A WELL FACTSHEET

Child survival and environmental health

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Edited and produced as a PDF document: May 2020

This factsheet looks at the role of environmental health in improving child survival, focussing on three important causes of child mortality; acute respiratory infection (ARI), diarrhoeal disease and unintentional injury (including drowning and poisoning). A broad overview is presented. Specific details of implementing interventions are not considered.

Introduction

As one of the Millennium Development Goals, the United Nations have agreed to the target of reducing the mortality rate of children under five by two thirds by the year 2015. The magnitude of this challenge is illustrated in Figure 1 below. The graph also highlights the enormous disparity between child mortality rates in 'developing' and 'developed' countries (as defined by UNICEF and WHO).

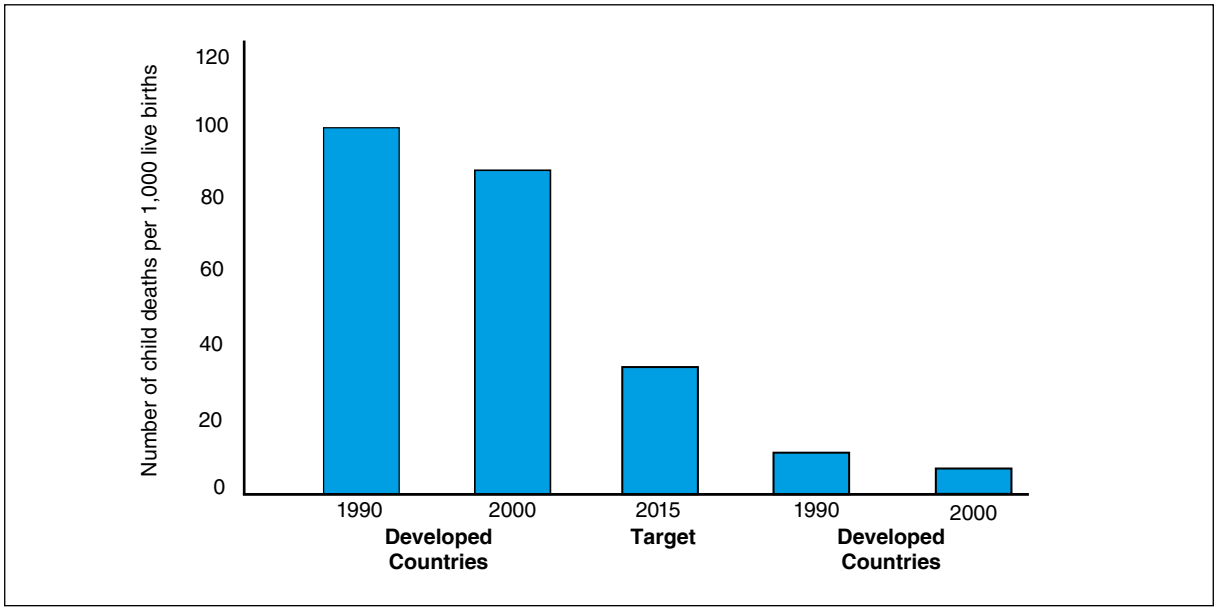

Figure 1. Mortality rates for children under five

Report of the Secretary General on the implementation of the Millennium Declaration. Date based on estimates of WHO and UNICEF. Source: David Kelsey

Causes of child mortality

Figure 2 below shows child mortality figures by cause for 2002. The picture will be a familiar one to many, with almost half of child mortality being caused by five preventable infectious diseases. A substaintial proportion of the category 'Other' is made up of unintentional injuries.

