emergency obstetric care services would be equally important in this region, but low estimated prices for the required services would result in a small share of costs for inpatient care (4%). By contrast, the bulk of investments in south Asian countries would be needed for health systems strengthening (56%) and another 12% specifically for inpatient care. The results highlight the importance of contextual factors with regard to estimating the need for additional investments at various levels, with estimated costs for salaries higher in middle-income countries than in low-income countries. Overall, strengthening community and outreach delivery platforms would require modest investments (2·4% of total costs) but could bring substantial health impact, particularly for newborn and child health.

Translating service outputs into workforce estimates indicates that up to an additional 675 000 nurses, doctors, and midwives would be needed in 2035, along with 544 000 community health workers, in the high scenario (results for medium scenario are shown in table 4). The estimates highlight a significant need to invest in human resources, particularly midwives and community health workers, but also doctors and nurses in low-income countries. At the same time, investments in preventive care will lead to reduced treatment costs. For example, we estimated that the reduced burden on the health system resulting from fewer malaria and diarrhoea cases as preventive interventions are scaled up would bring lower health-care costs equivalent to over $600 million for drugs and $2·8 billion in reduced outpatient costs (appendix).

Economic and social returns

Figure 9 summarises the estimated value of the economic and social benefits by source and by type as a share of GDP for the 74 countries, and also show the costs, in both cases comparing the high and the low scenarios. The figures only cover the period to 2035, when the interventions end, although it is characteristic of any investment that the benefits continue to accrue after the period of investment is completed. Table 5 provides some metrics out to 2050, and the appendix provides further results.

Rates of return would be very high, with a benefit-cost ratio of 8·7 for the entire 74 countries at 3% discount rate. The various series shown in figure 9 have different time profiles. The investment costs, which include costs for health system strengthening and infrastructure, would rise rapidly in the early years, but would be less than 0·2% of GDP of the 74 countries, and these costs would begin to fall as a share of GDP as these upfront costs are met. Total benefits (the sum of the three components in figure 9A) would exceed costs by 2017 and continue to increase rapidly beyond that date.

The social benefits of lives saved and morbidity averted begin to accrue immediately, but the economic benefits derived from enhanced workforce and participation as a result of better health outcomes take time to build up. It would take nearly 20 years before children younger than

	Current estimates*	High scenario: additional health workers needed			Medium scenario: additional health workers needed		
		2025†	2035†	Increase 2035 compared with current estimates (%)	2025†	2035†	Increase 2035 compared with current estimates (%)
74 countries							
Doctors	4 445 685‡	58 154	63 412	1%	21 429	34 601	1%
Nurses	6 098 578§	243 319	248 790	4%	48 350	72 406	1%
Midwives	1 609 065¶	318 288	362 947	23%	174 821	285 062	18%
Community health workers	1 327 923‖	501 571	544 205	41%	193 176	341 468	26%
Total for doctors, nurses, midwifes	12 153 328	619 761	675 150	..	244 600	392 069	..
Low-income countries (n=35)							
Doctors	229 381**	17 398	22 031	10%	10 387	17 393	8%
Nurses	424 294††	80 107	80 226	19%	23 885	37 815	9%
Midwifes	62 614‡‡	128 280	157 488	252%	93 873	157 201	251%
Community health workers	132 937§§	158 881	190 995	144%	104 031	179 134	135%
Total for doctors, nurses, midwifes	716 289	225 786	259 745	..	128 145	212 409	..

It should be noted that current data on availability of midwifes and community health workers is poor. *Source: WHO Global Health Observatory, http://apps·who·int/gho/data/node·main·A1446, accessed July 24, 2013. †Assuming 66% of health worker time is spent on delivering RMNCH services. ‡72 countries only. §71 countries only. ¶42 countries only. ‖30 countries only. **35 out of 35 countries. ††34 out of 35 countries. ‡‡24 out of 35 countries. §§16 out of 35 countries.

Table 4: **Additional health workers needed based on coverage increases above 2012 estimated coverage in respective scenario**

5 years whose lives are saved enter the workforce, but these benefits would continue to increase through to 2050.

The substantial benefits from reduced fertility emerge from several longer-term mechanisms operating in different timeframes. There would be initially an increase in GDP per head from lower dependency rates, and increased workforce participation by mothers and other carers would start to occur fairly quickly. But the broader factors leading to higher savings, investment, and productivity would also take time to build up, and to contribute to higher GDP per capita. The result is that the demographic dividend would increase slowly to about 2025 (figure 9), but then increase sharply to 2035 and, indeed, to about 2050. Beyond that period, as the population ages, the benefits of reduced fertility over 2013–35 would begin to be offset by the ageing of the population, and the demographic dividend would peak and then begin to fall.

