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# The Economic Benefits of Investing in Child Health

Paolo C. Belli and Olivier Appaix

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HEALTH, NUTRITION, AND POPULATION
THE WORLD BANK

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# Health, Nutrition, and Population Discussion Paper

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# Health, Nutrition, and Population Discussion Paper

# The Economic Benefits of Investing in Child Health

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**Paper prepared for the Expert Meeting on Assessing the Economic Benefits of Investing in Youth in Developing Countries, October 15, 2002, Washington, D.C., organized by the Committee on Population of the National Academies and the World Bank.**

**Abstract:** This paper presents a survey of the theory and the evidence on the economic impact of investing in child health. It shows that investing in the health of children is justified not only because it fulfills a basic human right, but also because it is an investment with high social and private returns. A central theme of this paper is that the relationship that links child health with economically relevant dimensions is circular—poverty contributes to disease, and poor health contributes to perpetuating poverty. The available evidence shows that almost 11 million children die every year from largely preventable diseases, and it unveils what the principal determinants of child illness are. The vast majority of children who die belong to the more disadvantaged socioeconomic groups within each country. Furthermore, the literature identifies several interventions and programs that could significantly contribute to improved child health, particularly in the areas of nutrition, communicable disease prevention and control, and education. We intuitively understand that there is a huge potential for largely positive social and economic returns on child health investments. Yet quantitative estimation of these benefits is still at an early stage. First, the association between health interventions and their social and economic consequences is multidimensional and complex. Second, the return on investment is measurable only over the long term. Third, the return is not automatic, and its magnitude is highly context-specific. For these reasons, few studies, mostly in the area of nutrition or of immunization services, have attempted to develop a full cost-benefit analysis, or to provide a quantitative measure of the benefits attainable by investing in child health. Instead, most empirical studies have focused on one of the several potential intermediate benefits of investing in child health, such as improved cognitive ability, increased school participation and attainment, and the induced demographic changes, which can be measured with greater precision.

**Keywords:** Child Health, Economic Impact, Health and Education, Demographic Transition



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The authors of this Discussion Paper make a valuable contribution to our understanding of the role of health, nutrition and population as determinants of economic growth and development. Beyond basic rights arguments, the investment in child health has important social returns such as future productivity of the workforce, and is one of the most effective instruments in the fight against poverty.

Although the topic has been hotly debated since Adam Smith's *Wealth of Nations*, the determinants of economic growth and prosperity are still not fully understood. Why have some regions experienced rapid economic growth and development during the past decade (Latin America and the East Asia and Pacific region), while others have stagnated or experienced negative growth, leaving a large part of their population in poverty (Sub-Sahara Africa, South Asia, and Central Asian Republics)? What role do globalization and international aid play in all of this?

Overall, the number of people throughout the world living in absolute poverty (defined as having an income of less than US$1 a day) has fallen by an estimated of 200 million since 1980. This situation may deteriorate during the next 12 to 18 months due to the sluggish global economic outlook. According to recent forecasts, global GDP is expected to rise by only 2.5 percent annually. High-income countries are expected to grow at about 2.1 percent in 2003, while developing ones will grow at 3.9 percent.

Factors contributing to economic growth and prosperity include policies and institutions that foster good governance, private sector investment, trade liberalization, natural resource conservation, basic education, and health. Good health, nutrition and population policies are now, also, recognized as important contributors to economic growth and development. And poor policies in these areas are often associated with poor economic performance.

Good health contributes to improved growth and development in the following ways:

- Nutrition affects labor productivity and growth
- Fertility and population dynamics affect growth
- Child health and youth health affect growth

Poor health and unhealthy habits reduce economic growth and development in several ways (Hammoudi 1999):

- HIV/AIDS, malaria, and tuberculosis (TB) lower labor productivity, growth and household incomes
- Tobacco use adds an economic burden on households
- Disability in most cases contribute to earnings loss and unemployment
- Treating diseases and the needed health care systems are expensive

The paper by Belli and Appaix explores the economic benefits of investing in child health, describes the pathways from improved health towards economic growth, and summarizes the available evidences in a compelling fashion. A central theme of this Discussion Paper is that poverty contributes to diseases of children and that poor health of children perpetuates poverty when these children grow up. Thus, the notion of a vicious life cycle that underpins our understanding of the links between child health and economic development.

Almost 11 million children die every year from largely preventable diseases. The vast majority of

these children live in low-income countries, and belong to disadvantaged social groups. This creates a heavy social burden on their families and entails serious economic and social costs in terms of lost of human capital and future productive capacity. Part of the reason these costs are difficult to document is that they accrue over long periods of time and are difficult to observe directly.

Although cost-effective interventions and programs to improve child health are known and available, the coverage of those interventions is still very low in the countries most needed. As described in the June 2003 Lancet series on child mortality, the coverage is also very different across socio-economic groups, and poor children are most disadvantaged.

In addition, current investments in child health are not easy to measure. Despite repeated attempts, the Bellagio group was unable to track investments on child survival over the past decade. Few development cooperation agencies or countries track child survival funding levels—most are unable to disentangle funds for child survival from their overall investments in health. We hope this Discussion paper will stimulate further understanding from policy makers and finance ministers on the importance of investments in child health and will contribute to the improvement of children lives.

Readers are encouraged to provide feedback to the authors and the World Bank on other ways that health, nutrition and population policy contribute to overall human welfare and economic development.

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| | |
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| AIDS | Acquired Immunodeficiency Syndrome |
| ARI | Acute Respiratory Infections |
| BMI | Body Mass Index |
| CMH | Commission on Macroeconomics and Health (WHO) |
| CREN | Centre de Récupération et d'Education Nutritionnelle |
| DALY | Disability-Adjusted Life Year |
| ECD | Early Childhood Development |
| ECCD | Early Child Care and Development |
| EPI | Expanded Program on Immunization |
| GDP | Gross Domestic Product |
| GNP | Gross National Product |
| HIV | Human Immunodeficiency Virus |
| ICD | Integrated Child Development |
| IMCI | Integrated Management of Childhood Illness |
| IMPB | Integrated Management of Pregnancy and Birth |
| IQ | Intelligence Quotient |
| NPV | Net Present Value |
| PFP | Population and Family Planning |
| SES | Socioeconomic Status |
| TB | Tuberculosis |
| UNICEF | United Nations Children's Fund |
| WHO | World Health Organization |

# Introduction

Childhood is a critical moment in the development of human beings and consequently of societies. Safeguarding the best conditions for such development is, in the longer term, the basis for a more productive and socially integrated adult individual.

This paper argues that investing in child health, besides the moral premises that justify it, is a sound economic decision for governments to take. The link between economic growth and health expenditure is often underestimated, and this leads governments to grossly underestimate the potential economic benefits of investments in child health.

Existing economic evaluation studies for the most part have relied upon cost-effectiveness and cost/benefit analysis, and have showed that child health interventions can produce a significant impact and an important economic return. The paper will follow the approach and present the principal results of the existing literature.

However, in our view, the "economic argument" should not be the exclusive, or even the main, reason for public investment in child health. Child health is first of all a positive social right, affirmed in international conventions.[1] As such, governments ought to guarantee that all enjoy it equally, regardless of the associated economic benefits or costs.

Furthermore, the fact that an investment is cost-effective or that it is characterized by an extremely high benefit/cost ratio, as child health interventions currently undertaken probably are, does not by itself justify public involvement in its funding and/or provision. Cost-effectiveness or cost-benefit measures are useful criteria to compare alternative interventions once it has been decided that the government should provide/subsidize them because their benefits are worth social protection, because they correct market failures, because they are pro-poor, or, as argued above, because they fulfill a human right. Cost-effectiveness criteria should not be used to compare different kinds of services of different nature or to decide which ones the government ought to provide/subsidize in the first place.[2]

A convincing economic argument should show that child health investments have benefits beyond those that private individuals would spontaneously seize or should prove that child health interventions produce a strong equalizing or pro-poor impact, rather than merely demonstrate that the benefit/cost ratio is high. Indeed, several arguments can be used to show that the social benefits of health investments in children exceed their private benefits.

First, the benefits of child health investments, unlike the associated costs, only accrue to households in the long term, and so they tend to be misperceived or underestimated by adults, particularly in situations of high fertility and extreme poverty.[3] This is not surprising, as immediate survival concerns hamper individuals' ability to

1. For instance, the Convention on the Rights of the Child, ratified by every country under the auspices of UNICEF in 1989 except for the United States and Somalia, recognizes health among the fundamental rights of all children (Art. 24). The United States did not ratify this convention because it states that no one should bear arms until the 18th birthday, whereas U.S. law authorizes arm bearing and military draft from 17 years of age. On the practical implications of considering child health as a positive right, see Belli (2002).
2. As Jack (2000) argued, cost-effectiveness picks up the cheaper interventions (those with the lower average cost), among those that the government decides to subsidize/provide, because they provide a benefit worth of social protection (see Hammer and Berman 1995, Hammer 1997, and Musgrove 1999).
3. Households can take decisions in their best interest when such decisions are repeated and their consequences are immediately perceived. This includes most consumption decisions. On the other hand, households are not as effective in taking one-time-only decisions or when benefits accrue only slowly over time. Decisions to save for retirement or to invest in child health belong to the latter category (see Atkinson and Stiglitz 1980, and Sadmo 1983).

envision long-term consequences of day-to-day actions. In some cases, households simply ignore the potential negative effects of their behavior on their children. Consider, for example, the importance of hygienic and environmental factors in explaining child morbidity and mortality. The World Health Organization (WHO) (2002) estimates that 3 million of all deaths among children under five years of age are related to poor environmental conditions. Children under five pay a high price, accounting for 40 percent of the total burden of disease associated with environmental hazards when they only account for about 10 percent of the world population. There clearly is an important role for public information and health promotion (which are largely "public goods" in economic terms, and as such can only be funded publicly).

Second, there are significant positive externalities linked to several child health investments, such as immunization and vaccination services. Third, public investments in child health can contribute to guarantee a more equal endowment of human capital across socioeconomic groups early in life. The literature shows that the poor disproportionately suffer from disease and premature mortality (Gwatkin et al. 2000) because of unfavorable determinants of health (see section II). Such disparities largely originate in early childhood, and they permanently impair individuals' economic potential, perpetuating poverty (Subramanian, Belli, and Kawachi 2002). Thus, in Sen's terminology, strengthening health during childhood can contribute to an essential "functioning,"[4] one of the material preconditions necessary for each of us to flourish as individuals[5] (Sen 1973, 1985, 1992).

The relationship between health and the economy (and development in general) is complex—another important reason for not mechanically utilizing estimates of economic return to justify investments in child health. Disentangling that complexity and establishing clear links of causation is a difficult task. More recent contributions have questioned the traditional approaches to measuring economic benefits, and have proposed more articulated and more rigorous methodologies (see section V).

The paper is divided into five sections. The first section briefly reviews current knowledge about the relationship between health and development at the macro level. The second section places child health in the health-development relationship; it briefly describes the underlying and proximate determinants of child morbidity and mortality, and then introduces the principal consequences of child illness in terms of impaired human development. The third section reviews existing evidence on the interventions available to improve child health and their cost-effectiveness. (These first three sections constitute an introduction to the last two sections, which are the core of our paper; a more detailed analysis of the literature surveyed in these first sections is left to annexes 2 and 3.) The fourth section presents our conceptual and empirical understanding of the economic benefits of investing in child health, outlining dimensions often neglected when public investment decisions are taken. In the fifth and final section we critically discuss the findings of the literature, pointing at the difficulties in the existing economic evaluation studies. We also attempt to outline some possible paths to improve our ability to evaluate the economic consequences of improved child health outcomes.

4. Sen (1985) argues that a person's well-being is characterized not only by the state (functioning) in which a person lives or is living, but also by the existence of a range of alternative states from which the person can choose (capability). In empirical studies, it turns out that it is in fact extremely difficult to distinguish between capabilities and achieved functionings.

5. Note, however, that this argument is not so much in favor of investing more in child health per se, but rather in poor children.

# I. The Relationship between Health and Economic Development

It has long been suspected that health plays a major role in the well-being of peoples and countries. The Great Plague of 1347–53 in Europe, which killed about 60 percent of the population in the countries affected (Le Roy Ladurie 1978), abruptly interrupted the Renaissance process started during the 13th century. It took over a century for affected countries to return to pre-epidemic demographic levels and to restore their economies. Nineteenth century British prime minister Benjamin Disraeli noted that "The health of the people is really the foundation upon which all their happiness and all their powers as a state depend" (Evans et al. 2001).

More recently, a large number of studies have attempted to document the complex but certain linkage between health and economic development. Studies documenting the relationship between aggregate data on health and economic outcomes were first included in the World Bank's 1980 *World Development Report*. Since then, an extensive body of literature in macro-economics and economic history has concluded that "the relationship between health improvement variables and economic growth is sufficiently significant in the long term to justify sustained national commitment to investing in health" (WHO 1999a, p. 9).

The macroeconomic literature, mainly focused on adult health, suggests that the two principal channels through which health improvements cause a positive economic impact are (1) increased labor productivity and work participation and (2) increased savings and investments in human and physical capital.[6] These effects are reinforced by the demographic changes resulting from reduced child mortality (the "demographic transition").

Several macroeconomic studies have indicated that lower levels of mortality and higher levels of life expectancy have a statistically significant effect on income levels and growth rates (Barro and Lee 1994; Bloom and Sachs 1998; Bloom and Williamson 1998; Jamison, Lau, and Wang 1998; and Radelet, Sachs, and Lee 1997). Jamison, Lau, and Wang (1998), analyzing data from 53 countries between 1965 to 1990, estimated the impact on income of a number of health-related variables, and concluded that around 8 percent of total growth in per capita income during that time was due to improvements in adult survival rates. An analysis of recent data from Madagascar confirms the strong link between life expectancy and growth (Dumont 1999).

Bloom and Williamson (1998) conclude that one-third to one-half of the growth experienced from 1965 to 1990 in East Asia can be attributed to reduced child mortality and the consequent reduction in fertility (the demographic transition; see section IV). Bloom and Sachs (1998) estimate that, between 1965 and 1990, morbidity/mortality rates associated with their impact upon demographic trends contributed to about half of the unfavorable gap in economic growth rate between Africa and the rest of the world.

Mayer (2001) conducted similar evaluations for 18 Latin American countries, comparing economic growth data with survival probability for various age groups over 30 years. He estimated that between 0.8 and 1.5 point of annual growth—or approximately 40 percent of the total growth for these countries

6. These channels are distinct from those significant for child health, because during the productive years improved health status immediately translates into improved labor market performance (see section IV).

over the 1950–85 period—could be explained by improvements in survival.

Fogel (1994, 1997) used a methodology comparable to that used by the existing macroeconomic literature to study the relationship between health, nutrition, and economic growth in 19th and 20th century France and Great Britain.[7] He pointed out the importance of health and nutrition variables in explaining economic growth, estimating that 30 percent of the per capita growth rate in Great Britain between 1780 and 1979 could be explained by health and nutritional improvements. He hypothesized that improved nutrition progressively lead to greater weight for height ratios (Body Mass Index—BMI), enhanced capacity to work, and therefore to increased growth potential.

More recently, the WHO's Commission on Macroeconomics and Health (CMH) revisited the health-economic growth relationship. According to the CMH report (WHO 2001a), during the 1990–98 period, countries with high human development according to the United Nations Development Programme's Human Development Index achieved robust and stable economic growth, averaging 2.3 percent per year, with 35 of the 36 countries enjoying rising living standards. The average growth rate for the same period for the middle human development countries was 1.9 percent, with 7 out of 34 countries experiencing declines in living standards. The poorest human development countries, meanwhile, experienced a growth rate close to zero.

All the above macroeconomic studies suffer from a number of shortcomings (see section V), and they may lead to the erroneous conclusion that there is a mechanical cause-and-effect link between improved health status and economic growth at the aggregate, as well as at the individual, level.[8]

In reality, the strength of this link depends on a number of other variables. As Prah Ruger et al. (2001) correctly underlined in discussing the economic impact of the demographic dividend in East Asia, improved health outcomes contributed to economic growth only because they occurred within favorable general economic conditions supported by adequate economic policies. Nonetheless, one major conclusion from the literature remains true: countries with the weakest health conditions have a much harder time achieving sustained growth than do countries with better health conditions.