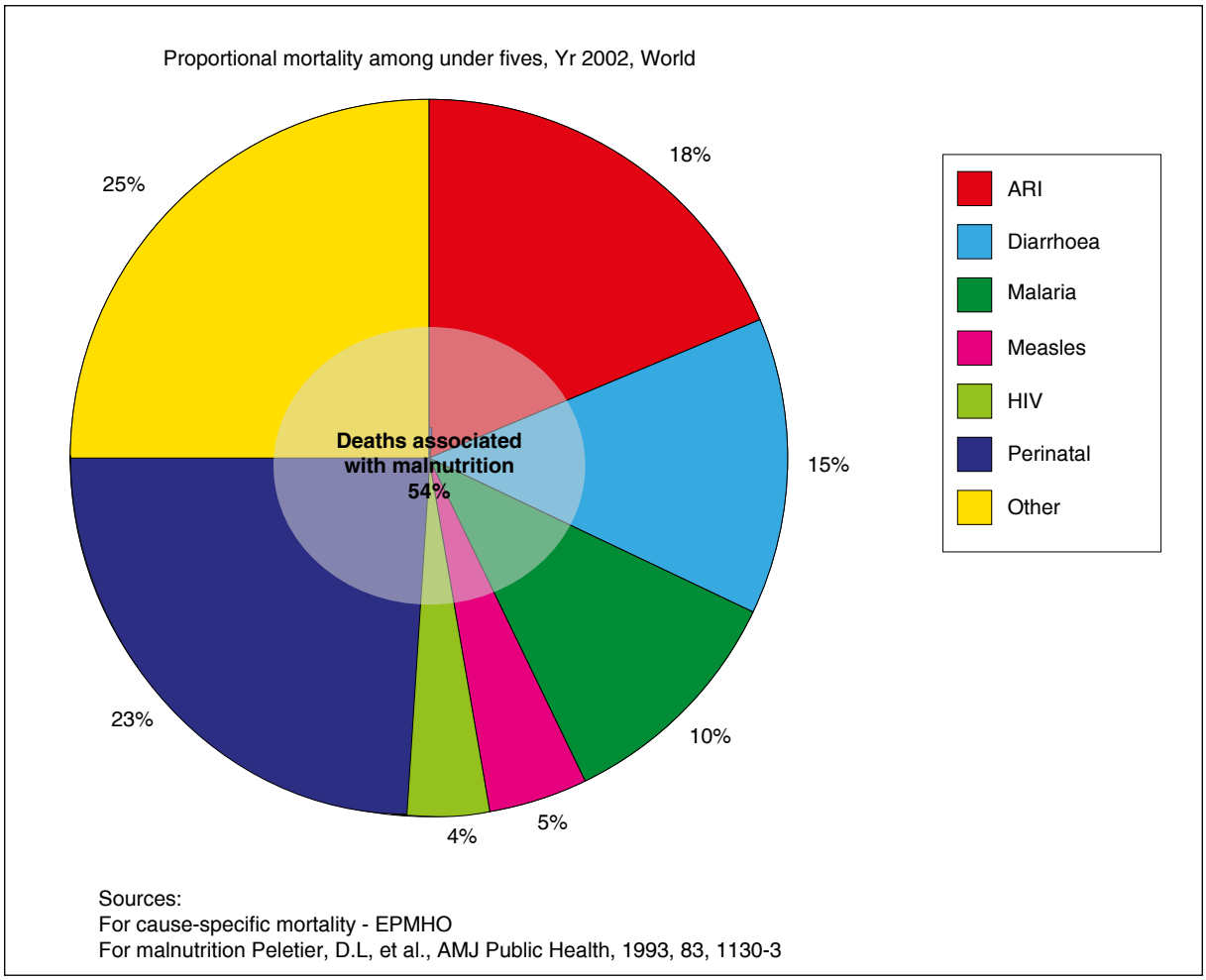

Figure 2. Mortality among children under five, worldwide, 2001

Source: Adapted from Cause-specific mortality rates from EIP/WHO

What may be less familiar is the important role played by environmental health hazards in maintaining this situation, and hence the great potential of environmental health interventions to improve it. It has been estimated that environmental health hazards account for at least 25% of the overall burden of disease worldwide (Smith et al, 1999), the vast majority of this being borne by developing countries. Diarrhoeal disease and ARI between them account for half of the global burden of *environmentally related* disease, with children accounting for most of the mortality from these causes. Unintentional injuries make up a further 14% of the global environmentally related disease burden, and these too are important causes of child mortality.

The sections below consider in more detail the role of environmental health in reducing child mortality from three important causes: ARI, diarrhoea and unintentional injuries.

Acute respiratory infection

Indoor air pollution: an environmental risk factor. ARI is the leading cause of death in children under 5 years in developing countries. The evidence for a link between indoor air pollution (IAP) and ARI in children has grown over the past ten years (Bruce et al, 2000; Smith et al, 2000) and according to WHO, nearly half of ARI mortality among under-fives can be attributed to IAP (WHO 2004).

Globally, the most important source of indoor air pollution, with regard to childhood ARI, is biomass fuels used in domestic stoves and fires. Currently around three billion people rely on biomass fuels (Bruce et al 2000). The majority of published studies report that children who are exposed to IAP are between two and fives times more likely to experience ARI (Bruce et al 2000; Smith et al, 2000). The problem is particularly acute for poor households who lack adequate household ventilation, lack efficient stoves and whose income restricts their choice of fuel type.

