Chapter 16

Returns on Investment in the Continuum of Care for Reproductive, Maternal, Newborn, and Child Health

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INTRODUCTION

The continuum of care for reproductive, maternal, newborn, and child health (RMNCH) addresses three key dimensions of service delivery across time, space, and type of care (Kerber and others 2007):

- Access to needed services throughout the lifecycle, including adolescence, pregnancy, childbirth, the postnatal period, and childhood
- Access to interventions with functional linkages among levels of care in the health system provided by families and communities, outpatient and outreach services, and health facilities
- Access to different types of health services and activities, including prevention, promotion, and curative and palliative care (World Health Assembly 2009).

Assessing the returns on investments in the continuum of care for RMNCH requires specification of a package of interventions and an estimate of the full costs incurred in the health system to deliver those interventions. On the benefits side, the outcome of the continuum of care is evidenced in the many dimensions of the health benefits arising from an integrated care program. These benefits are not only lives saved; they also include the improved health and welfare of mothers and children, and the benefits that arise from expanding the ability of women to plan their pregnancies. These diverse health gains will have a wide range of economic and social benefits. Thus, assessing the returns on investment in the continuum of care for RMNCH also requires a comprehensive attempt to measure the various benefits that accrue to communities, at different stages of the lifecycle, as a result of the interventions. The overall analysis compares costs and benefits, taking into consideration their varying patterns over time, to generate benefit-cost ratios and rates of return on investment.

This chapter assesses the costs and benefits of delivering a set of integrated RMNCH interventions across the continuum of care in countries with high child and maternal mortality. The purpose is twofold:

- To demonstrate that very high returns can be achieved by strengthening investments in the delivery of a suite of high-impact interventions
- To underscore the importance of an accurate assessment of those returns, including the full range of costs involved in delivering integrated care across the continuum and the full range of benefits that flow from the interventions.

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This chapter is based on the first attempt, to our knowledge, to undertake such a comprehensive analysis of the returns on investment in the continuum of care for RMNCH (Stenberg and others 2014).

CONTEXT OF THE ANALYSIS

The benefits of improving the health of mothers and children are indisputable, and considerable progress has been made in reducing maternal and child deaths since the publication of *Disease Control Priorities in Developing Countries*, second edition (Jamison and others 2006). The global maternal mortality ratio decreased 25 percent, from 288 per 100,000 live births in 2005 to 216 in 2015 (Alkema and others 2015; WHO, UNICEF, UNFPA, and World Bank 2015). The global mortality rate for children under age five years decreased 32 percent, from 63 per 1,000 live births in 2005 to 42.5 in 2015 (UNICEF, WHO, World Bank, UN 2013; You and others 2015). Although several factors have contributed to these reductions, including general socioeconomic development, the increased coverage of essential RMNCH interventions has played an important role (WHO and UNICEF 2013).

Notwithstanding this progress, 5.9 million children died before their fifth birthdays in 2015, and 303,000 pregnant women died in 2015 from preventable complications related to pregnancy and birth. Moreover, progress has been uneven—both among countries and within countries (Barros and others 2012); a number of countries did not reach Millennium Development Goal (MDG) 4, to reduce child mortality, and MDG 5, to improve maternal health, by 2015 (Alkema and others 2015; You and others 2015).

The remaining challenges in reducing maternal and child mortality are, to a large extent, the effects of uneven attention to the full continuum of care. For example, in the 75 low- and middle-income countries (LMICs) that account for more than 95 percent of global maternal and child deaths, coverage of routine diphtheria-tetanus-pertussis immunization has reached a median level of more than 80 percent; however, coverage of other life-saving interventions is much lower, especially those delivered in the immediate postnatal period (median coverage of less than 45 percent) such as postnatal care for mothers and babies (WHO and UNICEF 2013). Similarly, adolescence remains a neglected period, as highlighted by a series in *The Lancet* on adolescent health (Cappa and others 2012). The continuum of care, including referral chain, is often less than fully functional in these countries (Bossyns and Van Lerberghe 2004; Font and others 2002).

Additional investments are required to sustain gains achieved and to accelerate efforts to address the remaining gaps. With LMICs facing the double burden of communicable and noncommunicable diseases, priorities need to be set to allocate resources to the most effective outcomes.

INVESTMENT "WINS"

This chapter demonstrates the considerable social and economic returns realized through the effect of investments in RMNCH interventions, building on and adding more specificity to earlier results. For example, it has previously been estimated that 30 percent to 50 percent of East Asia's dramatic economic growth during 1965–90 can be attributed to reduced child mortality and subsequent lower fertility rates (Bloom and Williamson 1997), and that gross domestic product (GDP) per capita is increasing by 1.0 percent per year in China and 0.7 percent per year in India as a result of the effect of lower fertility on age structures (Bloom and others 2010).

There are additional reasons why investing in women's and children's health is not only the right thing to do; it is also the smart thing to do.

Improved and Equitable Access

Well-targeted investments along the continuum of care can respond to a fundamental human right: the right to health. Increasing equitable access to RMNCH services is a key strategy for moving closer to universal health coverage, defined by the WHO as when all people obtain the health services they need without suffering financial hardship when paying for them (WHO 2010, ix).

Health System Benefits

Investments in women's and children's health strengthen the entire health system. For example, the capacity to provide 24-hour emergency obstetric care requires that health system components, such as qualified health workers, medications, facilities, and a functioning referral system, be in place across geographic areas.

Extended Lifecycle Benefits

Investments in RMNCH bring benefits across age groups. For example, investments in nutrition have long-lasting effects beyond the immediate improvement in nutritional status, such as improvements in cognitive development, school performance, and future earnings (Ruger and others 2012).

Cost-Effective Interventions

A considerable body of research, including *Disease Control Priorities in Developing Countries,* second edition, has

established that RMNCH interventions are among the most effective and cost-effective available (Jamison and others 2006). Recent evidence confirms these findings. A study of diarrhea and pneumonia interventions finds that 15 highly cost-effective interventions exist that, if implemented at scale, would prevent 95 percent of deaths from diarrhea and 67 percent of deaths from pneumonia in children under age five years by 2025 (Bhutta and others 2013). Evidence from Afghanistan suggests that an approach combining improved family planning with incremental improvements in skilled birth attendance, transport, referral, and appropriate intrapartum care in high-quality facilities could prevent 75 percent of maternal deaths at a cost of less than US$200 per year of life saved (Carvalho, Salehi, and Goldie 2012).