	Benefit–cost ratio (%)		Internal rate of return (%)	
	To 2035	To 2050	To 2035	To 2050
Low-income countries	7·2	23·6	39·3%	39·8%
Lower middle-income countries	11·3	46·9	70·2%	70·2%
Upper middle-income countries (excluding China)	6·1	31·1	50·5%	50·7%
China	0·7	3·8	–4·0%	11·4%
All 74 countries	8·7	38·7	50·0%	50·2%

Data are benefit-cost ratios and internal rate returns at 3·0% discount rates.

Table 5: **Summary investment metrics, by region to 2035 and 2050, at 3% discount rate**

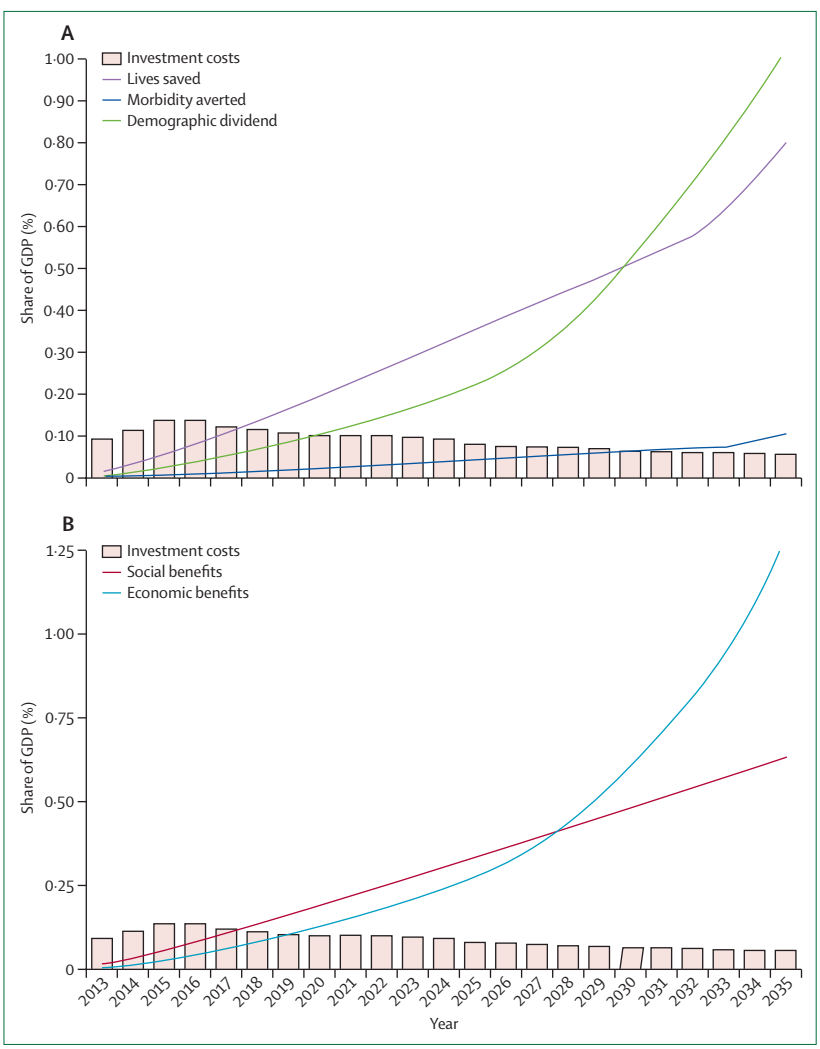

Figure 9: **Benefits (by type) and investment costs, share of GDP (%), to 2035: high scenario relative to low scenario**
GDP=gross domestic product. (A) Benefits arising from prevented mortality, morbidity, and reduction in fertility, relative to cost of interventions. (B) Social and economic benefits relative to cost of interventions.

The social benefits, although notionally valued here in terms of GDP per capita, are not captured within the formal economy. Figure 9B shows the relative importance of the economic and social benefits, in relation to costs, again expressed as a share of full sample GDP. The figure shows the dynamics, with both types of benefits lagging costs initially but the social benefits rising more quickly. By 2030 economic benefits have substantially exceeded costs, and they continue to rise rapidly to 2050 and beyond.

