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# MAXIMIZING HUMAN CAPITAL BY ALIGNING INVESTMENTS IN HEALTH AND EDUCATION



September 2018

This publication was produced for review by the United States Agency for International Development.

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## The Health Finance and Governance Project

The Health Finance and Governance (HFG) Project works to address some of the greatest challenges facing health systems today. Drawing on the latest research, the project implements strategies to help countries increase their domestic resources for health, manage those precious resources more effectively, and make wise purchasing decisions. The project also assists countries in developing robust governance systems to ensure that financial investments for health achieve their intended results.

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- Enhancing governance for better health system management and greater accountability and transparency;
- Improving management and operations systems to advance the delivery and effectiveness of health care, for example, through mobile money and public financial management; and
- Advancing techniques to measure progress in health systems performance, especially around universal health coverage.

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## **DISCLAIMER**

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# ACRONYMS

<b>CDRF</b>	China Development Research Foundation
<b>DCP3</b>	Disease Control Priorities, Third Edition
<b>ECD</b>	Early Childhood Development
<b>ECE</b>	Early Childhood Education
<b>GIZ</b>	Deutsche Gesellschaft für Internationale Zusammenarbeit
<b>GPE</b>	Global Partnership for Education
<b>GSFP</b>	Ghana School Feeding Program
<b>HCI</b>	Human Capital Index
<b>HPV</b>	Human Papillomavirus
<b>ITN</b>	Insecticide-Treated Bednets
<b>OVOP</b>	One Village One Preschool
<b>RMNCH</b>	Reproductive, Maternal, Newborn, and Child Health
<b>SDG</b>	Sustainable Development Goals
<b>TT</b>	Tetanus Toxoid
<b>UNICEF</b>	United Nations Children's Fund
<b>USAID</b>	United States Agency for International Development
<b>WDR</b>	World Development Report
<b>WEF</b>	World Education Forum

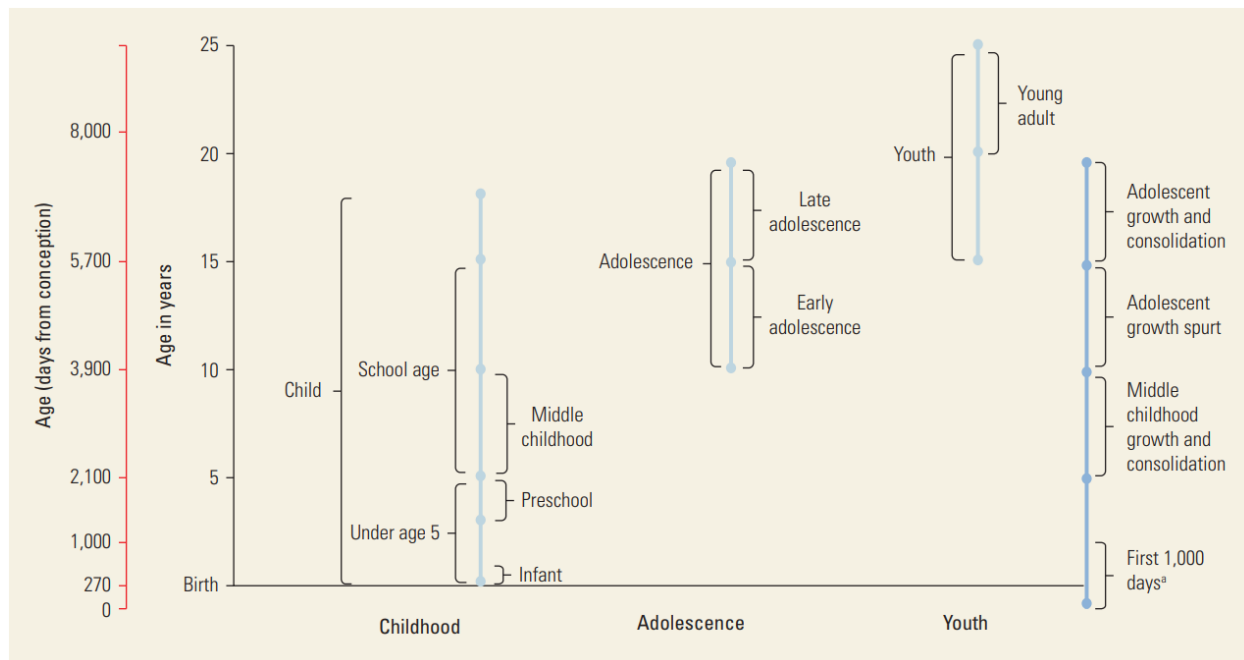


<b>First 1000 days:</b>	Measured from time of conception until age 2 years.
<b>First 8000 days:</b>	Measured from time of conception, and covers the life course until approximately 21 years.
<b>Cognitive skills:</b>	The basic abilities used for thinking, studying, and learning, including literacy and numeracy.
<b>Digital literacy:</b>	The ability to find, evaluate, utilize, share, and create content using information technologies and the Internet.
<b>Disease Control Priorities, Third Edition:</b>	The DCP3 series is comprised of nine individual volumes that provide the most up-to-date evidence on intervention efficacy and program effectiveness for the leading causes of global disease burden. The series was published by the World Bank and financed by the Bill & Melinda Gates Foundation. All volumes within this series are available open access from <a href="http://www.dcp-3.org">www.dcp-3.org</a> .
<b>Early Childhood Education:</b>	Programs that are typically designed with a holistic approach to support children's early cognitive, physical, social and emotional development and introduce young children to organized instruction outside of the family context.
<b>Human capital:</b>	Sum total of a population's health, skills, knowledge, experience, and habits.
<b>Soft skills:</b>	Abilities related to personality and behavior traits, such as self-esteem, critical thinking, reliability, and collaboration
<b>Stunting:</b>	Anthropometric measure of low height-for-age (Z score of -2 or lower). Stunting is an indicator of chronic undernutrition and a proxy for cognitive development.
<b>Youth Workforce Development:</b>	The programs and policy efforts that support young people and adults in gaining the specific skills and attitudes they need to be productively employed.



## Nomenclature Concerning Age of Child and Adolescent Development

The below figure illustrates the nomenclature used in this report. The report refers to children and adolescents between ages 5 and 14 years as “school-age,” since in low- and lower-middle income countries these are the majority of children in primary school, owing to high levels of grade repetition, late entry to school, and drop outs. As income levels rise and secondary schooling enrolment increases, children attending school will be older than age 14 years. Adolescents are considered those ages 15-19 years old, and those under 5 as pre-school or infants. This figure also demonstrates the overlap between many of these terms [1].



Source: Bundy and others 2017a



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# EXECUTIVE SUMMARY

This discussion paper was commissioned by the Health Finance and Governance Project (HFG) of the United States Agency for International Development (USAID). The timing of the analysis was triggered by the forthcoming launch of the World Bank Human Capital Index in October 2018. The international community, including USAID, has deep interest in this index as maximizing human capital is an imperative element in the journey to self-reliance. Therefore, it is important to discuss what further actions ministries of health, education, labor, youth, and finance can take to align investments and efforts to improve the human capital potential of its population. This paper analyses how key health and education investments have the potential to maximize human capital in low-resource settings especially if they are made in a well-timed and coordinated manner. The analysis draws upon two recent major reviews of human development [1, 2], references 136 original scientific papers and reference sources, and is further informed by qualitative interviews with 24 content experts across 17 institutions (methodology and list of interviewees is detailed within in Annex I).

This paper identifies five key messages:

- The scale of the contribution of human capital to national economic growth and stability has been significantly under-recognized;
- Effective human capital development requires synergistic investment in health and education across the life course;
- There are critical failures in the design of current approaches to investment in human capital;
- There is a strong evidence base on the most cost-effective ways to maximize human capital by investing strategically in both health and education; and
- There are key actions that can be taken by both health and education programs during the first 8000 days of life to maximize the development of human capital.

The following five sections summarize the background to these messages.

- 1. The scale of the contribution of human capital to national economic growth and stability has been significantly under-recognized.*

The aggregated skills and knowledge of a population is now understood to be the single greatest driver of economic growth and prosperity, reflecting the ability of populations to adapt, innovate, and perform competitively in the labor market. The scale of this effect is best reflected in the success of high-income countries, where some 70% of national wealth is now recognized to be attributable to human capital. In low- and lower-middle-income countries, this potential contribution is currently under-exploited, and many countries derive only about 40% of their wealth from the human capital of their populations [3].

This new recognition of the importance of human capital has led the World Bank to develop for the first time a Human Capital Index (HCI) to measure and compare this dimension of human development. The World Bank HCI is based on key development indicators, including child survival, stunting rates, and measures of education quality. The creation of this index has sparked an important and timely conversation on the most strategic approaches to improve human capital.

2. *Effective support for human capital development requires synergistic investment in health and education across the life course.*

Recent analyses on child and adolescent development in the third edition of Disease Control Priorities (DCP3) conclude that it takes some 8000 days, or approximately 21 years, for a human to fully develop into adulthood [1]. Key interventions, targeted at crucial development phases through that period can enhance development, help ensure every person achieves their potential, and contribute to the overall development of human capital. Investment throughout the first 8000 days helps secure the gains of investment in the first 1000 days, leverages improved learning from concomitant education investments, and put populations on the path to greater economic productivity, competitiveness, and self-reliance.

A crucial aspect of this investment is the synergy between health and education. Children need to be healthy to take full advantage of the education opportunities provided, and education is a key determinant of health outcomes. Health and education sectors need to work together to leverage synergies in their respective areas and achieve maximum benefit. School-based health interventions have the potential to reach 575 million children in low-income countries globally [4], and can achieve immediate education gains. School-based deworming, for example, can reduce absenteeism by 25% [5], and school meals can increase attendance by 8% [6]. Additionally, an integrated package of interventions can maximize impact.

3. *There are critical failures in the design of current approaches to investment in human capital.*

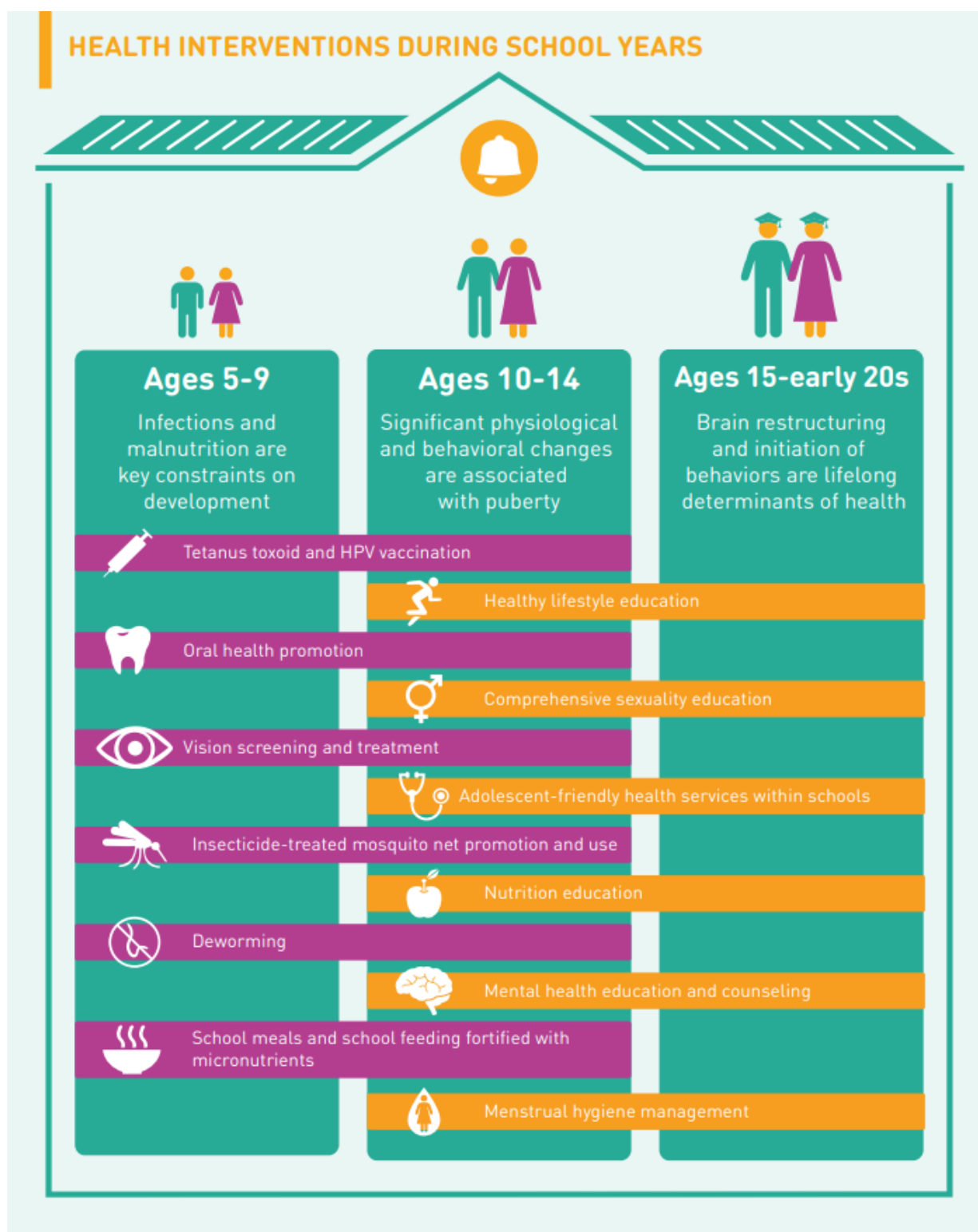
Current global investment in both health and education in low and lower-middle income countries is insufficient and is inappropriately targeted. Investment in the health of children under 5 years is estimated at \$29 billion, while investment in children and adolescents over the period 5 to 19 years is around \$3 billion globally [7]. The minimal investment in health during the school-age and adolescent years is thrown into even sharper focus by the investment of \$210 billion in the same children for education during this period. [8].

These extraordinarily unbalanced investments are not an argument for more equitable sharing of the existing investment, but for additional and better targeted investments. There is a need for substantial investment in early health. What is extraordinary is that there are almost undetectable levels of investment in early education and stimulation. Similarly, it is an extraordinary paradox that so little is invested in health during middle childhood and adolescence, at precisely the age when there is most opportunity for synergy with the almost 100 times larger investment in education. The incremental cost of essential health packages for children aged 5-19 years has been estimated to add \$3.4 – 5.5 billion to the current health sector budgets of low- and lower-middle income countries [7]. Investing this relatively small increment would enhance education returns through better learning and attendance, and leverage better health outcomes from a better educated population [1].

