

Global Child Health

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Author Disclosure
Dr Denno has disclosed no financial relationships relevant to this article. This commentary does not contain a discussion of an unapproved/investigative use of a commercial product/device.

Objectives After completing this article, readers should be able to:

1. State the current annual number of child deaths globally and percentage of these deaths occurring in developing countries.
2. List the seven leading causes of childhood deaths worldwide and the interventions recommended by international guidelines to prevent these deaths.
3. Be aware of the percentage of childhood deaths that could be prevented through widespread implementation of these interventions.
4. Describe Millennium Development Goal 4 and progress toward its achievement.
5. Discuss the socio-political-economic factors and policies that affect child health.
6. Identify specific ways in which child health professionals in the United States can affect child health globally.

Introduction

Each year, millions of children die, the vast majority in poor countries. Tragically, most of these deaths are preventable with technologies that are currently available and recommended for universal implementation. Progress is being made: 8.1 million children younger than the age of 5 years died in 2009, down from 12.4 million in 1990. Unfortunately, rates of reduction in child mortality are much less than what can be accomplished realistically with available technology. Furthermore, progress lags far behind what was expected when 189 nations committed to reduce poverty and improve health and development via the Millennium Development Goals (MDGs). The MDGs consist of eight specific goals, including MDG4, which explicitly relates to child health and aims to reduce child mortality by two thirds between 1990 and 2015. The world is not on track to meet MDG4, although several developing countries are demonstrating that substantial improvements in child health can be made by focusing on making key lifesaving interventions available to children who need them the most.

This article explores the scope and causes of childhood mortality, interventions to combat these killers, trends in child health, potential reasons for these trends, and opportunities for progress in improving global child health.

Scope of the Problem

Health is more than just survival, but as a starting point, it is hard to avoid the fact that more than 22,000 children younger than age 5 years are estimated to die each day. Ninety-nine percent of these deaths occur in developing countries, with 92% in Africa and Asia. A child born in sub-Saharan Africa faces a 1 in 8 chance of dying before his or her fifth birthday compared with 1 in 130 for a child born in the United States and an average of 1 in 167 for developed countries.

“Child,” as used in this article and as typically defined in the global health field, includes persons younger than 5 years of age because of their particular biologic and social vulner-

Abbreviations

ACT:	artemisinin combination therapy
AIDS:	acquired immune deficiency syndrome
CHW:	community health worker
Hib:	<i>Haemophilus influenzae</i> type b
HIV:	human immunodeficiency virus
IMCI:	integrated management of childhood illness
IPT:	intermittent presumptive treatment
ITN:	insecticide-treated net
MDG:	Millennium Development Goal
ORS:	oral rehydration salts
ORT:	oral rehydration therapy
PCP:	<i>Pneumocystis jiroveci</i> pneumonia
U5MR:	under-five mortality rate
UNICEF:	United Nations Children’s Fund
VA:	vitamin A
WHO:	World Health Organization

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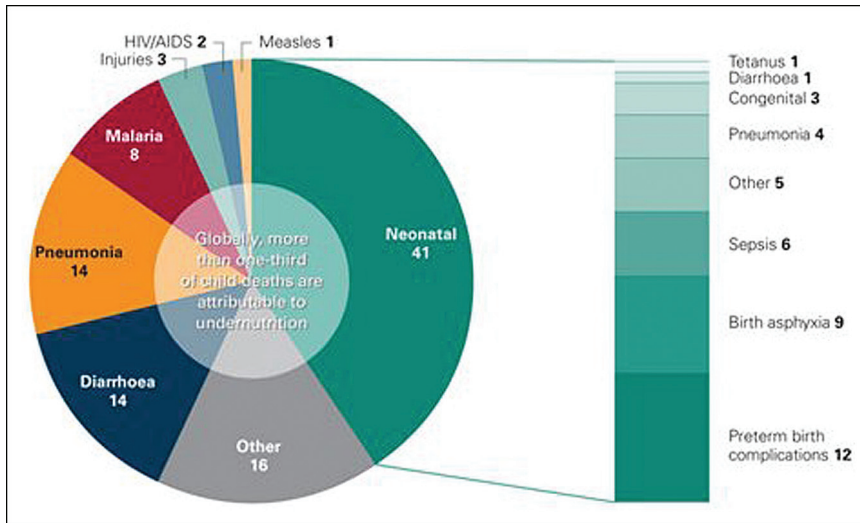


Figure 1. Causes of death among children younger than age 5 years. Reproduced from UNICEF ChildInfo website: <http://www.childinfo.org/mortality.html> and based on Black R, Cousens S, Johnson H, et al. Global, regional, and national causes of child mortality in 2008: a systematic analysis. *Lancet*. 2010;375:1969–1987.

ability. Age-specific mortality rates decline appreciably beyond 5 years. Under 5 mortality rates (U5MRs) are commonly used as indicators to assess the health of a general population. If conditions favor the health and welfare of this vulnerable group, the situation generally can be considered favorable for the overall society.

Statistics from developing countries can carry a wide margin of uncertainty due to lack of resources to support surveillance and registry systems and limited availability of diagnostics for precise determination of causes of illness and death. Furthermore, many important health-related events take place outside of health facilities, limiting the acquisition of information in centralized data sources. For example, parents often seek care for childhood illnesses from pharmacy shops or street vendors. Most births and neonatal deaths occur at home and often are unrecorded.

However, there are additional sources of helpful data, including nationally representative surveys, such as Demographic and Health Surveys (largely funded by United States Agency for International Development) and the United Nations Children's Fund (UNICEF) Multiple Indicator Cluster Surveys. Expert panels such as the Inter-agency Group for Child Mortality Estimation and the Child Health Epidemiology Reference Group have been working on improving estimation methodologies and standardizing reporting of estimates. Despite less-than-desirable margins of certainty, these collective sources of information allow for examination of trends

and help to set priorities within programs and policies to improve child survival.

Major Causes of Child Mortality

Eighty-four percent of global child deaths are due to seven major causes: neonatal problems, pneumonia, diarrhea, malaria, measles, human immunodeficiency virus (HIV)/acquired immune deficiency syndrome (AIDS), and injuries (Fig. 1).