Improved Integration of Services

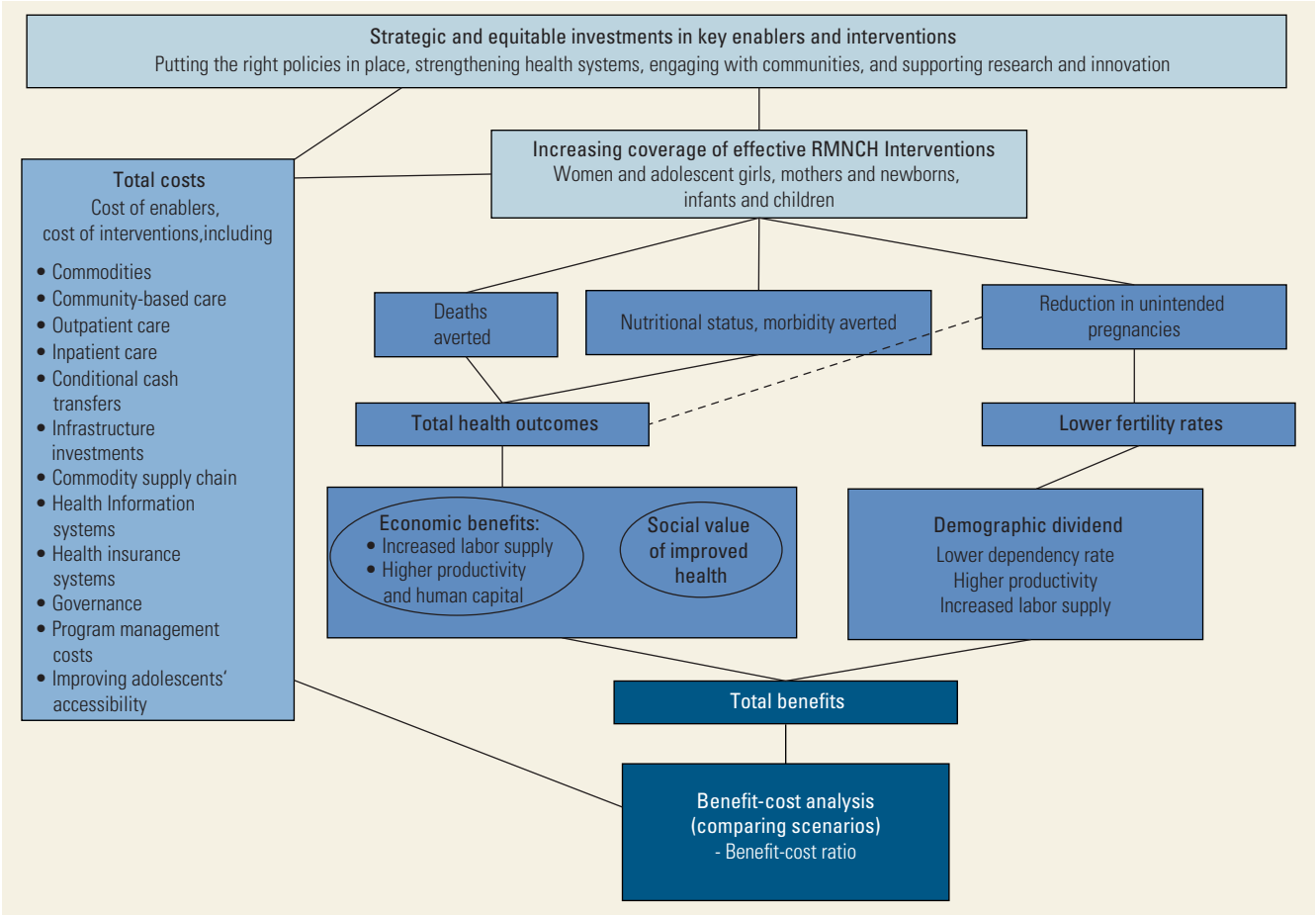
Opportunities exist to deliver packages of interventions when women and children present at health facilities, for example, to prevent sexually transmitted infections in conjunction with family planning programs (Church and Mayhew 2009). Findings of the Multi-Country Evaluation of the Integrated Management of Childhood Illness (IMCI) suggest that integrated care can lead to cost savings: the annual cost of providing health care to children was considerably lower in districts with IMCI compared with districts without it (Adam and others 2005).

ANALYTICAL FRAMEWORK FOR ASSESSING INVESTMENTS IN THE CONTINUUM OF CARE

The conceptual and methodological framework used is summarized in figure 16.1. This framework has three main elements:

- Identification of a suite of essential, cost-effective interventions

Figure 16.1 Conceptual and Methodological Framework



Source: Adapted from Stenberg and others 2014.
Note: RMNCH = Reproductive, maternal, newborn, and child health.

- Estimation of the health and fertility impacts and the total cost of specific levels of additional investment in these interventions
- Assessment of the economic and social benefits arising from these health and fertility impacts.

Selecting the Interventions

National policy makers must choose which services to provide, taking into account budgetary constraints and financial ceilings allocated by the ministry of finance and other financing partners. Evidence on cost-effectiveness, current health system capacity, feasibility, and acceptability will inform investment strategies. The framework outlined in this chapter includes interventions that were identified in a 2011 review as essential and cost-effective RMNCH interventions (PMNCH, WHO, and Aga Khan University 2011). Table 16.1 lists the 50 selected interventions grouped into six broad packages that follow program structures in many national health systems: family planning, maternal and newborn health, malaria, HIV/AIDS, immunization, and child health, with nutrition included in several packages.

The effective delivery of high-quality interventions depends on key enablers, including national policies, functional health systems, community engagement, and innovation. Strategies modeled include those supporting both the supply side (for example, expanding health

Table 16.1 Preventive and Treatment Interventions Modeled[a]

Promotive and preventive interventions	Treatment interventions
Family planning	
Modern family planning methods, including pill, condom, injectable, IUD, implant, female sterilization, male sterilization, LAM, vaginal barrier method, and vaginal tablets	
Maternal and newborn health	
• Multiple micronutrient supplementation[b]	• Safe abortion[c]
• Balanced energy supplementation[b]	• Postabortion case management
• Preventive postnatal care	• Ectopic case management
• Periconceptional folic acid supplementation	• Syphilis detection and treatment in pregnant women
• Calcium supplementation for prevention and treatment of preeclampsia and eclampsia	• Management of preeclampsia with magnesium sulphate
• Induction of labor (beyond 41 weeks)	• Detection and management of diabetes in pregnancy[b]
• Labor and delivery management	• Detection and management of fetal growth restriction[b]
• Clean practices and immediate essential newborn care	• Basic and emergency obstetric care
• Active management of the third stage of labor	• Management of eclampsia with magnesium sulphate
• Kangaroo mother care	• Neonatal resuscitation in institutions
	• Antenatal corticosteroids for preterm labor
	• Antibiotics for preterm premature rupture of membranes
	• Full supportive care for neonatal infections
Malaria	
• Insecticide treated materials	• Treatment of malaria in children
• Pregnant women sleeping under ITNs	• Treatment of malaria in pregnant women
• Intermittent preventive treatment for pregnant women	
HIV/AIDS	
• Prevention of mother-to-child transmission	• ART (first-line treatment) for pregnant women
• Cotrimoxazole for children	• Pediatric ART

table continues next page

Table 16.1 Preventive and Treatment Interventions Modeled (continued)