4. *There is a strong evidence base on the most cost-effective ways to maximize human capital by investing strategically in both health and education.*

There is a strong evidence base that identifies the interventions and precise timing of delivery throughout the 8000 days to have greatest impact on health and education outcomes. There are crucial phases for intervention along the life course, including early childhood, school-age, and adolescence, which require targeted interventions, as detailed within the DCP3 Child and Adolescent Health and Development volume [1]. Figure 1 below includes interventions that have synergistic impacts on physical health, diet, and learning when delivered during critical time periods.

Figure 1: Health interventions during school years



Source: Global Partnership for Education 2018

There are clear benefits from investing in cross-sector areas, including disability, mental health, water and sanitation, and gender. There are particular benefits to creating an enabling environment for adolescent girls to transition to secondary education and for adolescent boys to remain in schools in regions where rates of dropout are especially high.

This discussion paper identifies cost-effective interventions across five key stages of the life course – preconception through the first 1000 days, early childhood, school-age, adolescence, and transition to the labor market – as priority investments to maximize human capital. Age-specific interventions that have synergistic impacts on health and education can better position children of today to survive and thrive and build stronger economies tomorrow.

5. *There are key actions that can be taken during the first 8000 days of life to maximize the development of human capital.*

Investments in human capital have strong returns to human capital throughout the crucial development phases during the first 8000 days – from child survival, to early child development, through school age and adolescence. The health sector and education sector each have tangible and specific areas of investment that require greater attention to improve human capital outcomes.

- The education sector's current focus on early child development needs to be matched by a focus on early childhood education. Similarly, improving girls' access to education in particular can lead to improved health, reduced early child marriage and childbearing, and women's economic empowerment.
- The health sector should sustain its investment in the first 1000 days, and at least double its investment during middle childhood and adolescence when children have their most important opportunity to attend school and learn.
- The education and health sectors should coordinate their efforts to maximize synergies; the timing of interventions relative to critical development stages matters.

In summary, the call to action is urgent. Human capital development yields significant returns to the individual, the community, and the national economy. A more educated society leads to higher rates of innovation, invention and productivity, and can make the largest contribution to economic growth.



# INTRODUCTION

This discussion paper was developed in the context of the forthcoming launch of the World Bank Human Capital Index (HCI) at the Fall Meetings in October 2018. The index is intended to foster policy dialogue and serve as an impetus among countries to prioritize investments targeted towards human capital [9]. The index ranks countries according to the projected labor productivity of a population based on the outcomes of their current investments. This is estimated using data on child survival, childhood stunting, as well as the quality and quantity of education that a child born today can expect to achieve by the age of 18, and aggregates these indicators against measures of productivity for a healthy individual who has achieved complete education.

The HCI is anticipated to catalyze policy discussions around how to target health and education investments to increase the competitiveness of their population. This discussion paper aims to provide the evidence base for how to achieve this objective and further countries on their journey to self-reliance. This paper draws upon 136 original scientific papers and reference sources, two seminal reviews of human development [1, 2], and is enhanced by qualitative insight from 24 content experts. A comprehensive overview of the methodology used is detailed within Annex I.

This paper discusses key cost-effective interventions that can be implemented across sectors and across the life course - from preconception through the first 1000 days, early childhood, school-age, adolescence, and transition to the labor market. These should be considered priority investments to maximize human capital and productivity.

## 1.1 The Scale of the Contribution of Human Capital to National Economic Growth and Stability has been Significantly Under-Recognized

Economic stability is overwhelmingly built and maintained by the potential of its population to adapt, innovate, and perform competitively in the labor market, and to be active citizens. One of the requirements in meeting this challenge is a healthy, educated next generation of workers. This requires access to education, and within schools, the presence of children healthy enough to regularly attend and benefit from the education offered. Healthy children learn better, and educated, healthy citizens are better able to work productively, take up new technologies and innovate. Countries can help put their citizens on the path to academic success by providing simple and cost-effective interventions that improve the human capital potential – the full summation of acquired skills, knowledge, and abilities. As children of today transition to adulthood by 2030, improved human capital will propel prosperity and competitiveness at the individual and national levels.

The World Bank's Changing Wealth of Nations report identifies human capital as accounting for the largest component of global wealth, but that its contribution to wealth in rich countries (estimated to be 70%) far exceeded that in poorer countries (estimated to be 41%) [3]. This disparity is leading to a call to action to increase public resources in developing countries for evidence-based, targeted investments in health and education along the life course in order to support countries on their journey to self-reliance.



The call to action is urgent – human capital is the foundation to successfully entering into and competing in a rapidly evolving economy. The forthcoming World Bank World Development Report on the Changing Nature of Work warns that “without investments in human capital, individuals and countries may be in danger of being excluded from future prosperity, thus limiting individuals and countries from achieving self-reliance.” Conversely, it estimates that countries that move from the 25th to the 75th percentile of the index would achieve an additional 1.4 percentage annual growth rate for 50 years [10].

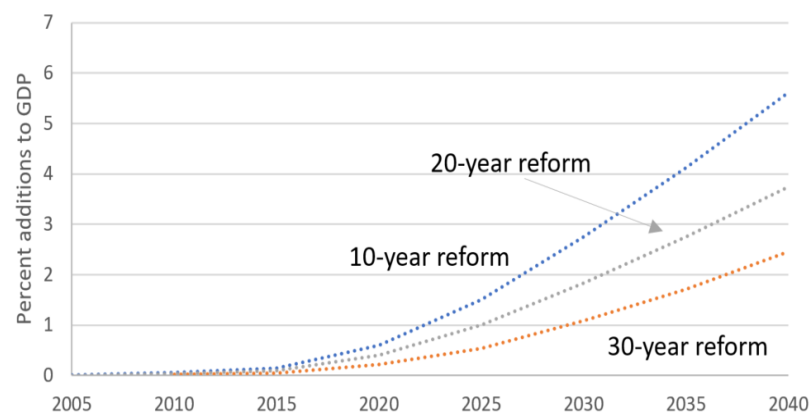
Investing in health and education of a population pays dividends. Healthier and more educated citizens are better able to leverage existing public investments, with benefits frequently being found in terms of earnings and productivity over and above the original investments [11]. Figure 2 illustrates the benefits of school improvement reforms on GDP, illustrating that benefits accrue over time [12]. Targeted and strategic investments towards both education and health translates to greater earning potential at the individual level and, when aggregated to the national level, better positions a national economy to compete globally. As technology reshapes the nature of work, countries must ensure their population has the foundational skills to adapt to an evolving workforce, as well as outlets to apply their talents.

Investments in human capital can continue throughout life – from child survival, to early child development, through school-age and into adulthood. However, these investments will require different formats depending on the life stage and sex-specific considerations, reflecting different stages of growth and development. For example, from birth to age 5, interventions need to be aimed at survival, growth and cognitive development.

Interventions targeted to children ages 5-14 children

should address physical health and diet, as infection and malnutrition can keep children from school and learning while there. Targeted education investments can help achieve key indicators relating to capacity of citizens, including the number of students achieving a minimum proficiency in reading towards the end of primary school. During adolescence, substantial physiological and emotional changes place commensurate demands on good diet and health to support continued growth and development. Adolescence also requires support to transition to and remain in secondary school and to protect against risk taking behaviors and sexually transmitted diseases. Education and health do not stop with reaching adulthood, in particular, with key interventions supporting maternal health, and outreach programs to facilitate transition to the workforce.

**Figure 2: The link between growth and education**



Source: Adapted from Hanushek 2005 (Note: The economic gains from school quality improvements can over time cover the entire costs of primary and secondary schooling.)

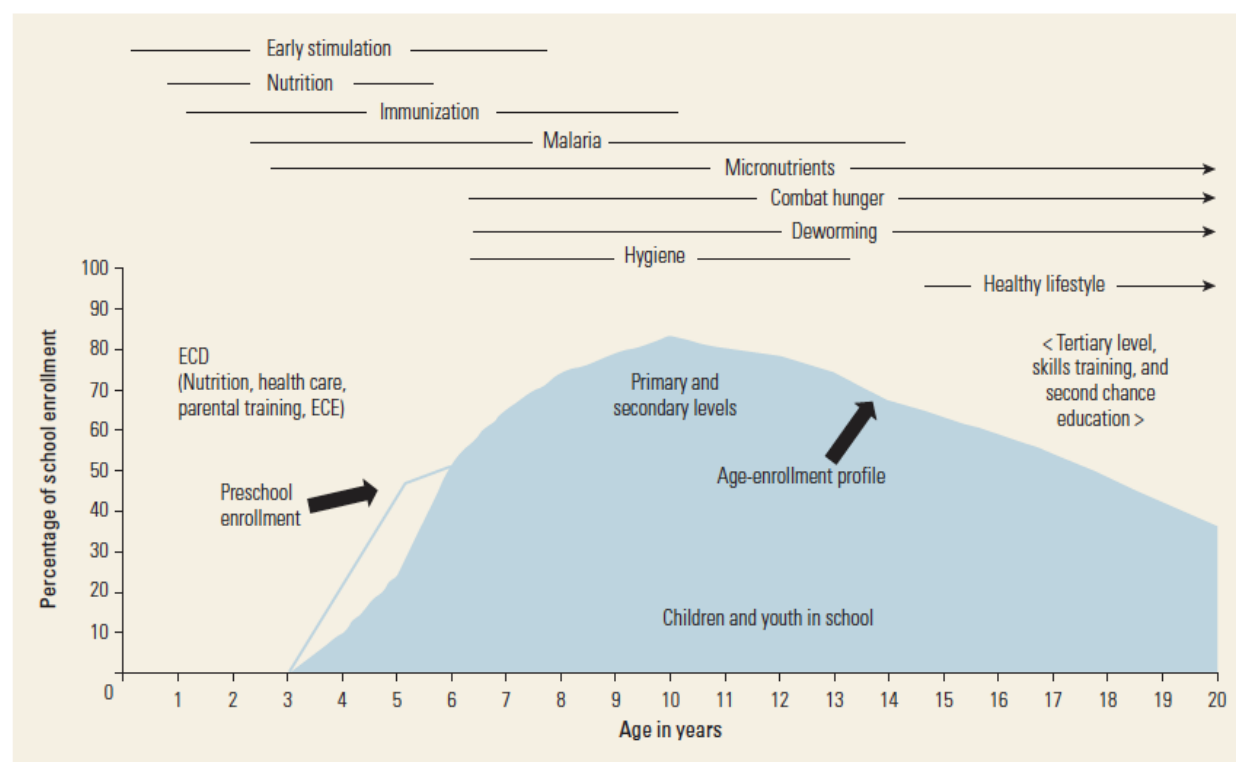


## 1.2 Effective Support for Human Capital Development Requires Synergistic Investment in Health and Education across the Life Course

Health and education are two sides of the same coin. Young children require proper nutrition for optimal brain development, and school-age children and adolescents need to be healthy enough to attend school and learn while there. In low- and middle-income countries, an estimated 200 to 500 million years of school are lost annually due to ill health [4].

It takes approximately two decades – or 8000 days – to reach adulthood, and proper education similarly requires significant time along the same trajectory. Figure 3 illustrates how the delivery of key health, nutrition, and education interventions might be effectively targeted according to the different developmental stages over the 8000 days, and the significance of delivery via a school-based platform, particularly between the ages 10 and 15 when school enrolment is high. The figure also indicates the likely levels of school participation at different ages in low- and middle-income countries, showing the relevance of using the school platform to reach children and adolescence across the life course.

**Figure 3: Relevance of Using the School as a Platform to Deliver Health Interventions along the Life course in Low- and Middle-Income Countries**

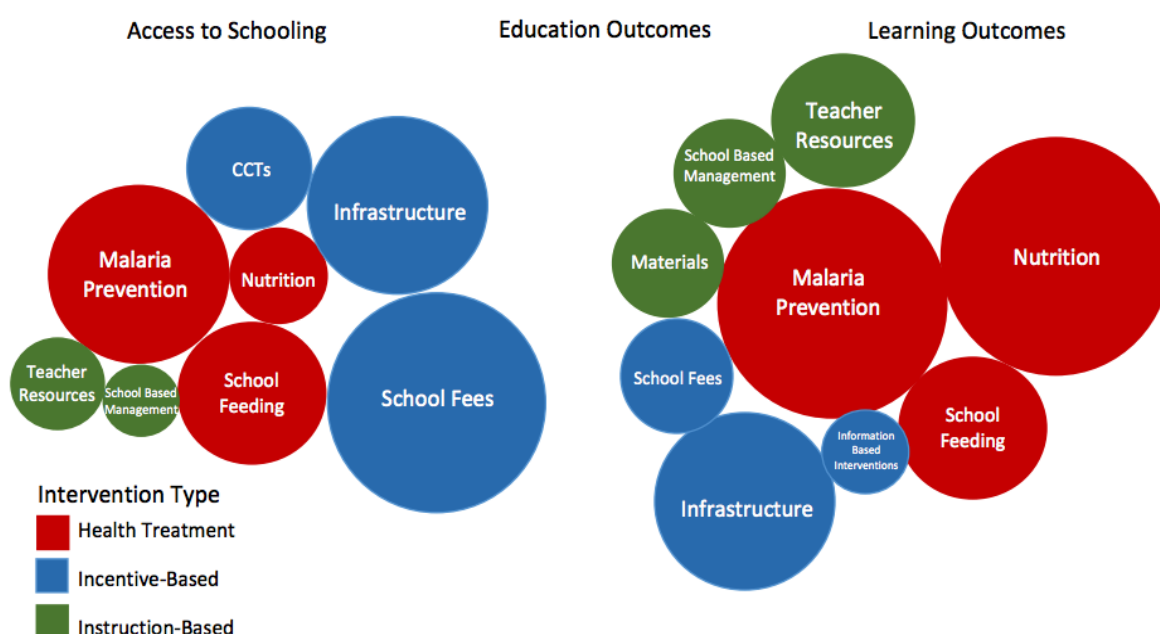


Source: Bundy and others 2017a; Adapted from World Bank 2011 (Note: ECD= early childhood development; ECE= early childhood education) Note: the figure illustrates the life-cycle approach to human development, key health, nutrition and education interventions that can be age-appropriately targeted against school enrolment. Age related positions and lengths of the lines are illustrative of approach and are not exact.

Health investments have notable impacts on education outcomes. Plaut and others analyzed the impact of health treatments, incentive-based investments, and instruction-based interventions to assess the

relative impact on access to schooling, education outcomes, and learning outcomes [13]. Their analysis combined health and education effect sizes from Krishnaratne, White, and Carpenter (2013) to assess the effect sizes relative to each other. The results are illustrated in Figure 4, which show that in some cases, health interventions can have as large an effect size on access to schooling and learning outcomes as incentive- and instruction-based interventions. However, it is important to note that health interventions alone do not guarantee improved learning outcomes, and vice versa. Quality health services and education must be provided to maximize the full benefit.

