Water, sanitation and hygiene: the unfinished agenda in the World Health Organization South-East Asia Region

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Abstract

Access to adequate water, sanitation and hygiene (WASH) is essential for the health, well-being and dignity of all people. The World Health Organization South-East Asia Region has made considerable progress in WASH provision during the past two decades. However, compared with increases in coverage of improved drinking water, in some parts of the region, access to adequate sanitation remains low, with continued prevalence of open defecation. The Sustainable Development Goals (SDGs) have set ambitious targets for WASH services to be achieved by 2030. Examples of major health outcomes that would benefit from meeting these targets are diarrhoea and nutrition status. Although the total number of deaths attributable to diarrhoea declined substantially between 1990 and 2012, inadequate WASH still accounts for more than 1000 child deaths each day worldwide. And, despite the reductions in mortality, diarrhoea morbidity attributable to diarrhoea remains unchanged at around 1.7 billion cases per year. It has been known for decades that repeated episodes of diarrhoea increase a child’s risk of long-term undernutrition, reduced growth and impaired cognitive development. Nutritional effects of inadequate WASH also include environmental enteropathy, leading to chronic intestinal inflammation, malnutrition and developmental deficits in young children. Inadequate WASH also contributes to iron deficiency anaemia resulting from infestation with soil-transmitted helminths. The cross-sectoral emphasis of the SDGs should act as a stimulus for intersectoral collaboration on research and interventions to reduce all inequities that result from inadequate WASH.

Keywords: diarrhoea, hygiene, sanitation, South-East Asia, undernutrition, WASH, water

Background

Access to adequate water, sanitation and hygiene (WASH) is essential for the health, economic and social well-being, and dignity of all people. This paper reflects on the unfinished agenda on childhood diarrhoea and undernutrition attributable to inadequate WASH in the World Health Organization (WHO) South-East Asia Region. Although diarrhoea and undernutrition are the focus, it is important to emphasize the growing consensus on evidence for inadequate WASH having a much wider-ranging impact on diseases, conditions and issues of equity. As explored in a recent review, examples include: food hygiene; violence against women and psychosocial stress, e.g. where poor access to WASH services can lead to vulnerability, rape and assaults, and fear of such assaults can prevent women and children from using sanitary facilities outside of the home at night; maternal and neonatal health; management of menstrual hygiene; school attendance; the efficacy of oral vaccine; and the health and well-being of people with disabilities. While noting that more robust data are needed, another review estimated the effects of inadequate WASH on health outcomes other than diarrhoea, including undernutrition; soil-transmitted helminthias; neglected tropical diseases, such as schistosomiasis and trachoma; and vector-borne diseases. The estimates indicated that the adverse health effects of inadequate WASH may be at least as great as – and possibly much greater than – those of diarrhoea (see Table 1).

Table 1. Health outcomes (excluding diarrhoea) and range of the fraction of disease globally attributable to inadequate water, sanitation and hygiene

<table>
<thead>
<tr>
<th>Contribution of WASH not quantified at global level</th>
<th>0–33%</th>
<th>33–66%</th>
<th>66–100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatitis A, E, F; legionellosis; scabies; arsenicosis; fluorosis; methaemoglobinemia</td>
<td>Onchocerciasis</td>
<td>Lymphatic filariasis; malaria; undernutrition and its consequences; drowning</td>
<td>Ascariasis; hookworm; trichuriasis; dengue; schistosomiasis; Japanese encephalitis; trachoma</td>
</tr>
</tbody>
</table>

WASH: water, sanitation and hygiene.

*Estimates are based on the source-document authors’ previous assessments, combining systematic literature review with expert opinion.

Water and sanitation in the World Health Organization South-East Asia Region

The WHO South-East Asia Region, in general, made considerable progress in WASH provision during the past two decades’ work towards the Millennium Development Goals (MDGs). However, compared with increases in coverage of improved drinking water, some countries still lag behind in sanitation coverage. In the 2015 MDG assessment, the proportion of the population using improved sanitation facilities varied widely among the 11 countries of the WHO South-East Asia Region – from 40% to 98%.

By contrast, the proportion of population using an improved drinking-water source in the region was 81–100%; Timor-Leste was the only exception at 72%. Notably, although use of improved drinking water was quite high in India (94%), the country also had the lowest proportion of its population using improved sanitation, at 40%.