As would be expected, the benefits arising from the reduction in unintended pregnancies predominantly occur in countries with high levels of fertility. Figure 10 provides more disaggregated information on this effect. Whereas for the total sample, the demographic dividend would amount to 1% of GDP by 2035, it would rise to 3% of GDP for 70 of the 74 countries by 2035 if we exclude Brazil, China, Indonesia, and Vietnam (where fertility is quite low). In 27 of the 74 countries (listed in appendix) the demographic dividend from enhanced contraception and family planning exceeds 8% of GDP by 2035, indicating the profound nature of the economic and social change which effective family planning makes possible. For many countries the demographic dividend rises until about 2050, with the effect exceeding 10% of GDP in some countries.

Table 6 reports selected investment metrics for the full sample of countries for both total benefits and for economic benefits alone. The main features are the very high return on investment shown and the dynamics of the benefit flows over time. For the period to 2035, the returns would be already strong: benefit-cost ratios of 4·8 for economic benefits and 8·7 for total benefits at a 3% discount rate, with internal rates of return of 26% for economic benefits and 50% for total benefits.

The incremental costs cease at 2035, but the benefits continue to rise for several decades; both benefit-cost ratios and the internal rates of return continue to rise out to 2070. While the social benefits of such fundamental changes in human health need to be taken into account, it is notable that for the period to 2070 the benefit-cost ratio for economic benefits only at a 7% discount rate is 27·0 and that the internal rate of return is 29·0%. In other words, these are very high return investments, even if only the effects that directly contribute to measured GDP are included.

	Benefit–cost ratio						Internal rate of return (%)	
	Economic benefits only			All benefits			Economic	All benefits
	3%	5%	7%	3%	5%	7%		
Investment in high scenario relative to low scenario								
To 2035	4·8	4·2	3·6	8·7	7·6	6·7	26·0	50·0
To 2050	29·4	20·4	14·4	38·7	27·6	20·0	28·9	50·2
To 2070	82·1	46·1	27·0	98·2	56·5	34·2	29·0	50·2
Uncertainty testing (to 2035)								
Higher costs, lower benefits (both 25%)	2·9	2·5	2·2	5·2	4·6	4·0	17·1	32·6
Lower costs, higher benefits (both 25%)	8·0	7·0	6·0	14·4	12·7	11·2	36·6	84·0
Different scenario comparisons (to 2035)								
Low-to-medium scenarios	5·2	4·5	3·8	8·2	7·1	6·1	..	..
Medium-to-high scenarios	4·0	3·6	3·3	9·4	8·6	7·8	..	..
Low-to-high scenarios	4·8	4·2	3·6	8·7	7·6	6·7	..	..

Data are benefit-cost ratios and internal rate of return at three discount rates (3%, 5%, and 7%).

Table 6: **Summary investment metrics, for economic benefits and all benefits, all countries, selected periods and discount rates**

Finally, table 5 and figure 11 report investment metrics across the 74 countries by income region, and bring out two contrasting points. First, whereas the investment returns are very strong in low-income countries, they are not as strong as in lower middle-income countries and, for some metrics, in upper middle-income countries (excluding China). This finding might reflect the fact that the additional costs tend to be higher in very poor countries, with more limited infrastructure, whereas the assessed economic benefits are lower. Second, however, in countries that are already well advanced in terms of maternal, child, and reproductive health, notably China, the marginal return to further investment is lower than in countries with substantial gains still to be made.

Results from sensitivity analysis

The margins of error around our estimates of both costs and benefits are clearly substantial, although difficult to quantify with any precision. Table 6 reports the results of some simple uncertainty testing, and shows that the results are robust to substantial variation in the key cost and benefit variables. If the costs turn out to be 25% higher, and the benefits 25% lower, than estimated (both in net present value terms) the overall benefit-cost ratio to 2035 drops from 8·7 in the base case to 5·2 (at a 3% discount rate), and from 6·7 to 4·0 at a 7% discount rate. Thus, even on this adverse case, the interventions remain a strong investment with an internal rate of return to 2035 of 32·6%. If a corresponding reduction in costs and increase in benefits occur, the investment metrics increase further.

Discussion

The new Global Investment Framework for Women's and Children's Health presented in this paper points to five important findings for policy makers.