Promotive and preventive interventions	Treatment interventions
Immunization	
• Tetanus toxoid vaccine	
• Rotavirus vaccine	
• Measles vaccine	
• DPT vaccination	
• Hib vaccine	
• Polio vaccine	
• BCG vaccine	
• Pneumococcal vaccine	
• Meningitis vaccine[b]	
Child health	
• Breastfeeding counseling and support; complementary feeding counseling and support	• Oral rehydration therapy
• Vitamin A supplementation in infants and children ages 6–59 months	• Zinc for diarrhea treatment
	• Antibiotics for treatment of dysentery
	• Pneumonia treatment in children
	• Management of severe malnutrition in children
	• Management of moderate acute malnutrition[b]
	• Vitamin A for measles treatment in children

Source: Based on Stenberg and others 2014.
Note: ART = antiretroviral therapy; BCG = bacille Calmette-Guérin; DPT = diphtheria, pertussis, and tetanus; Hib = *Haemophilus influenzae* type B; ITN = insecticide-treated bednet; IUD = intrauterine device; LAM = lactational amenorrhea method.
a. Some interventions may have both preventive and curative elements.
b. Current analysis includes impact only, not cost.
c. In countries where abortion is legal.

system access by constructing new hospitals and facilities) and the demand side (for example, mass media campaigns to encourage breastfeeding and care seeking for childhood illnesses).

Estimating the Costs

The second stage of the analysis is to use modeling tools to estimate the health and fertility impacts of the interventions and the investment costs required.

With respect to costs, attempts have been made to estimate the resources required to scale up the provision of essential RMNCH services in LMICs. Most of these are disease- or program-specific cost studies that determine costs more or less specific to the disease or age group (Bhutta and others 2013; Singh and Darroch 2012; Stenberg and others 2007). Such studies tend to include patient-level costs for intervention-specific commodities, such as vaccines, bednets, and nutritional supplements, as well as some estimates of the time and related cost of health workers involved in providing the health services. Ideally, these studies would also include program support costs, for example, for training in disease-specific management, epidemiological surveillance, and provision of vehicles specific to the program activities. However, the studies may not always do so, or the specific methods used to estimate such costs are not always well described. Finally, program- or disease-specific estimates may miss resources needed for broader health-system-strengthening activities, thereby underestimating the true resource needs for the provision of services. Health-system-strengthening activities to consider include preservice training and deployment of clinical staff, development of a functioning referral system, strengthening the health information system, and upgrading facility infrastructure. Figure 16.1 shows the 12 components of the full cost of scaling up the interventions that are estimated in the analysis presented in this chapter.

Estimating Health and Fertility Impacts

The scale up of a comprehensive package of care will have interactions across diseases and age groups. The interlinkages built into the OneHealth Tool and accompanying impact modules (box 16.1) eliminate double counting of lives saved, and they take into account the reduction in need for treatment as preventive care is scaled up. Increases in coverage are translated into reductions in maternal, newborn, and child mortality, along with declines in some aspects of morbidity such as prevalence of wasting and stunting. Fertility rates are modeled to decrease with increasing targets for contraceptive prevalence rates, in turn affecting population growth projections over time.

Assessing the Economic and Social Benefits of Achieved Outcomes

Once the improved health outcomes arising from the interventions—lives saved, morbidity averted, and unwanted pregnancies avoided—are determined, the task is to measure the benefits arising from these better outcomes. Some of these benefits will be strictly economic, reflected in higher GDP from increased workforce participation and from higher productivity. However, other benefits, although equally real and certainly economic in a broader welfare sense, will not be reflected in conventional GDP measures. A mother's life saved so that she is able to look after her children and support her community has great social value even if she does not enter the paid workforce. Equally, the value of a child's life saved does not depend only on his or her participation in the labor force when an adult. We refer to the benefits not captured in existing GDP measures as *social benefits*.

A strong consensus exists among economists that measurements of economic and social change need to move beyond production or conventional GDP to sustainable well-being (Stiglitz and others 2009) and that these more inclusive measures are especially important in relation to health (Arrow and others 2013; Suhrcke and others 2012). These more inclusive methods can be referred to as *full income methods*. They include additional benefits from improved health outcomes and more inclusive gauges of income than those included in GDP as it is currently measured.

The Lancet Commission on Investing in Health (Jamison and others 2013) argues strongly for a full income approach to measuring the benefits of investment in health, defined as measured increases in conventional GDP plus the value of additional life years gained. The approach presented in this chapter goes further, because it does not limit the analysis to the benefits arising from lives saved. We attempt to include in an explicit manner estimates of economic and social benefits from morbidity averted, and to estimate the economic benefits

Box 16.1

Translating Coverage Increases into Cost and Health Impacts: The OneHealth Tool

The OneHealth Tool (OHT) is a software program that aims to support integrated planning processes in low- and middle-income countries by bringing together disease-specific program planning and health systems planning. The tool was born out of a review of tools for strategic planning and costing that found that existing tools did not adequately allow for sector-wide scenario analysis (PMNCH 2008). The OHT aims to facilitate planning that incorporates health promotion, prevention, treatment, and disease management. Version 4 includes detailed modules for programs such as nutrition, child health, malaria, and noncommunicable diseases, as well as modules for health systems planning, for example, human resources, logistics, and infrastructure. It is prepopulated with demographic and epidemiological data by country, as well as input assumptions for prevention and treatment interventions based on World Health Organization–recommended treatment protocols. The tool estimates the likely health impact (mortality and morbidity) of scaling up coverage. The OHT incorporates preexisting models used by various United Nations' epidemiological reference groups such as the Lives Saved Tool (Winfrey, McKinnon, and Stover 2011); the AIDS Impact Model for HIV/AIDS interventions (USAID 2007; Stover and others 2010); and the FamPlan model, which computes the relationship between family planning and the total fertility rate (Bongaarts 1978; USAID 2004).

derived from control of fertility and hence from the reduction in unwanted pregnancies—the *demographic dividend*. Accordingly, the approach in this chapter allows for a more comprehensive approximation of the estimated benefits than that used in Jamison and others (2013) and other studies.

MEASURING THE HEALTH IMPACTS AND FULL COSTS OF INVESTMENTS IN THE CONTINUUM OF CARE

Estimates were derived for 74 high-burden countries in which more than 95 percent of the world's child and maternal mortality occurs (WHO and UNICEF 2013).[1] The list includes 35 low-income countries (LICs), 27 LMICs, 11 upper-middle-income countries (UMICs), and one high-income country (HIC). The investment occurs during 2013–35, and only health and fertility outcomes brought about by investment up to 2035 are considered. The economic and social benefits of those outcomes, such as lives saved or morbidity averted, continue to accrue for some decades to come and can be taken account of in the investment appraisal.