**Figure 4: Average Impact Size of Health, Incentive, and Instruction Interventions on Education Outcomes**



Source: Plaut and others 2017; Adapted from Krishnaratne, S., H. White, and E. Carpenter. 2013. "Quality Education for All Children? What Works in Education in Developing Countries." Working Paper 20, International Initiative for Impact Evaluation (3ie), London.

There is growing recognition that health interventions support education targets. The World Education Forum (WEF) held in 2000 in Dakar, Senegal included a formal recognition that health is a key determinant of education outcomes. This was reinforced at the 2015 WEF. The importance of health for education was also highlighted in the report of the International Commission on Financing Global Education Opportunity [8]. The Commission noted six health interventions as key to optimizing enrolment and retention, including school-based malaria prevention, deworming, early childhood development, school feeding, school-based water and sanitation, and reproductive health and sexuality education.

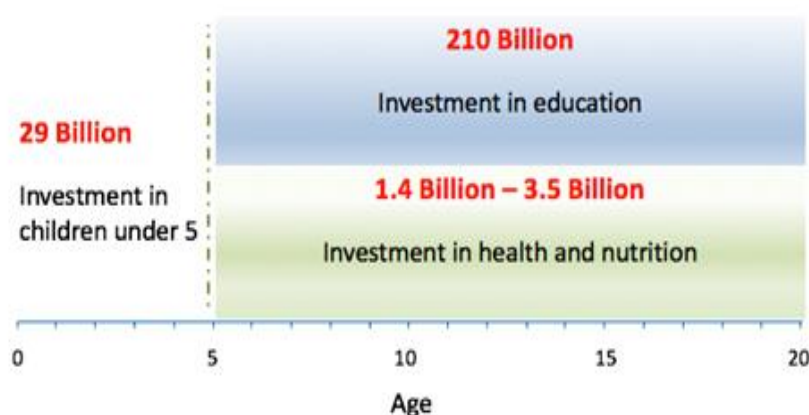
There is also evidence of greater appetite for cross-sector investments for health and education outcomes. The Global Partnership for Education (GPE), which supports over 65 countries to finance education, has been a particularly strong advocate for greater health and education sector collaboration. In 2016, GPE launched a \$3 million program with the World Bank to strengthen linkages and synergies between ministries of health and education, including regional knowledge exchanges with over twenty

countries across Africa and Asia. In 2018, Julia Gillard, chair of the Board of Directors at GPE, co-authored a call to action with WHO Director General Tedros Adhanom Ghebreyesus for greater investment in both sectors to achieve shared goals. Alice Albright, GPE CEO, similarly co-authored a comment in the *Lancet* with Donald Bundy, Lead Editor of the DCP3 Child and Adolescent Health and Development volume, on forging a stronger commitment to working with the health sector to achieve the Sustainable Development Goals (SDGs).

### 1.3 There are Critical Failures in the Design of Current Approaches to Investment in Human Capital

Presently, the global level of investment in both health and education is insufficient to meaningfully improve human capital. Health is heavily invested in younger age groups, ignoring the benefits that investments in school-age and adolescents can make to their current and future productivity, while education focuses on school-age, with less investment focused on developing soft skills and preparing child for school. Figure 5 illustrates public expenditure on children and adolescents in low- and lower-middle income countries according to education and health and nutrition.

**Figure 5: Estimates of public spending on children and adolescents in low- and lower-middle income countries (US\$ billion per year)**



Source: Figure redrawn from data published in Bundy et al 2017

In low- and lower-middle income countries, cumulative annual investments in health for under 5 years is around 29 billion, compared to approximately \$3 billion in 5 to 19-year olds. At the same time, \$210 billion is estimated to be spent on 5 to 19 year age groups in education [7]. The \$3 billion investment seems remarkably small, considering the known impact of various health conditions on this age group, and the modest sum required to make large impacts and attain maximum returns on the investment in education.

The incremental cost of essential health packages for children aged 5-19 years has been estimated to add \$3.4 – 5.5 billion to the current budget [7]. This represents a doubling of current expenditure on health in childhood and adolescence, and is a small increment in public expenditure for large returns on investments in early childhood and education. The potential for synergistic impact of these investments is frequently lost due to implementation silos. Identifying these synergies in financing and making investments across sectors will ensure the next generation is well equipped to fulfill their development potential and contribute to the future productivity of society.

Elected leaders often have weak incentives to prioritize health and education investments. Investments in health and education frequently have outcomes that are realized decades after their initiation, and limited public information relating to the impact of existing investments on health and education outcomes in the short- to medium-term prevents citizens from demanding reforms [10]. Governments

may require additional evidence to determine which investments to finance and implement to solve its specific development challenges.

Looking to successes in other sectors can identify strategies to maximize impact and move countries in their journey to self-reliance. As of February 2018, GPE provided grant funding to 22 countries to finance health interventions through schools [14]. The Global Alliance for Vaccines and Immunizations (GAVI), for example, provides performance-based financing, paying a set amount per child vaccinated, and ceasing funding if countries do not achieve specified immunization coverage targets. As with immunization, coverage of education can be measurable; via public expenditures, enrolment rates, contact-hours per student per year. Results-based rewards may therefore have an application in education, for example, rewarding for increased student hours in school, improving teacher-student ratios or other measurable intermediate outcomes [15]. Such schemes can provide the required flexibility of budget support at the same time as providing accountability, while expanding and strengthening activities conducted, rather than substituting for government resources.

Private-public partnerships have also proven successful in leveraging resources and supporting government programming. These partnerships can foster the involvement of the private sector at the intersection of development initiatives and business opportunities. For example, Fit for Schools is a GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit) supported program in the Philippines, designed to encourage better hygiene behaviors in schools. Unilever is able to subsidize the provision of soap and other tools essential for management of hygiene facilities in schools, an essential component to the proper development of hygienic behaviors.

An effective example of a partnership beneficial to multiple partners within a country includes *Home Grown School Feeding*, whereby local school feeding activities are linked with local agricultural production through the procurement of locally produced food, thus benefiting local farmers and producers by generating a stable demand for their products. Such examples of partnerships can help fill a gap in implementing capacity, potentially while supporting local initiatives.

## 1.4 There is a Strong Evidence Base on the Most Cost-Effective Ways to Maximize Human Capital by Investing Strategically in both Health and Education

Investment in the first 1000 days is essential but insufficient for children to fully achieve their developmental potential. Broadening investment to critical periods of development during the following 7000 days is cost-effective and can maximize the human capital potential. This section identifies cost-effective health and education interventions across five key stages of the life course – preconception through the first 1000 days, early childhood, school-age, adolescence, and transition to the labor market – as priority investments to maximize human capital.

## 1.5 Pre-Conception through First 1000 Days

### **Health Sector Interventions**

Health interventions for children to survive and thrive during the early years encompasses a wider continuum of care that extends along the life course, from adolescent girls and women before and during pregnancy and delivery. The DCP3 Reproductive, Maternal, Newborn, and Child Health volume identifies three packages of interventions with the greatest potential to reduce deaths and disability, reproductive health, maternal and newborn health, and child (1-59 months) health [2]. These three packages collectively include 61 essential interventions, with 18 interventions for reproductive health, 30

for maternal and newborn health, and 13 for child health, which are included based on their efficacy and appropriateness to address important health conditions during these development periods. The complete list of interventions and the cost of services by package are included within Annex II, and the evidence base behind each intervention is discussed in detail within the 19 chapters within the DCP3 RMNCH volume.

The World Bank HCI specifically includes child mortality as an indicator. Under-5 mortality fell by half from 1990 to 2015 in all world regions [2], and more progress is needed to meet the SDG 3.2 target to reduce under-five mortality to at least as low as 25 per 1000 live births. Malnutrition is associated with all-cause mortality and increased deaths due to diarrhea, measles, and respiratory infections [16]. Approximately 45% of under-5 deaths are attributed to nutritional disorders such as stunting, suboptimal breastfeeding, deficiencies of vitamin A and zinc, among other conditions [16]. The DCP3 RMNCH volume estimates that the largest impact (93% of avertable child deaths) can be realized by community-based delivery of interventions, including immunizations and treatment of infectious diseases [2]. Detailed information on vaccinations for children is covered within the DCP3 RMNCH volume chapter 10 [17].

Many children do not meet their developmental potential due to inadequate diets and infectious disease. Childhood stunting is a reflection of long-term malnutrition and has life-long consequences resulting from unfavorable conditions during the period when the brain matures the fastest. As a result, stunting negatively impacts health, cognitive development, social development, human capital, and earning potential [18-22]. Linear height also has intergenerational importance as women's height affects risks for pregnancy complications [23] and low birth weight [16].

Nutrition interventions to reduce stunting are identified as among the most cost-effective development actions [24] as they increase economic productivity and better prepare stunted children to escape poverty as adults. WHO recommends incorporating stimulation into management strategies for children with malnutrition [25]. There is evidence from Uganda and Bangladesh that show positive effects of stimulation on child development outcomes among severely malnourished children [26, 27].

Community-based intervention packages have the potential to reduce neonatal and maternal mortality. A systematic review found that community-based care packages can reduce neonatal mortality by 25%, increase referrals to health facilities for complications during pregnancy by 40%, and increase breastfeeding practices by over 90% [28]. The Lady Health Worker program in Pakistan is an example of a program that promotes health awareness and basic care to pregnant mothers, neonates, and children in the majority of rural areas. Studies show that women are more likely to use modern contraceptives if offered by Lady Health Workers, and that coordination with traditional birth attendants can reduce birth complications and stillbirths [29]. Community health workers have successfully delivered injectable birth control in Ethiopia, Madagascar, Malawi, Rwanda, and Uganda [30] and also contributed to reduction in maternal and child mortality rates. In addition, community health workers have been responsible for controlling and preventing Ebola epidemic in worst affected countries. According to the latest data in Liberia, community health workers were responsible for fivefold increase in vaccination coverage [159]. Evidence of the contributions of community health workers is growing.

Prevention, management, and treatment strategies of severe and moderate acute malnutrition in children is detailed within chapter 11 of DCP3 RMNCH volume [31], and nutrition interventions to improve fetal, infant and young child growth are detailed within chapter 12 of the DCP3 RMNCH volume [32]. The estimated costs and benefit-cost ratios of early childhood nutritional interventions are summarized in chapter 27 of the DCP3 Child and Adolescent Health and Development volume [33].

### **Education Sector Interventions**

Education is a foundational driver of development – sustainability of investments across all sectors requires skilled populations capable of leading and managing their own development

Investments in quality, equitable and inclusive education can create pathways for greater economic growth, improved health outcomes, sustained democratic governance, and more peaceful and resilient societies [160]. An extended-cost benefit analysis found that secondary education could bring large poverty reduction benefits by delaying age at marriage and first pregnancy and by avoiding maternal deaths. More lives would be saved among adolescent girls in the bottom two quintiles due to higher risk of early pregnancy, and greater out-of-pocket expenditure would be averted in richer groups due to more frequent contact with the health system [34]. An analysis conducted to inform the International Commission on Financing Global Education Opportunity found a 2-3% reduction in mortality per additional year of education and per 1 standard deviation improvement in test scores [35].

The literature documents an association with education and health promoting behaviors to improve maternal and child health outcomes. Studies in Bangladesh and India demonstrate a correlation between low parental education and increased risk of poor nutrition outcomes among children [36, 37]. Conversely, an analysis by Evjen-Olsen and others found that women who are educated are more likely to know where to obtain effective health services and to request those services [38].

Education programs for improved feeding practices, such as those that support breastfeeding and appropriate complementary feeding, have been shown to increase exclusive breastfeeding rates [39], improve dietary intake, and mitigate low height-for-age among children [40]. These programs have additional benefits, as infants who are exclusively breastfed for six months experience less infection-related neonatal mortality [41], and because micronutrient deficiencies are prevalent when children are moving from a milk-based to a food-based diet [42]. Conditional cash transfer programs, such as those linked to primary health care and nutrition education, are one approach to target and deliver these interventions [40]. The DCP3 RMNCH volume estimates that community-based peer counseling, education, and support for breastfeeding can cost approximately \$166.50 (\$162.55–\$170.44) for each beneficiary [43].

Very young children can benefit from community-based interventions to improve parent-child interaction and stimulation [44], but these interventions generally do not have national coverage. A home-visit intervention in Jamaica targeted to stunted children found that early interventions improve cognition and behavior at school entry [45], reduce the wage gap compared to non-stunted peers [46], and reduce violent behavior [47]. The long-term success of this intervention may be in part due to the availability of universal preschool education in the country, as the children in the intervention program were then reached at each critical stage of development.

There is also evidence of economic benefit of stimulation programs. A randomized control trial in the Caribbean showed instructional videos on responsive stimulation in health facility waiting areas and were coupled with group discussion. This approach was estimated to have a cost-benefit ratio of 5.3 [48]. Another program in Latin America taught caregivers about child development, which cost-benefit returns between 2.6 in Colombia and 3.6 in Guatemala [49]. Horton and Black summarize the unit costs of standalone child development interventions and interventions that integrate stimulation and nutrition [50].

## 1.6 Early Child Development

The period between ages two to five years presents a gap in care, as there is limited contact with both the health and education sector during this period. After age two, there are few routine health visits, and contact with the health sector is largely driven by acute care. While the health sector plays an important role in screening and referring for developmental delays, there are few linkages with the



education sector. Similarly, there are few government-supported early childhood education programs available in low- and lower-middle income countries. Instead, child care programs are often provided by private enterprises and non-governmental organizations (see Table 1) [42].

**Table 1: Early Child Development Platforms by Age of Child**

Sector	Platform	Preconception and prenatal	Age of Child			
			Ages 0–24 months	Ages 2–4 years	Age 5 years	Ages 6–8 years
Health sector	Clinic: individual or group sessions	X	X			
	Home visiting	X	X			
Nongovernmental organization, health and education sectors	Home visiting		X	X	X	
	Community groups		X	X	X	
	Media		X	X	X	
	Child care			X	X	
Education sector	Preprimary school				X	
	Primary school					X

Source: Black, Gove, and Merseth 2017

### Health Sector Interventions

Continued investment to address malnutrition and micronutrient deficiencies remain vitally important for children beyond the first 1000 days. The brain is the most metabolically active organ and requires balanced nutrition for proper maturation [51], and malnutrition slows brain development and challenges its functional properties [52]. Various components of the brain develop along different development trajectories, which means there are various periods when specific nutritional deficiencies are most detrimental. The brain develops most rapidly prenatally and postnatally, but the period before primary education remains critically important as the brain reaches approximately 95% of its adult volume by age six [52].