Undernutrition is an enormous risk factor for childhood mortality and morbidity. As defined in recent research that estimates it contributes to 35% of all child deaths, undernutrition includes: 1) lack of sufficient macronutrient (eg, protein) and caloric intake; 2) micronutrient deficiencies, especially vitamin A (VA), zinc, iron, and iodine; and 3) lack of early initiation of breastfeeding and exclusive breastfeeding in the first 6 months after birth. Undernutrition increases susceptibility to infectious diseases and is associated with long-term cognitive impairment and poor school performance as well as with poor health consequences in adulthood and into the next generation (eg, low-birthweight offspring among affected women).

It is worth noting that undernutrition and the common direct causes of child deaths are not exotic tropical diseases, but rather diseases of poverty. Many are the same diseases that killed children in the United States and other developed countries 100 years ago: neonatal problems, diarrhea, pneumonia, and measles. These scourges were largely controlled even before the advent of antimicrobials and vaccinations by social changes addressing crowding, sanitation, nutrition, and basic living conditions. Medical breakthroughs such as antibiotics, immunizations, and insecticides (to prevent malaria, a vector-borne disease that was endemic in parts of the United States) further accelerated gains in controlling disease and preventing childhood mortality.

An overview of causes of childhood mortality would not be complete without mention of less proximate, but perhaps even more important underlying causes: the social determinants of health. Children living in absolute poverty have limited access to the basics necessary to support survival (eg, essential medicines and health care, water, sanitation, adequate nutrition, education). Nearly

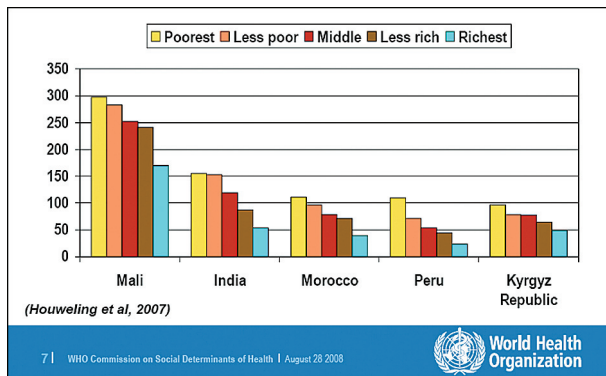


Figure 2. Under 5 mortality rate (per 1,000 live births) by wealth group. Reproduced from *Closing the Gap in a Generation: Health Equity Through Action on the Social Determinants of Health. Final Report of the Commission on Social Determinants of Health*. Geneva, Switzerland: World Health Organization; 2008.

1.4 billion people live on less than \$1.25/day, the international poverty line. Another 1.2 billion live on \$1.25 to \$2.00/day, which is closer to a practical poverty line, especially in middle-income countries. Altogether, approximately 40% of the world's population lives on less than \$2.00/day, an extreme hardship that reduces chances for survival and optimal health.

Relative poverty is also an important determinant of health, as borne out by research in both developed and developing countries. Large gaps between rich and poor within a society are associated with worse health outcomes among the poorer compared with the wealthier strata within the society (Fig. 2). This phenomenon of poor health among those living in material deprivation compared with those around them who are better off has been documented from New York to Glasgow to Uganda. Unfortunately, income gaps between rich and poor have increased dramatically over the past few decades, along with increases in health disparities. For example, in 21 developing countries where U5MRs have recently decreased, gaps in mortality rates between the rich and the poor increased.

A plethora of studies have documented the strong correlation between child survival and the mother's education level (Fig. 3). In Bolivia, for example, babies born to women who have no education are 2.5 times more likely to die before their first birthdays compared with those whose mothers have completed secondary school. Rural residence, slum dwelling, race, and ethnicity are other important social determinants of health.

Interventions to Reduce Child Mortality

The following section reviews current recommendations for preventing deaths from leading childhood killers. The term intervention is used to describe "a biologic agent or action intended to reduce morbidity or mortality." (1)

Neonatal Causes

More than one third of children who die do so during the first month after birth, accounting for more than 3.2 million deaths annually. Three major causes comprise 80% of deaths: prematurity and low birthweight, neonatal infections, and asphyxia. Most deaths occur at home and in the first postnatal week. A large proportion of neonatal deaths can be prevented if babies and their mothers receive known, effective interventions that span the ante-, intra-, and postpartum periods. Examples include antenatal screening and care, delivery by skilled birth attendants, promotion of early and exclusive breastfeeding, hygienic skin and umbilical cord care, keeping babies warm and dry (eg, skin-to-skin contact), family recognition of signs of illness requiring prompt medical attention, and early assessment of newborns by trained health workers. Unfortunately, coverage rates in developing countries for recommended neonatal interventions are poor (Fig. 4).

Widespread implementation of a package of inexpensive, simple, and effective interventions could cut neonatal deaths in half and bring global neonatal death rates to levels comparable with those of industrialized countries that were recorded just before the widespread availability of neonatal intensive care.

Acute Respiratory Infections

Pneumonia is the leading cause of death after the neonatal period, killing more than 1 million children annually. Although data on the microbiologic causes of pneumonia are limited, pneumococcus and *Haemophilus influenzae* type b (Hib) are the leading causes of childhood pneumonia deaths globally. This predominance is not unlike the causes of pneumonia deaths in industrialized countries, especially before Hib and pneumococcal vaccine introduction. Other causes include viruses (eg, respiratory syncytial virus); other bacteria (eg, *Staphylococcus aureus*); and where HIV prevalence is high, *Pneumocystis jirovecii* pneumonia (PCP). PCP is responsible for 5% of childhood pneumonia deaths worldwide, despite the availability of effective prophylaxis and treatment.

Preventive measures are important in reducing the incidence of pneumonia and case fatality rates. Undernourished children lack adequate immunity and have more difficulty in clearing secretions due to weakened