At present all of the available data on health impacts come from observational studies. In these studies health measures are compared across households that already use different stoves or fuels. Such studies suffer a major drawback because households that use different stoves or fuels may also differ with respect to other factors that influence their health (wealth being one common example). This problem is known as confounding. To overcome this problem there is a need for rigorous intervention studies in which participating households are assigned at random to either receive or not receive the different stove or fuel types under investigation. There is also an urgent need for information on the dose response rates for different pollutants. These in turn require the development of effective standardised techniques for measuring exposure (von Schirnding et al, 2002).

Reducing exposure to IAP. Possible environmental and behavioural interventions to reduce exposure to IAP from biomass fuels include; reducing pollution by switching to cleaner fuels, and/or by using cleaner stoves, removing pollution through increased ventilation and the use of hoods or chimneys, and reducing the exposure of children by excluding them from the cooking area.

Although no study of the health impact of any intervention has yet been completed, one study is currently underway in Guatemala looking at the effectiveness of an improved wood-burning stove (http://ehs.sph.berkeley.edu/guat/). A small study in Kenya (ITDG 2002) found that smoke hoods were more effective at reducing IAP than improved stoves. However, the Kenyan stoves were very different from those being trialled in Guatermala. Cultural variations in cooking practices, house design and patterns of fuel use rule out the possibility of a one-size-fits-all solution and necessitate close attention to local preferences. This complicates the search for effective interventions.

The switch from biomass to a cleaner fuel such as charcoal, kerosene, liquid petroleum gas or electricity can reduce levels of indoor air pollution. However, this option is not likely to be affordable for the vast majority of poor households in the foreseeable future (USAID, 2000). Fuel switching is a long term strategy (15-30 years) that would need to be implemented within an appropriate policy framework (Goldemberg, 2000).

One lesson that has emerged from interventions to date is that the indiscriminate use of government subsidies to encourage fuel switching tends to bring the greatest benefits to the wealthier irban households that consume more fuel (Ballard-Tremeer and Mathee, 2000), and who are unlikely to use biomass fuels anyway.

Handwashing to prevent ARI? Washing hands thoroughly at critical times is accepted as an effective intervention against diarrhoeal disease (see below). Evidence is now growing for its effectiveness against respiratory infections. Published studies to date relate to the less severe, viral infections in developed country populations so the potential for this intervention to reduce deadly bacterial pneumonia in developing countries is not known although an initial study is currently underway (Cairncross, 2003).

Diarrhoeal disease

Diarrhoeal disease causes 15% of all child deaths worldwide. There are environmental interventions for the control of diarrhoeal disease that are accepted as effective and feasible. The most important among these are safe sanitation and hygiene practices, the latter of which depend on the provision of an adequate water supply (Huttly et al, 1997). It is estimated that 1.7 million deaths annually result from inadequate access to water and sanitation and inadequate hygiene practices (WHO, 2002). The majority of these deaths are from diarrhoeal disease in children. The majority of this disease is endemic and hygiene related and is not due to waterborne epidemics.

A recent literature review (Curtis and Cairncross, 2003) suggests that washing hands with soap at key times can reduce severe diarrhoea by over 50% and could thus prevent one million diarrhoeal deaths annually.

Improvements in domestic hygiene practices can be brought about by hygiene promotion. Delivering effective hygiene promotion on a large scale is now a major public health challenge and there is growing interest in applying commercial marketing techniques to this problem (Curtis, 2002). Effective hygiene practices rely on access to convenient water supplies. Domestic water use declines when collection times exceed about 30 minutes and increases dramatically when household connections are provided (Cairncross et al, 2003). Water supply interventions need to take this pattern into account recognising that improving access over the intervening range will have a minimal effect on consumption patterns.

Sanitation improvements have the potential to bring about reductions in diarrhoeal disease in the region of 35% (Esrey et al, 1985; Huttly et al, 1997). The impact is likely to be greatest in dense urban communities with high levels of faecal contamination in the environment. In contrast to water supplies, which are universally desired and, in low income settings, generally public, low-cost sanitation tends to be installed on private property and is often not regarded as a high priority by householders. Improving access to domestic sanitation might best be approached as a marketing problem, combining innovative product design with communication strategy to increase demand (Cairncross et al, 2003).

One other environmental intervention that may offer possibilities for the reduction of diarrhoeal disease mortality is fly control. Recent studies (Chavasse et al 1999), Emerson et al 1999) found significant reductions in diarrhoea incidence during the peak fly season, following spraying of villages with insecticide. As a long-term solution, the use of insecticide sprays is not an option because of its high cost and the likely development of resistance among the fly population. The use of baited fly traps may offer an alternative. However, findings relating to the effectiveness of traps have so far been contradictory, and effective sanitation may present a better option for long term fly control.