First, health interventions and family planning can result in substantial health benefits and reductions in mortality and morbidity. Compared with current investment levels, our high scenario estimates that 5 million maternal deaths, 147 million child deaths, and 32 million stillbirths can be prevented in 2013–35 in 74 Countdown countries that currently account for more than 95% of such deaths globally. Of the 147 million child deaths prevented, 78 million (53%) would be deaths averted from scaling up family planning and 69 million (47%) would be lives saved from scaling up promotive, preventive and curative health services. Expanding access to contraception will be a particularly effective investment, accounting for half of the deaths averted, at small cost (4% of additional intervention-specific cost 2013–35). The expansion of coverage of these interventions as recommended will also avert illness, disability, and stunting. The mortality reduction in the high scenario is equivalent to a reduction in child deaths by 65%, in maternal deaths by 62%, and in stillbirths by 46%, through scaling up health sector interventions. The remaining burden needs to be addressed through a multisectoral approach.

Second, there are wider societal gains that go beyond the health sector to include economic growth and social empowerment. We estimate high benefit-cost ratios of seven for low-income countries and 11 for lower middle-income countries by 2035 and of higher than 20 by 2050. Improvement of preconception and maternal health, reduction of low birthweight and stunting through better nutrition, and expansion of a range of preventive child and adolescent health services are increasingly recognised as an investment in the potential for economic productivity and potential lifetime earnings in this and the next generation.[67,68] The so-called demographic dividend effect of family planning is particularly large in a subset of 27 countries with current high fertility where

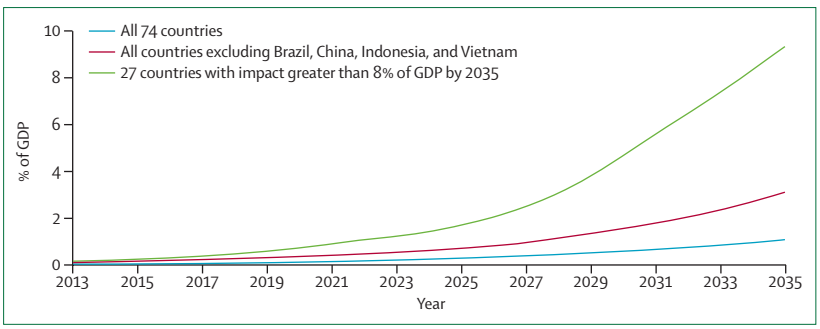

Figure 10: **Demographic dividend as a share of GDP (%), for all countries; for all countries excluding four large countries not affected; and for 27 countries where family planning measures have significant effects: high scenario relative to low scenario**
GDP=gross domestic product. For details of the 27 countries see appendix.

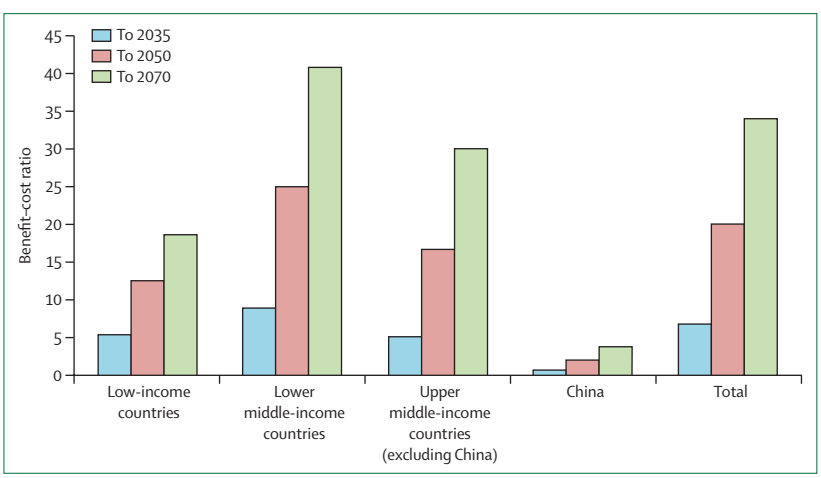

Figure 11: **Benefitcost ratios by income region, at 7% discount rate, for high-low scenario comparison**

rates of return from enhanced contraception could exceed 8% of GDP by 2035.

Some of these benefits are difficult to measure, including the potential for increased empowerment of girls and women and their capacity to make decisions about their own health and fertility.[69] Nor is it easy to estimate the environmental gains from investing in RMNCH. The current world population of 7·2 billion is projected to reach 8·1 billion in 2025 and 9·6 billion in 2050.[35] Population growth, when combined with increasing income and consumption per person, will have substantial implications for the environment and use of resources.[70] To increase the understanding of the potential wider societal gains of investment in women's and children's health, we recommend that subsequent analysis draws on previous work to explore the impact of reducing the unmet need for family planning on overall population dynamics on the environment and resource use.[71–74]