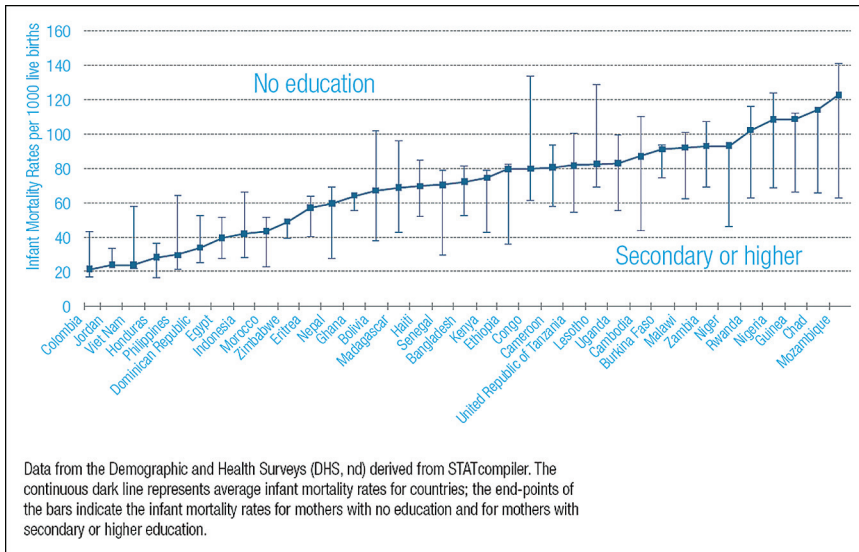


Figure 3. Infant mortality rates by mother's education in multiple countries. Reproduced from *Closing the Gap in a Generation: Health Equity Through Action on the Social Determinants of Health. Final Report of the Commission on Social Determinants of Health.* Geneva, Switzerland: World Health Organization; 2008.

respiratory muscles. Furthermore, children younger than 6 months of age who are exclusively breastfed and children who continue to breastfeed through the second postnatal year are less likely to develop acute respiratory infections. Micronutrients (especially zinc) play an important role in immune function and respiratory infection prevention.

Hib and pneumococcal vaccines were incorporated into routine vaccination schedules in industrialized

countries toward the end of the 20th century. However, despite the fact that the largest burden of Hib and pneumococcal disease has been and continues to be in developed countries, serotype coverage in pneumococcal vaccine has largely focused on markets in high-income countries. Furthermore, cost has been a major impediment for Hib and pneumococcal vaccine introduction in poor countries. Since 1997, Hib vaccine has gradually been incorporated into at least 115 national childhood vaccine schedules. Pneumococcal vaccine rollout is in its infancy in the developing world. At the time of this writing, South Africa, Rwanda, and Gambia are the only sub-Saharan African countries to have introduced the vaccine nationally, although other countries have plans to do so in the

near future. Measles vaccine plays an important preventive role because pneumonia is a common sequela of measles infection. Cotrimoxazole prophylaxis is important for PCP prevention among HIV-infected individuals.

Indoor air pollution is associated with a 1.8-fold risk of contracting pneumonia and is largely caused by burning of solid fuels (eg, dung, wood, charcoal) in dwellings for heat and cooking. These polluting fuels are used primarily by poor households that are unable to afford stoves that use cleaner burning fuels. Efforts to mitigate this exposure are ongoing through research to develop affordable and acceptable clean energy systems and through increasing the utilization of existing methods, such as solar cookers.

Although prevention plays an important role in pneumonia control, treatment with a full course of appropriate antibiotics remains a critical intervention to reduce rates of fatal pneumonia. The term pneumonia, as used in this article and customarily in the global child health field, actually refers to "suspected pneumonia." Diagnostic

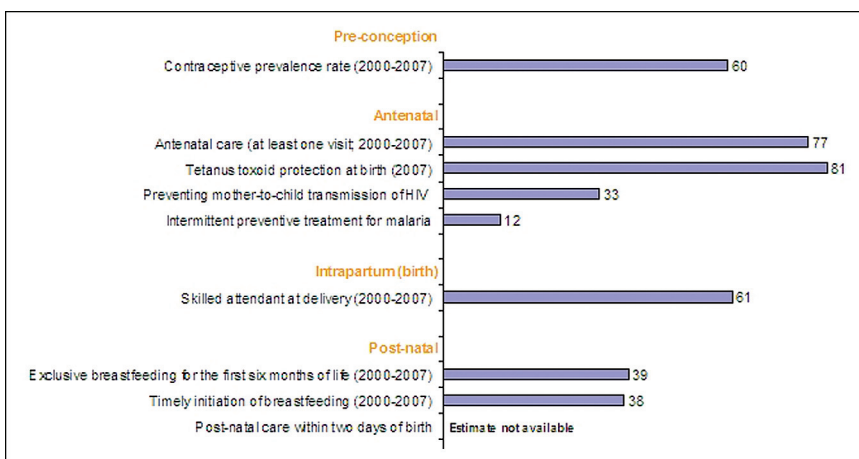


Figure 4. Coverage of key neonatal survival interventions in the developing world. Reproduced and modified from UNICEF ChildInfo website: <http://www.childinfo.org:80/newborncare.html>.

test availability, including radiography, is extremely limited in resource-poor settings. Diagnosis of suspected pneumonia hinges on clinical assessment, based especially on tachypnea or retractions in a child who has cough or cold symptoms.

Despite increasing resistance to first-line antibiotics (amoxicillin and cotrimoxazole), clinical trials continue to demonstrate the efficacy of these inexpensive oral drugs, even in the treatment of severe pneumonia. They remain the mainstay of recommended treatment in the World Health Organization (WHO) and UNICEF guidelines. Prompt and appropriate treatment is critical to reducing pneumonia deaths and hinges on: 1) parent/caretaker recognition of tachypnea and retractions as signs for which prompt care should be sought, 2) ability to access appropriate health care without delay (ie, services are available, geographically proximate, affordable, of good quality, and nondiscriminatory), 3) accurate diagnosis and treatment by health workers, and 4) availability and affordability of treatment and completion of a full therapeutic course. However, fewer than one fifth of parents/caregivers recognize that fast breathing and retractions require urgent medical attention. Only 54% of children who contract pneumonia in developing countries are taken for appropriate health care. An even smaller percentage actually receives antibiotics. Tragically, there has been little improvement in these coverage statistics over the past decade, especially in sub-Saharan Africa.