Finally, the macro-evidence-based literature includes a significant number of studies that have investigated the economic impact of specific health conditions such as HIV/AIDS and malaria. For example, the Gallup and Sachs (2001) study of the economic impact of malaria[9] uses a "malaria index" to measure the impact of malaria on economic growth in countries that are or have been heavily burdened by the disease.[10] The researchers point out the many

7. Essentially, to capture the independent impact of health variables, the literature uses country-level time-series and develops simple regressions—with per capita income growth on the left-hand side and macro health indicators (such as infant mortality rates and life expectancy) and other variables such as measures of market openness and macroeconomic stability on the right-hand side.

8. It is well known that aggregate analyses risk the invalid transfer of results observed at the aggregate to the individual level—the so-called "ecological fallacy" (Robinson 1950, Susser 1994). Consequently, the "contextual" determinants (the difference a place makes) and the "compositional" determinants (what is in a place) to health are often confounded (Hauser 1970). While statistical methods now exist to address this issue (Goldstein 1995), relatively few empirical investigations using improved quantitative procedures have been conducted. In general, existing studies are constrained by the quality of the available data (see section V).

9. In 2000, 84 percent of the deaths from malaria occured in children under five years of age (EIP 2000). Hence the burden of mortality for malaria, unlike for HIV/AIDS and TB, is particularly concentrated in children.

10. This index is obtained for each country by multiplying the share of the population that lives in areas with high malaria risk (according to WHO standards) by the share of the malaria cases that are P. Falciparum cases, the most dangerous of the different malaria parasites. A country is considered to be severely affected by malaria if the index is greater or equal to 0.5.

negative aspects of the disease on the well-being and economic opportunities of a country, showing that in the period 1965–90 malaria-affected countries grew 1.3 percent less annually than countries not affected by malaria. Over (1992), looking at the impact of HIV/AIDS on economic growth, showed that, at the beginning of the 1990s, HIV/AIDS was reducing growth rates by half a point annually in the countries worst affected by the epidemic. Studies of the economic impact of tuberculosis (TB) have shown similar results. In Peru, the Ministerio de Salud (2001) estimated that the total economic impact of TB is $95 million annually, or 0.2 percent of current gross domestic product (GDP).[11] In India, the economic burden of TB was evaluated at $3 billion according to a 1999 WHO review of the national TB control program. Health care costs related to the disease treatment were estimated to be equal to $500 million, while indirect costs accounted for another $2.5 billion. Overall, these costs represented 0.7 percent of gross national product (GNP), and 13 percent of the total health expenditure (Appaix in press).[12]

Thus the evidence shows that successful investments in health can create a potentially huge additional economic value in the future. The rest of this paper focuses specifically on investments in child health.

11. According to different mortality scenarios (mortality estimates differ according to data sources), the economic burden of TB in Peru is estimated to equal $95 (note that all dollar values used in this paper are U.S. dollars). This cost is composed of $19.5 million incurred by the health care system (direct costs, of which $4 million refer to expenditure paid for by the National TB Control Program), $24 million paid for by families (because of hospitalization and ambulatory care), and $50 million due to mortality (indirect costs to society). TB treatment costs represent 14 percent of public expenditure on health care, and 4 percent of the total (public plus private) national health care expenditure. Of the total impact ($95 million), $71 million (75 percent) is directly due to the disease, while $24 million (25 percent) is due to the fight against the disease.

12. Calculation made by Appaix from the Indian cost data and GNP and health expenditure estimates from World Bank (2000).

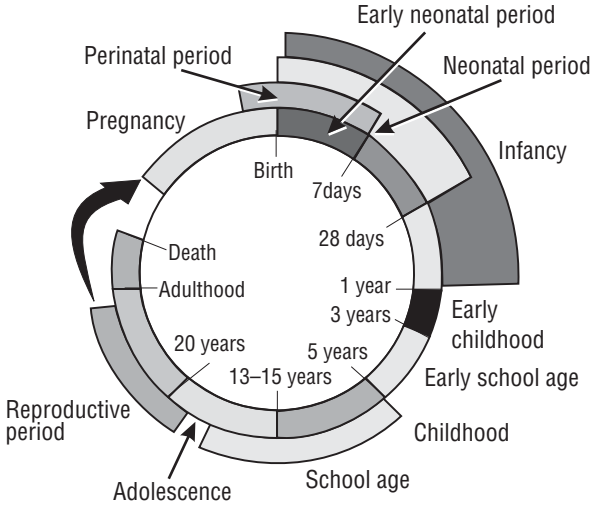
# II. Children's Health in the Development Cycle

For the purpose of this study, we propose the following definition of "child health": the physical, mental, and social well-being and sound development of the human being from conception to the time of sexual maturity. This also means that, in the context of this study, all that affects this development and can impair the harmonious and prosperous future of the child is of interest and a cause of concern.

This definition focuses not just on physical health, but takes into account a broader concept of "child development" (Claeson et al. 2000). Health is not an autonomous status that has no connections with the child's environment and socioeconomic context. In analyzing child health, we need to identify which factors affect or determine health, how health problems can be addressed, and the effects of health interventions over time. The notion of "development" permits consideration of psychological, cognitive, and social well-being components of health and health outcomes that are not necessarily translated into health statistics but are crucial dimensions of a healthy start in life.

However, we know that, even before the child is born, prenatal care for the mother and the future infant creates an important impact on the latter's health. Considering prenatal and perinatal health allows us to consider the mother's health as a determinant of child health.[13] This link between the child's and the mother's health has been well articulated by the life-cycle approach (see Claeson and Waldman 2000),[14] a conceptual framework that attempts to represent the various major steps and periods in the development of the human being (figure 1). The life-cycle approach reflects the fact that a significant share of deaths among children occur during the very critical early stages of life, with distinct determinants. Particularly, it identifies the "neonatal" period within "infancy," as a specific subcategory when factors linked to pregnancy are still dominant in explaining most morbidity and mortality; after a month or so of life, external factors are the predominant causes.

**Figure 1. The Life-Cycle Approach to Defining Health**




*Source:* Adapted from World Bank (2001a).

13. Life in uterus has been traditionally accounted for by some cultures. For example, Koreans acknowledge the uterine life in their way of counting years: the newborn is already one year old on his/her day of birth. Acknowledging the toll that infant mortality naturally takes on children, Koreans mark with two celebrations the first steps of the child in life: at 100 days (*bek'il*) and at one full year of life. The next birthday is celebrated at age…60!

14. We have slightly adapted the life-cycle approach by introducing "early childhood" and "early schooling" into the model to acknowledge the fact that most of the under-five mortality and morbidity actually take place in the first three years of life, and to better reflect the various situations concerning early schooling around the world.

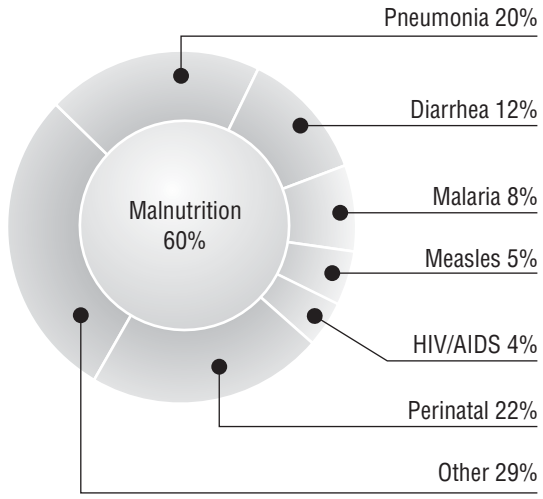
Using the life-cycle approach, we can define as "child" the human being from conception to the time of puberty, which includes the first years of schooling but excludes adolescence; by this definition, childhood is definitely terminated before the 15th birthday.[15] In accordance with this definition, we include in our review school-based health interventions, such as de-worming or nutritional programs, but do not include reproductive health issues related to puberty, adolescence, and sexual maturity.[16]

## Estimating the Burden of Disease for Children

The evidence shows some startling facts. First, children suffer from a handful of preventable or curable diseases. As Gelband and Stansfield (2001) remind us, in 1999, such preventable and curable diseases accounted for approximately 70 percent of the estimated 10.9 million annual deaths among children under age five in the world. The more widespread causes of deaths among children include acute respiratory infections (ARI), diarrhea, and vaccine-preventable communicable diseases such as measles.[17] Pneumonia alone accounts for approximately 20 percent of all under-five deaths (ARI as a group accounts for about 22 percent of the total), followed by diarrhea (12 percent), malaria (8 percent), measles (5 percent), and HIV/AIDS (4 percent) (WHO 2001b). Malnutrition is associated with the majority of these preventable deaths (Pelletier et al. 1995; Caulfield and Black 2002). Finally, deaths due to birth-related problems (prematurity, asphyxia, neonatal sepsis and meningitis, trauma, and tetanus) account for approximately 22 percent of all deaths among children under age five (WHO 2001b). This latter group of causes is where least progress in reducing child mortality has occurred (WHO 2002a). Figure 2 summarizes the main causes of under-five mortality in low- and middle-income countries.

Second, the bulk of mortality and morbidity affects children living in the developing world: 98 percent of the deaths between birth and 15 years occur in low- and middle-income countries (Murray and Lopez 1996),[18] particularly in sub-Saharan Africa and South Asia.

**Figure 2. Major Causes of Mortality among Children under Five in All Developing Countries**




*Source:* WHO (2001b).

15. The issue arises as to when to draw the line between child and adult health. International institutions interested in child health or development use different age limits in different studies according to the focus of their analysis. UNICEF covers human beings up to their 18th birthday as specified, for example, in the Convention on the Rights of the Child (1989). On the other hand, child health statistics usually concentrate on infants (up to one year of extra-uterine life) and on "children" up to the fifth birthday. For instance, one of the seven Millennium Development Goals relates to child health, and it demands that the death rates for infants and children under the age of five years be reduced in each developing country by two-thirds between 1990 and 2015. However, childhood does not stop at the fifth birthday, and the following years are equally critical to the harmonious development of the child.
16. Note also that our definition takes into account gender differences (girls tend to reach puberty a couple of years before boys).
17. Also in terms of disability-adjusted life years lost, the three main groups of disease are ARI, diarrheal diseases, and perinatal disorders (WHO 2001b).
18. The corresponding share of deaths between ages 15 and 59 occurring in developing countries is 83 percent.

Third, over 30 percent (53 percent in sub-Saharan Africa) of deaths in the developing world occur in children younger than five years (WHO 2001b), while the percentage of deaths in this age group in industrialized countries is negligible.

Fourth, the empirical evidence shows that, after registering a marked decline in the previous four decades, child mortality has been stagnant, or on the rise, since the early 1990s in several countries.[19]

## Identifying the Determinants of Ill Health

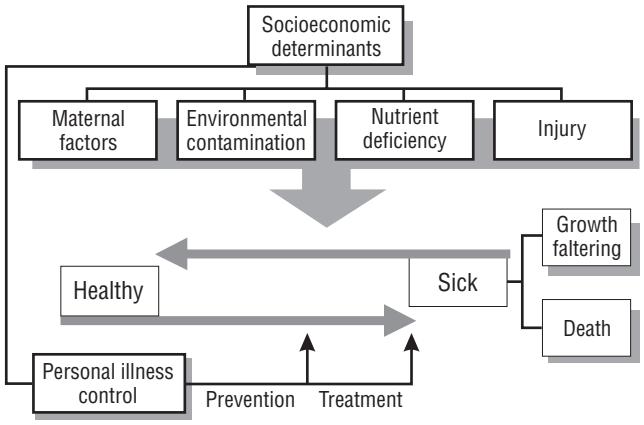
Provided here is only a brief overview of the comprehensive body of literature addressing the multidimensional causes of child illness. A more in-depth discussion of the various determinants of child health is contained in annex 2; see also Gelband and Stansfield (2001) for a more detailed account.

The evidence unequivocally shows that morbidity and mortality are concentrated on children living in poorer and marginalized conditions, and in poorer countries. The so-called "underlying, or sociodeterminants" (Mosley and Chen 1984) of child illness and premature death are, in the first instance, lack of income and other financial means, no access to health care and education services, absence of basic physical infrastructure such as sanitary facilities, and poor ecological setting. Social and cultural factors also play a role in a way that is partially independent from economic characteristics. For instance, children may be excluded from education even in relatively wealthy households and contexts, because their family is socially marginalized due to ethnicity or cast. Specific cultural norms, such as those regulating marriage and gender relationships, or beliefs about disease causation, may also have an impact on health outcomes. For example, the disadvantaged social position of the female child[20] and of the mother exert a negative influence on child health.

In turn, these socioeconomic or underlying determinants contribute to create a more proximate layer of determinants to health. These "proximate or intermediate determinants" of health include: nutrient deficiencies (both of the mother and of the child), maternal conditions such as maternal age and birth spacing, degree of environmental contamination (air, water, food, etc.), likelihood of experiencing injury, and personal illness control patterns (such as personal preventive and hygienic practices).[21] Figure 3 summarizes the original understanding of the underlying and the proximate determinants of health and their relationship by Mosley and Chen.

Almost 20 years ago, Mosley and Chen (1984, p. 27) wrote: "In an optimal setting, over 97 percent of newborn infants can be expected to survive through the first five years of life." Today, most high-income

**Figure 3. Underlying and Proximate Determinants of Health**




*Source:* Mosley and Chen (1984), p. 29.

19. The recent increase in child mortality in Africa is thought to be attributable to AIDS. However, child mortality rates have also stagnated or worsened in other countries, such as India, not yet affected by the HIV/AIDS epidemic, suggesting that other, less immediate reasons lie behind the observed negative results.

20. Desclaux (1996), among others, has shown that the social position of the child within the family is a significant determinant of his/her nutritional status.

21. All the proximate determinants of health can be grouped (WHO 2002a) into environmental and behavioral determinants.

countries are actually achieving better results than those hoped for by Mosley and Chen, with under-five mortality rates equal to or less than 1 percent. The same is not true, however, for lower-income countries, where up to 1 in 10, or, in the poorest areas within countries, up to 2 in 10, newborn infants die before reaching the age of five, mostly from preventable or curable diseases. Moreover, within each country, the infants and children who die belong disproportionately to poorer families, as tables 1 and 2 show, although disparities between poor and non-poor vary enormously across countries. Using data from the Demographic and Health Surveys, Gwatkin et al. (2000) show that, on average, a child born in a household belonging to the lowest wealth quintile is roughly twice as likely to die before reaching age five than a child born in a household from the highest quintile.

Unfavorable determinants of health not only lead to higher mortality but also result in disproportionately higher morbidity.[22] The early symptoms of impairments can be identified right from birth, with clear indicators such as premature births, birth defects, and low birthweight. Poor health status then leads to disproportionately high morbidity from communicable diseases, stunting, and low BMI (weight for height). Adverse health consequences continue in later stages of life, since children who are born with an impaired health condition are more likely to experience chronic illness throughout their life. Decouflé et al. (2001), reviewing longitudinal data for 9,142 children from Atlanta, Georgia (USA), observed that children born with major health defects have a higher probability of experiencing development problems (7.2 percent, compared with 0.9 percent for those born without such health problems).[23] In sum, the evidence shows that health status depends on all past health investments, particularly those that take place in early childhood; that poor health during childhood is likely to lead to

**Table 1. Intra-Country Disparities in Infant Mortality**

| | Total | Sub-Saharan Africa | Asia/ Near East N. Africa | Latin America/ Caribbean |
|---|---|---|---|---|
| Number of countries | 40 | 21 | 9 | 11 |
| Poor/rich ratio | | | | |
| Mean | 1.87 | 1.67 | 2.33 | 2.66 |
| Range | 1.11–4.18 | 1.11–2.46 | 1.42–3.93 | 1.26–4.18 |
| Concentration index[a] | | | | |
| Mean | (.106) | (.081) | (.125) | (.145) |
| Range | (.003)–(.251) | (.003)–(.141) | (.051)–(.195) | (.043)–(.251) |

*Note:* Infant mortality is the proportion of children born alive who die before reaching age one.

[a]The concentration index is equal to: 12 $2\int_0^1 MR_i(w_i)\,dw$, where MR is the cumulative proportion of mortality rates among children graphed against the cumulative proportion of their households' wealth (i=1,…,5). A negative (positive) value of the concentration index indicates inequality favoring the rich (poor).

*Source:* Gwatkin et al. (2000).