Interventions such as salt iodization and micronutrient fortification and supplementation have shown effective at reducing nutritional deficiencies. There is limited research on the impact of these interventions on brain development [52, 53], as well as the time paths for effective interventions to improve nutrition and cognitive and socioemotional abilities [54]. Considering investments in child development from the perspective of brain maturation reaffirms the importance of proper nutrition beyond the first 1000 days to provide children with the necessary biological foundation to acquire the skills needed to fully benefit from formal education when they enter primary school.

### Education Sector Interventions

Children are better prepared for school emotionally, socially, and cognitively if they have a preschool education [55]. Investments in early childhood education are cumulative, as they build on investment in the first 1000 days and better prepare children for skill acquisition in later years. The benefits of preschool education vary by the quality of program, with the strongest development outcomes attributed to programs that include exploration, play, and hygiene education [49].

Access to and enrolment in structured preschool programs varies widely. There are few government-supported early childhood education programs in low- and lower-middle income countries. Instead, child care programs are often provided by private enterprises and non-governmental organizations with

little regulation and consistency in quality [42]. UNESCO estimates that on average less than one in five children in low-income countries are enrolled in preschool programs compared to just over half in middle-income countries [56]. Within countries, more affluent and urban children are more likely to attend preschool programs compared to lower-income and rural children [55]. The disparities extend to budget allocation as well; the forthcoming World Development Report estimates that North American and Western European countries spent close to 9% of their education budgets on pre-primary education, while the budget share for pre-primary education was 0.3% in Sub-Saharan Africa (World Bank forthcoming).

Expanded access is critical to increased enrolment. Within one decade of the expansion of preschool services in Uruguay, more than 90% of all children attended structured preschool [57]. In addition to the need for greater and more equitable access to preschool programs, there is a concomitant need to invest in the quality of existing programs, including appropriate infrastructure and student-to-teacher ratio, and developmentally appropriate activities, such as play-oriented lessons [49]. Annex III includes a case study of the One Village One Preschool pilot program that provides early childhood education to 60,000 rural children across nine provinces in China.

Studies of daycare centers in Bolivia and Colombia that reach children up to age six have also shown promise. A daycare program in Bolivia for children 6-72 months in the homes of low-income women achieved improved motor skills, psychosocial skills and language acquisition [58]. A similar program in Colombia that targets children ages three years and older found that children who spent at least 15 months in the program showed improvements in both cognitive development and socioemotional skills [59].

Early childhood programs have high returns on investment. It is estimated that one additional dollar invested in quality early childhood programs have a return on investment between six to 17 dollars [55]. Most of the underlying data for these estimates come from high income countries. Horton and Black summarize the estimated costs of preschool programs, and estimate that preschool programs may cost US\$300 per child per year in lower-middle-income countries and US\$600 per child per year in upper-middle-income countries [50].

## 1.7 School-Age Children

School-age is determined to be those ages between 5-14 years, which is the age-range that represent children in primary school in LMICs. Health and education targeted to this age group can promote long-term gains in health, as well as education. Providing health services in schools is a cost-effective approach that can increase enrolment, attendance and achievement by mitigating earlier deprivations and by addressing risky behaviors, ill health and nutritional deficiencies [60]. Globally, more schools exist than health facilities, and rural areas are more likely to have schools than health centers, and more teachers than health workers. Using the school as a platform provides access to large numbers of children in a structured setting, at an age when building and reinforcing healthy habits can have lasting consequences. Ill health can lead to missed school days, and certain infections prevalent in this age group can impair cognition, attention span and learning, which taken together have a negative impact on education outcomes.

### **Health Sector Interventions**

School-age children are at particular risk for parasitic infections [61], and malaria has been identified as an emerging issue in this age group [62]. During this age period, certain conditions are starting to present, healthy habits can be formed, and certain key vaccinations which can protect the child's health into adulthood are best administered. A package of cost-effective interventions has been developed that can be effectively implemented from a school-based platform and when targeted to this age group can



have lasting impact for both health and education sectors [63]. The package which is discussed in detail below, and is included in Annex II, encompasses: (i) school feeding; (ii) health education to promote oral health and use of insecticide-treated bed nets (ITNs); (iii) vision screening; (iv) deworming; (v) tetanus toxoid (TT) booster; and (vi) human papillomavirus (HPV) vaccination.

The delivery of some interventions is recommended for all children (oral hygiene, deworming and vaccinations), while for other interventions, screening and treatment is recommended (eyeglass screening). Some of these interventions seek to change behaviors, or seek to protect the future health of the individual (promotion of oral health and HPV vaccines) and some will have immediate benefits to the individual and to their education (vision screening). Some transcend both time points, having benefits immediately and well into the future (school feeding), while some will need recurring implementation for long-term protection (deworming). For some of these interventions, the economic returns are greater when targeted to a subset of the population, such as school feeding for food-insecure areas or deworming only in parasite endemic areas.

### **School Feeding**

School feeding programs can have benefits across multiple sectors and have long been a mechanism to address both health and education goals. School feeding provides a social protection mechanism through which nutritional deficiencies and hunger can be addressed, as well as promoting school attendance by 8%, enrolment by 9% and increasing years of schooling completed, especially for girls [6, 64]. Short-term hunger can have adverse effects on learning, while micronutrient deficiencies, particularly of iron, iodine and vitamin A have a negative impact on the education as well as health of school-age children. Anemia, in particular, is associated with poor cognition and learning, reflected in poor performance on standardized tests [65, 66], and malnutrition is estimated to lead to a loss of as much as 16% of gross domestic product (GDP) [67]. The extra demands on a school-age child in walking to school, or being required to perform chores in the face of continuing physical and cognitive growth and development creates a much greater need for energy than that needed by younger ages. Providing balanced meals in schools can address many of these issues at the same time as reducing social vulnerability, increasing school participation and mitigating the effects of hunger on learning and educational achievement. For example, in Kenya, school feeding has been found to increase attendance and lead to improvements in test scores, result in a higher primary school completion rate, as well as improvements in nutritional indicators, greater activity levels and reduced iron-deficiency anemia [68-70].

Poor households in food insecure areas are incentivized to send their children to school in areas where school feeding programs provide a resource transfer of the value of the food distributed [71]. The food contributes to the ability of children to learn, by avoiding hunger and enhancing cognitive abilities, and the community is provided with support in providing for themselves and their family. Furthermore, the Home-Grown School Feeding (HGSF) modality creates local markets, supports smallholder farmers and prevents post-harvest loss [6, 71, 72].

School feeding can also provide a stop-gap in times of social unrest and instability [71]. In Ethiopia, the recent drought led to the launch of *emergency school feeding* as a response to help reduce school drop-outs and to support communities who were struggling to feed their families.

Using conservative estimates, Fernandes and Aurino estimate the benefit-cost ratios of more than 3 based on an estimated lifetime returns due to expected increases in wages due to more children spending more days in school [63]. Extending this to include gains in cognition, the returns could be even higher, and are estimated to be as much as 10-15% greater than the delivery cost [63]. Furthermore, these returns are progressive, disproportionately benefiting the poor and malnourished, and translating to an increase in the quantity and quality of education, leading to greater human capital development and productivity in the labor force [73]. Taken together, the benefits of school feeding can

have significant rates of return to the individual as well as to sector goals which, in their entirety, substantially exceed the cost of the intervention [74].

However, the extent of these returns have high variability dependent on the model of implementation, and governments, implementing partners and donors should be aware of the impacts of the current program, and be willing to adapt to the context and local situation for maximum impact. This idea is discussed further in a case study in Annex II.

### ***Skill-based Health Education***

Tooth decay (dental caries) is one of the most common diseases globally, particularly for school-age children and adolescents. Between 40% and 90% of 12-year-old children in low- and middle-income countries suffer from tooth decay [75].

Oral health promotion through schools is low cost and has the potential to influence positive social norms and establish lifelong oral hygiene behaviors [76], and is becoming more commonly seen in school-based programs. These programs, which do not require the involvement of health professionals, which are limited in LMICs, and can be supervised by teachers, achieve substantial improvements in oral health status and high rates of dental caries-free children [77]. One program estimated that integrating oral health into daily school activities resulted in the prevention of 17.3% of new caries lesions at a cost of US\$0.60 per child per year in supplies [78].

Successful malaria control programs targeted to younger age groups have shifted the peak age group for clinical attacks to older children, with more than 500 million school-age children at risk of malaria infection worldwide [79], and leading to significant levels of school absenteeism. For example, in Kenya, malaria is estimated to result in between 4 and 10 million school days annually [80], and a study in Sri Lanka reported a 62.5% reduction in school absenteeism among children who received chloroquine prophylaxis for malaria [81]. These significant impacts on school attributable to malaria represent losses to education sector investments, and suggest that preventive efforts have the potential to significantly improve school attendance.

Skills-based health education have been shown to be associated with decreased prevalence of malaria among school-age children in several countries [82, 83]. It is a cost-effective and effective way to increase regular and correct use of ITNs amongst school-age children for prevention of malaria transmission [81].

### ***Vision Screening***

WHO estimates that around 12 million cases of visual impairment are due to uncorrected refractive error. With an estimated 80% of all learning during the first 12 years of life occurring through visual instruction, students who have poor vision are at a significant disadvantage [84], and at risk of dropping out, repeating a grade, and performing less well on academic assessments compared to peers with normal vision [85]. A study in northwest China showed that wearing eyeglasses increased literacy and numeracy test scores by 0.26 and 0.44 standard deviations respectively, reduced the odds of failing a class by 35%, and wearing eyeglasses for one academic year improved academic performance by the equivalent of 0.3 to 0.5 additional years of schooling in children with refractive error [86].

Skilled eye care personnel and infrastructure are lacking in LMICs, and schools have successfully been used as a platform for delivering eye care services in various contexts [87-90]. Analysis has shown the effectiveness and cost-effectiveness of using teachers to deliver school-based vision screening, identifying children for follow-up and provision of spectacles [91], and periodic screening by teachers of a specific grade for refractive error and provision of ready-made glasses, with the aim of screening all children at-risk over time is estimated to cost US\$25 per child each year in low-income countries [63].

## **Deworming**

School-age children are at particular risk of infection with soil-transmitted helminths (STH) and schistosomes. While light infections are relatively asymptomatic, moderate to heavy intensity infections are linked with stunted growth, malnutrition, weakness and anemia [92-94], leading to impaired physical and cognitive growth and development in preschool-age and school-age children. High infection intensity has negative consequences on access to education, grade repetition or drop-out and student performance in school [4, 5, 95, 96], worker productivity in adults, and can result in adverse pregnancy outcomes in women of reproductive age and their offspring [92, 97].

Treatment for infection is relatively simple and safe, and periodic administration of single dose antihelmintics via mass drug administration (MDA) is recommended to reduce worm burden [98]. Treatment can rapidly alleviate associated morbidities, with significant catch-up-growth seen in middle childhood following curative treatment with positive impacts on cognition, height and weight, and reductions in worm associated anemia [93, 99-103]. Studies have indicated that treatment of infections in childhood can be more cost-effective at increasing school participation than community-based delivery [61], reduce school absenteeism by 25% [5] and can lead to significant long-term gains in productivity into adulthood [104] (for more information on effects of deworming, see the deworming case study in Annex II).

## **Vaccinations**

Vaccinations have the potential to protect against future incidence of disease, thus protecting the individual and via their significant externalities, society, from potential ill health and lost productivity, and reducing the potential burden of added infections on the health system. Their protective effects have most impact when delivered prior to exposure – thus in early and middle childhood. School-based delivery of vaccinations, delivered through nurses, have shown promise to achieve coverage for certain vaccines in LMICS, and can protect against infectious diseases and their debilitating effects. For example, vaccination of preadolescent girls for HPV has the potential to substantially reduce the morbidity and mortality and future health burden associated with cervical cancer [105]. An estimated 80% of the global burden of cervical cancer is concentrated in LMICs, underscoring the relevance of the HPV vaccine as a preventive measure [106]. Similarly, TT vaccination lowers the risk of contracting tetanus for recipients as well as for the children of vaccinated adolescent girls [107]. While these vaccinations may cost more to deliver in schools than through health facilities, school-based administration benefits from achieving higher coverage, particularly for children from disadvantaged households [63].

## **Education Sector Interventions**

Access to primary education has expanded significantly since the early 2000s and is considered one of the great achievements of the Millennium Development Goals. There has been impressive progress made with primary school gender parity, as illustrated by the female-to-male pupil ratio of 0.94 in low-income countries in 2016 [108]. However, despite the progress achieved with primary enrolment, attendance is not a reliable indicator for learning. The 2018 World Development Report, which explored the learning crisis, identified that more than 60% of primary school children in developing countries fail to achieve minimum proficiency in learning, including in basic mathematical skills and literacy [10]. To illustrate this point, an assessment in 10 countries found that half or fewer primary school completers assessed could read [109]. Gender parity in early grade reading is also important to consider, as approximately two-thirds of adults who lack basic literacy skills are women [110].

## **Education Quality**

The focus is now shifting to improving education quality and equity to ensure students master foundational skills in reading, writing, and math. These skills are necessary to benefit from additional

years of education and to gain the core competencies necessary to enter the workforce and adapt to technological changes. For this reason, there is increasing emphasis on improving the capacity of teachers to teach these subjects and measuring early grade reading and numeracy. New digital pedagogical tools are increasingly promising educational inputs that can be used in low-bandwidth settings. Mind Spark is one example of an online platform that enables curriculum differentiation for mathematics and English language. USAID is awarding funding for digital libraries and online publishing platforms to diversify and increase access to stories in local languages to promote reading at all levels, with particular emphasis on early grade reading. Similar technology innovations are being piloted to improve early grade reading capability among children who are deaf and hard-of-hearing [111].

Instruction-based interventions have proven to be the most effective at improving learning outcomes [13]. Conn emphasizes the value of pedagogical interventions that adapt instruction to children's particular learning levels and long-term teacher mentoring or coaching [112].

### *Health Education through Schools*

Health responses are more sustainable and have a greater reach when integrated into an existing framework, such as through a wider curriculum of health promotion [61]. Relatively simple lessons on skills-based health education can usefully influence protective health behaviors. In primary school, health behaviors can be taught through various methods, including practicing reading skills with stories that integrate messaging around health behaviors. An integrated curriculum at a higher level of complexity could usefully include the inclusion of nutrition education and STD and HIV/AIDS prevention through science curriculum, as an example. Research shows that the most trusted source for young people to learn about HIV/AIDS is through schools and teachers [113]. Pre-service and in-service training can equip teachers to deliver integrated lessons and motivate teachers by explaining that healthy children learn better.