Hundreds of thousands of lives could be saved if pneumonia prevention and treatment interventions were universally available. Universal treatment with antibiotics alone could reduce pneumonia mortality by approximately 40%. To make this treatment a reality, implementation strategies must focus on getting treatment to children in the communities where they live. Studies have consistently shown that community health workers (CHWs) trained in pneumonia case management can accurately identify and effectively treat childhood pneumonia. However, a recent study (2) demonstrated that only 27 of 54 countries that have a high pneumonia burden have implemented some type of community-based pneumonia case management program. One third of countries have policies that restrict community case management of pneumonia (eg, prohibition of CHWs in dispensing or prescribing antibiotics). Policies and programs that are conducive to getting interventions to children who need them the most (eg, the poor, rural dwellers), efforts to educate families about danger signs of pneumonia, and improved access to and quality of care

Glossary of Terms

- U5MR=under five mortality rate, also referred to as child mortality rate=number of deaths before 5 years of age/1,000 live births
- Infant mortality rate=number of deaths before 1 year of age/1,000 live births
- Neonatal mortality rate=number of deaths before 28 days of age/1,000 live births
- Absolute poverty=living below a minimum level of income or wealth that is necessary for attainment of basic needs (eg, adequate shelter and nutrition) and services (access to education and essential health care)
- Relative poverty=in a society with large differences between rich and poor, living at an income or wealth level significantly less than the societal average, so those living in relative poverty are excluded from the ordinary way of living of most people around them
- Skilled birth attendant=a health professional such as a midwife, doctor, or nurse who has been trained to manage normal pregnancies, childbirth, and the immediate postnatal period and can identify, manage, and refer complications in women and newborns
- Community health workers (CHWs)=persons living in a community and selected by their community to receive basic training to provide preventive health services, offer counseling on prevention and care-seeking practices, identify common illnesses, and in many countries, provide basic health services for common problems. CHWs are referred to with a variety of names in different settings, including community health volunteers or village health workers in Africa, health promoters in Latin America, and lady health workers in Pakistan
- Improved water sources are those that are protected from fecal contamination and include piped water, public taps, standpipes, boreholes, protected wells, protected spring, and rainwater
- Improved sanitation facilities are those that hygienically separate human waste from human contact, including units that flush or pour-flush into sewer or septic systems or pit latrines, ventilated improved pit latrines or pit latrines with slab, and composting toilets

For more information, see WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation <http://www.wssinfo.org/definitions-methods/introduction>

in clinics and hospitals are critical in increasing the number of patients who receive pneumonia treatment.

Diarrheal Disease

Diarrhea is the second leading cause of child death after the neonatal period and accounts for nearly 4 billion

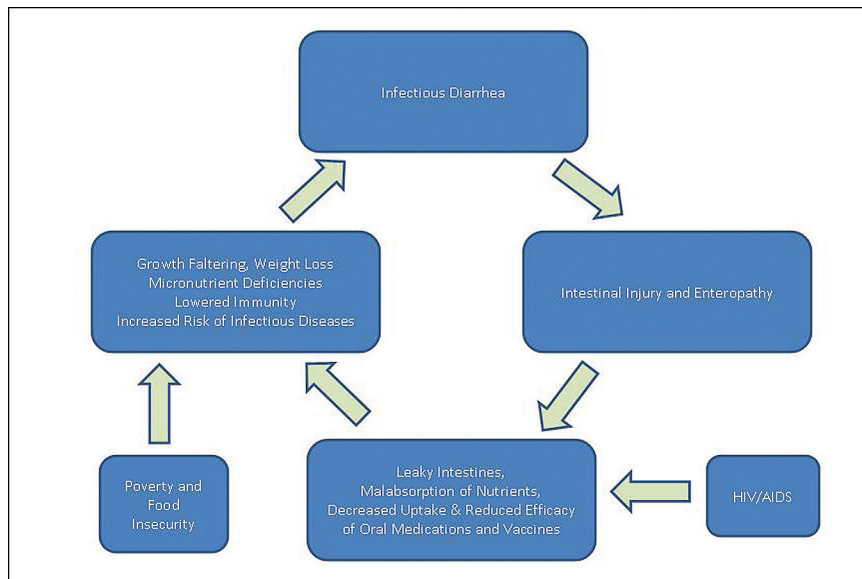


Figure 5. The vicious cycle of infectious diarrhea, malabsorption, and undernutrition.

cases (all ages) and 1.1 million child deaths annually. Microbiologic causes vary by locale and have not been well elucidated, especially in developing countries where the incidence and mortality rates are highest. A variety of bacteria (eg, *Campylobacter*, *Salmonella*, *Escherichia coli*, and *Shigella*), viruses (especially rotavirus), and parasites (eg, *Cryptosporidium*, *Giardia*) cause infectious diarrhea and are spread via water, food, utensils, flies, and hands. Deaths are due largely to fluid and electrolyte losses. Undernourished children are at greater risk of contracting and dying from diarrheal disease. Furthermore, repeated and persistent infections can lead to or exacerbate underlying undernutrition (Fig. 5).

The incidence of diarrhea and its mortality could be dramatically reduced by widespread implementation of currently available prevention and treatment interventions. Access to “improved” (see Glossary of Terms) water sources and sanitation facilities as well as sufficient quantities of water to facilitate improved hygiene could reduce diarrhea-related mortality by up to 88%. Furthermore, widespread coverage of these interventions could reduce the impact of other water-related diseases. For example, access to improved sanitation facilities reduces the risk of acquisition of helminth infections (eg, hookworm, whipworm, roundworm) from contact with contaminated soil (eg, walking shoeless in at-risk environments) or ingestion of contaminated food. These parasites are responsible for significant morbidity, including intestinal blood loss and reduced nutrient absorption. Availability of a sufficient water supply for adequate

hygiene could also contribute to control of diseases such as Guinea worm, trachoma, and respiratory infections.

Slightly more than 50% of the world’s population has access to piped water (going into their dwelling or yard), while 87% have access to any type of improved water sources, up from 77% in 1990. Further progress is still needed, especially in sub-Saharan Africa, where only 58% of the population have access to improved water sources. Much slower progress has been made in sanitation coverage. Only 62% of people globally have access to improved sanitation facilities (compared with 54% in 1990), and coverage in southern Asia and sub-Saharan Africa is abysmally poor at less than 33%.

Adequate nutrition, including breastfeeding and adequate micronutrients, also plays an important role in preventing diarrhea. In addition, new immunizations, such as rotavirus vaccine, hold promise for preventing diarrhea due to specific agents.

Key treatment interventions are oral rehydration therapy (ORT) and zinc. For more than 2 decades, ORT has been the cornerstone of treatment for preventing and treating dehydration and electrolyte losses. ORT is estimated to save the lives of 1 million children annually. ORT employs prepackaged oral rehydration salts (ORS) mixed with water or the use of appropriate other fluids such as homemade solutions. Most recently, the composition of internationally used ORS has been reformulated to a lower osmolarity, which has been found to shorten the duration of diarrhea and decrease the need for unscheduled intravenous fluids compared with the older formulation. International treatment guidelines also recommend a 10- to 14-day course of oral zinc for all children who contract diarrhea and live in areas that have a presumed high prevalence of zinc deficiency (ie, most developing countries). Treatment with zinc reduces the severity and duration of illness and decreases the likelihood of subsequent diarrheal episodes in the following 2 to 3 months.