Third, the required investments are substantial, but affordable, and the investment framework is not just about money. Indeed, the conceptual framework emphasises that all of the key enablers—policy, health systems, community engagement, and innovation—need to operate if there are to be significant and sustained health, nutrition, and wider societal gains for women and their children. Whereas such policy and legislation reforms are essential, increased financing is crucial. The increased expenditure needed, although substantial, is an affordable investment for most countries. Current total health expenditure per person is $31 ($12 of which is government expenditure) in the 35 low-income countries in our sample and $76 ($28 of which is government expenditure) in the 27 lower-middle-income countries included.[75] Relative to present-day health expenditure per person, the required investments in low-income countries by 2035 would be equivalent to an additional 6% (high) or 4% (medium) increase in health expenditure. The equivalent for lower-middle-income countries is 6% (high) and 3% (medium) whereas the entire 74 country sample would need on average a 2% (high) or 1% (medium) increase.

In view of the potential of increased government expenditures in the next two decades,[76] the average incremental investment costs for the high scenario at $4·97 per person per year in low-income countries and $4·60 per person per year in lower-middle-income countries by 2035 should be manageable for most countries, in some cases with support from international development assistance for health. Reflecting trends in overall development assistance for health, aid funding for RMNCH has levelled off in recent years.[77–79] This trend needs to be reversed, particularly for low-income countries, to realise the benefits within a generation. Maintaining the current level of investment would lead to 185 million otherwise avoidable deaths and significantly reduced economic growth.

There are several low-income and lower-middle-income countries in sub-Saharan Africa and Asia that have already made substantial financial commitments to scaling up investments in RMNCH. Panel 4 shows examples of such commitments.

The fourth conclusion for policy makers is that this investment package requires investments in strengthening the overall health system. Investments in the health workforce are particularly crucial. In many African countries, current outputs of health workers are insufficient to replace outflows of nurses and midwives leaving the workforce, and much less so to increase density to the WHO benchmark of 2·28 health workers per 1000 population nor to meet increasing health needs of the population.[81]

Women (of childbearing age) and children are more than 50% of the population in most countries. Investing in facilities and the health workforce to provide 24 h, 7-day-a-week, comprehensive obstetric emergency care in rural areas, functioning blood banks, and improved referral systems will benefit women and children. However, it will also strengthen the health system more broadly, especially at the periphery where health burdens are often greatest and services minimal. Access

***Panel 4*: Examples of increased financial commitments to reproductive, maternal, newborn, and child health by low-income and lower-middle-income countries**[5,80]

- Afghanistan will increase public spending on health to at least US$15 per person by 2020
- Benin will increase the national budget on health to 10% by 2015, with a particular focus on women, children, adolescents, and HIV
- Burundi commits to increase the allocation to health sector from 8% in 2011, to 15% in 2015, with a focus on women's and children's health
- Central African Republic commits to increase health-sector spending from 9·7% to 15%, with 30% of the health budget focused on women's and children's health
- Chad commits to increase health sector spending to 15%. Additionally, it has committed to allocate $10 million per year for implementation of the national roadmap for acceleration of decrease in maternal, newborn, and child mortality
- Comoros commits to increase health-sector spending to 14% of budget by 2014
- Djibouti commits to increase the health budget from 14% to 15%
- The Gambia commits to increase the health budget to 15% of the national budget by the year 2015
- Ghana will increase its funding for health to at least 15% of the national budget by 2015. Ghana will also strengthen its free maternal health-care policy, ensure 95% of pregnant women are reached with comprehensive services for prevention of mother-to-child transmission, and ensure security for family planning commodities
- Guinea-Bissau commits to increase financial spending from 10% to 14% by 2015, and to implement the Campaign on Accelerated Reduction of Maternal Mortality in Africa
- India is spending over $3·5 billion each year on health services, with substantial expenditure on services aimed towards women's and children's health
- Indonesia Central Government funding for health in 2011 will increase by $556 million compared with 2010. This fund will be available to support professional health personnel and to achieve quality health care and services in 552 hospitals, 8898 health centres, and 52 000 village health posts throughout Indonesia
- The Government of Lesotho is committed to meeting the Abuja Declaration target of 15% expenditure for health, compared with the present 14% expenditure
- Liberia will increase health spending from 4% to 10% of the national budget
- By 2015, Madagascar commits to increase health spending to at least 12% of the national budget
- Niger commits to increase health spending from 8·1% to 15% by 2015. It will quadruple its family planning budget for 2013, as well as increasing its overall health and reproductive health budgets
- Nigeria is committed to fully funding its health programme at $31·63 per person through increasing of budgetary allocation to as much as 15% from an average of 5% by the federal, states, and local government areas by 2015.
- Additionally to Nigeria's present annual commitment of $3 million for the procurement of reproductive health commodities, Nigeria commits to provide an additional $8·35 million annually in the next 4 years. This additional funding increases Nigeria's total commitment for the next 4 years from $12 million to $45·4 million—an increase of almost 300%
- Pakistan states that the amount spent on family planning, estimated at $151 million in 2011–12, will be increased to nearly $200 million in 2012–13, and will be further raised in future years. The federal government assesses the contraceptive need as $186 million between 2013 and 2020, which will need to be provided for
- The Philippines will commit $15 million in 2012 for the purchase of family planning commodities for poor women with an unmet need
- Rwanda commits to increasing heath-sector spending from 10·9% to 15% by 2012
- São Tomé and Príncipe commits to increase the proportion of the general budget for health from 10% to 15% in 2012
- Senegal commits to increasing its national health spending from the present 10% of the budget, to 15% by 2015. It also aims to increase the budget allocated to maternal, newborn, and child health by 50% by 2015
- Sierra Leone commits to increasing its annual health budget from 8% to 12% by 2013, and gradually thereafter, until the Abuja target of 15% is met. Within that expenditure, the country is committed to increasing the family planning budget from 0·42% in 2012, to 1% by 2020, in recognition that this will be 1% of a projected increasing budget for health overall
- South Sudan commits to increase the proportion of government budget allocation to the Ministry of Health from 4·2% to 10% by 2015
- Sudan commits to increase the total health-sector expenditure from 6·2% in 2008, to 15% by 2015.
- Tanzania will increase health-sector spending from 12% to 15% of the national budget by 2015
- Uganda will increase the annual government allocation for family planning supplies from $3·3 million to $5 million for the next 5 years, and will improve accountability for procurement and distribution
- Zambia commits to increase national budgetary expenditure on health from 11% to 15% by 2015, with a focus on women's and children's health.
- Zimbabwe will increase health spending to 15% of the health budget or $20 per person, and will establish a fund for maternal, newborn, and child survival by 2011 with the same approach as the successful Education Transition Fund led by the Ministry of Education, Sports, Arts and Culture and managed by UNICEF.