### *Disability and Education*

Millions of children and youth with disabilities, especially girls, are denied the right to quality, inclusive and equitable education. This is often due to stigma, poor data collection, and a lack of knowledge on how to make learning and work environments inclusive. This results in an over-representation of people with disabilities among the world's illiterate and among the poorest of the poor. Approximately one-in-twenty children age 14 and younger worldwide live with some form of moderate to severe disability [114]. Disability can be physical, cognitive, psychosocial, communicative, or sensory, and the barriers that children with disability face varies significantly at the country, community, and school level.

Poverty-related risk factors that may contribute to the onset of health conditions associated with disability include low birth weight and cumulative deprivations from malnutrition [16, 115]. Lack of clean water, and inadequate sanitation can manifest in developmental disabilities [116]. In addition, lack of access to health services may convert a health condition into a disability. For example, as discussed above, uncorrected poor vision can become a disability which can be addressed through school-based assessment and referral.

Children with disabilities are some of the most marginalized and excluded groups of children. Only 10% of all children with disabilities are in school [117] and more than 85% of out-of-school children who have a disability have never attended a school [118]. However, children with disability are more successful in schools that are accessible for all learners [119-121], and the opportunity to include them in primary school learning should not be missed but will require some adaptation from the education sector.

Approaches to consider include building accessible facilities, including ramps and providing accessible toilets, providing resources for teaching such as specialized materials and aids. Teachers as well as

administrators need to be trained to respond to an increased learner diversity, and the curriculum should be adapted to the individual learning needs of children [4]. The 2011 WHO and World Bank World Report on Disability provides an overview of the various funding mechanisms countries utilize to meet education needs for children with disability.

### *Improving Transparency*

The World Development Report on the learning crisis highlights that the perception of poor education quality can be a motivation for parents to withhold children from continuing their education [10]. Reducing information silos is one approach to improving education quality and demanding more school accountability; to encouraging citizens to demand more from service providers and their education system. Monitoring and reporting on school achievement can encourage parents to demand more from their education system, as well as benchmark for progress. The Learning and Education Achievement in Pakistan Schools Project demonstrated that providing parents with information on children's educational attainment improved learning outcomes, including a 0.10 standard deviation increase in achievement and reduced private school fees by 21% [122].

## 1.8 Adolescents

Older adolescence is considered the phase from 15 to 19 years. This phase brings further physical changes, as well as brain restructuring, linked with behavior changes – particularly exploration and experimentation, and initiation of behaviors that are life-long determinants of health. Yet, the importance of development during adolescence has, thus far, been grossly under-recognized and under-funded [1]. Adolescents are at a critical stage between childhood, and the transition to adulthood, requiring acquisition of skills for independence, completion of education and the transition to becoming productive members of society, contributing to the workforce, and supporting the development of the next generation [123].

Across the African continent, girls face unique challenges in education attainment due to structural and systematic gender inequalities. The barriers to girls' education are wide-ranging and interlinked, the key factors that drive millions of girls out of school, including: (i) high school fees combined with indirect costs of attending primary and secondary school; (ii) unsafe school environments including sexual abuse, harassment and exploitation by teachers, school officials and classmates; stigma linked to pregnancy and marital status; corporal punishment by teachers and school officials, and long distance to schools in rural areas that expose girls to sexual violence and other safety risks; (iii) discrimination by teachers and school officials, and lack of accessibility for girls with disabilities (Human Right Watch, 2018).

The period of adolescence has traditionally been considered one of good health and survival, hence there has been little focus on this age group to date. When considering what works in adolescence and how best to target interventions, it is important to note that the majority of evidence and data relating to this age group is generated from high income countries. The interventions discussed below are considered to have relevance for low- and lower-middle income country settings. However, moving forward, further research into the health of adolescents in low- and lower-middle income countries will be required.

Certain interventions discussed below will have overlap with primary education for multiple reasons: 1) the overlap of common health and education conditions into this age group – adolescence is a secondary period for development of myopia for example, 2) the widespread rate of grade repetition in low- and lower-middle income countries meaning there may be an older average age still attending primary school in many settings, and 3) certain adolescent related behaviors become apparent younger than 15. Including community-based interventions and media messaging alongside the school-based platform as

part of the approach for delivery can ensure greater coverage of this age group, which is not always easily identifiable through the school-based platform [60].

Despite this, schools remain the best opportunity from which to invest in health and wellbeing, especially for girls, and yet, in order to benefit from the education provided through secondary schools, education must be accessible, and students must continue to be healthy enough to attend school, free from infectious disease, hunger and undernutrition. Moreover, factors that increase risk of drop-out for this age-group must be mitigated, such as early marriage and pregnancy, lack of a safe, clean and welcoming school environment, and risky behaviors such as alcohol and drug abuse. Today's generation of adolescents is more connected through social media and technology than any generation before, providing new mechanisms for accessing this age group with messaging [124]. Developing strategies to harness these technologies for dissemination of messaging will be as important as developing opportunities to extend youth engagement from a technological interface into the real world.

The combined approach for delivery of health and educational messaging to this age group increases the potential for blurred lines with respect to roles and responsibilities. The importance of approaching adolescent health in a multi-sectoral manner cannot be over-emphasized, ensuring multiple stakeholders are at the table and involved in design, implementation, monitoring and maintenance of interventions and facilities. Well-designed and properly targeted health interventions in adolescence can continue to leverage the substantial investment in education, and better design of educational programs focused on health education and provision of messaging can support better health.

### ***Health Sector Interventions***

Adolescents can experience barriers in accessing health care at the community level, including costs, lack of knowledge, and stigma and concerns about [123]. Tackling preventable or treatable health problems such as undernutrition, HIV, sexual and reproductive health, poor vision and infectious diseases are critical to assure the long-term health, protection and wellbeing of this age group and is best achieved through schools and through media [1]. Introducing health packages, targeted at prevalent conditions, and delivering health messaging through schools and community platforms can overcome many of these barriers. DCP3 identified a package of cost-effective interventions that can be targeted to support adolescent health with proven positive outcomes and that are feasible to scale in low- and lower-middle income countries. Those interventions are included within Annex II.

Maintaining a focus on adolescent females is of utmost importance to ensure equity. Adolescence is a period when gender roles and stereotypes are established, bringing inequalities that can impact the course of a girl's life. Young females carry the greater burden of the impact of unprotected sex: in Sub-Saharan Africa, adolescent females are twice as likely to be living with HIV as males of the same age [125]. Similarly, pregnancy in female adolescents leads to the end of formal education, restricts opportunities for employment, and heightens poverty, and, can have spill-over negative effects onto the next generation, as discussed in relation to reproductive, maternal, newborn and child health above [126]. Finally, with the onset of menses, female attendance at schools is particularly sensitive to the availability of clean, sanitary and private latrine facilities that are separate from boys latrines [127]. In Ethiopia menstruation was reported to be responsible for reduced school attendance (51% of girls missed 1-4 days a month) and performance (39% reported reduced performance) [128]. Adequate water and sanitation is increasingly being included into Education Sector Planning Implementation Grants (ESPIG) submitted to GPE.

A comprehensive sexual and reproductive health care package, delivered through schools, and coupled with provision of contraception, can support prevention and management of each of these conditions, leading to increased use of contraception, decreases in sexual partners and delayed sexual debut [129, 130]. In remote and poorer areas, distribution of menstrual pads may be a strategy for supporting girls



to attend school. The literature relating to the impact of providing menstrual pads is still young, but identifies a potential slight increase in school attendance [131], and some countries are developing policies to support female education through such a mechanism. For example, Zambia recently included the provision of menstrual hygiene management products for rural and peri-urban school girls as part of its education budget [132].

Adolescents remain vulnerable to infectious diseases that can cause morbidity, like parasitic infections. Disseminating health and prevention information relating to these infections empowers the adolescent to start to take responsibility for their own health. In areas where intestinal parasitic infections (hookworm, roundworm, whipworm and schistosomiasis) are endemic, deworming can be administered. Hookworm especially is related to anemia in females and addressing this early with preventive chemotherapy is safe and effective, and treatment of women of reproductive age is now recommended by the WHO, and can protect the individual from pregnancy related anemia [133].

This age group is also experiencing a period of rapid growth and development, with both physical and cognitive changes associated with high energy expenditures and nutritional demand. One consequence of this rapid growth is changes in vision, with poor vision and myopia presenting during adolescence, creating a barrier to education uptake. Similar to interventions recommended for school-age children, vision screening conducted in schools and the provision of spectacles have been shown to keep children in school and learning longer [85]. Similarly, being well-fed and nourished during this period of growth is important to support resistance to infections, and reduce the impact of certain conditions and can be supported through the provision of micronutrient supplementation or school meals. This intervention has benefits beyond the health of the individual, encouraging school attendance and providing a social safety net to families as discussed previously and in Annex III.

In areas where enrolment in secondary education is low, community-based interventions targeted at adolescents can provide effective messaging. For example, adolescents who are not in school still require access to community-based sexual and reproductive health education. Deworming programs that target adolescents will need to consider strategies to reach this age group, and mobile health clinics and community health workers are both effective for this. Community-based activities and youth clubs (either as part of school activities or based in the community) can serve to develop social and emotional skills, developing self-confidence and empowerment. They can also serve as a platform for dissemination of messaging for health, as well as to address harmful behaviors and attitudes relating to gender, and gender-based violence, mental health and disability [134].

Adolescents are some of the earliest adopters of information and communication. Online interventions that harness these technologies provide a powerful platform from which to target this age group, effectively reaching marginalized populations not reached through community and school-based platforms. Technological health innovations include m-health; providing solutions such as online appointments with remote clinicians, in some cases encourages uptake due to the guaranteed confidentiality of their use. Delivery of health messaging via online platforms also has potential for impact, with web-based platforms, social media and text messaging showing promise for impact [134].

### ***Education Sector Interventions***

Adolescent pregnancy has been stubbornly high in sub-Saharan Africa, which has the world's highest prevalence [161]. Girls from poor and more marginalized households and communities are among the most affected. As previously discussed, the expansion of secondary education in many countries offers remarkable opportunities for health and well-being, with particular benefits being observed amongst adolescent females. At the same time, schools provide a platform from which health education messaging can be disseminated, providing messaging around sexual reproductive health, maintaining healthy lifestyle, and provision of essential knowledge for health. However, secondary schools only

provide an effective platform for health promotion when enrolment and attendance is maintained, especially for females.

As part of education for all, access to schools needs to be equitable, which is equally important for females, disabled, and poor and marginalized populations. A female who becomes pregnant whilst still at school is often encouraged to leave or feels shame in returning. Having 'open-door' policies and strategies for reintegration into school can support female education following birth of the child. Policies to support adult education and continued and flexible learning can provide an additional re-entry point for those individuals forced to drop-out of school due to unforeseen circumstances (see Adult Literacy and continuing education sections below).

Reducing or eliminating barriers to the uptake of education can prove successful. Providing incentives such as reduced schools fees and conditional cash transfers (CCTs) in return for school attendance have also been found to be cost-effective interventions [4], and found to be particularly effective at supporting female school enrolment. Once enrolled, education and health interventions are required to help children and adolescents achieve educational outcomes.

Continuation of the provision of school meals to secondary schools has been identified as a successful strategy to maintain enrolment, especially for females, improving their social and health status, by decreasing the rate of child marriage for example [6]. School feeding can support the 'second growth spurt' during adolescence, when nutrition requirements are considerably higher than other phases. Adolescence is also a time when behavioral habits form. Providing nutrient rich diets during this time period can have lasting effects on eating habits [134].

In Kenya, the *Education Subsidy* program subsidized the cost of education for upper primary school students by providing school uniforms in the older age grades. The impacts of this intervention were particularly noticeable for females when compared to schools which received no intervention, leading to a reduction in school dropout by 16.5%; a 17% reduction in the rate of teenage pregnancy and led to a 20% reduction in early marriage [135]. In Bangladesh, a conditional incentive program which provided cooking oil to families of females aged 15 through 17 on the condition of delaying marriage was an effective way to reduce child marriage, reduce teenage childbearing, and increase participation in education. The provision of cooking oil offset the associated increase in dowry related to marrying an older female. Those females whose families received the cooking oil incentive were 6.3% less likely to have married before age 18, had completed 2.2 months more school and were 3.3% more likely to be in school. Overall, every \$1000 spent on the program led to 6.6 years of delayed marriage, 1.5 averted child marriages and 3.6 additional years of schooling [136].

In too many countries, the quality of the teaching is poor, with only 44% of children in GPE countries who reach grade 4 having basic literacy and numeracy skills appropriate to their grade [137]. Improving teacher resources and availability of materials can improve the quality of teaching [138]. Similarly, altering the instructional techniques utilized by in-service teachers via adopting adaptive instruction that caters to children's learning levels and teacher coaching providing long-term teacher mentoring to existing teachers [112].

The emergence of technology as a force in social and economic development presents a wide range of possible to the education systems of developed and developing countries. In many developing countries, efforts to build strong educational foundations benefit from the use of technology to address problems that cause chronically poor learning outcomes. Such problems frequently include teachers' limited capacities, the lack of textbooks or other resources, poor school management, poor central decision making, and lessons that are irrelevant to the lives of students. These systemic problems limit the development of literacy and numeracy skills, as well as the higher-order thinking skills essential for participation in the global economy. Well-conceived uses of a broad array of locally appropriate and



cost-effective technologies, including radio, mobile phones, computers, low-cost projectors, the Internet, and other tools, can complement and strengthen education reform efforts.

Laying the foundation to achieve digital literacy skills among adolescents and youth directly relates to the SDG Goal 4 for inclusive and quality education. The Global Education Monitoring Report tracks achievements related to this goal, and includes an indicator related to digital skills, as well as two thematic indicators: percentage of youth/adults who have achieved at least a minimum level of proficiency in digital literacy skills and youth/adult educational attainment rates by age group, economic activity status, levels of education and programmed orientation [110].

Access and proficiency with using digital devices and the internet increases economic competitiveness at the individual and national level. Despite this benefit, there are notable discrepancies in access between developed and developing countries. As part of a longitudinal study of childhood poverty, Young Lives studied digital access in Ethiopia, India, Peru. The analysis identified wide disparities between these countries in regard to mastery of digital skills, with children in Peru and Vietnam showing greater access, more frequent use, and earlier engagement with digital devices than children in Ethiopia and India. Respondents with earlier and more frequent use were associated with higher digital skills, however, descriptive results reveal that many children across the four countries report lack of confidence performing simple tasks on the computer [141].

The findings underscore the importance of interventions that foster greater access, proficiency, and comfort with digital devices, particularly among disadvantaged populations. The investments will have increasing relevance and importance to enable that the future cohort of the labor market to perform their duties and be competitive.