Because it is a relatively new recommendation, data on zinc coverage are limited. However, progress in ORT coverage has been sluggish. In 2008, only 38% of children who had diarrhea in developing countries (data

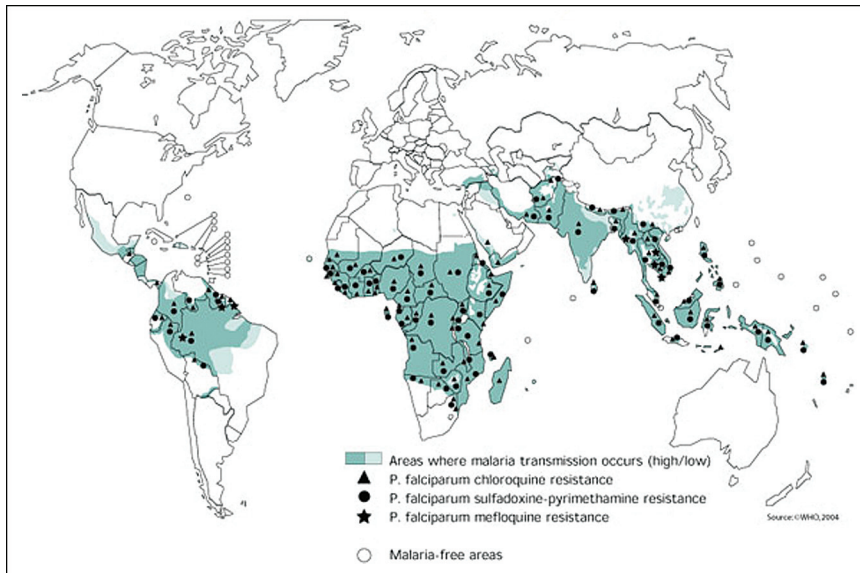


Figure 6. Malaria transmission areas and reported *P. falciparum* resistance, 2004. Reproduced from *Guidelines for the Treatment of Malaria*. Geneva, Switzerland: World Health Organization; 2006.

exclude China) received recommended fluid therapy compared with 32% in 2000.

The unacceptable toll of deaths from diarrhea is a tragic reminder of the work that remains in delivering known, effective prevention and treatment to those children most in need.

Malaria

Almost 50% of the world's population lives in areas where malaria is endemic. The *Plasmodium* parasites that cause malaria are transmitted by the bite of the *Anopheles* mosquito. Infection with any of the four malaria-causing species (*P. falciparum*, *P. vivax*, *P. malariae*, and *P. ovale*) is associated with significant morbidity, although the vast majority of malaria deaths are due to *P. falciparum*. The geographic distribution of *Plasmodium* species varies; Figure 6 depicts all areas where transmission from any of the species occurs and specifically denotes areas where *P. falciparum* resistance to conventional antimalarials has been reported.

People living in malaria-endemic areas frequently experience asymptomatic and “uncomplicated” malaria that primarily presents with the flulike symptoms of fever, headache, and vomiting. Malaria parasites replicate in and lyse hematocytes, causing anemia, which exacts a toll on physical and mental development in children and economic productivity in adults. Untreated uncomplicated malaria can rapidly lead to life-threatening “com-

plicated” malaria in pregnant women and young children (due to relative immunosuppression and lack of acquired immunity, respectively) in areas where *P. falciparum* cause disease. Severe hemolytic anemia and cerebral malaria (presenting with altered mental status, convulsions, or coma) are the most common forms of complicated malaria and are associated with high fatality rates. Malaria parasites infect the placenta and contribute to low birthweight, a major cause of neonatal mortality.

Reduction in malaria mortality requires a multipronged approach consisting of prevention and treatment interventions. Insecticide treated nets (ITNs) are one of the most effective methods of preventing transmission. Studies have demonstrated a 17% reduction in

all causes of child mortality in malaria-endemic areas associated with regular ITN use. Not only do ITNs protect sleeping individuals with a physical barrier against mosquitoes, but the insecticide also offers protection to nonusers up to several hundred meters away. Initially, ITN implementation strategies focused on creating demand for ITN purchase. However, even at subsidized prices, nets were not affordable to those in most need and at highest risk, and coverage rates were low. A recent shift to a mass distribution strategy (eg, through antenatal care and immunization clinics) has increased coverage multifold, although much more progress is required to move current 20% coverage rates to 80% coverage goals (set by the WHO World Health Assembly in 2005) by 2010.

Malaria parasites can become resistant to antimalarial drugs quickly; conventional therapies (eg, chloroquine, sulfadoxine-pyrimethamine) are no longer effective in many areas (Fig. 6). Artemisinin combination therapy (ACT), once deemed too costly for wide-scale use, is now the recommended first-line treatment for uncomplicated malaria in areas characterized by high resistance to conventional therapies. Artemisinin is an effective antimalarial, and when used in combination with another antimalarial agent, progression to resistance is slowed dramatically. To prevent rapid development of artemisinin resistance, the WHO recommends against the production, marketing, or use of artemisinin oral mono-

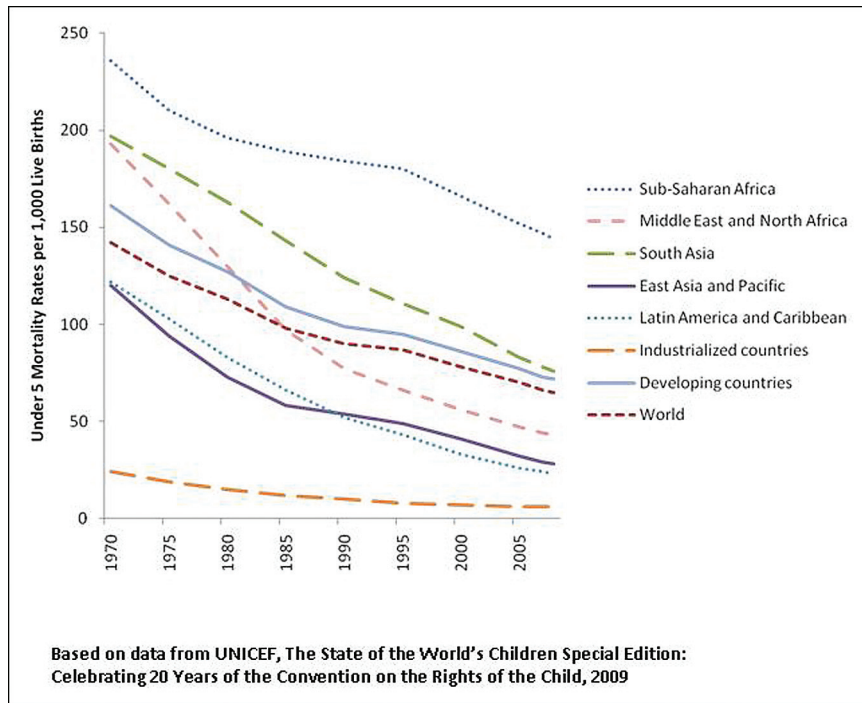


Figure 7. Trends in U5MR from 1970 to 2008.