Arguably, the strategy of targeting the provision of improved water sources without parallel progress in providing safe water and hygiene and adequate sanitation has been a limiting factor in achieving expected improvements in health outcomes. The commitment made by world leaders in September 2015 to achieve 17 Sustainable Development Goals (SDGs) by 2030 strengthens calls for investment to achieve SDG Goal 6, to “ensure availability and sustainable management of water and sanitation for all”.

Burden of diarrhoea attributable to inadequate water, sanitation and hygiene

The overall burden of disease related to unsafe WASH was first examined at the global level two decades ago. Although different methodological approaches have been proposed and used since then, there is international consensus that much of the global burden of diarrhoea can be attributed to inadequate WASH.

The most recent data were compiled by an expert group of scientists from 14 collaborating research institutions. This group was convened by WHO in 2013 to provide an updated assessment of the burden of diarrheal disease resulting from inadequate WASH, and to reassess the effectiveness of WASH interventions. For this analysis, the burden of WASH-attributable diarrheal disease in 2012 was estimated for 145 low- and middle-income countries. The proportions of mortality from diarrheal disease attributable to inadequate WASH were calculated separately and in combination.

The main findings for all 145 countries and for the WHO South-East Asia Region are summarized in Table 2. The project estimated that 842 000 deaths (361 000 of which were in children aged under 5 years) in low- and middle-income countries worldwide were caused by inadequate WASH, representing 58% of the total number of deaths attributable to diarrhoea. Within that total, the number of deaths in the WHO South-East Asia Region that were attributable to inadequate WASH was 364 000, which was 56% of all deaths attributable to diarrhoea in the region.

With respect to trends over time, the number of deaths in the 145 low- and middle-income countries that were attributable to inadequate WASH reduced by more than 50% from 1.8 million in 1990, to 842 000 in 2012. Globally, the total number of deaths that were attributable to diarrhoea declined from 2.9 million in 1990 to 1.5 million in 2012. Although the data indicate substantial reductions in mortality attributable to diarrhoea in recent years, the results also underscore that tackling the continuing burden of diarrhoea due to inadequate WASH remains an urgent global health priority. By WHO region, the greatest decreases between 1990 and 2012 in deaths in low- and middle-income countries from diarrhoea attributable to inadequate WASH were in the WHO Region of the Americas (87% reduction), the WHO European Region (80%) and the WHO Western Pacific Region (79%). These regions had similarly large improvements in access to improved drinking water and sanitation over the same time period. Decreases in WASH-attributable diarrhoea mortality during 1990–2012 in the WHO African Region and the WHO South-East Asia Region were 55% and 35%, respectively.

The number of deaths worldwide in children aged under 5 years that were attributable to diarrhoea has greatly reduced: from 1.5 million in 1990 to 622 000 in 2012. The authors of the multicountry analysis note that it is likely that improvements in water and sanitation have played a significant role in this marked reduction, in addition to improved access to health care and oral rehydration and reduced child undernutrition.

Within the WHO South-East Asia Region, these global trends have been seen at the national level in Bangladesh, where mortality in children aged under 5 years reduced between 1990 and 2015, from 144 to 38 deaths per 1000 live births. Diarrhoea accounted for 6% of these deaths in 2015. The proportion of the population using an improved source of drinking water reduced from 26% in 1990 to 13% in 2015; the proportion using unimproved sanitation facilities similarly reduced from 16% to 10% in the same time period. These data accord with research projects on the impacts of drinking water and sanitation on health and nutrition in Bangladesh, which have indicated that progressive increases in coverage

Table 2. Burden of diarrhoea attributable to inadequate water, sanitation and hygiene, 2012

<table>
<thead>
<tr>
<th>Population</th>
<th>Deaths/DMYs attributable to inadequate WASH (as proportion of total diarrhoeal deaths)</th>
<th>Deaths/DMYs attributable to inadequate water</th>
<th>Deaths/DMYs attributable to inadequate sanitation</th>
<th>Deaths/DMYs attributable to inadequate handwashing</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHO South-East Asia Region</td>
<td>364 000 (56%)</td>
<td>208 000/11 000</td>
<td>123 000/6000</td>
<td>132 000/7000</td>
</tr>
<tr>
<td>All LMICs</td>
<td>842 000 (58%)</td>
<td>502 000/34 000</td>
<td>280 000/19 000</td>
<td>297 000/20 000</td>
</tr>
</tbody>
</table>

DALY: disability-adjusted life year; LMIC: low- and middle-income country.