Modeling an Increase in Coverage Level

An investment case may take into account different scenarios of specific packages of services (content), levels of investment (level of ambition), and strategies (for example, community-based versus facility-based delivery) to achieve the set goals. At the country level, the various different scenarios should be assessed to inform national policy discussions regarding the most-effective resource allocations. Here, for illustrative purposes and in the interest of assessing the benefits of investing in a set of high-mortality countries, we scale up the same package of interventions across all countries. A scenario that maintains current baseline (2012) coverage is defined as *Low,* while an ambitious scenario with coverage increasing for all 50 interventions until 2035 is defined as *High* (table 16.2).[2]

The relative level of coverage across the scenarios drives the differences in intervention costs and impact so that the incremental effect of an investment strategy (that is, the High scenario) compared with maintaining current coverage without strengthening the health system (the Low scenario) can be assessed and valued. The analysis is centered on the comparison between

Table 16.2 Parameters of the Investment Analysis

Overall parameters	Scope of the analysis
Years of investment cost	2013–35
Years for which benefits are estimated	2013–35 (health benefits) 2013–70 (economic and social benefits)
Population considered	4.9 billion in 2013 (74 countries) (UN 2013)
Costs considered	
Service delivery costs[a]	• **Inpatient care**: Costs comprise the "hotel" component of hospital costs, that is, excluding the cost of drugs and diagnostic tests but including costs for personnel and infrastructure running costs. • **Outpatient care**: Personnel and infrastructure running costs. • **Community-based care**: A proxy value is applied, assuming that the running cost of community-based care would be one-third the cost of care provided at health centers.
Intervention-specific direct costs[b]	Drugs, vaccines, laboratory tests, and medical supplies based on treatment guidelines
Program administration costs[c]	• **General**: Resource needs are estimated using a bottom-up ingredients approach for each specific area (child health, maternal health, immunization) and comprise in-service training activities, development of preservice training materials, distribution of printed information materials, mass media campaigns, supervision of community health workers, routine program management, conditional cash transfers, and other activities considered essential for ensuring an expansion of quality services. • **Specific for improving adolescents' access to health services**: Costs for general program coordination at national and district level of adolescent-friendly health services (AFHS), development and distribution of national standards for AFHS, in-service training on AFHS, information and communication activities, and upgrade of infrastructure and equipment to adolescent-friendly standards

table continues next page

Table 16.2 Parameters of the Investment Analysis (continued)

Overall parameters	Scope of the analysis		
Health systems costs[d]	• 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 expansion in service delivery and effective referral systems. • Operational costs for transporting additional RMNCH commodities throughout the supply chain.[e] • Investments in equipment and procedures for better health information management. • Administration of social health insurance in 13 countries classified as having or planning to set up insurance schemes. • Investments in procedures for improved governance and management of resources.		
Scenarios considered	*Health interventions*	*Family planning*	*Economic growth assumptions*
LOW This scenario assumes that coverage is maintained at current levels.	• Coverage is maintained at predicted current levels (2012). • It is assumed that with constant coverage, mortality rates do not change over time.	• Coverage is maintained at predicted current levels (2012). • Population growth is as would occur with current contraceptive use and fertility and mortality profiles of the 74 countries. The total population will continue to increase over time, along with the cost of providing services; the total absolute number of deaths will increase.	GDP per capita converges from current estimates to an annual growth rate of 2 percent by 2070.
HIGH This ambitious scenario scales up coverage by accelerating current trends using a best-performer approach.	Projected coverage values are derived from historical trends using the fastest rate of change achieved by countries at specific coverage levels. • For newer vaccines (rotavirus, *Haemophilus influenzae* type b [Hib], and pneumococcal vaccines), predictions of rollouts by Gavi, the Vaccine Alliance were used. • For predictions of HIV incidence, PMTCT, ART for children and adults, and treatment with cotrimoxazole, we applied global targets of 80 percent by 2015, and 95 percent by 2035. • The average coverage level attained for the 50 interventions is 88 percent by 2035.	Family planning and contraceptive use increase based on best-performer trends, with TFR limited from going below 2.1 (unless currently below 2.1).	GDP per capita and year are calculated based on economic benefits and social benefits valued in monetary terms.

Source: Based on Stenberg and others 2014.
Note: ART = antiretroviral therapy; GDP = gross domestic product; PMTCT = prevention of mother-to-child transmission; RMNCH = reproductive, maternal, newborn, and child health; TFR = total fertility rate.
a. WHO-CHOICE estimates of service delivery costs by country.
b. Commodity, vaccine, test, and supply costs included as defaults within the OneHealth Tool, multiplied by quantities of services delivered based on intervention scale up.
c. Program administration and support activity costs calculated as part of previous analysis, notably WHO (2009) and Deogan, Ferguson, and Stenberg (2012).
d. Health-system-strengthening costs calculated as part of previous analysis (WHO 2009).
e. Supply chain costs calculated as a mark-up rate on the variable commodity costs associated with intervention scale up.

scenarios; it is important to note that the main counterfactual in our example is the Low scenario with constant coverage levels and a growing population. Accordingly, the results should not be interpreted as additional spending above current levels of health expenditure, but rather as the cost and impact of bending the curve and accelerating progress compared with a Low scenario in which coverage remains at the 2012 level while population increases.

We applied tools that have been developed by the international community, including the OneHealth Tool (box 16.1) to assess intervention-specific costs and

health and fertility impacts. Intervention-specific costs are driven by increases in coverage, with costs distributed to different levels of care (community, outreach, facility, and hospital). Program- and systems-related costs draw upon estimates made by the Taskforce on Innovative International Financing for Health Systems (WHO 2009) and are described in detail in Stenberg and others (2014). Costs are generally estimated using an ingredients approach (quantity times price), with the exception of supply chain costs, for which a mark-up ratio is applied.

ESTIMATING THE FULL BENEFITS OF INVESTMENT IN THE CONTINUUM OF CARE

Key Methodological Assumptions

The costs and the benefits are defined as the incremental costs and benefits between two scenarios. However, when fertility management tools are an important part of the suite of interventions, the populations in the two scenarios diverge substantially. The approach we adopt is to assess only those benefits that apply to those alive in the High scenario, and we compare their situation to what it would have been in the Low scenario.

Three broad types of benefit are identified:

- Some have the benefit of life because their lives were saved through the interventions.
- Others are in much better health because of the morbidity averted.
- The whole community has the benefit of higher per capita incomes arising from the reduction in unintended pregnancies and from the processes that the fall in fertility rates sets in motion.

The difference in deaths and in morbidity for children between the Low and High scenarios will reflect two different factors: the impact of the health interventions for a given level of births, and the reduction in the number of births (due to expanding family planning) for a given level of health. We partition the reduction in child deaths and in morbidity between the Low and High scenarios into these two components. We use only the former, which we refer to as *lives saved*, in calculating benefits.[3] The reduction in child mortality from scaling up contraceptives is thus counted in the health impact results but not in the cost-benefit analysis. All maternal deaths prevented are considered to be lives saved; that is, the full reduction in maternal mortality is translated into economic benefits.

GDP per capita paths were derived from World Bank data and were combined with population estimates from the OneHealth Tool projections; these were extended to 2070 on the basis of convergence to zero population growth in each country by that year. Per capita GDP estimates and assumptions about productivity are combined with data on labor force participation of those affected by the intervention[4] (ILO 2013).