therapy, especially because there are no effective treatment alternatives on the market. Unfortunately, oral artemisinin monotherapy is available in many countries, and resistance has recently been reported in Cambodia. Furthermore, even in countries that have adopted ACT as first-line treatment, few children who have malaria symptoms are receiving the agent. In fact, recent data from sub-Saharan Africa demonstrated that fewer than 60% of children who have had malaria symptoms have received any type of antimalarial. Updated WHO treatment guidelines recommend that all children presenting with fever and living in malaria-endemic countries be tested for malaria infection (by microscopy or rapid diagnostic tests) and treated accordingly. In settings without testing capacity, febrile children should be treated for malaria presumptively.

Malaria infection among pregnant women is common, even when asymptomatic. Intermittent presumptive treatment (IPT) during pregnancy is effective in reducing maternal (eg, anemia) and neonatal (eg, low birthweight) complications of infection by clearing parasites from the bloodstream and placenta. IPT, consisting of two doses of oral sulfadoxine-pyrimethamine, is recommended during pregnancy for those residing in endemic areas. IPT for young children holds great potential for reducing malaria mortality. Research is

ongoing to identify IPT drugs that have fewer current and potential resistance issues.

Other Major Causes of Child Mortality

Measles is a leading cause of vaccine-preventable mortality, contributing to 1% of child deaths. Two doses of vaccine are recommended. The first dose is usually administered at 9 months of age in endemic settings. Approximately 80% of 12- to 23-month-old children have received at least one dose. Children infected with measles are at high risk for secondary complications, including corneal ulceration, diarrhea, and pneumonia. Concomitant VA deficiency is associated with increased morbidity and mortality. VA plays an important role in immune and epithelial tissue function. VA deficiency is common in developing countries,

and measles infection further depletes VA stores. Treatment with high-dose VA reduces measles-related morbidity and mortality and is recommended for all children who have measles living in areas with high VA deficiency. Much recent progress has been made in reducing measles mortality: deaths have declined by 74% and 89% worldwide and in sub-Saharan Africa, respectively, between 2000 and 2007.

AIDS and injuries account for 2% and 3% of childhood mortality globally, respectively, but represent higher proportions of deaths, depending on geographic setting. For example, injuries account for higher proportions of deaths in middle-income countries where infectious diseases are better controlled. Most deaths due to injuries are preventable with interventions that employ a multidisciplinary approach to the problem. AIDS is responsible for a high proportion of child deaths in many sub-Saharan African countries. Transmission from mother to child accounts for 90% of childhood HIV acquisition and has been virtually eliminated in industrialized countries. This progress is not the case in developing countries due to poor access to antiretrovirals and less-than-optimal substitutes for breastfeeding due to cost and sanitation issues. Furthermore, only a small fraction of children meeting criteria for treatment of HIV/AIDS are receiving treatment.



Figure 8. Vila Manica District Hospital, Mozambique, 1991. Reproduced with permission from Stephen Gloyd.

Child Health Intervention Implementation Within the Health System

In the 1990s, in response to programs focused solely on controlling and treating single diseases, WHO and UNICEF developed the Integrated Management of Childhood Illness (IMCI), a strategy that focuses on caring for the whole child. IMCI includes preventive and curative elements, such as monitoring growth, development, and immunization status during all childhood sick visits. Effective IMCI implementation includes three components: 1) improving health worker case management skills, 2) improving health practices within families and communities, and 3) improving overall health systems. Nonpediatric physicians and nonphysician providers of care are trained in IMCI clinical algorithms. These types of HCWs, particularly nonphysician providers (eg, nurses, mid-level providers), provide the bulk of child health services in resource-poor settings. IMCI algorithms focus on identification of common causes of mortality, appropriate treatment, and referral for more specialized or hospital-based care when necessary. The community and family practices component encompasses education to increase key preventive practices in the household and community and to ensure that parents know symptoms for which to seek health care. Last, but not least, a functioning health system is critical for training and regular supervision of health workers and for ensuring timely access to referred care and steady stocks of drugs, vaccines, equipment, and supplies.

Evaluations of the IMCI strategy conducted in multiple countries have demonstrated improved performance by health workers and improved clinical care by those who have taken the IMCI course. However, the evaluations also showed that less attention has been focused on implementing the family/community

and health systems components. To achieve any significant reduction in child mortality through the IMCI strategy, full attention to all three components is needed as well as implementation of services on a larger scale.

Efforts are being made, including by the WHO, to revitalize the Primary Health Care movement, first advanced in the 1970s. This movement encourages integrated care but additionally focuses on universal access to essential medicines and health services and a comprehensive approach to health that includes addressing underlying environmental (eg, water and sanitation) and social determinants of health (eg, education).

Trends in Child Mortality

Tracking of health data globally started in the 1960s. There has been a continual decline in U5MRs and in absolute numbers of child deaths annually over the intervening decades. Remarkable gains were seen in reducing child mortality in the first couple of decades after commencement of data monitoring, followed by a marked diminution in progress, even stagnating and sometimes reversing course, with increased U5MRs in some countries. Worldwide, U5MRs dropped 20% in each decade between 1970 and 1990, but they dropped only 12% in the 1990s. Data to date from the first decade of the 21st century indicate modest improvements in reducing U5MRs compared with the previous decade (Fig. 7).

Sociopolitical and economic factors and policies can influence child health profoundly. An examination of trends in global health would not be complete without examination of some important sociopolitical and economic issues affecting these trends:



Figure 9. Laboratory technician, Somalia, 1983. Reproduced with permission from Stephen Gloyd.

