

Environmental Health and Child Survival

Interest in environmental health has increased in recent years, largely because the most vulnerable groups remain disproportionately exposed to and affected by health risks from environmental hazards. More than 40 percent of the global burden of disease attributed to environmental factors falls on children below five years of age, who account for about 10 percent of the world's population. Children are especially susceptible to environmental factors that put them at risk of developing illness early in life. Malnutrition is an important contributor to child mortality; malnutrition and environmental infections are inextricably linked, but these links have been forgotten or neglected by policy-makers. The World Health Organization (WHO) recently convened an expert panel, which concluded that about 50 percent of the consequences of malnutrition are in fact caused by inadequate water and sanitation provision and poor hygienic practices. Recent recognition of environmental linkages with malnutrition highlights the urgent need to develop a spectrum of interventions to reduce exposure to environmental risks.

What is Environmental Health?

WHO defines *environmental health* as those health outcomes that are a result of environmental risk factors, including *all the physical, chemical, and biological factors external to a person, and all the related factors impacting behaviors*. It encompasses assessment and control of environmental factors that can potentially affect health, with the aim of preventing disease and creating health supportive environments. Environmental health is fundamental for child health: the three main causes of death of children younger than five years in developing countries are: diarrheal diseases (mostly from poor water, sanitation, and

hygiene); acute respiratory infections (often linked with indoor air pollution); and malaria (from inadequate environmental management and vector control).

This report concentrates on those three specific environmental risk factors: that influence child health:

- *Poor access to water and sanitation (and associated poor hygiene) combine as a significant problem.* According to WHO and UNICEF (The United Nations Children's Fund), 1.1 billion people who lack access to safe drinking water and 2.6 billion are without adequate sanitation. Contaminated water and poor sanitation contribute to diarrhea; intestinal worms due to poor sanitary conditions infect close to 90 percent of children in the developing world.
- *Indoor air pollution results in respiratory infections.* This is mainly due to the use of solid fuels (such as coal) for household cooking and heating; women and children spend the most time inside and are more affected; indoor air pollution is responsible for more than 1.6 million deaths per year and for 2.7 percent of the global burden of disease; half of the deaths are children under the age of five.
- *Malaria continues to be a major problem.* Approximately 40 percent of the world's people are at risk, with most cases and deaths found in Sub-Saharan Africa, and Asia, Latin America, the Middle East, and parts of Europe also affected. Pregnant women are at especially high risk of malaria; WHO estimates 10,000 women and 200,000 infants die annually as a result of malaria infection during pregnancy.

Improvements in environmental health could contribute to achievement of the Millennium Develop-

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TABLE 1 Millennium Development Goals and Environmental Health

Millennium Development Goal	Environmental Health Determinants Relating to Child Health
1. To eradicate extreme poverty and hunger	<ul style="list-style-type: none"> Expenses incurred for informal sector delivery of water and sanitation services impose a burden on family budgets, as does costs of medical treatment due to diarrhea from lack of adequate water and sanitation services. In urban areas, time spent fetching or queuing for water limits earning capacity.
2. To achieve universal primary education	<ul style="list-style-type: none"> The environmental health burden has significant effects on school attendance and performance.
3. To promote gender equality and empower women	<ul style="list-style-type: none"> Women disproportionately suffer from exposure to smoke from cooking, drudgery of collecting water and firewood, and privacy issues related to inadequate sanitation.
4. To reduce child mortality	<ul style="list-style-type: none"> Sickness and deaths in children are a direct result of inadequate hygiene, water supply, and sanitation. Indoor air pollution adversely affects young children.
5. To improve maternal health	<ul style="list-style-type: none"> Inadequate hygiene and lack of access to clean water results in poor health outcomes related to delivery and birthing. Malaria and helminths affect pregnant women and can lead to malnutrition of the fetus.
6. To combat HIV/AIDS, malaria, and other diseases	<ul style="list-style-type: none"> HIV-infected children especially need clean environments. Adequate water resource management practices are needed to reduce mosquito breeding.
7. To ensure environmental sustainability	<ul style="list-style-type: none"> Access to water and sanitation is a goal in itself; slum dwelling children with poor access to services face dismal living conditions.
8. To establish a global partnership for development	<ul style="list-style-type: none"> Multisectoral coordination on environmental health issues is lacking. Both horizontal and vertical links are needed

ment Goals (MDGs). The links between MDGs and environmental health are explained in Table 1. There is an urgent need to mainstream environmental health into the development agenda.

Evidence on the Importance of Environmental Health for Child Survival and Development

Improvements in environmental health are very important for child survival and development. There is now strong evidence showing the link between infections and a child's nutritional status. Several of the studies reviewed for this publication demonstrate that exposure to environmental health risks in early infancy leads to permanent growth faltering, lowered immunity, and increased morbidity and mortality. Malnutrition is an underlying cause of death in half of the more than 10 million deaths globally in children under five; a recent collective expert opinion stated about 50 percent of the consequences of malnutrition is in fact caused by inadequate water and sanitation provision and poor hygienic practices. Environmental health inputs play a critical role in a child's survival and

growth, especially during the "window of opportunity," the period from the womb to about two years of age, when:

- Pregnant women are often exposed to environmental risks that contribute to poor fetal growth and result in babies with low birth weight.*
- In early infancy, improper feeding practices and poor sanitation have a pernicious synergistic effect on a child's nutritional status.*
- Negative impacts on child growth may result in cognition and learning impacts, and chronic diseases later in life.*

Current child survival strategies in developing countries mainly focus on reducing child mortality through treatment and case management, but do not attempt to reduce exposure to environmental determinants of health. Appropriate environmental health actions can complement and supplement strategies that focus on child health through: adding value to health systems; contributing to the adaptation of environmental management programs; and promoting adjustments to infrastructure strategies.