Economic and Social Benefits of Years of Life Saved

A vast literature discusses the value of a statistical life[5] and, by implication, the value of life years saved (VLY). Most studies use a willingness-to-pay approach, either in the form of analyses of revealed preferences evident in wage and risk data or analyses of stated preferences. Viscusi and Aldy (2003) review the revealed preference literature and suggest, albeit with a wide uncertainty margin, an implied value for a life year of about 4.0 times GDP per capita, with an income elasticity of about 0.6. These two facts, in turn, imply a value of a life year for LICs of 1.5 to 2.0 times GDP per capita.

Jamison and others (2012) estimate the VLY as 2.3 times GDP per capita in LMICs at a 3 percent discount rate, with estimates by World Bank region ranging from 1.4 for Latin America and the Caribbean and for the Middle East and North Africa to 4.2 for Sub-Saharan Africa. Cropper, Hammitt, and Robinson (2011) note the recent expansion of the stated preference literature, in which individuals are asked about how they would act in hypothetical situations, and that the value of a statistical life emerging from these studies is much lower than for revealed preference studies.

The revealed preference studies refer to both the economic and social value of a life year; by economic value we mean the value that would be captured in conventional GDP measures, primarily through labor force effects; the social value refers to all other benefits of an additional year of life to an individual or a community not captured in GDP. We regard it as useful to distinguish between the social and economic components of the VLY because they may have different roles in some investment analyses.

We have constrained the total value of a life year across these two components to 1.5 times GDP per capita for the sample as a whole, which we regard as being at the lower end of the range used in the literature. The calculated economic benefits of increased labor force participation amount to about 1.0 times GDP per capita, calculated as the sum of GDP for all 74 countries divided by the population for all 74 countries. A social VLY equal to 0.5 times the GDP per capita of the full set of sample countries is then applied as a common value across countries. Although the strictly economic value of an additional year of life will vary with local economic

parameters, there is no reason to think that the social value is lower in poorer countries than in richer ones. Although we do not use any age adjustment for the social value of a life, our procedure results in some discounting of the overall value of a life year for age, and the economic benefits of children's lives saved only begin to accrue when they enter the labor force.

Benefits of Morbidity Averted

Many women and children who survive adverse RMNCH events suffer serious and sustained disabilities (Ashford 2002; Blencowe and others 2013; Mwaniki and others 2012; Souza and others 2013) that undoubtedly have substantial human, social, and economic costs. The interventions studied here should be expected to generate important benefits through lower morbidity. In spite of its acknowledged importance, few attempts have been made to quantify the burden of maternal and child morbidity or to estimate its economic and social cost; we attempt to begin the process in this study.

Although the OneHealth Tool estimates the lives saved as a result of scaling up the interventions, it does not measure the morbidity averted (other than for wasting and stunting) or the impact on mortality in subsequent years from averting morbidity in the initial year. We estimate morbidity averted for four causes for children (preterm birth complications, birth injury, congenital abnormalities, and malnutrition) and two for mothers (obstructed labor and other maternal disorders), and calculate economic and social benefits.[6] Moreover, we derive parameters relating improved nutritional outcomes—prevention of low stature and low birth weight—to lifetime earnings and apply these to estimates of reduced wasting and stunting by country.

Benefits of Reduced Fertility Rates

The third benefit is the economic impact of the reduction in fertility rates, which is well documented in the literature.[7] Ashraf, Weil, and Wilde (2013) identify a range of channels through which a reduction in the total fertility rate (TFR), that is, the number of children born to the average woman during her lifetime, affects growth in GDP per capita; these channels can be grouped into three types of effect, each affecting GDP:

- A dependency effect because a reduction in births reduces the dependent population. Given that the nondependent population produces the GDP, the fall in the dependent population for a given level of GDP increases the level of GDP per capita.
- A labor supply effect because adults are able to devote more time to working. (With fewer births, women and other caregivers will have an increased propensity to enter the labor force, leading to increased labor supply per capita and hence to increased GDP per head.)
- A productivity effect covering a range of factors influencing long-term productivity, such as higher saving by households and higher investment in schooling. More generally, with lower birth rates, more of a society's resources can be devoted to capital deepening, thereby increasing productivity, rather than to capital widening to meet the needs of the expanding population.

The estimates of the demographic dividend draw on and adjust the methods of Ashraf, Weil, and Wilde (2013), who developed estimates of key parameters based on a review of relevant literature. We derive from their model an aggregate relationship between the reduction in the TFR and the change in GDP per capita over time, out to 2070, and apply this to the change in the TFR in each country to estimate the impact on per capita GDP and hence on overall GDP.[8]

In summary, we present economic benefits, valued in GDP terms, derived from the following:

- Lives saved
- Morbidity averted
- Demographic dividend.

Social benefits, also valued in GDP terms, are derived from the following:

- Lives saved
- Morbidity averted.

In the Low scenario, GDP per capita paths converge to an annual growth rate of 2 percent by 2070. The economic benefits here refer to the difference in GDP growth between the High and Low scenarios.

Two Country Case Studies

To illustrate how the investment framework could be applied at the country level, we present two case studies of LICs. One is a country in Asia that has seen increased coverage of RMNCH interventions and reductions in the fertility rate to about 2.5. The other is a country in Sub-Saharan Africa with low coverage of many RMNCH interventions and continued high fertility rates (table 16.3).

Table 16.3 Parameters of Country Case Studies

	Asia case study country	Sub-Saharan Africa case study country
Description	High coverage of maternal and child health interventions; fertility rates of less than 2.5	Low coverage of most RMNCH interventions; high child and maternal mortality and high fertility rates
U5MR per 1,000 live births	Low (< 60)	High (> 100)
Maternal Mortality Ratio per 100,000 live births	Low (< 100)	Medium (between 100 and 300)
TFR	Low (< 2.5)	High (> 4)
Current health expenditure per capita (2011 U.S. dollars)	Low (< 50)	Low (< 50)
Women's labor participation rate	Low (50–70 percent)	Medium (70–80 percent)
GDP per capita	US$700–US$1,000	US$500–US$800
Coverage increase, High scenario	• Use of modern contraceptives increases to 53 percent from 50 percent • Interventions surrounding child birth are scaled to 95–99 percent from ≃ 30 percent • Management of childhood illness and other child interventions reach levels of universal coverage approaching 95 percent • Exclusive breastfeeding rates (1–5 months) increase to 75 percent from 41 percent • HIV interventions reach 67–100 percent coverage by 2035	• Use of modern contraceptives scaled up to 49 percent from 13 percent • Interventions surrounding child birth are scaled up to 95–99 percent from around 50 percent • Management of childhood illness and other child interventions reach levels of universal coverage approaching 95–100 percent • Exclusive breastfeeding rates (1–5 months) increase to 99 percent from 22 percent • HIV interventions reach 73–100 percent coverage by 2035
Additional estimated costs (2011 U.S. dollars) and deaths prevented for High scenario compared with Low scenario	• Cumulative additional costs 2013–35 of US$17.9 million • Per capita costs in 2035 = US$2.65 • 3.1 million deaths prevented 2013–35	• Cumulative additional costs 2013–35 of US$2.4 million • Per capita costs in 2035 = US$6.88 • 3.4 million deaths prevented 2013–35

Source: Based on Stenberg and others 2014.
Note: GDP = gross domestic product; HIV = human immunodeficiency virus; RMNCH = reproductive, maternal, newborn, and child health; TFR = total fertility rate; U5MR = under-five mortality rate.