**Table 2. Intra-Country Disparities in Under-Five Mortality**

| | Total | Sub-Saharan Africa | Asia/ Near East N. Africa | Latin America/ Caribbean |
|---|---|---|---|---|
| Number of countries | 40 | 21 | 9 | 11 |
| Poor/rich ratio | | | | |
| Mean | 2.06 | 1.79 | 2.69 | 2.99 |
| Range | 1.27–4.67 | 1.27–2.60 | 1.69–4.60 | 1.55–4.67 |
| Concentration index[a] | | | | |
| Mean | (.124) | (.095) | (.147) | (.167) |
| Range | (.040)–(.259) | (.040)–(.164) | (.084)–(210) | (.071)–(.259) |

*Source:* Gwatkin et al. (2000).

22. The morbidity indicators more commonly used in child health research are malnutrition, low weight at birth and during growth (wasting), low height for age (stunting), and low weight for height (low BMI).

23. Initial health handicaps can become chronic and lead to lower performance at school, lower school participation, a perceived poorer health status, and higher use of health care services. According to Boyle, Decouflé, and Yargin-Allsopp (1994), children born with health handicaps in the United States are 1.5 times more likely to utilize health care visits, use an average of 3.5 times more hospital bed days, are absent twice as many days from school, and are 2.5 times more likely to repeat any school year than children born without health handicaps.

long-lasting negative health effects; and that health disparities separating children of different socioeconomic groups tend to widen over time (Case et al. 2002).

The question we turn to now is what other consequences, besides higher mortality and morbidity, can be expected from poor health during childhood.

## Secondary Consequences of Child Illness

Besides the primary consequences of illness (i.e., higher mortality and morbidity), there are also secondary effects, including reduced school participation and attainment and, later in life, reduced productivity.

### Box 1. The Link between Health and Learning Capacity in Children

The existence of a strong link between health and learning capacity is demonstrated by several studies focusing on the more widespread infectious diseases and on malnutrition affecting children in poor countries.

**Parasitic helminth infections:** There are two kinds of worm infections, those due to geo-helminthes (hookworm, roundworm, and whipworm) and schistosomiasis. Infections are most common among older children (aged 5 to 15). They induce anemia and have significant effects on cognitive function (Grigorenko et al. in press, Jukes et al. 2002) and school attendance. Nokes and Bundy (1993) found that absenteeism rose from about 15 percent in children not infected with whipworm to around 30 percent in children with the heaviest whipworm infections. Carefully controlled cross-sectional studies have found impaired cognitive function in children with the heaviest loads of schistosomiasis (Partnership for Child Development 2002, Jukes in press) and poorer school achievement in children with heavy loads of whipworm (Simeon et al. 1994) in Jamaica.

**Malaria:** Malaria is a leading cause of school absenteeism. In the Congo, malaria was found to be responsible for 36 percent of absenteeism in the high-transmission season but only 3 percent in the low-transmission season (Trape 1993). Cerebral malaria leads to cognitive impairments (Holding et al. 1999), but no convincing evidence has demonstrated chronic impairments associated with less severe forms of malaria (Holding and Snow 2001).

**Iron deficiency:** Iron deficiency is associated with poorer school performance and cognitive function in preschool and young school-age children (Grantham-McGregor and Ani 2001).

**Undernutrition:** The evidence for the impact of severe malnutrition on cognitive function is particularly convincing in infants and preschool children (Grantham-McGregor 1995; Grantham-McGregor, Walker, and Chang 2000). Early childhood malnutrition can lead to cognitive impairments that last into the school-age years. Even short-term hunger (missing breakfast) leads to impaired cognitive performance in school-age children (Simeon and Grantham-McGregor 1989).

**Iodine deficiency:** Iodine deficiency has its most profound effect during pregnancy, leading to cretinism and severe mental retardation. However, mild neonatal iodine deficiency can lead to long-term neuropsychological impairments (Lombardi et al. 1995). Iodine deficiency in school children is associated with impaired cognitive ability and poor school performance (Huda et al. 1999).

### *Poor School Attendance, Cognitive Development, and Educational Achievement*

An important secondary consequence of child illness is impaired cognitive development and schooling. Very young children have a great potential for fast improvements in their cognitive ability, but if they are exposed to adverse conditions, their future development can be critically jeopardized. Studies conducted in Ontario (Canada), France, and Great Britain (Institut Canadien de Recherches Avancées 1999) show how health during early childhood (until three years of age) impacts significantly upon the cognitive capabilities and school attainment of the child. Similar effects have been documented in studies conducted in developing countries, reviewed in box 1.

### *Impaired Socialization*

Illness or weakness may jeopardize the social participation of the child. Being unable to fully participate in social activities because of his/her health condition, the child is impaired socially, intellectually, and emotionally.

### *Long-Term Economic Consequences of Child Illness*

Health impairments and problems experienced during childhood—and their consequences—reduce individuals' potential during adolescence and adulthood, affecting their ability to be fully productive and to participate in economic and social activities. This, in turn, hinders the possibilities for the adult and his/her family to improve their economic status. In mainly agricultural settings, it also creates demographic consequences, as high mortality and morbidity rates maintain the necessity for high fertility in order to ensure a minimum number of surviving children and adults who can maintain the household's productive capacity (see section IV). Finally, a high level of child mortality and morbidity does not create a favorable context for investment in child development. The "value" of each child is maintained at a low level by uncertainty over his/her future and by the high fertility rate. Hence, a vicious underdevelopment cycle arises, as figures 4 and 5 illustrate (with figure 5 spelling out the consequences and effects in greater detail).

Where and how should one invest to break the negative cycle and to initiate a new virtuous cycle between health and development to bring about prosperity to both individuals and society? Which interventions are available, and how costly and efficacious are they likely to be?

**Figure 4. The Health Development Cycle I**

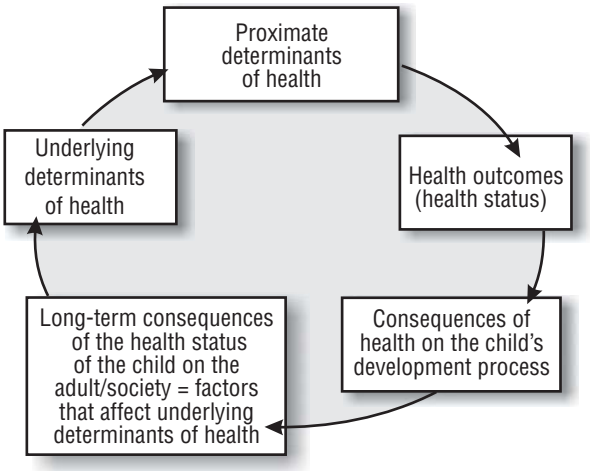
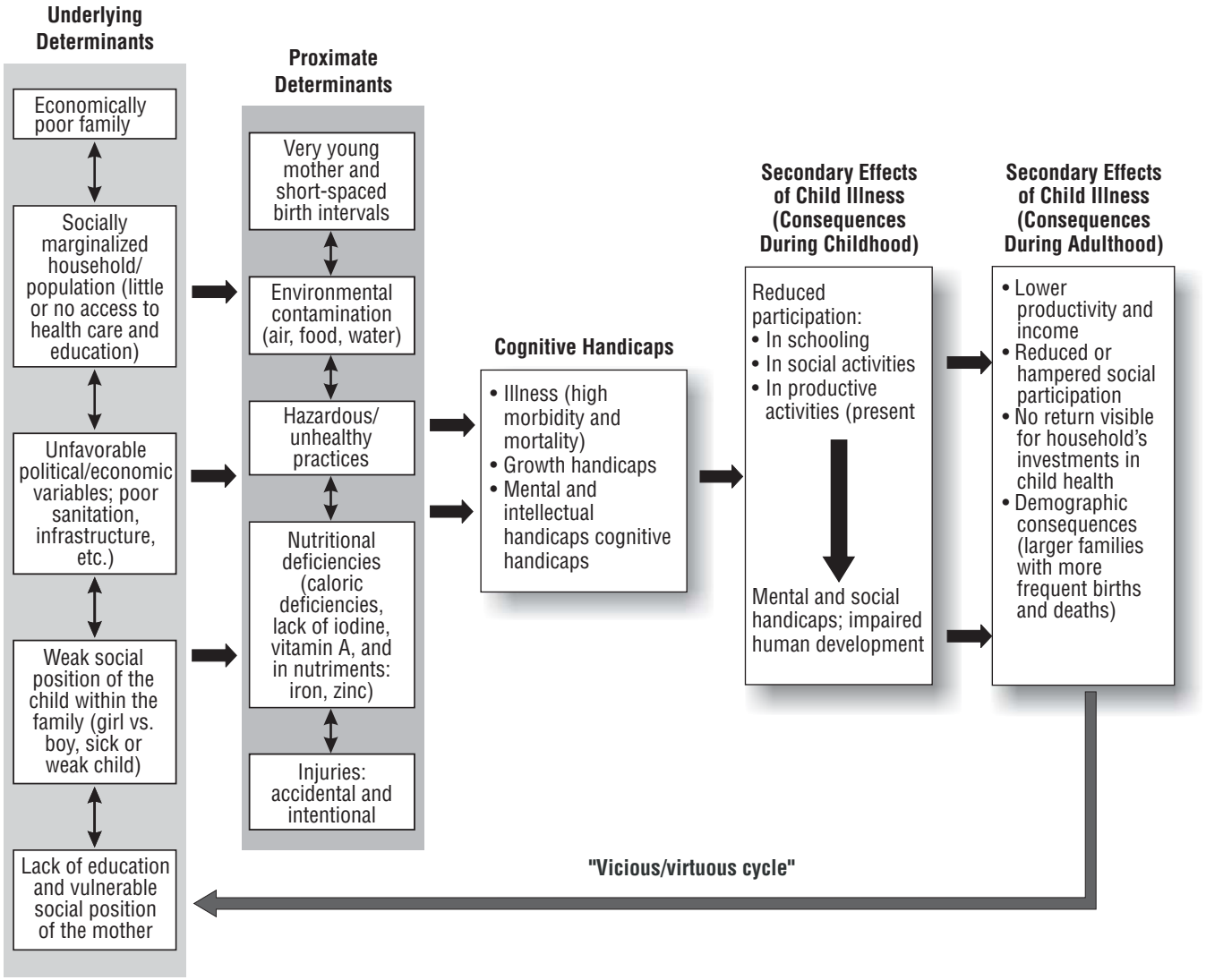


Figure 5. The Health Development Cycle II



# III. Correcting Children's Impaired Health and Development

Having identified the determinants of child health, their interaction, and their consequences, the paper now briefly reviews what can be done to correct them. We know that governments have at their disposal a vast array of prevention and treatment programs to impact child health, either directly targeting illnesses or acting upon the various determinants of health.

In recent years, integrated programs have been introduced that include joint case management of various diseases along with health education. These programs are meant to improve the quality and efficiency of health care services and to influence household behaviors (see box 2). Two such programs are the Integrated Management of Childhood Illness (IMCI)[24] and the Integrated Management of Pregnancy and Birth (IMPB). The IMCI program exploits the synergies among individual preventive, treatment, and educational interventions against child illness; the IMPB program acknowledges the role of the individual mother in her child's early development and tries to integrate mother and child health monitoring and care. IMPB interventions are often associated with family planning strategies that target the number of births and birth spacing, plus health education and medical care to mothers and children.

A sizeable body of research (for a careful review, see Gelband and Stansfield 2001) has reached largely positive conclusions concerning the potential effectiveness of many preventive and treatment interventions in reducing child morbidity and mortality. For instance, the World Bank estimated that the Expanded Program on Immunization is one of the most cost-effective child health interventions, costing $12 to $15 per disability-adjusted life year (DALY) gained in low-income countries (World Bank 1993).[25] The EPI covers all vaccine-preventable diseases affecting children, including measles, pertussis, polio, diphtheria, and tetanus. The Bank further estimated that 10 percent of all the burden of disease among children under five years of age could be averted through the diffusion of EPI (World Bank 1993, p. 76). The new integrated programs such as the IMCI and IMPB programs, although not yet fully tested, are potentially even more effective in reducing child morbidity and mortality than interventions against specific illnesses.[26]

Existing cost-effectiveness estimates should be taken with caution, because they are based on context-specific hypotheses[27] (see Filmer, Hammer, and Pritchett 1998 and section V of this paper), but the general message they convey still stands: several

24. Launched in 1996, by end 2001, IMCI was in the expansion phase in 29 countries, in the early implementation phase in 40 countries, and recently introduced in another 22 (WHO 2001b).

25. These costs are in 1990 U.S. dollars. Converted to 2002 values, these would become approximately $15 to $22.

26. Some recently implemented integrated programs such as IMCI still lack cost and effectiveness data. Systematic WHO-sponsored evaluations are currently under way.

27. Sometimes cost-effectiveness estimates are based on normative costs or best practice protocols rarely matched by real-world situations, particularly in poorer countries. Filmer and Pritchett (1997) showed that if one considered the evidence from developing countries on actual public sector cost-effectiveness, one would reach estimates of cost-effectiveness several orders of magnitude higher (worse), than those estimated by theoretical computations. A host of factors, mostly context-specific, contributed to determine how effectively health interventions and programs, all cost-effective in ideal settings, reached their objectives.

**Box 2. Main Interventions and Programs to Reduce Infant and Child Mortality and Morbidity**

- **Targeting underlying and proximate determinants or causes of ill health**
  - Environmental/sanitary measures (access to water—both in quantity and quality, refuse collection)
  - Domestic/household measures (refuse management, basic hygiene, ventilation)
  - Education (mainly for the mother, but some studies argue that paternal education is as important)
  - Asset redistribution and interventions aimed at enhancing asset productivity (for example, microcredit programs to improve agriculture)
  - Nutritional complements (mothers)
  - Family planning
- **Directly targeting illness and other health impairments**
- **Prevention**
  - Immunization (EPI)
  - Breastfeeding
  - Complementary feeding (calories)
  - Nutritional complements (essentially iron, vitamin A, zinc)
  - Prenatal care
  - Assisted birth
  - Social programs (impacting the management of child growth and the diffusion of health information to children and families)
- **Treatment**
  - Interventions on particular conditions (malaria, diarrheas, ARI, HIV/AIDS, helmynthic diseases)
  - Integrated programs (IMCI, IMPB)
  - Management of malnutrition (example of CREN in Burkina Faso)

existing interventions could potentially lead to significant reductions in child mortality and morbidity, if appropriately scaled up.

In summary, we know in principle what works. It is less clear, both conceptually and empirically, what the long-term costs and benefits would be of expanding child health interventions and programs.[28] This paper focuses on the benefits side, trying to give an account of the full economic potential of reducing children's burden of disease and mortality.

28. The WHO's CMH recently attempted to quantify the potential costs of scaling up interventions to reduce the burden of disease for HIV/AIDS, TB, and malaria. The CMH estimated that an additional 8 million lives per annum could be saved as soon as 2010, with an additional investment of $57 billion per year by year 2007, and up to $94 billion by 2015. These additional funds would practically double the total amount of current foreign assistance with investments specific for health, and it is probably unrealistic to expect that donor countries will pledge anything near this magnitude to scale up existing interventions. However, the CMH notes that, as a consequence of this investment and its return in terms of reduced burden of disease, "Economic growth would also accelerate, and thereby the saved DALYs would help to break the poverty trap that has blocked economic growth in high-mortality low-income countries." Based on a conservative estimate that each DALY saved yields an economic benefit equivalent to one year of income, the CMH calculates that the economic return of such a massive additional investment would be $186 billion per year (and may be several times that by 2015), thus largely exceeding its expected cost (WHO 2001b, p.13). No comparable estimates are available for the costs and benefits of scaling up investments specifically targeting children's health.