Unintentional injuries, drowning and poisoning

Historically, injuries have received little attention as a public health problem and have tended to be viewed as random events allowing little scope for intervention. However, there are patterns in the burden of injury related to exposure to hazards in the environment and there have been successful interventions to reduce injury (Sethi and Zwi, 1999).

Children suffer a disproportionate share of injuries. The under-fives, for example make up 10% of the population but account for 22% of the total global burden of injury-related ill-health (Murray and Lopez, 1996). Children's behaviour makes them more susceptible to accidental injury while

their physical characteristics, such as large head to body ratio, thin epidermis and smaller airways, increase the likelihood of serious or fatal outcomes. The importance of childhood injuries as a public health issue in developing countries is growing. This is partly a reflection of the declining importance of infectious disease, but also a result of increasing urbanisation and motorisation of societies, and the additional risks that these changes bring (Deen et al, 1999). Low and middle income countries have rates of child deaths by injury that are five times higher than those in higher income countries and account for 98% of all child injury mortality (Bartlett, 2002).

Falls, poisoning, drowning and burns are seen as the greatest accidental mortality risks for the under-fives (Zwi et al, 2001). However, the types of injury that occur are context specific. For example, kerosene poisoning is related to the use of kerosene as a domestic fuel and drowning requires exposure to water. This means that the choice of interventions to prevent accidental injury will also be context-specific.

The literature is characterised by a lack of data from developing countries. There is thus an urgent need for improved monitoring and surveillance of injuries in developing countries to help fill this information gap. More information is needed to facilitate the development of evidenced-based interventions to address the main causes of childhood accidents and injuries. Sethi and Zwi (1999) set out a framework of further research needs. These include; better understanding of the epidemiology of injuries, better understanding of the costs of injury and of prevention, and who pays them; also an assessment of possible interventions for effectiveness, affordability, feasibility and sustainability.

Possible synergies with other environmental health interventions

Interestingly, among the suggested interventions listed by Bartlett (2002) for reducing childhood injuries are improved stove designs and improved sanitation. These are suggested to reduce the risks of burns and falls respectively. Bartlett (2002) also cites evidence that lack of parental supervision increases the risk of injury. Improved water supplies and more efficient stoves both have the potential to reduce the time spent, predominantly by women, away from the home collecting wood and water. This could conceivably allow more time for child supervision. Thus the potential for synergies between environmental health interventions exists. However, the specifics of different contexts, such as the nature of an improved stove, or a woman's priorities for her use of time, mean that these should not be taken for granted.

Some useful websites for further information

www.who.int/indoorair/en/ (Indoor air pollution)

www.itdg.org/home.html (indoor air pollution, sanitation, hygiene and water supply)

www.who.int/child-adolescent-health/OVERVIEW/CHILD_HEALTH/child (Children's burden of disease)

www.who.int/violence_injury_prevention/unintentional_injuries/en/ (Unintentional injuries)

http://www.wsscc.org/load.cfm?edit_id=312 (Hygiene, sanitation and water supply)

www.lshtm.ac.uk/dcvbu/hygienecentre/ (Hygiene and sanitation)

www.lboro.ac.uk/well/ (Hygiene, sanitation, water supply and environmental health)

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Annex

Child survival hinges on families and communities having the basic needs to support life, survival and prosperity of children. Among these, a safe and healthy environment is fundamental. However, children everywhere are negatively affected by adverse environmental conditions. Each year at least 3 million children under the age of five die in the world due to environmental-related illnesses. Such young children make up roughly 10% of the worlds population but comprise more than 40% of the population suffering health problems related to environment, (WHO 2002). Environmental risks to children include unsafe water, poor sanitation and hygiene, indoor air pollution, exposure to toxic chemicals, injuries and accidents among others.

Many childhood deaths in developing countries can be attributed to five main causes or a combination of them; acute respiratory infections (ARI), diarrhoea, measles, malaria and malnutrition (UNICEF (2000).

Worldwide, diarrhoea claims the lives of 2 million children each year. 80-90% of these cases are due to environmental conditions (in particular inadequate water supply and sanitation). As much as 60% of ARI worldwide are related to environmental conditions and are responsible for the death of 2 million children (WHO 2002).

The situation in East Africa

Almost 42 million people in Kenya, Uganda and Tanzania do not have access to improved water supply and 13 million do not have improved sanitation facilities (WHO/UNICEF 2000).