RESULTS: INVESTMENT METRICS AND COMPONENTS OF COSTS AND BENEFITS

We present benefit-cost ratios of investing in RMNCH. For details on costs (in 2011 U.S. dollars) and health benefits, see Stenberg and others (2014). In brief, the High scenario would require an extra US$4.48 per capita in 2035, with country estimates ranging from US$1.2 to US$112.7, although the per capita numbers will be higher in earlier years because of frontloading in infrastructure costs and the increase in population over time. Total costs reach US$30 billion in the third year and remain at that level until 2035.[9]

Table 16.4 shows estimates of total deaths prevented, apportioned between deaths averted (the reduction in births due to enhanced access to contraceptives) and lives saved (the impact of the health interventions on those who are born). The distribution of deaths across these two categories varies across countries and regions, largely reflecting the importance of fertility reduction in individual countries. In UMICs, for example, where fertility rates are in general already fairly low, 75.6 percent of deaths prevented are lives saved.

Benefit-Cost Ratios for Investments

Applying a discount rate enables benefits and costs to be expressed as a net present value (NPV). The benefit-cost ratio for a given discount rate is the ratio of the NPV of benefits and costs at that discount rate.

Table 16.5 reports for all countries considered as a whole, and for groups of countries, the benefit-cost

Table 16.4 Costs and Deaths Prevented, High versus Low Scenarios, 2013–35

Country grouping (number of countries in parentheses)	Cost (billion 2011 US$)	Deaths prevented (millions)	Distribution of deaths prevented: Lives saved vs. deaths averted (percent of total)					Total lives saved (millions)
			Stillbirths		Maternal deaths	Child deaths		
			Lives saved (percent)	Deaths averted (percent)	Lives saved (percent)	Lives saved (percent)	Deaths averted (percent)	
Low-income countries (35)	173.6	78.9	30	70	100	46	54	40.4
Lower-middle-income countries (27)	316.3	98.1	40	60	100	58	42	59.9
Upper-middle- and high-income countries (12)	188.8	7.8	43	57	100	67	33	5.9
Total (74)	678.1	184.9	36	64	100	53	47	106.3
Sub-Saharan Africa (43)	232.9	109.3	27	73	100	45	55	54.5
Latin America and the Caribbean (6)	46.8	2.9	42	58	100	64	36	1.9
Middle East and North Africa (5)	24.1	4.7	22	78	100	48	52	2.2
Europe and Central Asia (5)	10.0	0.2	55	45	100	71	29	0.6
South Asia (5)	165.3	60.4	47	53	100	64	36	40.7
East Asia and Pacific (10)	199.0	7.4	61	39	100	86	14	6.5

Source: Based on Stenberg and others 2014.
Note: Numbers may not sum precisely because of rounding.

Table 16.5 Benefit-Cost Ratios for High Compared with Low Scenarios, Selected Periods and Discount Rates

Country grouping	Number of countries	To 2035 (3 percent discount rate)	To 2050 (5 percent discount rate)	To 2070 (7 percent discount rate)
All 74 countries	74	8.7	27.6	34.2
Low-income countries	35	7.2	16.9	18.5
Lower-middle-income countries	27	11.3	34.0	41.0
Upper-middle-income countries, excluding China	10	6.1	22.5	30.1
China	1	0.7	2.7	3.8
India	1	15.0	42.8	52.6
Sub-Saharan Africa	43	11.0	32.3	37.9
South Asia	5	12.7	36.2	43.4
High fertility impact countries[a]	27	13.7	40.6	47.4
Asia case study country	1	4.0	9.4	10.5
Sub-Saharan Africa case study country	1	9.9	24.6	27.4

Source: Based on Stenberg and others 2014.
a. The 27 high fertility impact countries are those in which the estimated demographic dividend by 2035 (comparing the High and Low scenarios) is 8 percent of gross domestic product or greater. These are Afghanistan, Angola, Benin, Burkina Faso, Cameroon, Chad, Comoros, the Democratic Republic of Congo, the Republic of Congo, Equatorial Guinea, The Gambia, Guinea, Guinea-Bissau, Iraq, Kenya, Liberia, Malawi, Mali, Mozambique, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Somalia, Tanzania, Uganda, and Zambia.

ratios calculated using rising discount rates over the period: 3 percent for 2013–35, 5 percent for 2013–50, and 7 percent for 2013–70. We present results individually for China and India given the significant size of these countries. China is also a particular case in that there is limited additional demographic dividend to gain (table 16.6). Although the 3 percent rate is commonly used in this type of analysis (appendix 3 in Jamison and others 2013), the use of rising discount rates for longer periods is one way of taking account of higher uncertainty over the longer term as well as myopic time preferences and likely increases in consumption over time.

The benefit-cost ratios shown in table 16.5 indicate high returns on increased investment in RMNCH in most countries, especially when benefits beyond the intervention period are included. For all countries considered as a group, the benefit-cost ratio is 8.7 for the intervention period to 2035 at a 3 percent discount rate, 27.6 at 5 percent for the period to 2050, and 34.2 at 7 percent for the period to 2070. The benefit-cost ratio is generally higher for lower-middle-income countries and UMICs than for LICs, especially post 2035, as well as for those 43 countries in Sub-Saharan Africa and 5 in South Asia where maternal and child mortality are highest.

Analysis of Benefits and Benefit-Cost Ratios by Type of Benefit

Tables 16.6 and 16.7 show the contribution from the three sources of benefits to 2050 comparing the High and Low scenarios (using a 5 percent discount rate) expressed in two ways: as a contribution to the overall benefit-cost ratio and as a percentage share of all benefits in NPV terms. These tables illustrate four points about the distribution of benefits.