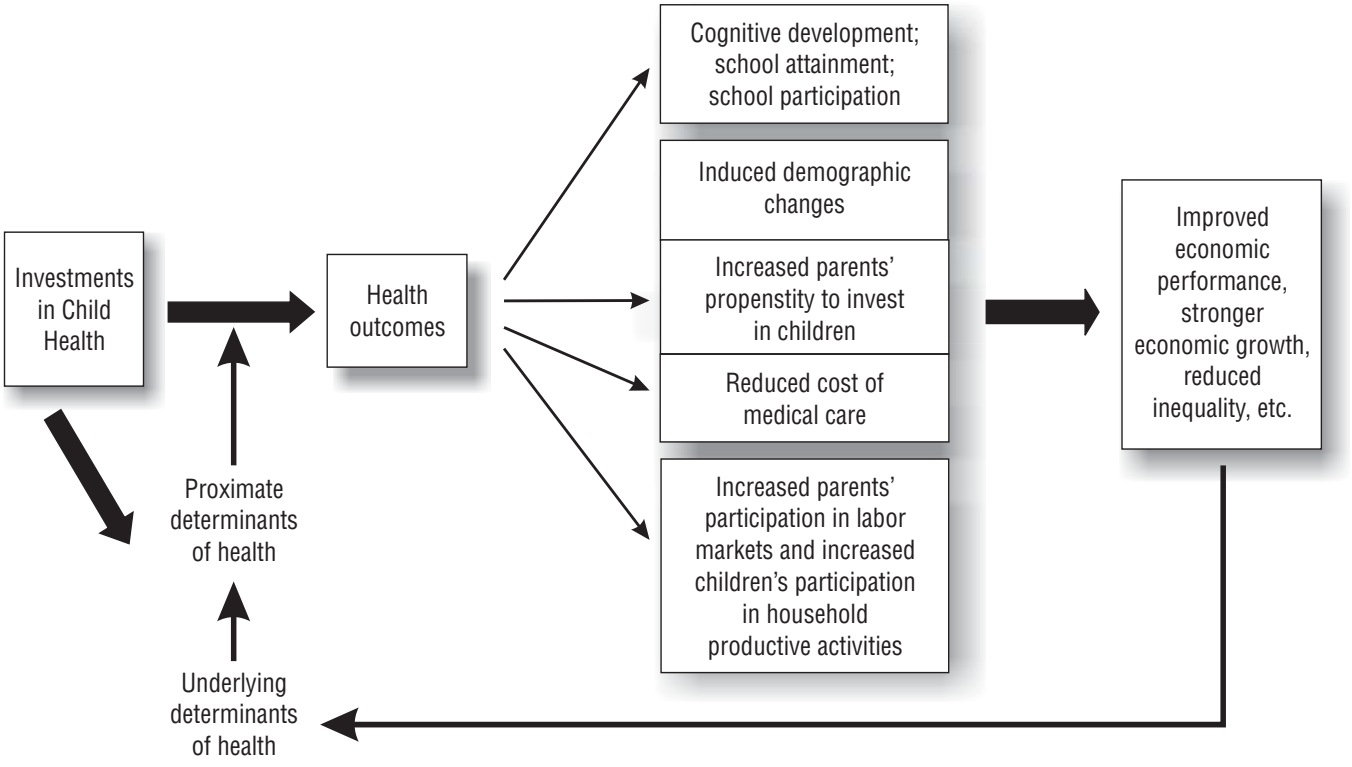
# IV. Potential Economic Benefits from Child Health Investments

Child health improvements can create an economic impact through a variety of channels:[29]

1. Improved cognitive ability.
2. Increased school participation and enhanced school attainment.
3. Benefits from the induced demographic changes (reduced fertility, wider birth intervals, slowing of population growth, demographic transition with smaller dependence ratios).
4. Reduced cost of medical care (in the short term).
5. Increased parents' participation in labor markets and increased children's participation in household productive activities.
6. Increased household propensity to save for and to invest in children.
7. Increased social cohesion.

Figure 6 shows how these channels link child health to economic performance, as well as how economic development in turn affects child health, i.e., the link is reciprocal. Investments in child health can prove beneficial for the economy in the medium-to-long term, and the positive economic effects will

**Figure 6. Channels through which Child Health Interventions Affect the Economy**




29. Not all of these channels have been examined empirically—the first four have, the last three have not.

then reinforce the improved health outcomes for adults and for children, thanks to better living conditions, better access to care, lower fertility, etc.

## The Impact of Better Health for Children: The Evidence

Over the last few years a significant body of research has attempted to measure the socioeconomic impact of child health interventions. Determining the economic effects of a program to improve the health status of children, particularly in the first five years of life, requires a multistep process, corresponding to each of the links represented by the arrows in figure 6. If the investigation is to be rigorous, one should first identify a few health outcome variables (for example, morbidity and mortality measures) and estimate the program's impact on them. The second step would be to estimate the impact of improvements in health outcomes over cognitive ability, years of schooling, grade achievement, etc. Finally, one should evaluate the impact of the latter "intermediate performance" variables, such as years of schooling, upon individual productivity, wages, and other economically relevant variables (such as labor force participation) in the future.

It is immediately clear how difficult it would be to isolate individual effects from the complex links of mutual causation, and that a rigorous analysis would require "experimental" data observed over time of a quality rarely available in reality.[30]

In the absence of longitudinal data, few studies have attempted to develop a full cost-benefit analysis of specific child health interventions. Most studies focus on one of the potential intermediate channels, mainly the impact of better health on children's cognitive abilities, school participation, and school attainment; the demographic changes induced by lower child mortality; and the savings in treatment costs attainable through preventive interventions such as immunizations.

### *Improvements in Cognitive Abilities, School Participation, and Attainment*

As discussed in section II, the combination of high mortality and high morbidity thwarts children's cognitive development and discourages human capital investment (because parents are insecure about their children's survival, and because returns from investing in education when children are frequently or chronically ill are lower than when they are healthy). This reduces skill-accumulation and thus over time stymies returns to the economy's human capital, jeopardizing growth potential.

A significant body of literature has studied the impact of various health interventions on children's cognitive ability and school participation, focusing on children in the poorest countries where infectious disease is rampant. The literature shows that medical and nutritional supplementation interventions can contribute to increased school attendance, and over time can remedy cognitive deficits, particularly if accompanied by educational interventions or psychosocial stimulation in younger children. The literature offers the following two key messages:

1. As far as the effect of disease on cognitive development is concerned, prevention is clearly better than cure;
2. Multidimensional, or integrated, programs that combine educational, nutritional, and health interventions are more efficacious than single-intervention programs.

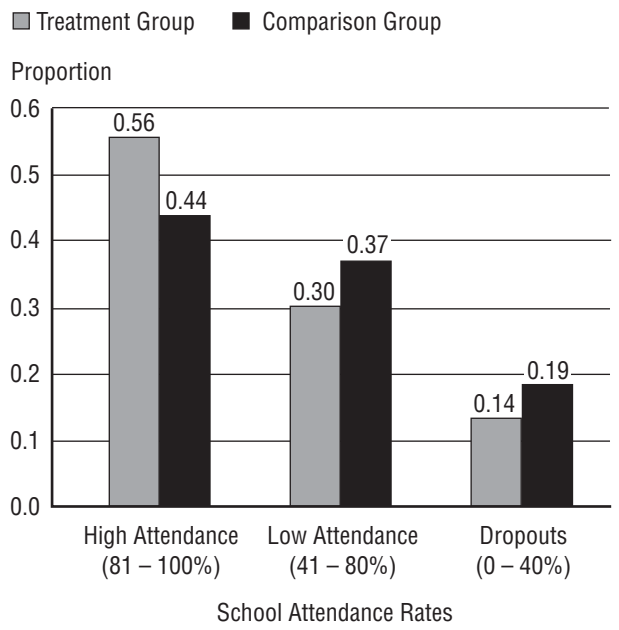
30. Two types of study design, cross-sectional (based on survey data) or longitudinal, characterize the research on the socioeconomic impact of child health interventions. In fact, longitudinal data are the only appropriate ones to determine links of causality, but data measuring the economic impact of health interventions are rarely available over a long period of time (see section V).

The link between children's anthropometric measures and their cognitive skills, school attendance, and grade achievement has been extensively studied. For example, Jamison (1986) studied 3,000 children in Gansu and Jiangsu (China); he estimated that a one standard deviation increase in the weight-for-age ratio is associated with an extra 0.3 year of schooling. Behrman and Lavy (1993), using data from Ghana on 1,224 children, showed that the effects of health on schooling and school attainment tend to "evaporate" with time, but confirmed that nutritional and health status do impact cognitive capacities at early ages. Moock and Leslie (1986) found a positive link between height-for-age and weight-for-height and the probability of school attendance. They also found a positive relationship between height-for-age and school attainment. On average, in their study sample, an increase of 10 points (from 80 to 90 percent and from 90 to 100 percent of the standard height-for-age) was associated with an increase in the probability of school attendance for that year (from 0.004 to 0.053 and from 0.053 to 0.271, respectively).

Several studies focus on the short-term impact on cognitive ability, school participation, and school attainment of interventions against specific infectious diseases or nutritional deficiencies.

**Parasitic Helminth Infections.** Simeon et al. (1995) found that spelling scores were positively affected by anti-helminthic or de-worming treatment only for children with the heaviest worm burdens, and school attendance was improved for children who were also stunted. In general, conventional tests show improved cognitive abilities as a result of treatment only in children with the heaviest worm loads. By contrast, a recent approach using an innovative method of "dynamic testing"—tests of ability to learn (Grigorenko et al. in press)—found that anti-helminthic treatment improves potential to learn in children with moderate to heavy infections as well. However, children were only able to translate this improved learning potential into actual improvement in their cognitive abilities if they were exposed to specific education programs.

**Figure 7. Impact of a De-Worming Program on School Attendance in Kenya**




*Source:* Miguel and Kremer 2001.

A recent study in Kenya by Miguel and Kremer found improved attendance in primary schools receiving anti-helminthic treatment, and also in neighboring schools that did not receive treatment, pointing to a positive externality of the de-worming program (figure 7). After treatment, infections and absenteeism both decreased by 25 percent. Miguel and Kremer estimate a cost of the program per additional year of school participation of only $3, and a benefit/cost ratio of approximately 10:1.

**Malaria.** Shiff et al. (1996) found improved school attendance in Tanzanian villages participating in an insecticide treated bednets trial. Earlier studies (Colbourne 1955) demonstrated a 50 percent reduction in school absenteeism due to sickness among children receiving malaria chemoprophylaxis in Accra, Ghana. No study has demonstrated improvements in cognitive function or school

achievement as a result of interventions designed to reduce malaria prevalence.

**Iron Deficiency.** A few studies suggest that, after as little as two or three months, iron therapy has a positive impact on cognitive function of preschool and young school-age children. In Chile, children with anemia who were successfully treated performed 10 to 400 percent better on standardized tests than children who were not (Claeson and Waldman 2000). A recent study in Tanzania by Stoltzfus et al. (2001) found benefits in language and motor development for preschool children exposed to an iron supplementation program. Soemantri, Pollitt, and Kim (1985), analyzing a study of 231 anemic children (not stunted, with no height or weight deficit, no communicable or parasitic disease, divided at random into one treatment and one control group) showed that school test results for the treatment group improved 10 percent after 12 weeks of treatment with iron supplementation. However, a study of 1,222 children by Johnston (1995), conducted in four remote villages of Guatemala, estimated that intelligence quotient (IQ) test results were more significantly linked to socioeconomic conditions than to nutritional history. The evidence linking iron therapy to school achievement and school attendance is still unclear (see Grantham-McGregor and Ani 2001 for a review).

**Iodine Deficiency.** Van Stuijvenberg et al. (1999) showed that fortified biscuits containing iodine, iron, and beta-carotene lead to improvements in cognitive function and school attendance. By contrast, trials with iodine supplementation alone failed to find any benefit on children's cognitive function (Huda, Grantham-McGregor, and Tomkins 2001).

### *Induced Demographic Changes*

Significant reductions in child mortality set in motion the so-called demographic transition. Bloom and Williamson (1998) identify three phases in this transition. In the first phase, child mortality declines while no reduction in fertility occurs. As a result, there are relatively more unproductive youth (the "youth glut"), the dependency ratio (the ratio of the inactive to the total population) increases, and economic growth tends to fall. This first phase is called the "demographic burden."

In the second phase, birth rates start declining. Since parents make decisions about the number of children to have based on the likelihood of the number of children surviving, families progressively adjust their fertility rates to the lower infant and child mortality rates. Over time, the lower birth rates, and the progressive entry into the labor force of extra workers, due to higher child survival rates in the first phase, reduce the dependency ratio: the share of population that is of working age rises, determining higher economic growth. At the same time, mothers are burdened by fewer pregnancies, and they can participate more in the labor market. In studying East Asian economic growth, Bloom and Williamson (1998) called this stimulus to growth induced by demographic changes the "demographic gift." They suggest that East Asia went through the first phase between 1945 and 1960, and through the second phase between 1960 and the late 1980s. Their estimates show that the demographic gift might have accounted for nearly 2 percentage points of East Asia's average economic growth of 6 percent per annum over the period 1965–90. South Asia and Africa, by contrast, have only recently begun to see

31. The conclusion from Bloom and Williamson's analysis was that the demographic changes induced by accelerating declines of child mortality in Africa and South Asia, where most of child mortality is concentrated, would initially hamper economic growth. However, Bloom and Williamson noted that mortality rates were already declining in South Asia and Africa, and that these regions were already in the gift stage. However, as noted in section II, the previous trend toward declines in child mortality seems to have stopped over the 1990s.

any appreciable demographic gift, and the estimated contribution for 1990–2025 to current growth trends is smaller than that experienced earlier by East Asia (around 0.75 to 1.6 percentage points per annum between 1990 and 2015).[31]

In the last stage of the demographic transition, as survivors from the first phase start aging, the share of the population that is working eventually declines. The lagged effect of the decline in birth rates in the second phase accelerates the fall, the dependency ratio rises again, and, as a consequence, economic growth is reduced. The initial demographic gift eventually evaporates.

The demographic gift theory is mainly supported by macro-, non-experimental evidence. However, new evaluation studies of the Progresa project in Mexico (Skoufias 2001; see annex 4 for a detailed discussion) are bringing fresh and more rigorous empirical support to the hypothesis that health and education interventions bear a significant demographic impact. Progresa is a program launched in August 1997, with education, nutrition, and health components. The evidence shows that investments in health and education are contributing significantly to reduce fertility and demographic growth among the more than 2.5 million poor rural families targeted by Progresa.

### *Savings in Health and Other Social Expenditures*

Children who are ill in lower-income countries are less likely than children in industrialized countries to receive any formal medical treatment. Hence, improved child health cannot translate immediately into reduced medical expenses, as is the case in higher-income countries. In fact, the opposite is most likely to be true: overall, achieving better health care for children in poor countries would entail higher health costs and higher levels of government expenditure.

There is no doubt, however, that even in poorer countries certain preventive programs are able to bring about reductions in future medical expenditures. An immunization program, for example, can save future expenditures in health care to cure ill children and non-immunized adults. Reviewing the effects of immunization against measles in the state of Guerrero (Mexico), Solis (1999) showed that the total monetary cost of achieving 100 percent immunization for children under five years of age was lower than the expected cost of confronting an epidemic comparable to that which affected the Mexican state in 1989–90.[32] Karoly et al. (1998), reviewing data on several immunization programs, reported that estimates for savings in future medical costs can range from 6 to 30 times the cost of the programs.[33]

Similarly, studies on the impact of family planning policies have shown that they constitute cost-effective investments whose benefits include lower numbers of births, fewer abortions (and fewer complications), lower maternal deaths, and savings in future health care costs. Among several studies, one by Martinez Manautou (1987), showed that, due to the Mexican population and family planning (PFP) program, between 1972 and 1985, 0.4 million abortion complications were avoided. Benefits of the PFP program (in terms of avoided health care costs) started to exceed its direct costs as early as 1974 (cost/benefit ratio equal to 1:1.2). In 1985, the ratio had increased to 1:10.6.

32. Their computations do not take into account that families frequently had to sell their much-needed assets to be able to afford health care services, nor do they consider the psychological suffering associated with the loss of life.

33. However, these estimates only cover direct costs to the health system, and cost savings are computed by comparing the immunization costs with treatment costs for various communicable diseases if there had been no immunization program and the disease had occurred. One can argue that a health system that does not invest in immunization is likely not to be able to treat the future disease either, as is the case in many of the poorest countries around the world.

In 1997, a government commission that investigated Vietnam's PFP programs estimated that for each dong invested at the national level in PFP programs, 7.6 dong were saved in social sector spending (NCPFP 1997) A similar inquiry in the Philippines showed that benefits of PFP programs range from lower child and maternal mortality to savings in a variety of other health and health-related government expenditure (Legislators' Committee on Population and Development 1993). The study expected PFP programs to save 9.3 pesos in education, health, and social services for each peso invested in the programs. Favorable returns on the investment in PFP programs have also been observed in wealthy industrial countries such as the United States (Torres et al. 1986) and the United Kingdom (Laing 1982).