### ***Identifying synergies***

For many of the interventions described above, there are synergies in implementation. For example, the impact of school feeding may be enhanced by providing preventative chemotherapy against parasitic infection, and improvements in availability of water and hygiene measures can prevent reinfection and disrupt onward parasite transmission. These synergies should not be overlooked when considering program design, as they can lead to significant efficiencies. The Ethiopian School Health and Nutrition program, *ESHI* (Enhanced School Health Initiative) integrated multiple complementary health interventions, finding efficiencies and potential cost savings in joint use of infrastructure and resources, with estimates of significant savings predicted in implementing the program at scale [142].

### ***Transition to Workforce***

The school-to-work transition is a critical component of harnessing human capital and is an important route out of poverty. Many adolescents and young people prematurely leave the education system, and lack the key skills to success on the job. Many of these individuals become stuck in low wage jobs due to lack of training. Employment and vocational training programs for youth, adult literacy programs, and improvements in digital literacy can help achieve this youth and adolescents enter the labor market.

Workplace training can fill the gaps and increase productivity of the worker, with onward gains transferred to the firm. In Kenya and Zambia, workplace training has been associated with increased output and a concomitant 20% increase in wages of manufacturing workers [143]. Unfortunately, workplace training participation is lower for younger workers, and those with limited education and literacy proficiency [10]. At the same time, evidence shows that workplace training can be especially beneficial for young adults under the age of 35 [144].

Short term job training shows most promise as a strategy to develop capacity when targeting disadvantaged groups. Targeting comprehensive training packages, including career guidance, mentoring and job search assistance, can improve young women's socio-economic skills, labor market outcomes

and aspirations [145]. Such programs provide an opportunity to include information technology skills training, filling gaps in this skill set that is so important for productivity and job security. In Kenya, for example, the Ninaweza Youth Empowerment program integrates information and communication technology (ICT), life skills, and job training placement support for youth, showing positive labor market outcomes [146].

Informal traineeships, such as apprenticeships can offer young people, especially those with little formal education, the opportunity to learn on the job. These latter points can be addressed by incorporating apprenticeships into the formal training system [10]. Technical and vocational education and training (TVET) programs, when well designed and designed in collaboration with future employers, can yield significant wage growth, equivalent to that seen with completion of general education, and with greatest returns to women [147].

### **Adult Literacy Programs**

Education does not finish with the completion of formal schooling, and as discussed above, learning and skill development needs to continue into adulthood to maintain a competitive workforce. This can be particularly important for those who dropped out of formal education before completion. A population with an incomplete education has significant socio-economic impacts, for example, literate mothers are more likely to encourage, and be engaged in, their children's education.

Worldwide, more than 21 billion adults age 15-64 and 61% of workers in Sub-Saharan Africa have low reading proficiency. The economic and social cost of adult illiteracy to developing countries is estimated at more than US \$5 billion a year [10]. Adult literacy programs can serve to improve literacy and numeracy skills. However, in many countries, these programs and the impacts they can have, are largely ignored [148]. However, the impact that they can have on enhancing participants' health knowledge and income generating activities, with resultant positive socioeconomic outcomes can be significant. In Ghana, for example, the National Functional Literacy Program, a 21-month long program which incorporates modules on health (immunization, sexual education, childcare, drug abuse, safe drinking water), income generation (maize cultivation, dry season farming, basket weaving, soap making) and civic awareness (taxation, bushfires, community empowerment and child labor). The program yields weak results for improvements in writing and numeracy, but substantial improvements in reading, labor market participation, child mortality, teenage pregnancy and household [148]. The estimated returns in subsequent labor market is more than 66%. Similar to Ghana, the Mexican National Institute for Adult Education has developed flexible modules to deliver education programs that are equivalent to primary or secondary education for out-of-school individuals [10]. These programs run 2-3 evenings a week, thus allowing participants to engage in other activities in the daytime, and they utilize existing infrastructure from the formal education system, with required costs as low as \$12 per participant.

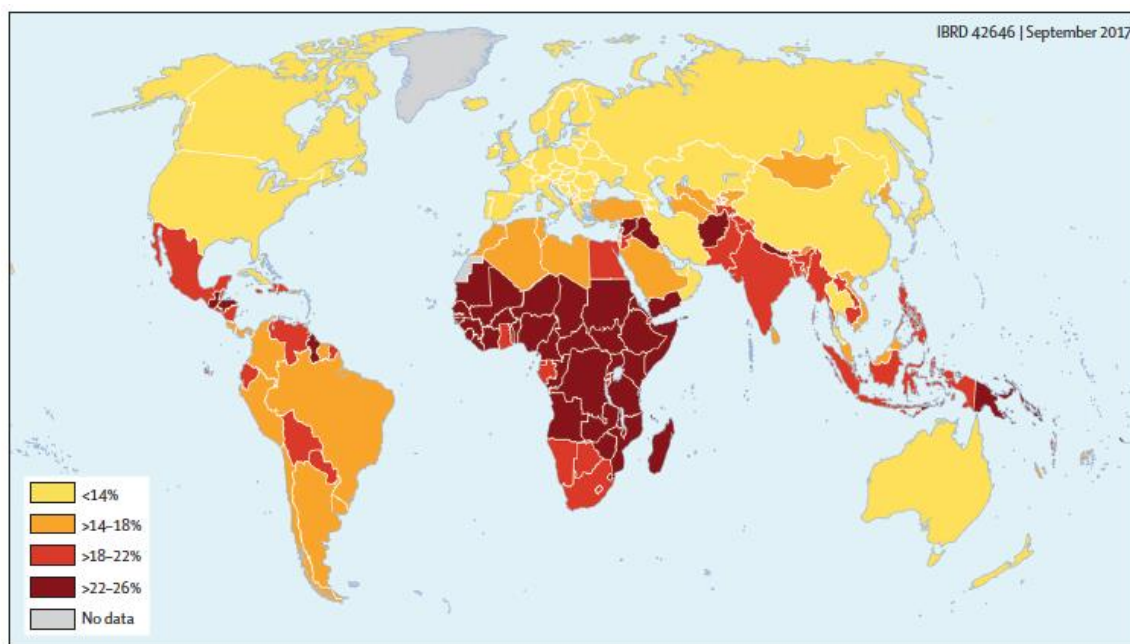
### **Youth Employment and Training Programs**

Soft skills rival technical skills for workplace success [149]. The forthcoming World Development Report finds that the share of employment in occupations that require soft skills has increased from 19 to 23% in emerging countries [10]. An analysis conducted by USAID, Child Trends, and FHI 360 identified five of the most important soft skills to enter and perform well in wage employment: (i) social skills; (ii) communication; (iii) higher-order thinking skills (encompassing problem solving, critical thinking, and decision making, and reasoning); (iv) self-control; and (v) positive self-concept [150]. An analysis showed that across seven countries, a one-standard deviation increase in ability to problem solve and learn new skills is associated with a 10- to 20-% higher wage [10, 151].

In many low-income countries, education systems are not designed to teach adolescents and youth the job-relevant skills required to navigate and sustain employment within a rapidly evolving workforce [152]. Adolescents and youth constitute the largest population in developing countries, particularly in

Sub-Saharan Africa (see Map 1). As a result, adolescents and youth face particularly strong competition for limited private sector employment opportunities that are commensurate with their skills [145]. Vulnerable adolescents and youth are at greatest risk for losing out, exacerbating existing inequalities. ILO estimates that 25.2 million youth in LMICs were unemployed in 2017 [153].

**Figure 6: Proportion of country population comprised of adolescents (10–19 years)**



Source: Bundy and others 2017a

Youth workforce training programs can help augment specific professional and soft skills that are not be cultivated through traditional schooling to help youth find work and remained employed and productive. Impact assessments show that the impact of training programs for youth tend to be limited, mostly short-term impacts, and at high cost. However, training that is paired with practical opportunities to apply the training in a work setting can be more effective. It is worth testing the efficacy and cost-effectiveness of integrating soft skills and behaviors within secondary school curricula to prepare adolescents and youth for wage employment [145, 154].

USAID supports youth workforce development programs in 36 countries. Projects awarded through the USAID Youth Power initiative have piloted practical approaches to address constraints youth face in entering the formal labor market. The *Empleando Futuros* (Employing Futures) pilot in Honduras offers one example of how to integrate marginalized youth into the workforce, with the broader goal of teaching skills that can be built upon for lifelong employment, and indirectly reduce violence and instability [155]. *Empleados Futuros* conducted a labor market assessment and partnered with the National Institute for Professional Development to align its training curricula to meet the pressing needs of the private sector in the country. The pilot includes three components: (i) bolstering soft skills; (ii) vocational training to hone job-specific technical skills; and a (iii) capstone to practically apply these skills in a work setting [155].

The World Bank has also committed to better prepare adolescent girls to transition to the workforce as part of its Adolescent Girls Initiative. The Uttarakhand Workforce Development Project in India, as one example, allocates US\$74 million to diversify the training programs offered at female training

institutes to include non-traditional women's trades, making programs more labor-market-relevant, and establishing industry linkage cells in training institutes for linkages with women-friendly industries [156]. Along the same vein, the World Bank funds the Rwanda Priority Skills for Growth project, which trains adolescent girls in fields that have disproportionately fewer women through vocational training institutes, technical secondary schools, and universities, with payment linked to achievement of performance results [157].

## 1.9 Workplace Health Interventions

Health interventions can further build on these investments and allow more significant economic returns to human capital. Prevalent diseases, such as malaria, can make people too ill to work which adversely affects worker earnings and the productivity of the workplace. A study at a sugarcane plantation in Nigeria found that workplace-based malaria testing and treatment programs increased earnings and labor supply of piece-rate workers by approximately 10% [158].

# CONCLUSIONS

## There are Key Actions that can be Taken During the First 8000 Days of Life to Maximize the Development of Human Capital

The evidence presented above makes a clear case that investments in health and education can lead to greater realization of human potential; increasing individual socio-economic status and societal productivity and leading to longer term development of human capital. Achieving this growth requires a cross-sectoral, lifecycle approach, and targeted investments into successful implementation of cost-effective interventions and policies for greatest impact. This report highlights three key areas for investment, strengthening and collaboration in order to realize these cross-sectoral benefits.

- The education sector's current focus on early child development needs to be matched by a focus on early childhood education. Similarly, improving girls' access to education in particular can lead to improved health, reduced early child marriage and childbearing, and women's economic empowerment.

Health and education are both required throughout childhood and into older adolescence, and for maximum benefits, cross-sectoral linkages need to extend to ensure a comprehensive continuum of care from ECD, to school-age, through to adolescence and adulthood. This not only requires cross-sectoral linkages, from both health sectors and investment in the school platform, but needs to go further. Investments should be targeted across the life course; education sectors need to invest in early childhood development focusing on socialization, soft-skills development and play; through to adolescence, investing in health, and digital literacy. Similarly, the health sector needs to look beyond the first 1000 days to support health, growth and development and reduce morbidity during the next 7000 days of development. Targeted interventions to corresponding life stages demonstrate significant returns on health and education outcomes, and can serve to prepare a young child for school, a school-age child for adolescence, and an adolescent for adulthood, family and the workforce. Throughout each stage of the life course also lies the opportunity to ensure investments are inclusive and equitable.

- The health sector should sustain its investment in the first 1000 days, and at least double its investment during middle childhood and adolescence when children have their most important opportunity to attend school and learn.

Limited and finite resources in country financing warrants wise and effective investments. Development of human capital can yield significant returns to an individual as well as to an economy. This development requires strategic investments in both education and health, yet currently investment in both these sectors is insufficient to meaningfully improve human capital. Key will be a refocusing of investments to go beyond current investment strategies, and identifying opportunities for cross-sectoral, synergistic investments across the life course.

Health and education sectors can support each other achieve sector goals through respective investments. By investing in cross-sectoral approaches, targeted at age-specific life stages, individuals will be better equipped to their developmental potential, bettering their economic opportunities and laying the foundation for partner countries to increasingly manage and resource their own development trajectory.

- The education and health sectors should coordinate their efforts to maximize synergies; the timing of interventions relative to critical development stages matters.

Health and education sectors do not exist in isolation and need to be viewed through a cross-sectoral lens to identify synergies and linkages, rather than viewed and implemented through siloes. Many key interventions require multi-sectoral programming in order to capitalize on investments, and in many cases, leveraging synergies and identifying efficiencies across sectors will lead to even greater efficiencies. Government strategies, structures and policies may need to be re-structured to facilitate such collaboration. For maximum effect, this cross-sectoral support also needs to be reflected internally as part of organizational structuring, ensuring accountability for cross-sectoral engagement and motivation to work across sectors. The Feed the Future program, funded by USAID, is an example of programs that can successfully collaborate across disparate sectors to achieve shared development and humanitarian goals.

Development partners can support these strategies through leveraging existing relationships with ministries and stakeholders in country, advocating for stronger cross-sectoral programming and structuring both at various levels of government administration, as well as within their own organizations. Partners can provide support to countries to identify and address challenges, priorities and resource needs, such as human resourcing, over the medium and long-term through development of budgeted, evidence based, institutional plans. Finally, investments in tools and monitoring strategies can go a long way to address data gaps and build the evidence base for requirements for interventions.

Finally, Donors could explore maximizing their education investments by investing in the delivery of interventions that have high education impact, and supporting training to better equip teachers to deliver these interventions.

### ***Final Thoughts***

Investing in health and education throughout the life course can lead to gains in attainment that can reach beyond the individual to positively affect those immediately around them as well having intergenerational impacts. Health and nutrition interventions can level the playing field for maximizing learning opportunities. Education holds the potential for making the individual receiving it, and others they interact with, better off. Specifically, a more educated society may lead to higher rates of innovation, invention and productivity, at the same time, this effect is compounded by the fact that an educated society is more likely to uptake new technologies, including new health interventions.

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# ANNEX I: METHODOLOGY AND KEY EXPERTS INTERVIEWED

This discussion paper provides an overview of evidence-based investments in health and education, and identifies how investments could be targeted to position the children of today to productively enter a technologically-driven workforce in the coming decades. The report draws from three areas of information gathering:

1. Literature reviews of relevant studies which present evidence on effective interventions and their proper implementation, drawing upon 136 original scientific papers and reference sources. This includes content from the recently published Disease Control Priorities, Third Edition (DCP3), including both volume 8, entitled Child and Adolescent Health and Development (Bundy and others 2017b) which identifies cost-effective, scalable essential health interventions that can promote physical, cognitive, and intellectual development in 5-19 age groups, and volume 2, Reproductive, Maternal, Newborn and Child Health (Black and others, 2017), which focuses on health in mothers and children under 5 years. Following the publication of Volume 8, and the overwhelming evidence presented for the case to support child health, both the Global Partnership for Education (GPE) and the World Food Programme (WFP) education and nutrition sector developed compendium publications to advocate for targeted interventions to support education and nutrition outcomes.
2. Case studies of field-driven solutions to improve human capital as well as examples where countries have increased their commitment and capacity over time to oversee and finance relevant policies and interventions.
3. Information gathered through qualitative interviews with 24 international experts, country representatives, practitioners, and development partners from across sectors and organizations. Particular attention in the interviews was dedicated to identifying opportunities for development agencies, such as USAID, to support its partner countries in initiating, broadening, or building upon investments to develop the potential of its citizens. The experts interviewed, and their areas of expertise are noted in Table A below.