Uneven Distribution of Demographic Dividend

First, the demographic dividend is unevenly distributed across countries, depending on each country's projected fertility rate reduction. Overall, the reduced fertility generates a benefit-cost ratio of 13.3 by 2050 (the demographic dividend in table 16.6), but the estimated impact of reduced fertility rates in the High scenario is particularly high in 27 countries, where it could lead

Table 16.6 Analysis of Contribution to Benefit-Cost Ratio, High versus Low Scenarios, 5 percent Discount Rate for Net Present Value, 2013–50

		Direct workforce-related benefits					Social benefits			
		Lives saved	Morbidity averted	Increase in GDP	Demographic dividend	Economic benefits	Lives saved	Morbidity averted	Total	All benefits
Country grouping	Benefit-cost ratio	(a)	(b)	(c) = (a) + (b)	(d)	(e) = (c) + (d)	(f)	(g)	(h) = (f) + (g)	(t) = (e) + (h)
All 74 countries	27.6	5.7	1.4	7.1	13.3	20.4	6.7	0.5	7.2	27.6
Low-income countries	16.9	1.4	0.3	1.7	5.5	7.1	9.2	0.6	9.8	16.9
Lower-middle-income countries	34.0	4.2	1.2	5.4	20.0	25.4	8.0	0.6	8.6	34.0
Upper-middle-income countries, excluding China	22.5	6.7	1.8	8.5	11.0	19.5	2.8	0.2	3.0	22.5
China	2.7	1.3	0.3	1.5	0.0	1.5	1.1	0.0	1.2	2.7
India	42.8	5.1	1.5	6.6	21.3	27.9	13.9	1.0	14.9	42.8
Sub-Saharan Africa	32.3	4.1	0.8	4.9	17.4	22.3	9.4	0.6	10.0	32.3
South Asia	36.2	4.4	1.3	5.7	18.1	23.8	11.5	0.9	12.4	36.2
High fertility impact countries	40.6	4.7	0.9	5.6	22.0	27.6	12.2	0.7	13.0	40.6
Asia case study country	9.4	1.0	0.4	1.4	1.8	3.2	5.5	0.7	6.1	9.4
Sub-Saharan Africa case study country	24.6	2.0	0.3	2.3	9.6	11.9	12.2	0.5	12.7	24.6

Source: Based on Stenberg and others 2014.
Note: Total direct health benefits = increase in gross domestic product (GDP) from work-related benefits (c) + total social benefits (h). Numbers may not sum precisely because of rounding.

Table 16.7 Analysis of Contribution to Benefits, High versus Low Scenarios, by percentage Shares, 5 percent Discount Rate for Net Present Value, 2013–50

	Direct workforce-related benefits					Social benefits			
	Lives saved	Morbidity averted	Total	Demographic dividend	Economic benefits	Lives saved	Morbidity averted	Total	All benefits
Country grouping	(a)	(b)	(c) = (a) + (b)	(d)	(e) = (c) + (d)	(f)	(g)	(h) = (f) + (g)	(t) = (e) + (h)
All 74 countries	20.6	5.1	25.7	48.3	74.0	24.2	1.7	26.0	100
Low-income countries	8.2	1.8	10.0	32.2	42.1	54.4	3.4	57.9	100
Lower-middle-income countries	12.4	3.4	15.8	58.9	74.7	23.4	1.9	25.3	100
Upper-middle-income countries, excluding China	29.7	7.8	37.5	49.0	86.6	12.6	0.7	13.4	100
China	46.4	10.6	57.0	0.0	57.0	41.9	1.1	43.0	100
India	11.9	3.5	15.5	49.7	65.2	32.4	2.4	34.9	100
Sub-Saharan Africa	12.6	2.5	15.1	54.0	69.1	29.1	1.8	30.9	100
South Asia	12.2	3.5	15.6	50.1	65.8	31.7	2.6	34.2	100
High fertility impact countries	11.5	2.3	13.8	54.3	68.1	30.1	1.8	31.9	100
Asia case study country	10.5	4.8	15.2	20.0	34.3	58.1	7.6	65.7	100
Sub-Saharan Africa case study country	7.8	1.3	9.1	39.0	48.1	49.4	2.6	51.9	100

Source: Based on Stenberg and others 2014.
Note: Total direct health benefits = increase in gross domestic product (GDP) from work-related benefits (c) + total social benefits (h).

to an increase in GDP per capita of 8 percent or more by 2035. In these countries, which are mainly lower-middle-income countries, the demographic dividend on total investment generates a benefit-cost ratio of 22.

High Direct Health Benefits

Second, the direct health benefits, excluding the demographic dividend, are very high at 14.3 for the sample as a whole. These direct benefits are much more evenly distributed across countries, 11.4 for LICs and 11.5 for UMICs, excluding China.

Total Economic and Social Benefits Are Fairly Equal

Third, the workforce-related economic benefits (excluding the demographic dividend) and the social benefits are about equal for the sample as a whole. The benefit-cost ratio generated by the direct workforce benefits alone is 7.1, and that generated by the social benefits alone is 7.2 for the 74 countries. The contribution of direct workforce benefits versus social benefits varies significantly across country income groups; social benefits are much greater than workforce-related benefits in LICs, but the reverse is true in UMICs. This finding presumably reflects the lower economic value of lives saved and morbidity averted in poorer countries, whereas the social benefits are valued using a sample-wide metric.

Significant Morbidity Benefits

Finally, in spite of the very preliminary nature of the morbidity analysis, the morbidity benefits are significant, representing 6.8 percent of the total benefits (table 16.7). These results suggest that further detailed work on maternal and child morbidity is both appropriate and necessary.

Results from Two Case Studies

The Asian country is considerably larger in both population and GDP than the Sub-Saharan African country and has a somewhat higher level of GDP per capita. The Sub-Saharan African country has higher mortality rates for both children and mothers in addition to a higher

fertility rate and a higher level of labor force participation by women (table 16.3).

Although the total cost of the intervention for the Asian country is larger than that for the Sub-Saharan African country, reflecting the disparity in population size, the additional cost per person for the High versus the Low scenario is considerably lower at US$2.65 (versus US$6.88). This result is due to the higher fertility and maternal and child death rates in the Sub-Saharan African country, which require a higher level of intervention and a greater cost per capita. Despite the differences in population size, the numbers of maternal, child, and stillbirth deaths prevented by the interventions are similar in the two countries, with a proportionally greater impact in the Sub-Saharan African country.

Table 16.5 shows a high benefit-cost ratio for the Sub-Saharan African country, with results similar to those for the average of all 74 countries and for the group of LICs. Although positive, the benefit-cost ratio for the Asian country is more modest, again reflecting the differences in initial fertility and death rates.

A more detailed description of the sources of the benefits that arise from the intervention for the two country case studies is provided in tables 16.6 and 16.7. For the Asian country, the biggest contributors to the benefit-cost ratio are those benefits arising from the social value of lives saved and morbidity averted (65.7 percent). The contributions from the increase in GDP from workforce-related benefits (15.2 percent) and from the demographic dividend (20.0 percent) are more modest but still significant. Considered solely as a function of either the increase in GDP from workforce-related benefits or from the demographic dividend, the benefit-cost ratio still shows benefits outweighing costs (ratios of 1.4 and 1.8, respectively).

For the Sub-Saharan African country, in contrast, the contributions from the economic and social benefits are virtually equal (48.1 percent and 51.9 percent, respectively). The demographic dividend is about twice as important as for the Asian country (39.0 percent), while the contribution from additional GDP is lower (9.1 percent). Again as a function of either the increase in GDP from workforce-related benefits or from the demographic dividend, the benefit-cost ratio shows benefits outweighing costs (ratios of 2.3 and 9.6, respectively) and the ratios are higher than for the Asian country.