*All data are rounded to the nearest thousand.
Exposures to faecal-oral pathogens through drinking water, sanitation or hygiene are not independent; thus, the total burden is not the sum of the separate burdens of those risks; it is slightly lower.

of drinking water from protected sources have coincided with a gradual reduction in rates of both infant mortality and mortality in children aged under 5 years. The rate of reduction observed became more pronounced as the proportion of coverage of safe water increased, suggesting a relationship between reductions in these mortality rates with enhanced water supply. Similarly, a recent cross-sectional as well longitudinal analysis being conducted in West Bengal, India, has shown that provision of solar-supported drinking water in arid areas has not only increased the availability and use of water but also reduced diarrhoeal disease significantly, with improved health and nutritional status.

Socioeconomic status also has a clear link with diarrhoeal burden. The Bangladesh National micronutrients status survey 2011–12 analysed diarrhoea-related morbidity in preschool children by their socioeconomic status. In the 2 weeks preceding the survey, 11.6% of the poorest preschool children (wealth quintile 1) had diarrhoea, compared with 5.7% and 2.9% of preschool children in wealth quintiles 4 and 5, respectively.9

The role of water, sanitation and hygiene in nutritional outcomes
WASH interventions are critical to breaking the links between undernutrition associated with diarrhoea, environmental enteropathy/ environmental enteric dysfunction and soil-transmitted helminthias.

Undernutrition
Undernutrition is directly related to inadequate dietary intake and infectious disease. However, it has been recognized for many years that effective programmes to combat undernutrition in children include not only interventions such as exclusive breastfeeding, complementary feeding and micronutrient supplementation, but also access to adequate WASH. Easy accessibility of water has a significant impact on saving loss of energy from the body, by reducing the burden of carrying water, as well as saving time spent accessing water. Women and girls benefit especially from better water accessibility. For example, a study supported by the United Nations Children’s Fund (UNICEF) conducted in the three geographical regions of Nepal – mountainous, hilly and Terai – showed that use of gravity flow to provide safe sources of drinking water resulted in significant savings in the time and energy spent in collecting water, together with improvements in the nutritional status of children.10

A recent report by WHO, UNICEF and the United States Agency for International Development summarized the current evidence on the benefits of adequate WASH for improving nutrition outcomes, especially in young children, by integrating WASH interventions into national nutrition policies and programmes.11 Despite the significant reductions in recent years in deaths in children aged under 5 years, discussed above, the burden of morbidity attributable to diarrhoea remains unchanged at around 1.7 billion cases per year.2 A 2013 systematic review of studies worldwide concluded that rotavirus, calicivirus and enteropathogenic and enterotoxigenic Escherichia coli cause more than half of all diarrhoeal deaths in children aged under 5 years.12 Recent research, published in 2015, aimed to identify the pathogens associated with diarrhoea in the community, i.e. in cases not seen at a health-care facility, in eight low- or middle-income countries. Pathogens associated with non-severe diarrhoea in children aged 0–24 months varied substantially between the study sites and, in addition to pathogens commonly associated with more-severe diarrhoea, Campylobacter spp., norovirus genogroup II and astrovirus were also associated with a substantial number of the diarrhoea episodes.13

For children in low- and middle-income countries, repeated episodes of diarrhoea resulting from high exposures to enteric pathogens have a negative effect on their nutritional status for several reasons, including reduced appetite, increased loss of nutrients and impaired intestinal absorption. Long-term consequences include undernutrition and impairment of normal growth and cognitive development. For example, a recent report on the linkage between the global burden of diarrhea and the environment, it was estimated that 15% of protein–energy malnutrition may be attributable to inadequate WASH.14 Undernutrition is linked to food intake, general health status and the physical environment, all of which are affected by WASH. The association between coverage of water and sanitation services and children’s weight and height has been known for some time.16–18 A WHO-supported study carried out in the 1980s in West Bengal, India, found that universal provision of drinking water and sanitation facilities, along with hygiene education, improved the nutritional status of children significantly, even though no food supplementation was provided. Rates of worm infestation and diarrhoeal disease also decreased significantly.19 Also in the 1980s, Esrey and colleagues reviewed previous studies on the impact of environmental interventions on diarrhoea and found that improvements in water quality were considerably less effective than improvements in water availability and sanitation.20 In 1996, a multicountry study by Esrey showed that improvements in sanitation resulted in increases in the heights of children that were larger than those found resulting from many nutritional interventions.17