The literature has also investigated the broader, long-term economic benefits of investing in child health, focusing on nutrition programs; integrated programs containing nutrition and health components; and the influence of anthropometric measures on labor market performance. These studies are discussed below.

### *Evidence of the Economic Impact of Nutrition Programs*

This section reviews the literature that has attempted to conduct a full economic evaluation of child health interventions. Most of the available studies linking child health intervention to their future economic benefits are in the area of nutrition.[34] Three early examples include a cost-benefit study of a protein-supplementation program in Chile by Selowsky (1971), a nutrition program in the Philippines by Popkin et al. (1980), and a study of the cost and economic benefits of a supplemental feeding program targeted to malnourished children in the Indian state of Tamil Nadu (Knudsen 1981). All three authors try to evaluate the effects of nutrition health programs on children's future earning potential. Popkin et al. also consider what they call "social benefits," identified as reduced treatment costs in outpatient facilities for children suffering from severe vitamin A deficiency but benefiting from the vitamin A supplementation program. Knudsen explicitly evaluates social benefits by considering distributional weights that assign greater weight to the poor in computing program benefits.

In an early study of the effects of proteinic supplementation given to severely malnourished infants (the proteinic supplement was given through milk), Selowsky (1971) built a full cost-benefit analysis by linking the sequential effects of the nutritional intervention on weight, intellectual capacity, and future earnings (based on adults' IQs). He used data collected in the late 1960s by Kardonsky and colleagues from 33 infants from a northern barrio of Santiago and hospitalized for malnutrition (with a weight at least 40 percent lower than standard for their age). Kardonsky et al. (n.d.) had already observed a correlation between severe

34. Note that none of the existing cost-benefit studies can base its conclusions on real data, but they are all based on simulations of the long-term economic benefits of improved health outcomes.

35. Kardonsky and colleagues, whose preliminary work served for Selowsky's analysis, seemed to have anticipated Behrman's critique of the lack of control on socioeconomic variables in this type of study. They had elaborated a socioeconomic control variable made up of ten indicators of well-being: type of housing, toilet facilities, bathing facilities, cooking facilities, location of cooking facilities, ownership or rental arrangement of the house, elimination facilities, water source, lighting system, and per capita income (Selowsky 1971, p.13). Each indicator or sub-component of the variable was measured by a quality index. Four per capita income brackets were also defined, and all components, including the per capita indicator, had the same maximum score. Even with the introduction of this variable to control for the socioeconomic context, results of the analysis of the relationship between nutrition and IQ were not altered.

36. For this, Selowsky used a longitudinal study involving 61 children from high-income households and conducted over 18 years by Bayley (1949). The study showed that the IQ measured at age 17 (with a Stanford-Binet test in particular, but not only) was predicted with a probability of 0.51 by that measured at age 2, 0.71 at age 4, and 0.92 at age 11.

malnourished status and results on cognitive tests. Selowsky, following on the same path, compared these data with those of 7 normally nourished children from the same barrio. Controlling for a variety of socioeconomic variables,[35] he estimated that a gain of 10 percent in weight was associated with a gain of 5 to 6.5 points in IQ tests (Terman-Merril Intelligence Test). Then Selowsky used the results of a study of IQ tests given to a group of 91 construction workers, showing that wages were strongly linked to the IQ tests' results (a 10 percent increase in IQ was associated with 6 to 6.5 percent higher wages). Projecting children's IQ differentials to adult age,[36] Selowsky estimated that the proteinic supplementation program could be characterized by a cost/benefit ratio of 7.5 to 8.2 and a return rate of 19 to 25 percent, varying mostly with the price of milk. Comparing this return with those prevalent at the time in Chile for investments in physical capital (15 percent) and education (17 percent for primary and 15percent for secondary), Selowsky concluded that investing in nutritional programs would be one of the more productive investments that the government could undertake.

In his concluding remarks, Selowsky wrote:

> *If infant nutrition has an effect on an individual's future economic productivity, it must be considered as one of the sources of human capital formation. However, infant nutrition is characterized by some major differences with other types of investment in human capital, i.e., formal schooling, on-the-job-training, etc. First, infant malnutrition can hardly be substituted by later types of investment in human capital. On-the-job training is a much better substitute for deficit in years of schooling than deficits in preschool IQ. Second, later types of investment in human capital can, for policy purposes, be affected by an improvement in capital markets (i.e., loans for high school or college education). This is hardly true for earlier types of investment in human capital. For these investments, perfect capital markets are not a substitute for income redistribution, the main determination of early investment in human capital (Selowsky 1971, pp. 26–27).*

This last remark is important. It demonstrates an early attempt to go beyond cost-effectiveness and cost-benefit criteria to justify public investment in child health, by showing that the consequences of failing to provide adequate nutrition to children at an early age are irreversible. The qualitative considerations at the margin of the early attempts at measuring economic benefits are still vital and signficiant for today's debate, perhaps more than their quantitative cost/benefit estimates.

Knudsen (1981) estimates the increase in earnings resulting from improvement in cognitive development and longer schooling for severely and moderately malnourished children exposed to a nutritional program.[37] He estimates that the earnings potential increase due to the program is equal to 55 percent on average for severely malnourished children,[38] and 27.5 percent for non-severely malnourished children. Knudsen also considers the impact of reduced child mortality and longer life expectancy on total population growth.

The overall economic rate of return for the project, under the more realistic assumptions concerning its coverage and its performance, is estimated to be 14.5 percent. It increases to 21.5 percent if its redistributional benefits are considered as well (the program disproportionately benefits the poor and the more vulnerable individuals within poor families).

37. The earnings equation estimated by Knudsen is the following: Log W = a + bS +cA +dT, where W = wages, S = years of schooling, A = preschool ability, and T= age. It is assumed that the nutrition program influences A and S (considered as a function of A).

38. Ten percent of the total 55 percent increased earning capacity results directly from the effect of higher cognitive capacity, while 45 percent results from an increase in schooling, due to improved cognitive capacity. Knudsen points out that "malnutrition…seems to reduce productivity of adults by reducing ability and the number of years and effectiveness of education" (Knudsen 1981, p. 48). Rates of return of the feeding program are calculated separately for children of poor and rich families, and the conclusion is that the rate of return is higher for children of relatively wealthier households who enjoy better access to education.

Knudsen also develops a sensitivity analysis, concluding that, under all but the most pessimistic scenario, the expected efficiency benefits of the project exceed its costs (assumed to be 10 percent, the opportunity cost of capital). If the social benefits are also taken into consideration by using the distributional weights, the program's expected benefits always exceed its costs.

A few more recent examples of cost-benefit studies to evaluate the economic impact of a nutrition program include:

1. Soemantri et al. (1985), who estimate that an increase of 10 percent of cognitive capacities is associated with an increase of 13 to 22 percent of wages, according to their analysis of Indonesian data.
2. Behrman (1993), who reports results from studies in Pakistan (Behrman, Ross, and Sabot 1991) as well as from Kenya and Tanzania (Boissière, Sabot, and Knight 1985), which show that the improvement in intellectual capacities of children under five can bring about increases in future wages of 10 to 27 percent.
3. Glewwe, Jacoby, and King (2001), who utilize longitudinal data from Cebu (Philippines) to estimate the cost/benefit ratio of a nutritional program, and conclude that every monetary unit invested in the program could return approximately three units of additional wages through improved academic achievement.

### *Evidence of the Impact of Integrated Programs with a Significant Health Component*

Recently, integrated programs, including health, nutrition, education, and income-supplementation components, have been introduced in several countries. These include treatment and control groups, and are currently undergoing a process of rigorous evaluation. One such program is Progresa (now Oportunidades) in Mexico. Behrman and Hoddinott (2000) have attempted to isolate the future economic benefits of the nutrition component, and have estimated that this component of Progresa alone might trigger an increase in future wages (at adult age) for beneficiary children of 2.9 percent. This does not include the effects of better nutrition on schooling, which, in turn, will create a further positive effect on future productivity and wages of beneficiaries. Annex 4 presents the main findings of numerous evaluation studies of the program Progresa/Oportunidades, as well as of other integrated programs such as the High/Scope Perry Preschool program.

**Table 3. Increase in Net Present Value (NPV) of Productivity Due to Improved Social Indicators Resulting from ICD Programs**

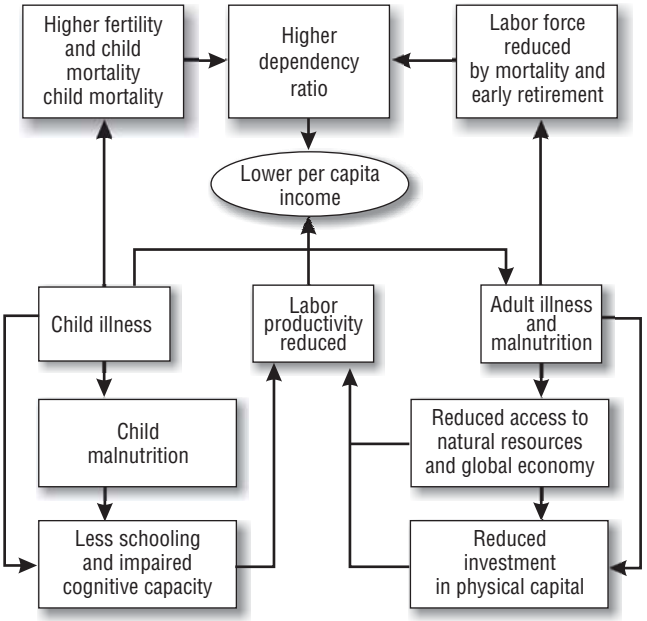
| Indicator | NPV of Education System | Increase in NPV due to ICD |
|---|---|---|
| 0. Baseline: without ICD | 966,212 | — |
| A. Under-5 mortality reduced from 162 to 105 per 1,000 live births | 1,031,933 | 65,721 |
| B. Primary enrollment increased from 65% to 95% | 1,412,156 | 445,944 |
| C. A and B combined | 1,508,210 | 541,998 |
| D. C, plus improved primary school performance | 1,997,847 | 1,031,635 |
| E. D, plus increased progression to post-primary education | 2,901,864 | 1,935,652 |

*Note:* Data represent estimates in U.S. dollars of the less favorable of two scenarios simulated by the authors; discount rate is 7%.
*Source:* Van der Gaag and Tan (1996).

Another example of an integrated program where the health component is large enough to be specifically studied is the Programa Integrado de Desarrollo Infantil, or Integrated Child Development (ICD)

39. Several contributions have shown that most of stunting happens before age three. See, for instance, Martorell (1985) and Steckel (1986).

**Figure 8. Channels through which Illness Reduces Income**




*Source:* Prah Ruger (2001).

programs, in Bolivia. Using data from the program, Van der Gaag and Tan (1996) estimated the economic return of the health component of ICD programs. They did so by first estimating the impact of health gains achieved through the ICD program on years of schooling, and then by estimating the economic returns to education. They conclude that increased survival of young children leads to significant economic benefits. Table 3 summarizes their findings.

The estimates in table 3 mean, for example, that a reduction in under-five mortality from 162 to 105 per 1,000 live births would generate an additional economic return equal to $65,721, just considering the direct health benefits of the program in terms of higher child survival. Considering also the secondary effects of improving children's survival rates, such as the increase in the number of children attending school, the expected benefits are much higher. Considering all measurable benefits, the authors finally estimate that the total cost/benefit ratio lies between 1.38 and 2.38 for every monetary unit invested in the program.

### *Micro-Studies on the Relationship between Anthropometric Measures and Labor Market Performance*

This section briefly reviews the literature on the economic impact of adult health and improved health outcomes in general (for more detailed reviews, see Prah Ruger et al. 2001 and Subramanian, Belli, and Kawach 2002) through labor market performance. This literature is directly relevant for evaluating the economic impact of child health interventions because of the measures of health that it presents. For instance, one measure frequently utilized (see Behrman 1993, and Thomas and Strauss 1997) is height, which is clearly dependent on all past health investments in health, particularly those that take place in early childhood.[39] Hence one could conclude that, in the absence of longitudinal evidence, the cross-sectional evidence that shows a positive relationship between adult height and labor-market performance provides the strongest supports for the hypothesis of a positive long-term economic impact of child health interventions. As Fogel wrote, "These findings (linking mainly anthropometrical measures related to nutritional state during childhood and economic outcomes) suggest that payoffs later in life need to be factored into the cost-benefit analyses of programs aimed at improving nutrition and health care at younger ages" (Fogel 1997, pp. 471–72). Figure 8 shows the impact of illness in both adults and children on the economy and per capita income.

40. In fact, although the significance of the correlation between anthropometric measures and productivity and wages is different in the different studies, it is always of the same sign, showing that more favorable health indicators result in higher productivity and wages, particularly for low-skilled laborers.

A study by Deolalikar (1988) found no clear linkage between the amount of calories absorbed by workers and their wages or the output in the agriculture sector of southern India, but it did find a positive relationship between their anthropometric characteristics (such as weight for height) and productivity (with an elasticity equal to 1.9) and wages (with an elasticity of up to 1.6). Deolalikar estimated that the human body (of adults) adapts better to nutritional hazards, while it is more difficult to compensate for unfavorable anthropometric structural characteristics, especially for tasks requiring strength. A study by Haddad and Bouis (1991) in rural Philippines (on the island of Mindanao) also showed a positive relationship between anthropometric data and wages. Thomas and Strauss (1997) investigated the relationship between anthropometric data and wages in a study based on a sample of 34,000 adults in urban areas of Brazil in 1974–75 (16,000 women and 18,000 men). They showed that height and weight-for-height are positively correlated with wages, and that this relationship is particularly strong for uneducated adults.

Similarly, Dumont (1999) confirmed the robustness of the relationship between health, level of education, and income. Using data collected from 3,000 urban households in Antananarivo (Madagascar), he estimates that, for the adults surveyed, being 10 centimeters taller than average was associated with one third of a year of additional schooling and 11 percent higher wages.

Reviewing the literature on the labor market impact of improved health status outcomes, Strauss and Thomas (1998, p. 813) concluded more cautiously that if "poor health…does appear to reduce labor supply…the evidence that it affects productivity and wages is more ambiguous."[40] However, they note that

> *a small number of studies suggests that health has a larger return at very low level of health and (perhaps) in jobs requiring more strength. With economic development…one might expect the labor market impact of improved health to decline, especially relative to the impact of education and skill acquisition (Strauss and Thomas 1998, p. 813).*

# V. Analyzing Economic Benefits of Investments in Child Health: Limitations and Potential

The literature reviewed in the previous section attempts to document the potential returns of specific interventions and more general programs that target children. This section discusses these findings and explores the limitations of the studies and the possibilities offered by new methodologies.

Knudsen's work (1981) on the economic benefits of a supplemental feeding program targeted to malnourished children is a very good example of the difficulties entailed in evaluating the economic impact of a health program. It clearly shows, in particular, how many assumptions—about program intake, performance, general economic and demographic conditions over time, etc.—must be made to reach quantitative conclusions. Finally, it shows how the final results crucially depend on whether the program is able to set in motion some sort of multiplier effect (what we have referred to as a virtuous cycle), while avoiding a "substitution effect" (in which households adopt a behavior that can potentially nullify most of its positive potential).

Behrman (1993), reviewing the empirical literature on the impact of nutritional interventions on productivity and wages through schooling, pointed out numerous methodological shortcomings of existing studies. Some results seem biased, and many are of dubious usefulness for policy purposes. Citing the estimates by Levin (1986)—based on studies in Indonesia, Kenya, and Mexico—Behrman asserted that, despite their high economic returns, nutritional interventions do not deserve public funding, because they yield mostly "private" benefits. (Private benefits are those accruing to the individual rather than to society at large; see Introduction). According to Behrman, the only public-good component of nutrition programs consists in the collection and dissemination of information on nutrition and its benefits.

Building upon Behrman's contribution, one can point to the following shortcomings of the literature that has attempted full cost-benefit evaluations of child health programs:

- Socioeconomic variables are rarely controlled for
- Econometric evaluations are based on a series of questionable assumptions (in part because of the absence of longitudinal data or complete data sets)
- The area of benefits are often limited to individual ones, omitting social benefits[41] (i.e., the benefits from the correction of market failures and of pro-poor redistribution), which in fact should be central to any evaluation exercise (see Introduction)
- Costing methodologies and the definitions of benefits are not always well stated.