Evidence indicates that the primary causes of many childhood illnesses in the three countries are water related (Sharm et al. 1996). Among these illnesses, diarrhoea remains one of the most important environmental health problems.

In Kenya, the majority of deaths among children under five are attributed to unsafe environmental living conditions. Malaria, diarrhoea, upper respiratory infections and TB infestations are all leading contributors to child mortality and morbidity in Kenya. In Tanzania, one in every five children dies needlessly due to malaria before they reach five years (World Vision 2004).

The introduction of Free Primary Education in Kenya and Uganda has put a lot of strain on the physical infrastructure including sanitary facilities in schools. In Uganda in 1999, only 2% of the schools had adequate latrines, only 37% of teachers had sanitation training and only 25% of schools had hygiene information. The situation is worse in camps for internally displaced persons in Northern Uganda, (Water, Environment and Sanitation, WES Uganda). It is also reported that about 3.5 million people are at risk of schistosomiasis infection and up to 67% of school going children along the River Nile and around Lake Victoria are infected with the disease, (Narcis B.K et al. 2004).

Lack of safe water, inadequate sanitation, poor waste disposal and indoor air pollution are environmental health risks related to poverty and lack of development. Consequently children born into poor families have a higher chance of dying before their first and fifth birthday than those born into better off families. More than 10% of Kenya's 15 million children are orphans, the majority of whom are likely to be exposed to poor living conditions, (UNICEF 2006).

Although new regulatory standards and greater awareness of children's vulnerability to such hazards have improved the situation of childrenin a number of more developed countries, many children especially in less developed countries continue to be exposed to the risks. Their vulnerability is exacerbated by lack of protective policies and medical and public health interventions.

Information gaps

One of the challenges in measuring progress on the improvement in child health and survival is lack of appropriate indicators. Developing such indicators would help monitor the impacts of environment on the health of children highlighting the special vulnerabilities children are exposed to in relation to environment and health and to track the progress of interventions in addressing these vulnerabilities. Dimensions of hazards like injuries, poisoning and drowning in East Africa remain poorly understood due to a persistent lack of information and research.

Interventions

The possible benefits of improved water supplies, sanitation and hygiene on the health of the populations are well known and documented. However, due to weak policies for example those related to sanitation and environmental health, lack of funding and inadequate sharing of knowledge on the best practices and experiences, these interventions are yet to be implemented on a large scale to significantly improve the lives of children in less developed countries.

In line with the Millennium Development Goal on Child Health, there is a lot of effort within East African countries to ensure increased access to adequate, safe water and sanitation facilities for children. There are also ongoing interventions targeting reduction and mitigation of the impacts related to indoor air pollution (IAP) risks. These interventions focus on improving ventilation in houses and introduction of improved cooking stoves.

Integrated Management of Childhood Illnesses [IMCI] is the main framework within which the current child health interventions among East African countries are implemented. Stronger emphasis has been on the treatment and management of cases. However, recently a community component [Community IMCI] has been introduced with a set of sixteen key family practices which aim at addressing child health, survival and development at household and community levels.

The family practices target among others,

- Diarrhoea prevention and control through installation and use of safe water supplies and sanitation facilities,
- Behaviour change through hygiene education,
- Sanitation promotion,
- Food hygiene, and
- Improved housing to reduce indoor air pollution

In East Africa, several organizations have instituted interventions to address environmental health issues affecting children. Christian Children's Fund, which operates in Kenya, Uganda and Tanzania, supports child survival through community-based approaches that help families and care givers to recognize and treat Acute Respiratory Infections. It also supports control of diarrhoeal diseases through hygiene promotion, sanitation and water supply interventions among other child centred programmes.

UNICEF and its partners have been involved in providing safe water through installation of water systems and sanitation through provision of latrines to schools. UNICEF has also been involved in malaria control initiatives among the under fives and so far has distributed 250,000 nets to pregnant mothers and children below five years.

Other players include Plan International which besides promoting other childhood welfare services is also involved in environmental health interventions like provision of safe water supply, malaria control and providing safe learning environments.

Other strategies that have been put in place to address sanitation include the Participatory Hygiene and Sanitation Education (PHASE) initiative in schools, Healthy Cities initiative, and water quality surveillance. There has also been the formulation of the Children's Act which among other things gives guidelines on addressing children's health needs.

Efforts to increase communities understanding of the linkage between environment and child health should be integrated with measures to economically empower communities to provide basic health services.

There is a great need to document the successes of the already instituted interventions and their successes for replication and scale up.

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