“The Asian enigma” was a term first coined by economists in the 1990s for the counterintuitive observation that children in Asia, on average, were shorter than their counterparts in sub-Saharan Africa who, on average, were poorer.21 Subsequent analyses found that the height of children in India correlates with their and their neighbours’ access to toilets, and that open defecation accounts for much of the excess stunting in India that is attributable to faecally transmitted infections.22,23 The practice of open defecation, i.e. where human faeces are disposed of in open spaces, such as fields or beaches, is especially harmful in locations where the population density is high. A recent analysis using multisectoral indicators in 32 districts of the state of Tamil Nadu in India, has shown that the district with the highest prevalence of open defecation also has the highest rate of stunting in children.24

Environmental enteropathy
The most nutritionally significant, yet most neglected, condition linked to WASH is environmental enteropathy, also known as environmental enteric dysfunction, a condition resulting from...
ingestion of faecal bacteria. Children living in poor sanitary conditions are exposed to high quantities of enteric pathogens. The pathogens damage the wall of the small intestine, reducing its ability to absorb nutrients. The resulting gut hyperpermeability also evokes energy- and protein-consuming immune responses to subsequent infections. The condition is subclinical and difficult to measure. Thus, the nutritional and health significance of many non-diarrhoeal faecally transmitted infections has also been masked by their diversity, their multiple presences in the same child, and their often subclinical nature. In 2009, Humphrey argued that “prevention of tropical [environmental] enteropathy, which afflicts almost all children in the developing world, is crucial to normalize child growth, and that this will not be achievable without provision of toilets”.25

Soil-transmitted helminthiases and anaemia

More than 2 billion people globally are estimated to be infected with soil-transmitted helminths – parasitic diseases caused by nematode worms that are transmitted to humans by faecally contaminated soil.26 The soil-transmitted helminths of major concern to humans are Ascaris lumbricoides and Trichuris trichiura, and the hookworms Necator americanus and Ancylostoma duodenale. Soil-transmitted helminthiases are most prevalent where sanitation is inadequate and water supplies are unsafe. Heavy-intensity infections with soil-transmitted helminths result in impaired physical growth and cognitive development in children. They also cause micronutrient deficiencies, including iron deficiency anaemia, leading to poor school performance and absenteeism in children, reduced work productivity in adults, and adverse pregnancy outcomes.26

Hookworm infection results from the ingestion or skin penetration of the hookworm larvae in soil. Larvae develop in soil through the deposit of faeces containing eggs from infected persons. Hookworm infection is not transmitted from person to person but is associated with poor sanitation and hygiene. Intervention studies have shown the effectiveness of adequate WASH in prevention of hookworm infection.7,27–29 An in-depth study conducted in several districts of West Bengal, India, on hookworm and other parasitic infections, indicated that hookworm infection is universal in all age groups of both sexes, with a higher prevalence in areas with a limited number of latrines, or poor rates of sanitation use. Hookworm infection exacerbated pre-existing dietary iron deficiency.30

The public health intervention recommended by WHO for the control of morbidity associated with soil-transmitted helminthiases in endemic areas is preventive chemotherapy – the periodic administration of anthelmintic medicines.31 WHO has set the goal that at least 75% of preschool and school-age children in all endemic countries should be treated by 2020.31 Preventive chemotherapy is not required in only three countries the WHO South-East Asia Region: Maldives, Sri Lanka and Thailand. In 2015, preventive chemotherapy was administered to more than 56 million preschool children, equivalent to a regional coverage of 52.1%. The Democratic People’s Republic of Korea, Myanmar and Timor-Leste reached their national coverage target of ≥75%.31 Also in 2015, 214.8 million school-age children received preventive chemotherapy, equivalent to a regional coverage of 86.8%. Bangladesh, Bhutan, Democratic People’s Republic of Korea, India, Myanmar and Timor-Leste reached >75% national coverage.31 It is anticipated that future reports will show a marked increase in regional coverage, owing to the introduction in 2015 of an annual countrywide deworming day in India.

However, preventive chemotherapy with regular administration of anthelmintic drugs to at-risk groups does not stop rapid reinfection. A systematic review and meta-analysis has shown that the availability of sanitation facilities is associated with significant protection against infection with soil-transmitted helminths, indicating a need to prioritize improved sanitation in parallel with preventive chemotherapy and health education.32

Conclusion

Although considerable advances have been made, sustained work is still needed to close the gaps that preclude people from accessing adequate WASH in the WHO South-East Asia Region. Although hindered by lack of attention from the health research community, evidence of the importance of adequate WASH to health and social outcomes beyond the challenge of childhood diarrhoea is growing.1 The emphasis of the SDGs on intersectoral collaboration and cross-sectoral goals and targets raises awareness of the wide-ranging benefits that can accrue through providing people with access to adequate WASH.

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