The lack of a solid empirical base, in the absence of longitudinal studies on the economic impact of child health interventions, is one major reason for the shortcomings. Another one is the small samples and thus the context-specificity of the results derived. Selowsky (1971), commenting on studies of the rates of return in education, noted that they vary in methodology but also that the differing ages at which school starts and the types of economic sector used as a reference to compute those rates make them difficult to compare.

41. When social benefits are considered, they are limited to medical cost savings.

When longitudinal data are available, as in the case of the Cebu longitudinal study, other methodological problems arise, such as the lack of a control group. In their economic evaluation of the data from Cebu, Glewwe, Jacoby, and King (2001) attempted to build a control group with data collected on the children's siblings. To obtain cost benefit estimates for the nutrition program, they also complemented their database with effectiveness and cost data from a program in Narangwal (Punjab, India). Apart from the intrinsic problem of mixing data from two very different locations, another problem is that the methodology of transferring (particularly as the study applied costs from the Narangwal study to the Philippino context) is not clearly explained. All these methodological shortcuts, which are meant to compensate for the lack of rigorously controlled data, obviously limit the scope of the analysis.

A few authors have attempted to develop new methodologies to evaluate the economic benefits of investing in child health. In addition to Glewwe, Jacoby, and King (2001), one other notable example of these attempts is the work done by Van der Gaag and Tan (1996), whose work is discussed in section IV. The authors develop a complex but quite mechanical methodology to estimate the economic return of Integrated Child Development programs, and utilize it to estimate the economic returns of an ICD program in Bolivia (Programa Integrado de Desarrollo Infantil). They also point out that many possible "intangible" benefits of such a program (reduced crime, increased social participation, higher self-esteem, better knowledge of health practices and attitudes) are not valued in monetary terms, and their consideration would certainly increase the benefit/cost ratio even further.

## Disentangling the Complex Web of Co-Determinants

As noted earlier (see figures 5 and 6), it is difficult in many instances to disentangle the impact of socioeconomic conditions on the one hand, and nutritional and health interventions on the other, as they seem to be intricately related. Behrman (1993) criticized many of the studies he reviewed for not controlling the simultaneous effects of socioeconomic factors on both health and school attainment and participation. Behrman and Lavy (1994), using data from Ghana on 1,224 children, and controlling for the simultaneity of the impact of socioeconomic variables on health and school attainment, showed that the effects of health on schooling and school attainment tend to "evaporate" with time. Yet they confirmed that the nutritional and health statuses do impact the cognitive capacities at early ages.

In Knudsen's analysis (1981) of a nutritional program in Tamil Nadu, the cost-benefit results depend crucially on whether the supplemental nutrition program is able to stimulate households' awareness of malnourished children's needs and thus to lead to better nutritional practices within the households (multiplier effect), or whether it simply leads households to further reduce the amount of food given to children benefiting from the nutritional program (substitution effect).[42]

## A Multiplicity of Benefits

Numerous types of benefits can be ascribed to any health intervention. In general, studies have concentrated on quantifiable benefits such as productivity, wages, and cost savings. However, as Van der Gaag

42. To prevent such substitution effects, Knudsen advocates the use of larger rations than those planned in the original program design.

43. The ECCD programs are integrated and comprehensive programs that include education, nutrition, health and general child care. Benefits listed in the table are relative to all these different interventions.

**Table 4. Benefits of ECCD (or ECD) Programs**

| Beneficiary | Direct Benefits | Indicators of Change |
|---|---|---|
| Young children | Improved health, nutrition, and hygiene | Increased chances of survival<br>Reduced morbidity<br>Improved height/weight for age |
| | Psycho-social development | Improved cognitive development<br>Improved social development<br>Improved emotional development<br>Improved language skills |
| | Progress and performance in primary school | Higher chance of timely enrollment<br>Less chance of repeating<br>Better performance and more schooling |
| Older children (siblings) | Reduced custodial responsibility for younger siblings | Greater chance to stay at school and eventually improve earnings |
| Parents and adults | Improved employment | Caregivers (especially women) freed to seek employment or improve their situations<br>New employment opportunities created by ECCD<br>New markets for ECCD-related goods |
| | Changes in general knowledge | Better parenting practices<br>Improved nutrition, health, and hygiene practices<br>Preventive medical monitoring |
| | Improved psychological well-being | Reduced stress for parents and other caregivers |
| Communities | Changes in physical environment | Improved sanitation, more spaces for play, new multipurpose facilities |
| | Greater social participation | Improved solidarity<br>Community projects benefiting all |
| Institutions | Improved efficiency | Reduced grade repetition and drop-out rates; improved school curriculum |
| | Improved effectiveness | Better health care |
| | Improved capacity | Greater coverage |
| | Improved practice and content | Changes in ability and confidence |
| Society | A healthier population | Reduced days lost to sickness<br>Reduced suffering for families |
| | A more literate, educated populace | Greater social participation<br>Reduced violence |
| | Cost savings | Reduced spending on correctional, special education, and social welfare programs |
| | More productive adults | Higher productivity and wages<br>Larger economy |

*Source:* From IADB (1999a), Karoly et al. (2001), and Myers (1995), with minor additions. Further discussion of these benefits and their definition is available in annex 4.

and Tan (1996) noted, several probable benefits not included in evaluations, including social participation, do create some economic impact in the future.

The definition of benefits needs to be better stated and, in many cases, broadened. This has been attempted, for example, by reviewers and analysts of

Early Child Care and Development (ECCD) programs, such as that conducted by the Inter-American Development Bank (1999a). In this document, prepared by Ricardo Morán and colleagues, the authors list a variety of benefits with corresponding indicators. Table 4, reproduced from that study, is a useful base to develop a more rigorous and systematic modeling of future economic benefits of investing in children's health.[43]

Clearly, some benefits that reductions in infant and child mortality and morbidity bring about are "intangible" and extremely difficult to translate into monetary terms. For instance, a reduction in child mortality is likely to promote higher confidence and social participation among adults, communities, and nations, and to reduce fatalism among adults. As it does, the vicious cycle of poverty in which vast populations are caught is interrupted. Such benefits are obviously extremely difficult to measure and, indeed, the empirical literature has not yet attempted to measure them. Other benefits, such as those derived from the demographic transition, are relatively easier to evaluate but are rarely included in cost-benefit analyses.

## Hidden Costs

In costing, the time profile can make a very significant difference. What seems a fixed cost, because it does not fluctuate within a certain time frame, can become a variable cost if the time frame is extended.[44] In a long-term perspective, extending life expectancy, which facilitates the epidemiological and the demographic transitions, may actually entail new costs, new burdens on society and individuals. The transition from an epidemiological profile where transmissible and parasitic diseases are widely prevalent, to a profile where chronic conditions prevail, requires different approaches to health with far more costly interventions and programs. Moreover, a number of programs, deemed necessary to improve health and nutrition, schooling and school attainment, once put in place, entail a recurrent disbursement over the long term. An immunization campaign becomes a regular immunization intervention and part of the recurrent activities of the health system. Its benefits are seen as permanent, provided the intervention is maintained.

Similarly, it is expected that in the future, to be sustainable, health systems in developing countries will require an increasing share of national resources and a productive and growing economy. The case of Cuba (Barberia and Appaix 2002) shows that a sluggish economy is detrimental to the missions of health systems. In Cuba, which accomplished its epidemiological transition very rapidly (in approximately 15 to 20 years), the cost of the health system is now sky-rocketing; as a proportion of national income, health care costs grew at more than half a point of GNP each year during the late 1990s (Cárdenas-Rodríguez et al. 2001).

Table 5 summarizes our view of the costs and benefits accruing to child health interventions, including hidden costs that can be detected in the long run.

44. For example, the quantity and cost of equipment and buildings, which are seen as fixed by facilities' managers, are not viewed as such if one stands from the broader perspective of the whole national health system, and even more so, if this perspective includes a long period of time. Demographic, epidemiological, and technological variations do, indeed, greatly influence the necessities and costs of such resources.

**Table 5. Summary of Costs and Benefits of Interventions and Programs Impacting Children's Health and Development (Physical, Mental, and Social)**

| Cost/Benefit | Short Term | Long Term |
|---|---|---|
| Cost of intervention/program; costs of health care in general | Treatment costs decrease if better prevention is implemented. On the other hand, implementation or expansion of programs and interventions leads to increased costs.<br><br>Costs of larger dependant population. Fewer births are necessary to ensure generational renewal. On the negative side, transitionally, families are more numerous (beginning of the demographic transition).<br><br>Furthermore, resources for new health programs are subtracted from other programs and activities (unless external funds can compensate).<br>Finally, family income is lost because children are subtracted from traditional productive activities, hence a certain resistance from poorer families to consent to the investment (i.e., let their children be diverted into education). | Decrease of expenditure for transitional programs (family planning for example), and for interventions and programs that target infectious diseases.<br><br>Increase in health care expenditure due to the epidemiological/mortality transition, and because long term programs and interventions that have proved efficacious remain, including education, health care services, immunization.<br><br>Lower number of dependants as fertility rates adapt to lower mortality rates among children. |
| Economic and other main benefits of the intervention/ program | Improvement in cognitive capabilities, school participation, and school attainment.<br><br>Child in better health, which increases participation of the child in family and social activities (including productive activities—e.g., domestic and community's production activities).<br><br>Increased time for productive activities for parents. | Higher life expectancy, delayed retirement.<br><br>Enhanced human capital and higher productivity.<br><br>Demographic gift.<br><br>Disease transition, with a lower burden of disease on children. |

*Note:* This table includes only effects of health interventions that seem economically quantifiable. Moreover, it includes both positive and potentially negative effects of health interventions. It includes both short-term and long-term costs and benefits to individuals and society. On the benefits sides, this includes effects that would reduce costs (of programs, health care, special education, correctional and welfare programs, social programs in general) or create a larger economic output. On the costs side, it includes increases in future costs (because of a larger surviving and more educated population requiring more sophisticated health care, education, and other social services).

# Conclusion

The conclusion to draw from the analysis of the vast body of literature that has studied the relationship between child health and the economy is that investing in child health is a potentially valuable economic investment. It opens a dimension of benefits that has not yet been appropriately considered by governments or the international community. The literature shows that greater investments in child health would result in better educated and more productive adults, and that safeguarding health during childhood is more important than at any other age, because poor health in early years is likely to permanently impair individuals over the course of their lifetime.

By looking at the evidence worldwide, the conclusion is clear: millions of children die every year from largely preventable diseases. This creates an ominous burden on families and entails serious economic costs in terms of excess fertility, insufficient investments in human capital, and other less tangible, but equally important, effects. Part of the reason why these costs (and the potential benefits foregone) are not appropriately factored in most analyses is because they accrue over the long term, so they are beyond the short-term horizon under which households, but often also political leaders and international institutions, operate.

Empirically, several interventions and programs that could significantly contribute to improving child health have been well documented, particularly in the area of nutrition, disease control, and education. It is also clear that acting on determinants and consequences of children's ill health would be a powerful tool to correct unfavorable conditions for development, particularly to the benefit of poor children. Such interventions are not implemented on a larger scale for reasons that are mainly not of a technical but rather of a political-economic nature. A significant share of child mortality and morbidity is concentrated in the poorest countries and among the poorest segments of the population in those countries. These children and their parents are voiceless.

The need to assess returns to investments in the health sector in a context of tight economic and financial constraints has spurred numerous endeavors to estimate the magnitude of these returns. This paper has attempted to review a number of evaluations of economic benefits of investments in child health. These evaluations show the intricacy of tracking the great variety of possible impacts of each health intervention, and that evaluating the full benefits of health programs is doubtlessly a complex if not daunting task. Yet, work on standardized approaches to cost-benefit analyses has been attempted, including the Early Childhood Development (ECD) "calculator" developed by Van der Gaag and Tan (1996, see table 2, p. 29).

However, to achieve real breakthroughs in the measurement of the economic impact of investing in child health, we need new empirical evidence, based on the direct observation of economic impact over time.

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# Annexes

## Annex 1. Strategy for Literature Search

Literature was searched using a number of on-line databases, web sites, as well as publications reviewing literature:

- POPLINE
- Institut National de l'Information Scientifique et Technique
- MEDLINE
- Lexis Nexis
- The World Health Organization (including the Commission on Macroeconomics and Health)
- The World Bank
- The Inter-American Development Bank
- Other regional development banks
- The United Nations (working papers)
- The United Nations Children's Fund
- The United Nations Development Programme
- JSTOR (economic literature database)
- ECONLIT (economic literature database)
- U.S. Department of Health and Human Services, Centers for Disease Control and Prevention

**Key words used for these searches were:** health, child(ren), santé, enfant(s), child health, economic(s), development, economic benefits, health benefits, growth, investment, human capital, family planning, developing country, economic costs, health care policy.

## Annex 2. Identifying the Determinants of Ill Health

Traditionally, the literature that investigated the causes of child morbidity and mortality followed one of two leading research perspectives: (1) the biomedical perspective, and (2) the social science perspective. *Biomedical research* focused on the immediate biological causes of individual ill health and death and emphasized physiological interactions. *Social science research* focused on the association of socioeconomic and behavioral factors with mortality and health status, and their links to overall policy. The two approaches have for a long time been confined to their disciplinary boundaries: biomedical scientists were aware of the limitations of focusing solely on the biological determinants and medical interventions but tended to relegate socioeconomic factors to background variables of little direct interest. Social science researchers focused on the associations between socioeconomic status (SES) variables and mortality, and tended to avoid investigating underlying biological pathways.

Mosley and Chen (1984) were the first to articulate a conceptual framework where the biological and the social science perspective could be considered jointly by distinguishing between the proximate and the underlying determinants of health. They considered SES characteristics alongside cultural factors among the underlying determinants, and they identified 14 proximate determinants, grouped into five broad categories: maternal fertility, environmental contamination, nutrient deficiency, injury, and (lack of) personal illness control practices.

Since Mosley and Chen's seminal contribution, a vast literature on the underlying and proximate determinants of health has blossomed. The list of determinants has been refined, but the core conceptual framework developed by Mosley and Chen remains the same.

### Underlying Determinants

This paper focuses on the economic impact of better (child) health outcomes and argues that in the long term poor health is an important co-determinant of persistent poverty. However, in the short term, poor health and particularly poor child health is certainly a consequence more than a cause of poverty. The link between poverty and poor health is one of the more widely studied associations in the literature, and the evidence shows that there undoubtedly is a strong positive association between the two, and between poverty and child health outcomes specifically.

The SES-health relationship has been studied from different perspectives and with different methodologies. First, it has been studied in single-country studies looking at the evolution of health and economic indicators over time. For example, Khaldi and Ben Mansour (2001) reviewed the association between living conditions and health outcomes in Tunisia, and showed that the sharp increase in life expectancy at birth (from 51.1 to 72.4 years) and decrease in infant mortality (from 138.6 to 24.7 deaths per thousand live births) between 1966 and 1998 were due primarily to improvements in living conditions. All material well-being indicators markedly improved over this period: precarious dwelling, for instance, which was prevalent in 1966 (44 percent of households), went down to 1.2 percent in 1999. During that time, drinkable water became available to over 90 percent of the population, and electricity to 93 percent. These improvements also translated into a reduction in stunting of the population under age five from 22.2 percent in 1973 to 8.7 percent in 1996. Wasting was also dramatically reduced (from 18.8 percent of under-five population to 3.8 percent).

Second, the SES-health relationship has been studied through comparisons of health outcomes among countries at different levels of economic development. For instance, Gwatkin (forthcoming) compared infant mortality rates in countries at different levels of socioeconomic development and concluded that in the period 1970–90 infant mortality differentials across countries declined in absolute terms but increased in relative terms. "While infant mortality in 1970 was around 6.5 times as high in the poorest as in the richest countries, it was over 11 times as high by 1990" (Gwatkin 2002, p. 19).[1]

The conclusion to draw from these cross-country comparisons is that although there is little doubt about the important effect that income bears on individual health, the relationship between average national income (measured, for example, by per capita GDP) and average national life expectancy, child mortality, and other health indicators is by no means universal or automatic. Countries at similar levels of economic development experience wide variations in health outcomes, and relatively poor societies exhibit unexpectedly high levels of health achievements, such as Vietnam, Costa Rica, Sri Lanka, the state of Kerala in India, and Cuba.[2] These experiences point to the significance of factors other than per capita income in explaining variations in health outcomes across countries.