Measuring the Burden of Disease from Environmental Health Risks

To help policymakers understand the burden of disease from environmental factors and the associated economic costs, it is important to revise earlier estimates of the environmental health burden and links with malnutrition. Policymakers can then decide on how to integrate environmental health into economic development. They can also make informed decisions on allocation of resources to improve child health.

The World Health Organization recently revised *global burden of disease* estimates to specifically take into account the links between malnutrition and the impacts on health of inadequate water and sanitation coverage and improper hygienic practices. The new WHO estimates reveal that the environmental health burden in children under five years is substantially higher when all links through malnutrition are incorporated. In sub regions such as Sub-Saharan Africa and South Asia, the new estimates point to the burden of malnutrition and poor environmental conditions.

To examine the economic costs of environmental risks at the country level, case studies based on updates of earlier estimates were developed for Ghana and Pakistan. For the first time, measures of total effects provide estimates of longer-term impacts of environmental health risks on cognition and learning and on future work productivity.

- *The total costs of environmental risks for Ghana and Pakistan range from 4 to 6 percent of each country's gross domestic product (GDP). The revised estimates show that when malnutrition linkages with health effects that are attributed to environmental health risks are included, the economic costs to the country are at least 40 percent higher than when malnutrition effects are not included.*
- *For Ghana and Pakistan, longer term impact of malnutrition translates into an annual cost of stunting attributable to early childhood diarrheal infections that is estimated to be 4 to 5 percent of the country's GDP. In the longer term, malnutrition (partly attributed to environment-related infections) is found to affect a child's cognitive function, school enrollment, grade repetition, school dropout rate, grade attainment, and future income-earning potential.*
- *The result is that the total estimated annual costs may be as high as 9 percent of a coun-*

try's GDP. These estimates are based on selection of conservative assumptions, but the effects through malnutrition, including education costs, are significant (Table 2).

Results indicate that there is an urgent need for policymakers to position environmental health at the center of all child survival strategies. A multiplier effect exists for environmental health interventions. Investments that address environmental risks, for example through addressing the lack of water and sanitation, have multiple effects on child mortality: they reduce mortality due to diarrhea; they also reduce mortality from malnutrition-related diseases; and the reduction of illness from diarrhea has positive consequences on education attainment.

Common Elements for Successful Environmental Health Actions

Environmental health actions are the earliest public health activities on record. Lessons from history have shown the enormous benefits of multisectoral environmental health actions. There are interesting examples of how different developing countries have incorporated environmental health activities within integrated child survival, nutrition, and other health programs; infrastructure programs; and vector-control programs. For example:

- Innovative projects in Peru and Nicaragua have promoted key hygiene behaviors within health programs that have resulted in significant improvements in health outcomes; hygiene education is a specific component of the Honduras Integrated Community-Based Child Care Program; and the Integrated Child Development Services in India includes hygiene and a multi-sectoral approach to health, education and nutrition interventions.
- There are a few examples of integrated child survival programs that are comprehensive, with multi-sector approaches to improving water, sanitation, hygiene, and reduction of indoor air pollution and vector diseases, as in Eritrea. Thailand's national nutrition program is an effective multisectoral approach that includes water, sanitation, literacy, and other development projects.
- Infrastructure programs with behavior change and education components, such as the Total Sanitation Campaign in rural Bangladesh, have

TABLE 2 Annual Cost of Direct and Indirect Impact of Environmental Risk Factors in 2005

	Ghana				Pakistan			
	Annual Deaths	Cost (¢ million)	Cost (US\$ million)	Cost (% of GDP)	Annual Deaths	Cost (PRs billion)	Cost (US\$ million)	Cost (% of GDP)
Estimation Excluding Malnutrition-Mediated Effects								
Mortality effects	24,712	371	412	3.84	131,611	195	3,250	2.90
Estimation Including Malnutrition-Mediated Effects								
Mortality effects	35,702	537	595	5.55	187,429	278	4,633	4.13
Education effects		367	407	3.79		317	5,281	4.71
Total effects		904	1,002	9.34		595	9,914	8.84

Source: Compiled by World Bank team.

Note: ¢ = Ghanaian new cedi.

proved to be effective at improving health; the success of this model has led to its adaptation to other countries.

- Malaria control interventions that have emphasized a multiple of interventions have led to success in Malaysia; community participation led to effective vector control of dengue virus mosquitoes in Vietnam.

There are common elements for successful environmental health actions in developing countries. These include:

- Securing high level political commitment;
- Involving and empowering communities;
- Allocating responsibilities and resources at the local level; and
- Finding a balance between private and public sector roles.

Strong institutional underpinnings, with clearly articulated roles at all levels of administration, are key elements of successful environmental health governance. This means that national and local governments have defined roles to play in managing and delivering environment health interventions, with support from the international community.

Key Conclusions

There is great potential in environmental health actions that complement existing health, infrastructure, and environment management strategies in the developing world. The key conclusions of this report are that:

- There is a larger role for environmental health as diseases from environmental risk factors remain the top killers of children under five in developing countries;
- Specific sub regions of the world with high levels of burden of disease, notably Sub-Saharan Africa and South Asia, should be targeted for action; and
- Developing countries can learn from experience on addressing sanitation and air pollution with relatively cost-effective interventions.

Additional research is needed to guide governments and donors in appropriate environmental health interventions, develop country level cost-effectiveness and cost-benefit analysis to prioritize interventions, and determine coordination mechanisms and roles and responsibilities of different agencies.

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