**Table A: List of Key Experts Interviewed**

Area of Focus	Organization	Name
Health	GIZ	Bella Monse
Health	BMGF & Islamic Development Bank	Edward Lloyd-Evans
FRESH	UNESCO	Janelle Babb
Education	UNICEF	Saadhna Panday
Education	RTI	Michelle Ward-Brent
Education	GPE	Tara O'Connell
Social Protection	IFPRI	Harold Alderman
School feeding	WFP	Carmen Burbano
Nutrition/ECD	U. Waterloo	Sue Horton

Area of Focus	Organization	Name
ECD	Brunel University	Andreas Georgiadis
Economics/Health	U. California San Francisco	Dean Jamison
Economics/Education	Harvard University	Michael Kremer
Economics/Education	Harvard University	Ricardo Maertens
Gender	World Bank	Oni Lusk-Stover
Education	Ministry of Education, Ethiopia	Bereket Akele
Education	Ministry of Education, Gambia	Amicoleh Mbaye
Health	USAID	Shannon Young
Health	USAID	Bijou Muhura
Health	USAID	Sheila Kyobutungi
Reproductive Health	USAID	Teshome Woldemehin
Youth Employment	USAID	Michael McCabe
Education	USAID	Patrick Collins
Education and Technology	USAID	Anthony Bloom
Health	Abt Associates	Carlos Cuellar

# ANNEX II: PROPOSED ESSENTIAL INTERVENTIONS FOR RMNCH, SCHOOL-AGE, AND ADOLESCENTS

## Proposed Essential Interventions for RMNCH

The DCP3 Reproductive, Maternal, Newborn, and Child Health volume identifies three packages of interventions with the greatest potential to reduce deaths and disability, reproductive health, maternal and newborn health, and child (1-59 months) health (Black and others 2015). The interventions by package and the associated estimated costs in low- and lower-middle income countries are shown below.

### Essential Interventions for Reproductive Health

	Delivery platform <sup>a</sup>		
	Community workers or health post	Primary health center	First-level and referral hospitals
Information and education	1. Sexuality education		
	2. Nutritional education and food supplementation		
	3. Promotion of care-seeking for antenatal care and delivery		
	4. Prevention of sexual and reproductive tract infections	1. Detection and treatment of sexual and reproductive tract infections	
	5. Prevention of female genital mutilation (may be for daughters of women of reproductive age)	2. Management of complications following female genital mutilation	
	6. Prevention of gender-based violence	3. Post-gender-based violence care (prevention of sexually transmitted infection and HIV, emergency contraception, support and counseling)	
	7. Information about cervical cancer and screening	4. Screening and treatment of precancerous lesions, referral of cancers	1. Management of cervical cancer
Service delivery	8. Folic acid supplementation <sup>b</sup>		
	9. Immunization (human papillomavirus, hepatitis B)		
	10. Contraception: Provision of condoms and hormonal contraceptives <sup>b</sup>	5. Tubal ligation, vasectomy, and insertion and removal of long-lasting contraceptives <sup>b</sup>	2. Management of complicated contraceptive procedures

Source: Black and others 2015

Note: Red type denotes urgent care, blue type denotes continuing care, and black type denotes routine care. In this table, the community worker or health post consists of a trained and supported health worker based in or near communities working from home or a fixed health post. A primary health center is a health facility staffed by a physician or clinical officer and often a midwife to provide basic medical care, minor surgery, family planning and pregnancy services, and safe childbirth for uncomplicated deliveries. First-level and referral hospitals provide full supportive care for complicated neonatal and medical conditions, deliveries, and surgeries.

## Essential Interventions for Maternal and Newborn Health

	Delivery platform <sup>a</sup>		
	Community worker or health post	Primary health center	First-level and referral hospitals
<i>Pregnancy</i>	1. Preparation for safe birth and newborn care; emergency planning		
	2. Micronutrient supplementation <sup>b</sup>		
	3. Nutrition education <sup>b</sup>		
	4. IPTp <sup>b</sup>		
	5. Food supplementation <sup>b</sup>		
	6. Education on family planning	1. Management of unwanted pregnancy <sup>b</sup>	
	7. Promotion of HIV testing	2. Screening and treatment for HIV and syphilis <sup>b</sup>	
		3. Management of miscarriage or incomplete abortion and postabortion care <sup>b</sup>	
		4. Antibiotics for pPRoM <sup>b</sup>	
		5. Management of chronic medical conditions (hypertension, diabetes mellitus, and others)	
<i>Delivery (woman)</i>		6. Tetanus toxoid <sup>b</sup>	
		7. Screening for complications of pregnancy <sup>b</sup>	
		8. Initiate antenatal steroids (as long as clinical criteria and standards are met) <sup>b</sup>	1. Antenatal steroids <sup>b</sup>
		9. Initiate magnesium sulfate (loading dose) <sup>b</sup>	2. Magnesium sulfate <sup>b</sup>
		10. Detection of sepsis <sup>b</sup>	3. Treatment of sepsis <sup>b</sup>
			4. Induction of labor postterm <sup>b</sup>
			5. Ectopic pregnancy case management <sup>b</sup>
			6. Detection and management of fetal growth restriction <sup>b</sup>
	8. Management of labor and delivery in low-risk women by skilled attendant <sup>b</sup>	11. Management of labor and delivery in low-risk women (BEmNOC) including initial treatment of obstetric and delivery complications prior to transfer <sup>b</sup>	7. Management of labor and delivery in high-risk women, including operative delivery (CEmNOC) <sup>b</sup>
<i>Postpartum (woman)</i>	9. Promotion of breastfeeding <sup>b</sup>		
<i>Postnatal (newborn)</i>	10. Thermal care for preterm newborns <sup>b</sup>	12. Kangaroo mother care <sup>b</sup>	8. Full supportive care for preterm newborns <sup>b</sup>
	11. Neonatal resuscitation <sup>b</sup>		
	12. Oral antibiotics for pneumonia <sup>b</sup>	13. Injectable and oral antibiotics for sepsis, pneumonia, and meningitis <sup>b</sup>	9. Treatment of newborn complications, meningitis, and other very serious infections <sup>b</sup>
		14. Jaundice management <sup>b</sup>	

Source: Black and others 2015

Note: Red type denotes urgent care, blue type denotes continuing care, black type denotes routine care. In this table, the community worker or health post consists of a trained and supported health worker based in or near communities working from home or a fixed health post. A primary health center is a health facility staffed by a physician or clinical officer and often a midwife to provide basic medical care, minor surgery, family planning and pregnancy services, and safe childbirth for uncomplicated deliveries. First-level and referral hospitals provide full supportive care for complicated neonatal and medical conditions, deliveries, and surgeries. BEmNOC = basic emergency newborn and obstetric care; CEmNOC = comprehensive emergency newborn and obstetric care; HIV = human immunodeficiency virus; IPTp = intermittent preventive treatment in pregnancy; pPRoM = preterm premature rupture of membranes.

## Essential Interventions for Child Health (1-59 months)

Delivery platform <sup>a</sup>		
Community worker or health post	Primary health center	First-level and referral hospitals
1. Promote breastfeeding and complementary feeding <sup>b</sup>		
2. Provide vitamin A, zinc, and food supplementation <sup>b</sup>		
3. Immunizations <sup>b,c</sup>		
4. Cotrimoxazole for HIV-positive children <sup>b</sup>	1. Antiretroviral therapy for HIV-positive children <sup>b</sup>	
5. Education on safe disposal of children's stools and handwashing <sup>b</sup>		
6. Distribute and promote use of ITNs or IRS <sup>b</sup>		
7. Detect and refer severe acute malnutrition <sup>b</sup>	2. Treat severe acute malnutrition <sup>b</sup>	1. Treat severe acute malnutrition associated with serious infection <sup>b</sup>
8. Detect and treat serious infections without danger signs (iCCM <sup>d</sup> ); refer if danger signs <sup>b</sup>	3. Detect and treat serious infections with danger signs (IMCI <sup>d</sup> ) <sup>b</sup>	2. Detect and treat serious infections with danger signs with full supportive care <sup>b</sup>

Source: Black and others 2015

Note: Red type denotes urgent care, blue type denotes continuing care, black type denotes routine care. In this table, the community worker or health post consists of a trained and supported health worker based in or near communities working from home or a fixed health post. A primary health center is a health facility staffed by a physician or clinical officer and often a midwife to provide basic medical care, minor surgery, family planning and pregnancy services, and safe childbirth for uncomplicated deliveries. First-level and referral hospitals provide full supportive care for complicated neonatal and medical conditions, deliveries, and surgeries. HIV = human immunodeficiency virus; iCCM = integrated community case management; IMCI = integrated management of childhood illness; IRS = indoor residual spraying; ITN = insecticide-treated net.

a. All interventions listed for lower-level platforms can be provided at higher levels. Similarly, each facility level represents a spectrum and diversity of capabilities. The column in which an intervention is listed is the lowest level of the health system in which it would usually be provided.

b. The intervention effect was included in the Lives Saved Tool (LiST).

c. Immunizations included in the standard package are those for diphtheria, pertussis, tetanus, polio, bacillus Calmette-Guerin, measles, hepatitis B, Haemophilus influenzae type b, pneumococcus, rotavirus.

d. Components of iCCM are treatments for diarrhea, pneumonia, and malaria; and of IMCI are treatments of diarrhea, pneumonia, malaria, AIDS (acquired immune deficiency syndrome), other infections, and severe acute malnutrition.

## Costs of Essential Reproductive Health, Maternal and Newborn Health, and Child Health Services by Package

	Low-income countries		Lower-middle-income countries		Upper-middle-income countries		Total cost per package	
	2015	2035	2015	2035	2015	2035	2015	2035
<b>Reproductive Health package</b>								
Cost in millions*	\$562	\$603	\$520	\$630	\$151	\$164	\$1233	\$1397
Cost per capita	\$0.6	\$0.5	\$0.2	\$0.2	\$0.1	\$0.1	\$0.2	\$0.2
<b>Maternal and Newborn Health package</b>								
Cost in millions*	\$1183	\$1268	\$2922	\$3542	\$1768	\$1923	\$5872	\$6733
Cost per capita	\$1.3	\$1.0	\$1.1	\$1.1	\$0.9	\$0.9	\$1.0	\$1.0
<b>Child Health package</b>								
Cost in millions*	\$4484	\$4810	\$8838	\$10712	\$6060	\$6591	\$19382	\$22113
Cost per capita	\$4.8	\$3.9	\$3.4	\$3.3	\$2.9	\$2.9	\$3.5	\$3.3
<b>Total package</b>								
Cost in millions	\$6229	\$6681	\$12 406	\$14 884	\$7979	\$8679	\$26 487	\$30 243
Cost per capita	\$6.7	\$5.4	\$4.7	\$4.6	\$3.9	\$3.9	\$4.7	\$4.5

Annual incremental costs of essential health packages by country income groups for 2015 and 2035. Estimates have been inflated to US\$ 2012 using the US Consumer Price Index data (World Bank World Development Indicators). \*Costs include commodities, front-line health workers, and additional health system strengthening costs for scaling up services.

**Table 2: Costs of essential Reproductive Health, Maternal and Newborn Health, and Child Health services by package**

Source: Black and others 2016

## Proposed Essential Package of Investments for School-Age Children and Adolescents

The DCP3 Child and Adolescent Health and Development volume proposes two cost-effective packages for 5-19 year olds that are prioritized because of their health and education benefits. The first package addresses physical health and diet for school-age children (5-14 years) through a school-based approach; the second focuses on older adolescents (15-19 years) through a mixed approach involving the community, secondary schools, media, and health systems. In practice, both packages are required to cover the needs of adolescents from 10 to 19 years. The interventions within each essential package and the estimated costs of delivering each package in a low- and lower-middle income country are shown below.



## Essential Interventions for School-Age Children (5-19 Years)

	Primary health centre	School	Benefit of intervention delivery in schools
<b>Physical health</b>			
Deworming	Deworming	Deworming	In endemic areas, regular deworming (following WHO guidelines) can be done inexpensively in schools since most deworming drugs are donated; benefits in school attendance has been reported as a result
Insecticide-treated net promotion	Insecticide-treated net promotion	Insecticide-treated net promotion	Education about the use of insecticide-treated nets in endemic areas is important because schoolchildren tend to use nets less often than mothers and small children.
Tetanus toxoid and HPV vaccination	Tetanus toxoid and HPV vaccination	Tetanus toxoid and HPV vaccination	Schools can be a good venue for administration of tetanus boosters, which benefit young people and babies born to those young women.
Oral health promotion	Oral health promotion and treatment	Oral health promotion	Education on oral health is important; poor households generally cannot afford dental treatment.
Correcting refractive error	Vision screening and provision of glasses	Vision screening and provision of glasses	Vision screening and provision of inexpensive ready-made glasses boost school performance
<b>Diet</b>			
Micronutrient supplementation	..	Micronutrient supplementation	Supports learning
Multifortified foods	..	Multifortified foods	Supports learning
Food provision	..	School feeding	School meals promote attendance and education outcomes
<p>HPV=human papillomavirus. School-age children do not regularly contact the health system unless they seek treatment. With the remarkable success of the Millennium Development Goals in increasing enrolment and participation and the continuing focus on universal education with the Sustainable Development Goals, it makes sense to use schools to promote health in this age group and to deliver preventive and curative health interventions. These interventions are affordable and the highest priority because of their health and educational benefits. Table 5 presents the cost of components of the essential package of investments for school-age children. Data are from Fernandes and Aurino.<sup>24</sup></p>			
<b>Table 3: Essential package of interventions for school-age children (ages 5–14 years)</b>			

Source: Bundy and others 2017a

## Essential Interventions for Adolescents (around 10-19 years)

	Population	Community	Primary health centre	School	Benefit of intervention delivery in schools
Physical health	Healthy lifestyle messages: tobacco, alcohol, injury, and accident avoidance and safety	Adolescent-friendly health services	Adolescent-friendly health services: provision of condoms to prevent STIs; provision of reversible contraception; treatment of injury and abuse; and screening and treatment of STIs	Healthy lifestyle education including accident avoidance and safety	National media messages on healthy life choices designed to appeal to adolescents, combined with national policy efforts to support healthy choices (ie, limit adolescent access to products most harmful to their health)
	Sexual health messages	..	..	Sexual health education	Additional health education in schools aimed at issues relevant to older ages (15–19 years) in countries with higher levels of secondary completion, intended to supplement earlier messages for children aged 10–14 years in the school-age package
		..	..	Adolescent-friendly health services	Provision of adolescent-friendly health services within schools or health-care facilities that respect adolescent needs
Nutrition	Nutrition education messages	..	..	Nutrition education	..
Mental health	Mental health messages	..	Mental health treatment	Mental health education and counselling	..