Third, the poverty-health relationship has been examined by focusing on health inequalities across different economic groups within the same country. Households' SES can be measured by their wealth, consumption, expenditures, or, more rarely, income. The evidence from these studies shows that higher infant and under-five mortality rates and prevalence of malnutrition are concentrated among children from the poorer segments of society (Gwatkin 2002, Wagstaff 2000b, and WHO 2002a).

Recent literature has investigated the links between poverty and poor health, to determine what impact public expenditures or specific pro-poor

1. The evidence also shows that in the period between 1960 and 1990 income change contributed positively to improvements in the under-five mortality rate, adult mortality rate, as well as life expectancy. The contribution was largest in reducing the male adult mortality rate, and smallest in reducing the under-five mortality rate.
2. For instance, in 1997, Costa Rica had a GDP of $6,650 per capita and a life expectancy equal to 76.0 years, and Cuba had a GDP per capita equal to $3,100 and a life expectancy equal to 75.7 years, comparable to that of the United States. At comparable GDP per capita of approximately $600, life expectancy is 69 years in Honduras, whereas it is 51 years in Senegal (World Bank 1999).
3. For example, in a study on health outcomes for children living with one dollar per day, Wagstaff (2001) concludes that the proportion of public spending over the total of expenditure in health could be a significant determinant of inequality of health outcomes in a population. The higher the proportion of health spending that comes from public funds, the smaller are health differences across various socioeconomic groups. One reason for this could be that public spending tends to redistribute access to health care by subsidizing it for the poor. Wagstaff (2001) cites countries in Central Asia, such as Kazakhstan (lower-middle income) and Uzbekistan (low income), and very-low-income countries in Africa and Asia, such as Ghana and Bangladesh, where health outcomes for children from poorer and from wealthier segments of the population seem to differ very little. He estimates that an increase of 10 percent in public expenditure per capita can yield a 2.4 percent reduction in infant mortality for the poorest segments of the population (those living with less than $1 per day). These results are not surprising, if we consider that the poor are less able to substitute private care for public care when the latter is lacking or it is of extreme poor quality. Despite the fact that public health services are pro-rich in India, the poor still disproportionably use them relative to private services, particularly for hospital care and public health services such as immunizations (Mahal, Yazbeck, and Peters 2001).
4. The evidence concerning the distribution of health and health care leads to extremely different conclusions in industrialized countries. These countries, at least those (the majority) who opted for mainly public funding (through social insurance or taxation) and public provision of health services, achieved a fairly even distribution of the financial burden and of utilization rates across socioeconomic groups, although there are still pockets of underserved poor (Van Doorslaer 1997). Despite this, inequalities in health status across socioeconomic groups persist; in some countries, they seem to have widened (for the United Kingdom, see Acheson, 1998). By contrast, in the United States, health financing seems more regressive and inequalities across income groups are more pronounced.

public policies may bear on it.[3] Currently available evidence shows that in low and middle-income countries the distribution of health benefits across socioeconomic groups is highly unequal in favor of the rich.[4]

In conclusion, the relationship that ties poverty to health is complex, and the relative role that wealth and income play—in contrast to other factors such as the amount of public expenditures, health services' accessibility and quality, the level of education, or the ecological setting (climate)—are still disputed. Moreover, the wealth/income-health relationship is circular, as we saw when we discussed the economic impact of child health. Poverty is one of the principal causes of poor health, but poor health contributes to trapping people into poverty. "Poverty is both a fundamental cause and an outcome of under nutrition and poor health" (Allen and Gillespie 2001, p. 4).

Another underlying determinant of health widely studied in the literature is education. Because of her responsibility for the care of her child during the earliest and most vulnerable stages of her/his life, the mother's level of education is a crucial determinant of child health. Her education level influences her choices and her skills in breastfeeding and nutrition, hygiene, preventive care, and disease treatment. In their review of determinants of under-five mortality in India, Claeson et al. (2000) pointed out the impact of the status of women and gender differentials. Women's low rates of literacy, lack of autonomy, early marriages and childbirth, exposure to sexually transmitted infections, low rates of perinatal care, and large numbers of deliveries by untrained personnel, all contribute to women's poorer health status and higher infant mortality. Domestic violence against women is also a contributing factor. These factors, in turn, create a crippling environment for the future development of children, for girls in particular.[5]

More recently, the literature has started to recognize that the level of education of the father also is an important predictor of the child's health status. Desclaux (1996) showed father's level of education to be an important determinant of child malnutrition in Burkina Faso.

Finally, among the underlying determinants of health investigated in the literature, it is important to mention cultural factors. Mosley and Chen (1984), for example, cite evidence from Mott (1979) and Poffenberger (1981) that shows the influence of marriage expectations as a factor of child survival:

> In Kenya, where girls are valued for the bride-price they bring, child survival rates are slightly higher for females than for males, while in South Asia, where female dowry is the main concern, the reverse is true (Mosley and Chen 1984, pp. 35–36).

## Proximate Determinants

A large body of literature singles out nutrition as the most important factor determining child health. Nutrition deficiency or malnutrition is estimated to contribute to more than half of premature deaths (Caulfield and Black 2002, and Pelletier et al. 1995).

Nutrition deficiency is a multidimensional phenomenon whose major aspects include:

- Low energetic intake (calories)
- Lack of proteins
- Lack of vitamins (A in particular)
- Anemia (iron deficiency)
- Lack of other nutriments (especially zinc)
- Iodine deficiency.

5. A study in Punjab cited by Claeson et al. (2000) shows that, on average, health care expenditure is 2.3 times higher for boys than for girls, while in India a girl is 30 to 50 percent more likely to die between her first and fifth birthday than is a boy.

The main consequences of nutritional deficiencies are:

- Low weight at birth (nutritional problems associated with the mother mainly)
- Growth faltering (stunting) during early childhood (first three years of age)
- Mental disorders due to iodine deficiency (affects cognitive capabilities in particular)
- Greater severity and length of childhood diseases (especially ARI, diarrhea, measles, and hookworm infection).

Claeson et al. (2000) state that malnutrition is the main factor retarding improvements in human development and hindering further reductions in infant mortality in India. Rice et al. (2000), reviewing evidence on the impact of malnutrition on infectious diseases, conclude that malnutrition is clearly associated with a higher probability of dying from diarrhea diseases and low-tract respiratory infections. Allen and Gillespie (2001) underline that "under-nutrition often starts in uterus and may extend throughout the life cycle. It also spans across generations: under-nutrition occurs during pregnancy, childhood, and adolescence and has a cumulative negative impact on the birth-weight of future babies" (p. 1).

The role of malnutrition as a factor in ill health underlines the critical role that poverty plays in explaining child morbidity and mortality. In developing countries, the poorer segments of the population spend a significant share of their total budget (more than 80 percent) just to buy food, and the food they are able to provide for themselves and their children is insufficient or of insufficient quality. For example, vitamin A deficiency is one of the more severe nutritional problems. As Behrman (1993) noted, at the beginning of the 1990s, some 240,000 children became blind every year in developing countries because of vitamin A deficiencies; preventing vitamin A deficiency would create a significant positive effects on their individual futures and economic opportunities, as well on their families and the societies in which they live.

At the same time, malnutrition contributes to a great extent to maintaining the vicious cycle of ill health/poverty in which the majority of the poor in low- and middle-income countries are trapped. Ghosh (1990) shows that malnutrition itself is the result of a variety of determinants, and that it creates a fatal cycle, particularly for girls. Malnourished girls are also those who tend to marry early and have babies who are born in poor conditions and unfavorable contexts, often with birth defects and low weight.

*Environmental contamination* is another important proximate determinant of health outcomes. It includes indoor air pollution (particularly due to crowding, biomass burning, and smoking), lack of heating, water pollution, and food pollution.

Environmental hazards and malnutrition thus combine to create a detrimental context for the sound and safe development of children. Environmental determinants play a large role in the incidence of infectious diseases, while malnutrition increases the severity of infections (Martorell and Ho 1984). Infectious disease (by reducing the child's capacity to absorb nutrients and by causing anemia) and nutrition deficiency (by lowering the child's strength and ability to resist infectious diseases) reinforce each other in a vicious cycle whose outcome is often death.

Closely linked to environmental contamination are *injuries*, considered by Mosley and Chen (1984) as another proximate determinant of health. Exposure to injury and to potentially health threatening situations are often a consequence of unsafe living conditions that make children subject to burns, traumatisms, and intoxications. Injuries can also be intentionally inflicted on children, the most extreme case being infanticide.

A large body of literature also associates child health with *maternal factors* (maternal health, maternal age, birth intervals). Maternal health produces an important impact on the health of the fetus and of the newborn, because of the biological links between mother and child during pregnancy and lactation. Gelband and Stansfield (2001) remind that up to the first month of life, during which the risk of mortality is very high, most of the health risk is associated with perinatal conditions. Those are tightly linked to the mother's own health and its determinants.

The health of the child has also been associated with his/her mother's and more broadly his/her family's health in the new reproductive health perspective (Dayaratna et al. 2000). At the beginning of the 1980s, a new child survival package promoted by UNICEF (Cornia 1984) emphasized that increasing mothers' age, broadening child spacing (time between two consecutive pregnancies), and thus reducing the fertility rates were critical elements for improving children's health status. The program also pioneered a new approach to family planning programs, made explicit and further developed at the 1994 Cairo Conference on Population and Development. The new agenda for reproductive health interventions focuses on the mother's well-being, rather than on control of population growth per se. Evidence emerging from reproductive health studies in the 1990s clarified the link between child health and the family reproductive health practices. Using data on 3,500 children from urban Brazil, Huttly et al. (1992) show that health outcomes of children conceived within intervals shorter than six months after their siblings were born are worse than those of children born 24 to 71 months after the prior birth.

Short pregnancy and birth intervals adversely affect the mother's as well as her child's health, according to a cross-sectional study of 456,889 women conducted in countries of Latin America and the Caribbean area, reported by Conde-Agudelo and Belizán (2000). It was evidenced that pregnancy intervals shorter than six months (2.8 percent of all cases) resulted in significantly higher maternal mortality, more prevalent anemia, as well as more frequent third-term bleeding and rupture of membranes.

Finally, among the proximate determinants of health, Mosley and Chen (1984) and subsequent literature assigned special importance to behavioral factors, and specifically to personal illness control practices (personal preventive and medical treatment practices). These include hygienic practices, breastfeeding, traditional behaviors like circumcision, as well as modern preventive treatments such as immunizations. For instance, breastfeeding is a significant factor contributing to child health, among other things because it reduces the incidence of diarrhea. Breastfeeding also plays an important role in the growth of children belonging to socioeconomically vulnerable populations. Citing Feacham and Koblinski (1984), Claeson and Waldman (2000) claim that, other factors being equal, non-breastfed babies are 14 times more likely to die from diarrhea than those who are breastfed.

Social, cultural, and economic underlying factors largely determine personal illness control practices.

## Annex 3. Preventive and Curative Interventions to Improve Child Health

The government can strongly influence several of the more important underlying and proximate determinants of health. For instance, significant improvements can be achieved in sanitation, access to water, and electricity, which produce a long-term impact on the prevalence of diseases that mostly affect children. Briscoe (1987) argues that in the past water and sanitation projects were not properly considered by the "child survival revolution" promoted by UNICEF and the U.S. Agency for International Development because they were deemed as not cost-effective. More recent evidence is changing that negative perspective. Reviews of such evidence on the impact of access to water and sanitation by Esrey and colleagues (1985 and 1991) showed a median reduction in diarrheal morbidity of 20 to 26 percent associated with better water and sanitation facilities. Moreover, improved anthropometric indicators were recorded in connection with water and sanitation interventions.

Hygiene promotion is another important factor contributing to reduce health risks for children, particularly diarrhea. Combined with sanitation and water, hygiene promotion constitutes an effective prevention against diarrhea. In a review of hygiene promotion conducted by Huttly et al. (1997), the authors found that hand washing alone could lead to a 35 percent decrease in diarrheal morbidity.

Since malnutrition is a major proximate determinant of health outcomes, programs and interventions that specifically aim to combat malnutrition are likely to yield significant improvements in the health status of children as discussed in the text. Fogel (1997) showed that improvements in nutritional status were instrumental in the historical increase in life expectancy among Western European populations over the last two centuries.[1] Governments can act to improve nutrition in a variety of ways, not least by promoting innovations in agriculture, by micro-credit programs, by favoring a better use and redistribution of land in favor of the poor, by information campaigns on nutrition, or by directly financing/managing nutritional programs for the poor. A vast literature developed since the early 1980s has proved that appropriately designed and implemented nutritional programs are among the more cost-effective interventions. For example, in Chile, distribution of milk supplemented with ferrous sulfate and vitamin C was instrumental in eliminating anemia among newborns—reducing it from 27 percent of newborns to none (Allen and Gillespie 2001).

Nutritional programs such as the Centre de Récupération et d'Education Nutritionnelle (CREN) in Burkina Faso described by Desclaux (1996) also include health education.[2] Table A3-1 summarizes the major interventions that target malnutrition and their effects on children and mothers.

Immunization programs are another extremely cost-effective preventive measure to reduce child morbidity and mortality. The Expanded Program on Immunization (EPI) aims to cover all vaccine-preventable diseases affecting children (including measles, pertussis, polio, diphtheria and tetanus).

1. He shows that economic development and better health and nutrition patterns across the population reinforced each other in a virtuous cycle. Nutritional intakes and life expectancies in France and England at the end of the eighteenth century were similar to what they are now in low-income countries such as Pakistan. The improvement in nutritional status registered ever since, first in England then in France, translated into increased height, improved height for weight, improved work capacity, and further increases in food availability.
2. People trust the work done by these nutritional centers because they have witnessed the positive changes in health status achieved through them. However, the HIV/AIDS epidemic has altered the work of these centers because of the stigma that surrounds HIV-infected people, including children, even among health workers. (Desclaux 1996).

If nutrition interventions, immunizations, and other preventive measures do decrease health risks, diseases still occur that have to be tackled with effective treatment. As in prevention, several inexpensive interventions are available for disease treatment. These include oral rehydration therapy (effective for approximately 95 percent of all cases of acute watery diarrhea) and antibacterial treatments (against pneumonia) that have proven extremely effective in reducing infant and child mortality. In their review of interventions that can contribute to the reduction of under-five mortality in low- and middle-income countries, Gelband and Stansfield (2001) note that case-management of ARI can reduce mortality by an average of 80 percent for a set of specific diseases.[3]

Malaria can be successfully managed both by preventive measures such as bednets and by anti-malarial treatment such as sulphadoxine-pyrimethamine (Gelband and Stansfield 2001).

Figures A3-1 and A3-2 provide a synthetic summary of the different preventive and treatment interventions available to improve child health. The first figure uses the life-cycle approach presented in figure 1 in the text, adding a specific set of intervention to address the health risks and diseases specific to each period in the early development of the human being. The second figure utilizes the health development cycle in figure 5 in the text, and illustrates the different interventions available to influence underlying and proximate determinants of child health, as well as specific prevention and treatment interventions to correct adverse health outcomes.