IMPLICATIONS OF THE ANALYSIS

The analysis presented refers to 74 countries that account for more than 95 percent of global maternal and child deaths. This approach goes beyond the standard full income approach to allow for a more comprehensive picture of the returns on investment by explicitly including estimates of economic and social benefits from morbidity averted, and by estimating the effect of the demographic dividend. The analysis points to six main findings.

Large Economic and Social Returns

First, investments in high-impact interventions across the continuum of care in RMNCH have large economic and social returns in addition to the impact on health outcomes. The benefit-cost ratio of investments in the High scenario for the full country sample is 8.7 in 2035. Findings are robust to variations in the methods of analysis, such as discount rates.

Affordable Investments

Second, the required investments are affordable for most countries. On average for the 74 countries, an additional US$4.48 per capita would be needed in 2035 to finance the High scenario. However, affordability needs to be examined in the context of fiscal sustainability as issues related to universal coverage, financial protection, quality, responsiveness, and efficiency will affect the policy dialogue around public investment in health, and macroeconomic conditions will set the overall boundaries for what can be achieved. The Global Financing Facility to Advance Women's and Children's Health, created in 2014, will support countries in overcoming fiscal constraints in the short term and in setting up mechanisms to achieve long-term sustainable domestic financing.[10]

Variable Returns on Investment

Third, the magnitude of returns on investment varies across country groupings. By income, the highest returns are realized in lower-middle-income countries. This finding might be explained by two factors: First, economies of lower-middle-income countries with higher GDP have higher returns operating through workforce benefits and the demographic dividend compared with LICs. Second, returns in UMICs might be lower than in LMICs, given their already lower mortality rates and more strongly diminishing returns.

The findings vary by individual countries, reflecting the epidemiological and demographic situation in each, current health systems performance, and country-specific economic factors. The substantially different findings of the two country case studies confirms that individual countries will find considerable value in undertaking their own investment analyses, to give results specific to their circumstances. For example, the returns on

investment in the Sub-Saharan African case study country, with low coverage of most RMNCH interventions, and therefore still facing high child and maternal mortality rates and high fertility rates, are more than twice as large as the case study country in Asia, which has managed to increase coverage of RMNCH interventions and reduce fertility rates to less than 2.5. The country case studies confirm the importance of investing in family planning; the effect of the demographic dividend is substantial even when the investment reduces the TFR by a small amount.

Similarly, we present results for China and India separately, given the size of their populations and economies. Given current low birth rates in China, no significant economic benefits are to be derived from increasing the availability of family planning. This is not to argue that significant benefits could not be bought by increasing the quality of current programs and ensuring their responsiveness to population needs (Kane and Choi 1999). In India, our model estimates high economic benefits from increasing the contraceptive prevalence rate to respond to the unmet need.

High Rates of Return for a Comprehensive Approach, Including Family Planning

Fourth, investment in each of the elements in the continuum of care matters. The analysis finds that family planning programs generate particularly high returns, especially in countries with current high fertility rates, primarily through its effect on the demographic dividend. We have not separated out the rate of return on investment in maternal versus child health because the analysis deals with investing across the full spectrum of RMNCH; however, we note that there may be specifically high returns on investment in maternal care for adolescents, given that adolescent pregnancies pose a much higher risk for both mother and newborn compared with pregnancies among women of older age groups (Patton and others 2009; WHO 2008, 2011).

Returns on Investment Vary over Time

Fifth, the different types of interventions often generate benefits in different time frames, so that the rate of return varies over time. Returns increase substantially over time, particularly beyond the investment period of 2013–35. For example, at a discount rate of 3 percent, the benefit-cost ratio for the full sample of 74 countries is about four times larger in 2070 (34.2) as in 2035 (8.7). Although policy makers often make decisions in much shorter time horizons, it is nevertheless important to note that returns are realized well beyond the investment period.

An Extended Modeling Approach

Finally, on a methodological note, the overall economic and social benefits are driven by the demographic dividend generated by the investment. For example, in 2050 the demographic dividend accounts for 48.3 percent of the benefit-cost ratio (for the 74 countries). Workforce-related benefits and social benefits account for about 25 percent each. The relative share of morbidity-averted benefits compared with lives saved benefits is low because only a few sources of morbidity are included in the model, and the gains in morbidity are adjusted for the degree of disability averted. For LICs, the social benefits predominate because these are valued using the average GDP per capita of all countries; the workforce-related benefits are valued using country GDP per person in the workforce.

CONCLUSIONS

The analysis extends the full income approach to include estimates of economic and social benefits from morbidity averted and estimates of the effect of the demographic dividend, thereby providing a more comprehensive picture of the returns on investment in RMNCH interventions.

The analysis is limited to the health sector and does not include all sexual and reproductive health interventions; notably, surgical care is omitted because of a lack of data to enable us to model related costs and impacts. Estimates do not take into account costs and returns of some interventions that contribute to improving RMNCH outcomes, such as water supply, sanitation and hygiene, girls' education, empowerment of women and girls, and food fortification. Moreover, it should be acknowledged that the high returns calculated here are dependent on those investments being made, for example, in the education sector, to empower women with greater decision-making authority in relation to planning family size. To realize high returns, countries need to consider effective multisectoral policies to deliver public goods associated with family planning and maternal and reproductive health, including for adolescents.

Despite these limitations, the results underscore the value of addressing remaining gaps. RMNCH concerns should feature prominently in the post-2015 landscape, for example, in the Sustainable Development Goals that are to supersede the MDGs. The development of models focused more strongly on the morbidity

elements of maternal and child health, and the evolution of that morbidity over time, is an important topic for future research. Further work should also consider nonhealth interventions, including activities that affect social determinants of health.

NOTES

World Bank Income Classifications as of July 2014 are as follows, based on estimates of gross national income (GNI) per capita for 2013:

- Low-income countries (LICs) = US$1,045 or less
- Middle-income countries (MICs) are subdivided:
  a) lower-middle-income (LMICs) = US$1,046 to US$4,125
  b) upper-middle-income (UMICs) = US$4,126 to US$12,745
- High-income countries (HICs) = US$12,746 or more.

1. Of the 75 countries accounting for more than 95 percent of global maternal and child mortality, data limitations prevented inclusion of South Sudan in the analysis.
2. The original analysis also includes an intermediate *Medium* scenario.
3. The methods by which this is done are discussed in Stenberg and others (2014).
4. For assumptions on participation rates and labor market productivity of women and children upon entering the labor force, see Stenberg and others (2014).
5. For reviews see Viscusi and Aldy (2003); Jamison and others (2012); and Cropper and others (2011).
6. For more details, see Stenberg and others (2014).
7. For a recent review, see Canning and Schultz (2012).
8. In subsequent work it would be appropriate to take account of the specific characteristics, especially of the population structure, of each country.
9. Per capita costs in 2035 for *High versus Low,* refer to the difference between the estimated costs in the High and in the Low scenarios in 2035, divided by the population in the High scenario in 2035.
10. http://www.worldbank.org/en/news/press-release/2014/09/25/development-partners-support-creation-global-financing-facility-women-children-health (accessed October 24, 2014).

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