- **Conflict:** Most countries experiencing U5MR increases are embroiled in conflict. Since World War II, civilian deaths, including those of women and children, outnumber combatant deaths, accounting for 90% of conflict-related deaths and half among those younger than 18 years. Most civilian deaths are non-trauma-related; rather, they are due to disruptions in civilian infrastructure, including health services. For example, pneumonia, diarrhea, and undernutrition rates typically increase during conflict.
- **Global free trade policies:** Free trade policies have largely been negotiated to the benefit of rich countries. The United Nations estimates that trade rules that are unfair to poor countries deny them \$700 billion in income every year. For example, subsidies to farmers in rich countries have shut many farmers in poor countries out of markets, including in their own countries. Other policies have encouraged privatization of health care, which leaves the poor with fewer access options. Trade policies on drug patents have resulted in limited access to medicines.
- **Debt:** Many poor countries are servicing debt burdens from high-interest rate loans owed to international lending agencies, such as the International Monetary Fund and World Bank. African countries pay more in debt than they receive in donor aid.
- **International economic policies:** Structural adjustment policies (now often incorporated as part of “poverty reduction initiatives”) are conditions imposed by international lending institutions on loaning money or forgiving debt and are intended to rein in borrower government spending. As such, these conditionalities call for reduced subsidies for public services that directly affect those who most need the services. For example, as many sub-Saharan countries went from free to fee-based health care and education, utilization subsequently declined. Many Latin American countries privatized water sources, with resultant decreases in water access among the poor. These policies also include reductions in civil service workforces (eg, health professionals, teachers) through layoffs. Salary caps have effectively reduced buying power because pay cannot keep pace with high inflation rates of many countries. Slashed funds for improvement and even upkeep have resulted in crumbling health facilities (Fig. 8), lack of even basic equipment (Fig. 9), and reduction in quality of services.
- **Unmet development aid promises:** High-income countries have recognized that to attain development goals, low-income countries require at least \$50 billion in external funds in addition to what is currently

being given. (For the purposes of context, \$16 billion a month has been spent by the United States on the direct costs of the wars in Iraq and Afghanistan, and recent United States stimulus and financial institution bailout packages were allocated more than \$700 billion each.) The Millennium Declaration is a compact between poor and rich countries whereby the latter committed to supporting poor countries to meet MDGs. Extending back to 1970, wealthy countries have pledged and reiterated their pledge to give 0.7% of their gross national income as donor aid to help developing countries achieve basic development goals. However, only five countries (Denmark, Luxembourg, the Netherlands, Norway, and Sweden) have actually met this pledge. The United States gives the most in terms of total dollars, but the least in relation to the pledge, donating 0.18% of gross national income (compared with 0.3% for 22 Western donor countries overall).

- **Aid effectiveness and priority setting:** There is increasing recognition that more donor aid* without aid effectiveness measures can translate to wasted dollars, or worse, negative impact. Donor aid is often allocated to countries not on the basis of need but on the basis of strategic interests. For example, less than one third of United States donor aid goes to the least developed countries. In 2007, the top five recipients of United States donor aid (Iraq, Afghanistan, Sudan, Columbia, and Egypt) received approximately one third of United States donor funds.

Other problems can translate to less effective donor aid. For example, aid is increasingly being given through nongovernmental organizations (both for-profit and not-for-profit) based in donor countries instead of directly to developing countries. These organizations often have high overhead costs, using up to 50% of project funding. Furthermore, internationally run projects often draw away indigenous talent with substantially higher salaries, leaving local institutions further understaffed. It is also not unusual to have hundreds of internationally run projects working in the same country and not communicating with each other or with local structures. They often work outside of national health systems, but this practice only diverts from and weakens existing systems. Moreover,

*The term donor aid refers to funds that are for the purpose of development to resource-poor countries. Foreign assistance includes donor aid but may also include military assistance, for example. Health expenditures comprise only 15% of total donor aid, with the remaining going to other areas of development, emergency aid, and debt repayment.

funders determine where, how, and on what priorities their money will be spent.

Donor aid often mandates that recipient countries buy donor goods in return. It is not uncommon for more than half of donor aid to funnel right back to donor countries, diminishing the “effectiveness” of aid dollars in producing intended outcomes. Projects tend to concentrate in capital cities and at national-level hospitals and less commonly reach underfunded, understaffed, more outlying district hospitals, clinics, and communities.

The last few years have seen an influx of funding for high-profile diseases, especially AIDS, tuberculosis, and malaria, scourges certainly worthy of global attention. However, funding for more common maternal and childhood killers has been abysmal. For example, pneumonia kills more children than AIDS, tuberculosis, and malaria combined and yet receives far less attention and funding than any of them. The same can be said for diarrhea and neonatal problems.

- **Unmet government commitment to health:** Governments of developing countries have also pledged to prioritize health, including by providing resources for the health sector. For example, African heads of state have agreed to devote 15% of domestic expenditures to the health sector. Malawi has made substantial increases in health funding, and Zambia has met the pledge. Most other countries lag far behind their pledges, and many have decreased the proportion of funds going to the health sector.
- **Skewed research priorities:** In 1998, the term “10/90 gap” was coined by the Global Forum for Health Research to express that only 10% of health research funding was directed toward the 90% of the disease burden that affects the poor globally. The term continues to be used to express the continued wide gaps, despite recent increases in global health research spending that have largely focused on HIV/AIDS, to a lesser extent on tuberculosis and malaria, and relatively little on neonatal problems, pneumonia, or diarrhea, which cause more than half of all child deaths. Furthermore, 97% of child health research funding goes toward the development of new technologies (eg, new drugs or immunizations to prevent or treat disease) that have the potential to reduce child mortality by 22%. Only 3% of child health research dollars are spent on research to determine how to increase coverage rates of interventions and get effective services delivered to children who need them the most. *Increasing delivery*

and coverage could reduce child mortality by 63%.

- **Inequity:** Although the recent financial crisis has struck developing countries even harder than developed countries, it takes a few years before the impact of such events on child survival is exacted and measured. The economic boom that preceded the current financial crisis, however, did not necessarily result in improved child health. In fact, India experienced unprecedented economic growth but only weak reductions in child mortality. This outcome is in contrast to neighboring Bangladesh, which simultaneously made weak economic strides but strong improvements in child survival. Although national economic stability is an important element in the ability to provide resources to health systems and programs, studies have indicated that national wealth and economic growth in the absence of equity-oriented strategies do not translate to improved child health, especially among the poor.
- **Global food crisis:** Even before the onset of the economic crisis, soaring food prices resulted in 100 million more people joining the ranks of the 1 billion people living with hunger. Reasons for increased food prices are multifactorial and include decreased food production due to climatic causes, diversion of crops for biofuel, and an increasing share of grains going to feed domestic animals to meet growing worldwide consumer demand for meat among those in better-off strata of society. Although there are alarming predictions of a future lack of sufficient food supplies to meet an increasing global population, global food supplies currently are adequate to meet global nutrition needs. However, sharp price increases have dramatically affected the amount of food that the poor are able to purchase, and global rates of hunger have increased. The full impact on undernutrition rates have yet to be measured.