to antenatal care or infant immunisations can be a first entry point to the wider health system for poor and at-risk women and children. Antenatal care can be an entry point for the identification of risk factors for wider and otherwise undiagnosed health burdens, including sexually transmitted infections, micronutrient deficiencies, diabetes, and hypertension.

This investment case does not specifically target the lowest wealth quintiles (except where country circumstances require conditional cash transfers). However, to the extent that women and children from higher-income quintiles already have greater access the health system,[20,21] then expansion of service coverage should benefit poorer women. Applications of the framework at country level might take account of the important role the private sector can have in RMNCH—eg, through public-private partnerships.

The fifth and final conclusion is that action at the country level is crucial. Although we have set out an investment framework at global level, our analysis is country-specific and highlights the substantial differences in costs and outcomes between countries. We outline an approach for developing investment scenarios, quantifying their resource implications and expected associated health impact, and the associated economic rates of return. A similar approach within a national policy dialogue could identify which key enablers and interventions should be prioritised for investment, based on the local context, national strategic health plans, and national priorities. Specific opportunities might exist at the individual country level that are practicable, affordable, and cost-effective and that are not captured by the broader global norms: for example, task shifting to community case management has been shown to be an important delivery platform that can reduce the need for intensive pre-service training.[82]

Similarly, each country will determine their appropriate health financing path. However, the high rates of return suggest that RMNCH should be treated as a public good, and to reduce out-of-pocket payments with associated financial hardship for women and children, RMNCH interventions should be deemed as high value within benefit packages supported with public financing. Synergies with existing delivery platforms and funding streams, including those for HIV and malaria, should be closely examined. Mechanisms for accountability need to be set up with the contribution of various stakeholder groups, including parliamentarians.

The analysis shows that scaling up the 50 health interventions alone is not enough to eliminate preventable child and maternal deaths. Country level planning will require a multisectoral approach, including water and sanitation, education, and other sectors. Nevertheless our analysis shows the substantial impact that will be achieved by allocating greater resources towards the health sector, which will be needed to achieve gains in the short to medium term.

One of the strengths of the investment framework is that it provides a comprehensive global cost estimate for the integrated delivery of a full set of RMNCH interventions. It generates country-specific, scenario modelling, based on epidemiological needs, evidence-based global treatment protocols, and coverage trends across the continuum of care for women and children, including the full inclusion and integration of family planning. The framework uses an established method (OneHealth) harmonised with inputs from a range of international institutions, and with impact models (LiST, AIM, FamPlan) recognised by the epidemiological reference groups. Our analysis is aligned with previous and ongoing modelling efforts, and makes use of best data currently available internationally at a global level as highlighted in the methods section.