In addition to specific interventions to tackle specific conditions, integrated programs have been designed in recent years that include case management of various diseases along with health education meant to impact household behaviors, as well as to

**Table A3-1. Nutritional Programs and Their Impact**

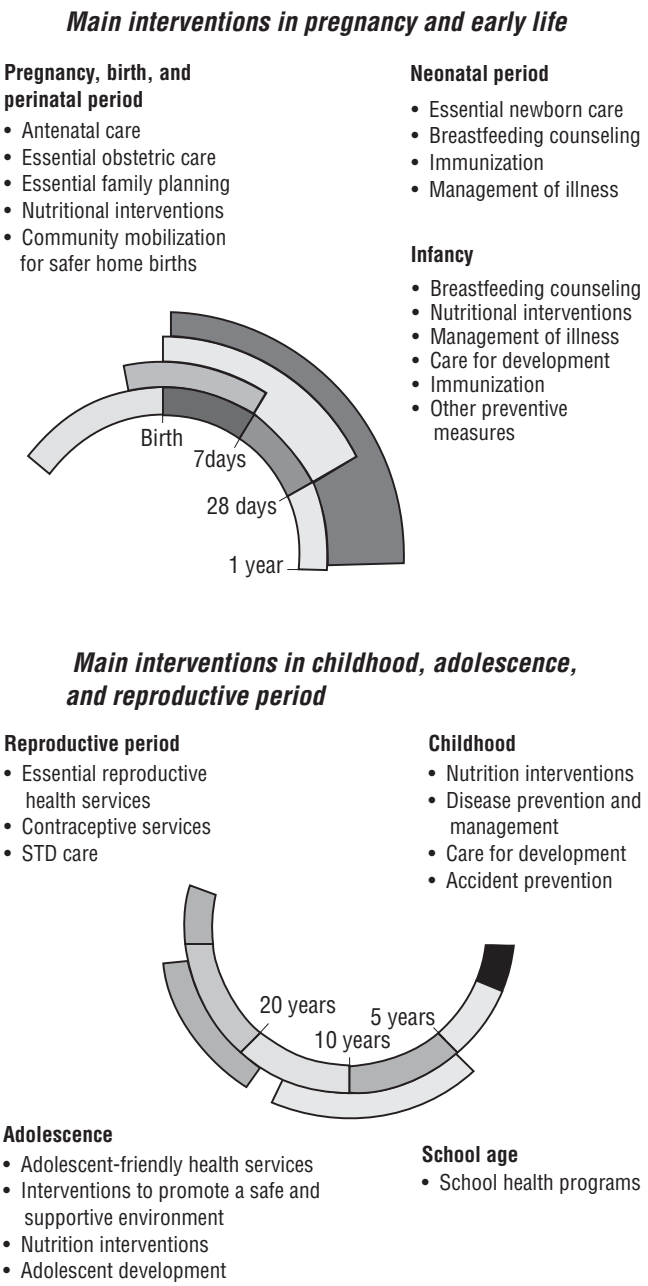
| Malnutrition Issues | Interventions | Effects/Benefits |
|---|---|---|
| Malnutrition is associated with over half of the 11 million deaths among children aged under five, annually. | Nutritional interventions targeting the mother (caloric and nutriment supplements)<br>´ 88% of pregnant women suffer from anemia in Asia | Increases weight at birth<br>Reduces risk of growth handicaps during early childhood |
| Main problems associated with malnutrition:<br>´ Low weight at birth<br>´ Growth handicaps during early childhood (stunting, wasting)<br>´ Anemia<br>´ Mental and physical disorders associated with iodine deficiency<br>´ Vitamin A deficiency | Iron supplements given to children (to correct anemia) | Reduces risk of malaria and hookworm infections<br>Improves cognitive capacities<br>Improves motor development |
| | Vitamin A supplements | Reduces ocular lesions<br>Reduces mortality due to diarrheas and measles<br>Increases hemoglobin synthesis |
| | Vitamin B12 supplements | Improves growth of cognitive capacities |
| | Zinc supplements | Enhances growth in stunted children |
| | Iodine supplements | Reduces infant mortality<br>Prevents cretinism<br>Reduces goiter<br>Improves mental and physical functions |

*Source:* Allen and Gillespie (2001).

3. This is actually comparable to what can be achieved with nutritional interventions on an even broader array of ARI-related conditions.

improve the quality and efficiency of health care services. The evidence shows that they are indeed extremely effective. For instance, Mother and Child Health programs associated with family planning programs proved effective in Narangwal (India), as reported by Parker and Reinke (1983). They show that the provision of health services to children reduced infant mortality by more than 35 percent and child mortality by more than 60 percent, where attention to mothers' health was included. The average annual number of days of illness per child was reduced by 16 percent for infants, and by 21 percent for children one to three years of age in villages where child care was available along with family planning activities.

**Figure A3-1. Main Interventions Associated with Each Phase of the Life-Cycle**



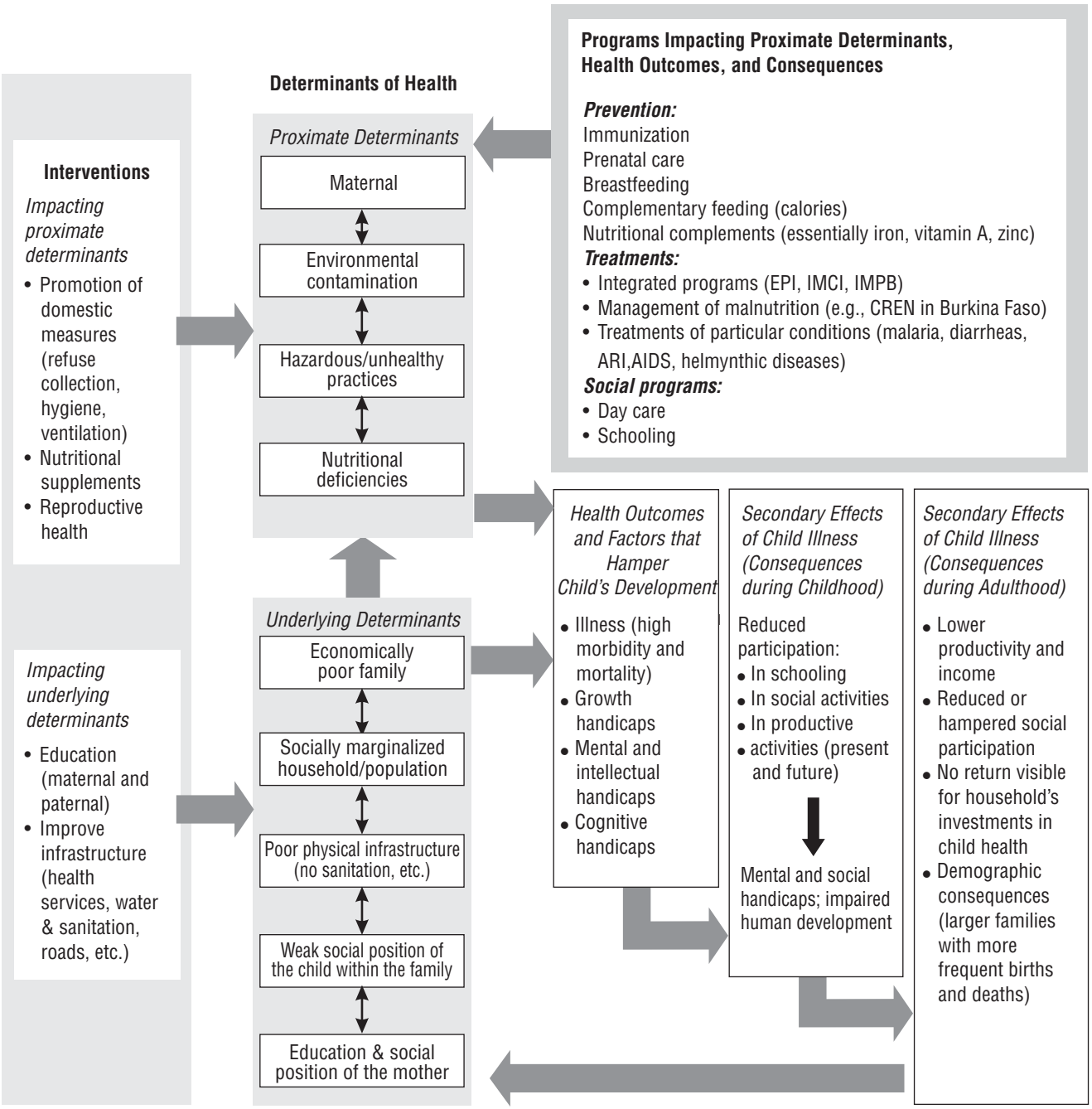

*Source:* World Bank (2001a).

Other tools to increase child survival and future economic returns include education programs channeled through the preschool system, including early education and child-care. Randolph (1994) shows that child preschool care can be effectively used to provide nutritional supplements, health care, and immunization to children, as well as basic health and hygiene education. Such preschool programs have secondary effects on parents, as health education can be shared with them through the program. An integrated early child development program in Bolivia (Programa Integrado de Desarrollo Infantil) shows that, indeed, access for children from poor sectors of the population caused a particularly strong positive effect on their health status and school participation (Van der Gaag and Tan 1996).

Schooling is another means of correcting intellectual growth handicaps that may have resulted from malnutrition. Glewwe and Jacoby (1995) show that the length of schooling is an important factor in that correction, but also point out that children's attendance is precisely affected by their nutritional status, as evidence from Ghana shows. Therefore, nutritional supplements should be coupled with education, particularly for children suffering from malnutrition. This is another example of why integrated programs may be a solution—at least theoretically—to the very complex links between health and development; integrated programs attempt to cover as many determinants of health as possible in recognition of the cyclical nature of the health-development relationship.

In general, cost-effectiveness estimates such as those presented here cannot be considered valid in different settings, because they rely on a host of concrete organization and contextual factors that are likely to vary enormously across places. A discussion of the several concrete implementation and sustainability issues critical to the success of any child health program goes beyond the scope of this paper. For instance, Gonzalez (1991) reports on the difficulties a school health education program in the Philippines had in attracting children; families were reluctant to let their children attend school both

**Figure A3-2. Child Health Determinants and Consequences (with entry points for programs and interventions aiming at improving children's fate)**



because the children were needed for productive tasks and because they could not envision the long-term benefits of schooling. Especially among the poorest families, the primary concern was to meet short-term necessities. The education program paid no attention to such demand factors and largely failed to attract the poor. Gonzalez, along with others, concluded that increased health and education expenditure is not enough, particularly for the poorest, for whom short-term benefits such as school meals need to be provided that can render long-term investments more attractive. Equally important is giving communities a sense of ownership of the new services provided to them. Analysts of family planning programs have come to similar conclusions; Ramakanth (1986) reported that, in order for family planning to be accepted and viewed positively, it must be accompanied by immediate benefits that families can visualize, experience, and control.

Supply-side incentives are needed as well. Recent analysis has tried to break new ground on how to involve the private sector more effectively (Waters, Hatt, and Axelsson 2002) in child health promotion, particularly among the poor, and on how to sharpen incentives for patients and providers for improving accessibility and quality of service in the public sector (Belli 2002). A general conclusion from all these studies is that the role of government in protecting children's health needs to be strengthened and transformed. (See also "World Development Report 2004: Making Services Work for the Poor," an unpublished draft available at http://econ.worldbank.org/wdr/wdr2004.)

## Annex 4. Economic Analysis of Integrated Programs

Over the last decade a large number of integrated programs, which include millions of families in new education, nutrition, and health services, have been introduced.

A large body of evidence and analysis is now available for a few of these integrated or comprehensive programs, including programs in India (in Aryana and Tamil Nadu states), Colombia (Promesa), Mexico (Progresa—the largest such program in the world), and Turkey (the Early Enrichment Project). These programs have included rigorous evaluation studies (with randomized controlled samples) that show improved cognitive development, higher school enrolments (up to 100 percent in the case of Promesa, according to Young 2002), lower dropouts and repetitions, better health and nutritional status, and reduced social inequality for the children exposed to them. Integrated programs have also brought about an indirect positive effect on household income, as improved child health allows mothers to spend more time at work and to participate more in the labor force.[1]

The Mexican program Progresa—now called Oportunidades—was launched in August 1997 and from the start included control groups and evaluation protocols that allowed thorough analyses of its immediate and medium-term effects. Progresa combines education, health, and nutrition interventions. In 2000, it covered 2.6 million poor Mexican families dwelling in rural areas, or 40 percent of rural families and one in nine families in Mexico (Skoufias 2001). In 1999, its budget was equivalent to 0.2 percent of the Mexican GDP, or $777 million ($960 million according to Gertler 2000). Recently, the Inter-American Development Bank granted a $1 billion loan to Mexico as part of a $4.8 billion six-year, multiphase expansion of Progresa that will include urban areas. The program has now being replicated throughout Latin America, including Honduras, Argentina, Brazil, Nicaragua and Colombia.

The main goal of Progresa and other similar integrated or comprehensive programs is to reduce poverty. The Mexican program, specifically, provides families with financial aid linked to school participation of children 8 to18 years of age and visits to health centers. It also provides nutritional supplements to children under five and health care and health information (through *pláticas* or informative talks) to both children and their mother (perinatal care). Monetary transfers—given to mothers—amount to one fifth of families' levels of consumption prior to transfers (Coady 2000).

It is estimated that integrated programs such as Progresa bring about an economic benefit to individuals in the form of higher income through four channels (Behrman and Hoddinott 2000):

- Increased cognitive capacities;
- Increased height, that directly influences earnings;
- Higher education degrees obtained;
- Lower repetition/drop-out rates (or lower age at which children complete school).

Evaluations of Progresa have identified the following specific education, health, and nutrition results.

***Education***

- An increase in secondary school participation after three years of 12 percent for girls and 6

1. However, some of that increased income is offset by lost income from children as they now spend time (or more time) in school.

percent for boys (who were already characterized by a higher participation), according to calculations by Coady (2000) and confirmed by an evaluation done by Schultz (2000). This increased participation leads, according to various evaluations, to an increase equal to 0.6 to 0.7 years (0.72 for girls and 0.64 for boys) of school and to 0.4 higher grades, according to Behrman (2001) and Schultz (2000).

***Health***

- Up to a doubling in visits to health centers for families included in the program (Gertler 2000).
- A decrease in the incidence of diseases by 12 percent for children under two and by 11 percent for children between three and five years of age (Gertler 2000).

***Nutrition***

- An increase in food consumption of 7.1 percent (in calories) after two years, which corresponded to an increase in expenses equal to 10.6 percent.

An attempt to evaluate the efficiency of the program conducted by Coady (2000) was limited to the ratio of administrative costs to monetary transfers and what costs would be incurred per beneficiary under various alternative selection and distribution scenarios. A cost-benefit analysis of the program that would include future economic benefits could use estimates of return to education in Mexico, which has been evaluated to be 5 percent for each year of primary school and12 percent for each year of secondary school (Parker and Skoufias 2000). Behrman and Hoddinott (2000) attempted to isolate the future economic benefits of only the nutritional component of Progresa and estimated that it might trigger an increase in future wages (at adult age) among beneficiary children of 2.9 percent. This does not include the effects of better nutrition on schooling, which, in turn, will have positive effects on beneficiaries' future productivity and wages.

Reviews of ECD programs in the United States (Karoly et al. 2001), such as the High/Scope Perry Preschool Project or the National Institute of Child Health and Human Development study in Early Child Care, have attempted to quantify these programs' future economic return to beneficiaries. Though the health component of the ECD programs reviewed is generally secondary if not negligible, the processes and results of the evaluations can be useful in identifying methodologies to evaluate costs and benefits of interventions and programs, particularly those that include a variety of components.

Table A4-1 shows the types and values of benefits that have been monetarily estimated for the High/Scope Perry Preschool program, which covered 58 African-American children (with 65 children in a control group) from age three to five (Karoly et al. 2001). These children received center-based education (2.5 hours per day) as well as 90-minute home visits from educators. Participants in the program as

**Table A4-1. Costs and Benefits of the Perry Preschool Program**

| Item | Value |
|---|---|
| Program costs | 12,148 |
| Savings to government | 25,437 |
| Reduction in education services | 6,365 |
| Reduction in health services[a] | — |
| Taxes from increased employment | 6,566 |
| Reduction in welfare cost | 2,310 |
| Reduction in criminal justice cost | 10,195 |
| Additional monetary benefits | 24,535 |
| Increase in participant income net of welfare loss | 13,846 |
| Reduction in tangible losses to crime victims | 10,690 |
| Total benefits | 49,972 |
| Net benefits | 37,824 |

*Note:* Values are expressed in 1996 U.S. dollars per child, with a 4% discount rate. All costs and benefits are "due to child."

[a]Not evaluated.

*Source:* Karoly et al. (2001).

well as children from the control group were subsequently followed until age 27. A number of potential benefits that accrued to the program, including differences in IQ tests, were not valued economically and, therefore, are not included in the table. The main economically quantifiable benefits were (Karoly et al. 2001, p. 55):

- Reduced use of special education and fewer years of grade retention (net of increased education costs due to greater educational achievement) through age 27
- Increased taxes from higher employment projected through age 65 based on employment and earnings data at age 27
- Less time spent on welfare projected through age 65 based on welfare utilization observed through age 27
- Reduced criminal justice system costs projected for their lifetime based on outcomes observed through age 27.

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