What Will it Take to Meet MDG4?

MDG4 is based on earlier trends in U5MRs and data demonstrating that two thirds of child deaths can be averted with interventions that are already available and are recommended for full implementation. MDG4 is not “pie in the sky”; it is an achievable goal. However, examination of current trends in child health demonstrates that the world is alarmingly far from meeting its MDG4 commitment (Fig. 10). Perhaps most distressing is that of 64 countries with the highest U5MRs, only nine are on track to meet MDG4.

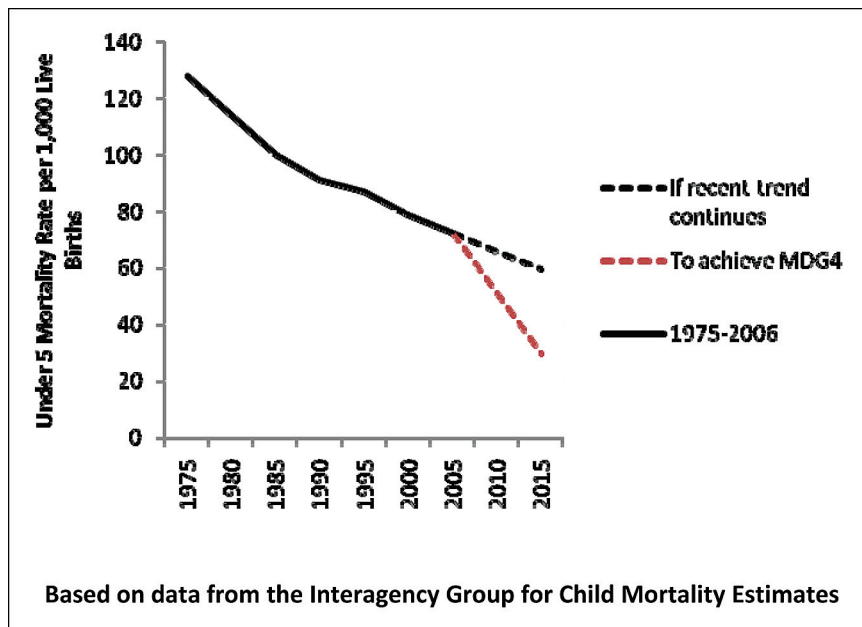


Figure 10. Accelerated improvements in child mortality are needed to meet MDG4.

MDG4 is attainable, even in the poorest countries, as evidenced by remarkable progress in several high-mortality countries: Nepal, Bangladesh, Eritrea, Loa People's Democratic Republic, Mongolia, Bolivia, and Malawi. (3) Malawi, for example, has reduced its U5MR by 53% over a 17-year period. Resource-poor countries making great strides in child health are doing so through equity-oriented national policies or through targeting of simple, effective, inexpensive interventions (such as antibiotics for pneumonia, ORT for diarrhea, improved home care for newborns, and ITNs to prevent malaria) to those who need them the most, especially poor children and those living in rural areas. These real-world case studies provide optimism that dramatic improvements in child survival can be attained. Long-term inroads in promoting child health additionally require addressing the underlying determinants of health.

Opportunities for Progress

American pediatricians can and do play an important role in improving the lives of children in poor countries, which is the majority of children in the world. Many pediatricians are working to improve child survival and health through overseas work or are supporting organizations that are on the ground in resource-limited settings. On-site work can contribute greatly (eg, through training and clinical work), especially when services are delivered to those in the greatest

need and are consistent with in-country priorities and international care guidelines. Through careful consideration of ethical engagement in participatory and sustainable global health work to address local needs and build local health institution and health professional capacity, individuals and organizations can avoid unintended negative consequences and provide maximal benefit.

The contribution of American pediatricians to improving global health is not limited to work on foreign soil. Pediatricians can advocate for much needed accountability among the growing number of players in global health, making certain that: 1) major causes of childhood morbidity and mortality are no longer neglected; 2) re-

search agendas expand to determine how best to deliver available, effective interventions and services to those in most need; 3) international initiatives have a more comprehensive and participatory outlook and are less oriented toward single diseases; and 4) research and service programs avoid contributing to the further collapse of health systems, but rather work in conjunction with ministries of health and their clinical institutions, such as district hospitals and clinics, to facilitate the strengthening of health systems.

Perhaps the most effective approach for American pediatricians to make an impact is by supporting policies that address poverty, the major underlying cause of child deaths globally. Such policies include meeting United States donor aid pledges and effectively allocating aid based on need, debt relief, elimination of structural adjustment policies, and transparent trade proceedings and trade policies that are fair to poor countries. Surveys have demonstrated that most Americans are concerned about global child health, but there are many misconceptions about the nature of global health problems and activities. Pediatricians can play an important educational role to aid community members in becoming better informed advocates.

Just as American pediatricians have played and continue to play a vital role in advocacy for American children, we can support children everywhere through advocacy on their behalf.

Summary

- Approximately 8 million children die annually (based on 2009 data), and 99% of child deaths occur in developing countries. (3)
- Eighty-four percent of global child deaths are due to seven major causes: neonatal problems, acute respiratory infections, diarrhea, malaria, measles, injuries, and HIV/AIDS. (4)
- Undernutrition is an underlying cause in 35% of child deaths. (5)
- Determinants of child mortality include lack of access to improved water sources and sanitation facilities, lack of access to care, lack of maternal education, absolute poverty, and relative poverty. (6)(7)(8)(9)(10)
- Two thirds of child deaths could be prevented with interventions that are currently available, effective, and feasible for widespread implementation (1)(11)(12) as well as consistent with MDG4. However, trends in decreasing child mortality have slowed, (13) and based on current trends, the world is not on track to meet MDG4.
- Sociopolitical and economic factors and policies have a tremendous influence on health and the determinants of health (6)(13)(14)(15)(16)(17)(18)(19)

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