By using efficacy on cause-specific mortality and applying each intervention to the residual deaths remaining after the previous intervention, the LiST model avoids double counting of lives saved.[83] The model accounts for the higher susceptibility to infection and higher mortality rates of those with weak nutritional status.

Moreover, our analysis explores the economic benefits of investments, and makes a start in identifying and attempting to measure the economic benefits of averted morbidity, and not just averted mortality.

The conceptual framework adds to the case for investing in the health of women and children by emphasising long-term health and nutrition gains and human capital development, increased and sustained economic development, reduced health-care costs, social benefits through empowered women and girls and stronger communities and societies, and discusses environmental outcomes.

Several limitations of the analysis should be noted. The focus of our quantitative analysis is on the health system enablers and list of essential RMNCH interventions delivered through the health sector and for which acceptable effectiveness estimates exist.[32] We were consequently unable to model mortality and morbidity reductions for interventions not included in the OneHealth and the LiST methods and for interventions for which no globally agreed impact estimates are available. Therefore, we did not include some interventions in the analysis, such as water supply, sanitation and hygiene, girls' education, sex empowerment, and food fortification, all of which contribute to improving RMNCH.[84] Complementary analysis is available. For example, the cost of scaling up human papillomavirus vaccination has been estimated to be at least $900 million for a 10-year period in 72 low-income and middle-income countries, averting 2·4 million cases of cancer and more than 1·9 million deaths.[85]

We assume efficient delivery of services, and that with the costed investments there will be sufficient absorptive and managerial capacity to manage the expansion of services. At the same time, in view of the absence of data for current capacity utilisation, our estimates of

additional health workers assume that the current workforce is fully used and unable to absorb additional demand. We have highlighted that investments in the health workforce will be crucial to achieve success, but we have not attempted to model increases in health worker training capacity in countries. The estimates do not include preservice training costs since these would fall on the education sector, nor does it account for future developments in research and innovation. The development of new (or improved) technologies, interventions, and delivery platforms and strategies will further increase the effect on health outcomes of the RMNCH intervention package (panel 5) and could potentially lower intervention costs, but data limitations prevented us from modelling these innovations.

We assume constant prices in real terms for goods and services over time, although we recognise that real unit costs could decrease (because of economies of scale, the emergence of new manufacturers and innovative procurement and finance mechanisms) or increase (because of additional costs of reaching remote areas).

Data and model limitations prevent us from disaggregated analysis by income quintiles, or to capture robust estimates of displaced people and refugees—very susceptible populations with high burdens of mortality and morbidity.[89] More broadly, the analysis assumes a health-care system that is not affected by situations related to disasters (man-made or natural), fragile states and conflict-affected states. Data limitations and gaps in the research agenda also prevent firm predictions about how the private sector—whether qualified or not—will respond in terms of provision of services.

The analysis of the economic and social benefits of the interventions reported here requires a wide range of assumptions, and in some cases (such as the benefits of morbidity averted) the data and study basis of these assumptions is poor.

Although many of the limitations listed here could not be directly addressed, the use of scenarios and the uncertainty analysis undertaken for cost and rates of return provide indicative ranges for the outputs.

Panel 5: Current and future innovations will increase the positive impact on reproductive, maternal, newborn, child, and adolescent health

The investment framework emphasises the extended provision of existing interventions that work (and work efficiently), but also new interventions that are coming that will enhance impact and in some cases efficiency. Our analysis includes interventions that are already included in the Lives Saved Tool (LiST). Inevitably, LiST is a model under continuous development and there are interventions that have become recently available but not yet incorporated. For post-partum haemorrhage, the evidence suggests that the use of a non-pneumatic anti-shock garment could reduce maternal mortality[86] and the findings of a large cluster randomised trial that will be published in 2013 support the same conclusion.[87] Tranexamic acid, an inexpensive drug that has been shown to reduce post-traumatic haemorrhage related mortality is currently being assessed as a treatment option for women with post-partum haemorrhage. This trial is halfway through to its target recruitment of 13 000 women.[88] The Odon device is an easy-to-use device that may facilitate birth when there is difficulty at the second stage of labour. This device, if effective, might replace the vacuum device for use at the peripheral levels of health care and could potentially reduce caesarean sections.