STI=sexually transmitted infection. Adolescents are the hardest group to reach since many are no longer in school and feel uncomfortable accessing health services predominantly designed for adults. They might fear inadequate confidentiality, and in some cases (such as teen pregnancies) might be stigmatised by health-care workers. The total costs of the school-age package are about US\$10 per child aged 5–14 years and \$9 per adolescent aged 10–19 years. Table 5 presents the cost of components of the essential package of investments for adolescents. Data are from Horton and colleagues.<sup>25</sup>

Source: Bundy and others 2017a

## Costs of Components of Essential Packages to Promote Health of School-Age Children and Adolescents in Low- and Lower-Middle Income Countries

	Mode of delivery	Approximate cost per child who benefits (US\$) in LLMICs	Approximate cost per child (US\$) in relevant age group	Aggregate cost in low-income countries (US\$, millions, per year)	Aggregate cost in lower-middle-income countries (US\$, millions, per year)
<b>School-age children</b>					
School feeding	Meals (fortified with micronutrients) provided at school	41 (targeted to 20% of population in most food-insecure or poor areas)	8.20 per child aged 6–12 years	340	2400
Health education (oral health, reproductive health, and ITN use)	ITN education delivered only in endemic areas	0.50 per educational message (ITN message delivered only in endemic areas; assumed 50% of children in LLMICs)	0.75 per child aged 6–12 years	31	110
Vision screening	Pre-screening by teachers and vision tests and provision of ready-made glasses on-site by eye specialists	3.60 per child to screen and provide glasses to the fraction of the age group needing glasses	0.60 per child aged 6–12 years	25	90
Deworming	Medication for soil-transmitted helminths or schistosomiasis delivered by teachers once a year in endemic areas	0.70 per child in endemic areas; 50% of areas endemic	0.35 per child aged 6–12 years	14	52
Tetanus toxoid booster	Single-dose booster administered to all children in one grade by nurse or similar	2.40 per child	0.40 per child aged 6–12 years	16	59
HPV vaccine	Part of the cancer essential package	10 per fully vaccinated girl (Gavi-eligible countries)	0.83 per child aged 6–12 years	43	74
Aggregate costs without HPV vaccine	..	48	10	430	2700
Aggregate costs without school feeding and HPV vaccine	..	17	2	130	390
<b>Adolescents</b>					
Media messages or national policy regarding health	Messages concerning use of tobacco, alcohol, and illicit drugs; sexual and reproductive health; mental health; healthy eating or physical activity	1 per adolescent	1 per adolescent aged 10–19 years	..	..
Health education in schools	Education for targeted age group	9 per year per adolescent aged 14–16 years	3 per adolescent aged 10–19 years	90	450
Adolescent-friendly health services	Health services offering respectful and confidential access for adolescents	5 per adolescent	5 per adolescent aged 10–19 years	790	2300
Aggregate costs	..	15 per adolescent aged 10–19 years	9 per adolescent aged 10–19 years	880	2700

LLMICs=low-income and lower-middle-income countries. ITN=insecticide-treated net. HPV=human papillomavirus. The total cost of the school-age package is about US\$10 per child in the age group of 5–14 years and about \$9 per adolescent in the age group of 10–19 years. Compared with per capita public expenditures on health in 2013 of around US\$31, this cost does not seem unreasonable, but it is high for low-income countries, which spent only \$14 per capita on health in 2013. Data are from Fernandes and Aurino 2017<sup>24</sup> and Horton and others 2017.<sup>25</sup>

Source: Bundy and others 2017a

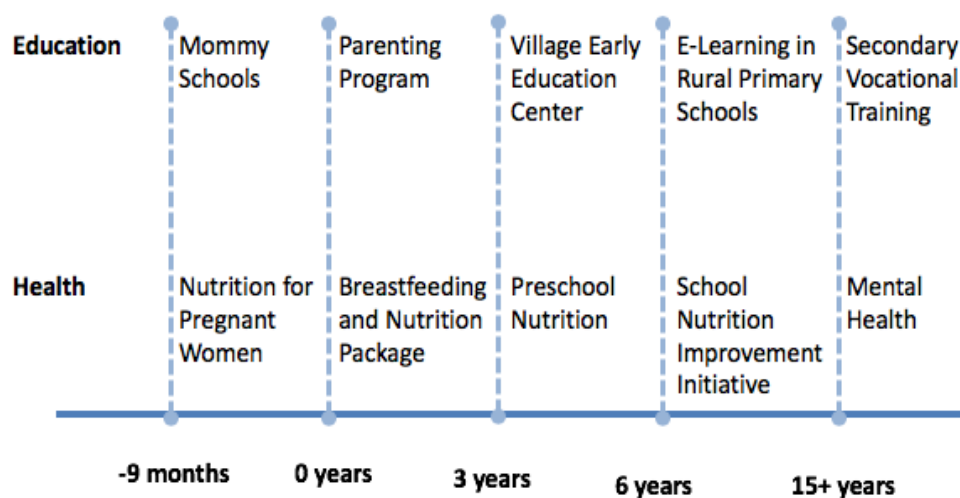
## ANNEX III: CASE STUDIES

### Case Study: Investment Across the First 8000 Days; An Example of Investing in Preschool Education in China

China offers an important case study to complement our understanding of human capital and economic development given its population size, recent urban migration, and widening education gap. In addition, China has implemented holistic social programs from birth-to-job, offering insight into the potential to improve human capital through the delivery of developmentally appropriate, evidence-based interventions.

The China Development Research Foundation (CDRF), a national public foundation devoted to advancing China's social and economic development and poverty alleviation, has been leading research and evaluating large-scale pilots to effectively impact national poverty alleviation. CDRF has implemented a total of 9 large-scale social programs for rural populations that extend to every developmentally-sensitive stage from conception to the completion of secondary vocational education, with a focus on nutrition and health for rural children in preparation for school entry and improved access and provision of preschool education and parenting services in remote rural villages (see figure A). The objective of these pilot programs is to provide the poorest children with the foundation necessary to reach middle-income stratum when they enter adulthood [1].

**Figure A: Programs in China Across the 8000 Days**



Long-term, country-specific data from China reveals that total human capital increased more than three times between 1985 and 2008 [2]. National wealth during this period were mainly driven by increases in educational attainment and by higher returns to education [2, 3].

The contribution of human capital to national wealth can be understood by analyzing trends in migration and education between rural to urban centers over this time period. The rural areas accounted for more than three times the population of urban centers in 1985, yet, in 2008, exceeded the urban

population by a narrow margin [2]. As a result, the concentration of human capital and economic growth has shifted from rural to urban centers in China [2].

China has seen widening disparities in preschool enrolment and budget between rural and urban areas. CDRF and Peking University identified that child development indicators for children ages 3-6 in Ledu County of Qinghai province scored 60% lower for cognitive development and 40% lower for language development compared to their urban counterparts [1].

To address this disparity, CDRF initiated a pilot program in 2009 entitled “One Village One Preschool” (OVOP; previously known as “Village Early Education Centers”) to identify an effective approach to scaling preschool education and school readiness for children ages 3-6 in the central and western mountain regions in areas where there are no preschools. Each school year lasts 42 weeks, with six hours of instruction five days a week led by trained volunteers. CDRF estimates the annual cost of one OVOP to be approximately RMB 30000 yuan (US\$4500) [1].

To date, CDRF, in collaboration with provincial and county governments, has set up nearly 2100 OVOPs in 19 counties across 9 provinces including Qinghai, Guizhou, and Hunan, reaching 60,000 rural children. An evaluation of the pilot shows that children that participated in OVOPs had better developmental outcomes compared with children who had no preschool experience, and their outcomes were comparable to those of children who attended county preschools. This pilot has the potential to be scaled to 700 impoverished counties [1].

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## Case Study: Home Grown School Feeding in Ghana

The Ghana School Feeding Program (GSFP), a nationally owned initiative, was launched in 2005, with goals of contributing to poverty reduction and increasing domestic food production, household incomes, and food security in deprived communities. By 2011, GSFP was reaching over 1.6 million primary school children across Ghana, funded by the Government of Ghana, and with a budget of over US\$200 million [1]. In 2012, a gap was identified between food production and caterers, who were responsible for procuring and preparing the food as well as for identifying mechanisms for linking farmers directly to the school feeding program [2].

In response, a two-year Home-Grown School Feeding (HGSF) pilot program was launched to explore the potential for development of an integrated package of community-level activities that aimed at enhancing the impact of the GSFP on poverty, food insecurity, and health outcomes. The pilot program, which ran from 2013 to 2016, was rigorously evaluated next to the existing GSFP modality as well as control schools who were not yet part of the existing GSFP program. The randomized control trial (RCT) aimed to build the evidence base to understand the impacts of various school feeding modalities across health, nutrition, small enterprise development and agricultural domains<sup>1</sup>.

The reported impacts from the study intersect the fields of education, health and agriculture, having cross-sectoral benefits to each. Positive impacts include an increase in enrolment increased by 2% (and as much as 12% for kindergarten), a decrease in school absenteeism of 6.9%, a gender specific response to participation in schools, whereby girls reportedly were spending an additional 30 minutes a day on school related activities, compared to an additional 20 minutes a day for boys. This gender difference in response extends to improved learning outcomes in schools where micronutrient fortification was provided, with gains related to literacy (14%), mathematics (13%), and reasoning ability (8%) being greatest for females.

Individual dietary diversity improved among school feeding communities, particularly amongst those aged 5-10 years. Children receiving school feeding were more likely to report consuming nutritious foods like green leafy vegetables and other types of vegetables, roots, meats and fish. Farmers from HGSF communities reported an increase of 5% in household agricultural income, those that also owned a business had a 10% increase in income. HGSF communities reported an increase in produce sales, and a 33% increase in the value of agricultural products sold.

These findings highlight the range of outcomes that can be supported through a HGSF implementation model, with clear benefits to multiple beneficiaries that spanned across multiple sectors. School feeding resulted in more children in schools, contributed to learning through enhanced participation, and may have impact on long-term health outcomes through improved nutrition and eating habits. The program influenced gender equity, having greater impacts on girls. The HGSF model also supported local agricultural production and economic productivity through supporting local markets and increasing reported income.

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<sup>1</sup> The case study provided here presents unpublished results from an impact evaluation undertaken between 2013-2016 in a collaboration between the Government of Ghana, University of Ghana, the Partnership for Child Development (PCD), and International Food Policy Research Institute (IFPRI), and with financial support from Dubai Cares, Bill & Melinda Gates Foundation and the World Bank. Further details on study design is provided by Gelli et al. (2016) [3].

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## Case Study: Long Term Impacts of Deworming in Kenya

Some of the most convincing evidence of a health intervention contributing to human capital development stems from a randomized school-based deworming program in Busia, Kenya. The program had long-term follow up over the following 15 years and identifies the long-term gains in development and productivity associated with deworming [1].

Busia is a poor and rural region in western Kenya, adjacent to Lake Victoria, with particularly high rates of helminthic infection, including schistosomiasis. In 1998, Primary School Deworming Project (PSDP) was launched, providing periodic deworming across 75 primary schools. The 75 schools were randomly divided into 3 groups of 25 schools each with deworming phased into each group over a three- year period, such that the first group of schools received 3 more years of deworming than those in the third group of schools. A representative sample of 7,500 individuals from these schools were also recruited into the Kenya Life Panel Survey (KLPS), which has allowed for long-term follow up. KLPS tracked individuals at periodic stages, including migrants who moved beyond Busia to other areas of Kenya and the wider East African region. Such data allows insight into impacts of the deworming campaign through and beyond adolescence.

At the 15-year mark, most respondents were between 23 to 30 years old, and well established into adulthood and the workforce. The KLPS 10-year and 15-year surveys had a remarkable response rate of 83% and 85% respectively, accredited in part to the saturation of mobile phone use. Data arising from the cohort has been subject to multiple analyses and provides a comprehensive examination of both short and long-term impacts of deworming on the cohort, as well as the externalities it provided [1-5], showing substantial evidence for the short- and long-term impacts and cost-effectiveness of deworming.

In those schools receiving additional deworming large reductions in worm infections were found, not only among treated individuals, but also untreated individuals attending the treated schools, as well as individuals attending nearby schools and infant children not included in the deworming program, presumably due to reductions in transmission to the wider community. These 'externality' effects of deworming treatment extended to increased school participation and a reduction in school absenteeism. The authors estimated an increase in school participation of 9.3 percentage points in treatment schools, with an associated decrease in school absenteeism of 25% [1, 2]. Deworming was associated with increased enrolment for both boys and girls, and for girls, overall schooling increased by 0.35 years [4].

While test scores in this study did not show any improvements, follow-on studies indicate that such analysis may require a longer-term view. Baird and others (2016) found that among girls, deworming increased the rate of passing the national secondary school entrance exam by almost 25%, and more of these girls attended secondary school. Furthermore, in a study looking at externalities, children who were too young to receive treatment during the program benefited from the externalities provided, and showed cognitive gains in later tests [3].

In terms of employment and earnings, 10 and 15 year follow-up surveys indicated that those in the deworming group had better were earning higher wages and working longer hours than the group who received less years of deworming [4]. With women being more likely to grow cash crops and be involved in entrepreneurial activities, while men were working longer hours (3.49 hours a week) in higher-wage manufacturing jobs [4]. These economic effects have continued to improve between survey rounds, with 15-year follow-up continuing to show better measures of agricultural productivity and earnings [5]. At this time point, earnings were 15.4% higher amongst beneficiaries than the control group, driven by both higher wages as well as more individuals in employment, leading to higher reported consumption expenditures (In Kenya, the main source of tax revenue is via consumption), with an estimated overall internal rate of return of 32% over 10 years, increasing to 42.5% 15 years after the deworming program [5]. These figures indicate that subsidized deworming generates substantially more

in government revenue than it costs. Indeed, the authors conclude that deworming in this population is likely to generate more in future tax revenue than it cost: the increase in individual wages indicates that just 10 years of increased earnings, and ignoring all future earnings and productivity of these individuals, is still enough to justify the government investment in the intervention [5].

This follow-up, randomized school health study investigating the short-term and long-term impacts of a school-based intervention indicates significant returns to both health and education. Moreover, the returns on investment in terms of long-term economic growth and productivity provides an economic, and ethical argument to include deworming as a subsidized intervention for impacts on human capital.

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BOLD THINKERS DRIVING  
REAL-WORLD IMPACT