The scale-up of existing vaccines—including human papillomavirus, rubella, meningitis A, yellow fever, Japanese encephalitis, cholera, and maternal influenza—could save millions of lives. New vaccines under development that are likely to be ready for scale-up early within the time period covered by this investment framework could save millions more lives—these include malaria, dengue, and typhoid conjugate vaccines, among others. Poor quality of care is a well documented impediment to access. Current and future research initiatives to improve quality of care will provide effective strategies for scale-up. It is highly likely that in the next two decades covered by this framework, there will be other innovations and effective interventions that are unknown as of now. The additional health impact of these "new" innovations is likely to kick-in in the second decade (2025–35) of this framework. Future versions of this and similar analyses should take the cost and impact of new interventions as well as innovations and improvements in delivery of existing interventions—including quality and equity—into account.

Conclusion

We present a new global investment framework which makes the case for accelerated and targeted investment. With increased coverage of life-saving interventions across the continuum of care, rapid and sustained progress in RMNCH outcomes is achievable in a wide range of country settings across the globe. Experience from countries as varied as Bangladesh, Cambodia, Ethiopia, Rwanda, and Turkey show that coverage of reproductive, maternal, and child health interventions can indeed be scaled up rapidly.[36,90]

Our analysis reaffirms the importance of addressing the remaining agenda for reproductive, maternal, and child health at the global level over the next two decades. A post-2015 agenda should aim to sustain current successes and to bring these benefits to all women and children, particularly the most vulnerable. Many women and children in low-income and middle-income countries often bear a triple burden of ill-health related to pregnancy and childbirth, to communicable diseases, and to non-communicable diseases (NCDs), mainly cardiovascular disease, cancer, chronic respiratory disease, and diabetes.[91] Discussions need to consider the many interrelations between RMNCH and other areas.[92]

Despite recent high-level advocacy drives, investments for the health of women and children are insufficient. The investment framework shows the substantial economic and social benefits of investing in RMNCH, and outlines the outcomes of not making these investments—in terms of continued deaths and disability, medical costs, and lost productivity. As such, it supports the case for viewing investment in women's and children's health as an important contribution, not only to preventing mortality and reducing morbidity, but also to strengthening societies and economies.

Contributors

FB, CP, DJ, PS, HA, and KSt conceptualised the study. NW provided coverage projections which were further modified by KSt, AB, and AR (Amelia Baker and Aurélie Rablet). KSt developed the analytical

approach to estimating health outcomes and cost, and undertook the analysis with AB and AR. BR undertook a literature review to inform the morbidity benefits model for the socioeconomic returns analysis. PS, KSw, and BR undertook the analysis on economic and social returns. HA, KSt, IA, PS, and AMG drafted the first version of the manuscript. KSt, HA, PS, IA, AMG, MT, EM, HsF, ZAB, JEL, KSw, JPV, MO, BR, CL, SK, JT, PH, MK, AdF, NN, CP, DJ, and FB contributed to the modelling approach, interpretation, and writing. AMG, HA, KSt, BR, KSw, and PS prepared the appendix. All authors saw drafts of the report and provided input. All authors approved the final version of the manuscript. KSt finalised the report and is the guarantor.

Cost, impact, and economic returns analytical review group

Henrik Axelson, Flavia Bustreo, Thomas Cherian, Metin Gulmezoglu, Mikael Ostergren, Elizabeth Mason, Armando Seuc, Karin Stenberg, Marleen Temmerman, Dilip Thandassery, Joshua P Vogel (WHO); Amelia Baker, Aurélie Rablet (independent consultants); Andres de Francisco, Carole Presern (PMNCH); Peter Sheehan, Kim Sweeny, Bruce Rasmussen (Victoria University, Australia); Howard Friedman (UNFPA); Zulfiqar Bhutta (Aga Khan University, Pakistan); Colin Boyle (University of California at San Francisco, CA, USA); Marge Koblinsky (USAID); Joy Lawn (London School of Hygiene and Tropical Medicine, London, UK); Dean Jamison, Carol Levin (University of Washington, Seattle, WA, USA).

Conflicts of interest

PH is employed by the GAVI Alliance. DJ's research at the University of Washington is funded by a grant from the Bill & Melinda Gates Foundation. During the period from October, 2012, to December, 2013, DJ was co-Chair and Study Director for *The Lancet* Commission on Investing in Health and in this capacity declares project funding from the Bill & Melinda Gates Foundation. He also declares support from GlaxoSmithKline to participate in a January 2012 consultative meeting of the advisory group for evaluating economic models for use of the RTS,S malaria vaccine.

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