



CHAPTER 8

Clean Is Nourished

The Links between WASH and Nutrition

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MORE THAN 660 million people lack access to an improved water source and 2.4 billion people lack access to improved sanitation.¹ Growing awareness of the global challenge we face in improving water, sanitation, and hygiene, widely known as WASH, has won the problem a prominent place on global nutrition and health agendas. And an expanding body of research points to the great potential of WASH, as a set of interventions, to improve nutrition and health. For example, systematic reviews have shown that improving water quality can reduce the risk of diarrhea by 17 percent²; and introducing hand hygiene interventions can reduce gastrointestinal illness by 31 percent and respiratory illness by 21 percent.³

WASH comprises three very different sets of interventions that address similar environmental barriers to good nutrition. The synergistic relationships between low quality or quantity of water, poor sanitation facilities (or lack thereof), and poor hygiene practices have complex links with nutrition. Aside from the indirect ways in which WASH affects nutrition, such as the time taken

away from food production or childcare to collect clean water, there are at least three direct pathways between WASH and nutrition outcomes. The first is through diarrhea, the leading cause of mortality and morbidity among children under five. Diarrhea impairs appetite, the absorption of nutrients, the immune system, and physical and cognitive development.⁴ In 2013, 578,000 children under five died from diarrhea globally, despite a 6.5 percent annual decline in these rates from 2000 to 2013.⁵ Evidence shows some links between poor WASH conditions and diarrhea.⁶ For example, research provides strong evidence that better water *quality* reduces reported diarrhea, but finds a lack of high-quality evidence on the effects of water *quantity*, especially on handwashing practices.⁷ There is also substantial evidence of the association between diarrhea and nutrition. In 2010, children in low- and middle-income countries each experienced nearly three episodes of diarrhea annually, on average, increasing their risk of stunting during the first two years of life, the most critical window for development.⁸ Every five diarrheal episodes puts a child of two

years at a 13 percent greater risk of being stunted, and diarrheal illnesses during this period may lead to an average growth shortfall of 8.2 centimeters.⁹ Nevertheless, more rigorous research is needed on the entire impact pathway, from water quality, access to sanitation, and hygiene practices, to the prevalence of diarrhea, to final impact on nutritional status. Recent estimates suggest that access to different WASH interventions, especially safe and reliable pipe water supply (improvements in water quality) and sewer connections, could prevent more than 360,000 diarrhea-related deaths among children under five in low- and middle-income settings, a 5.5 percent reduction in deaths in that age group.¹⁰

A second link is through other types of infection. Poor sanitation, for example, can increase the risk of infestation of soils by the eggs and larvae of helminth (parasitic worms). When humans ingest

contaminated water and food or walk barefoot on contaminated soil, these helminth and fomites (objects or substances that can carry germs or parasites) can cause parasitic infections such as roundworm, whipworm, and hookworm.¹¹ Infections in turn impede the absorption of nutrients and impair growth.¹² Hookworm infections also cause anemia in children and pregnant women, which increases the risk of preterm delivery and low birth weight.¹³ Again, there is substantial research on the impact of various WASH conditions on infections (for example, the availability and usage of sanitation facilities is associated with a 46–78 percent reduction in soil-transmitted helminth infections¹⁴), but not enough data on the entire WASH–infection–nutrition pathway.

A third possible link is through environmental enteropathy. Poor sanitary environments contain



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A billboard in Liberia suggests one way to prevent diarrhea, a leading cause of illness and death in children under five.

high levels of pathogens. When ingested by children, these may damage the gut and lead to poor absorption of nutrients, a condition known as environmental enteropathy or environmental enteric dysfunction (EED).¹⁵ While diarrhea is episodic, EED can be a chronic condition: a study from the Gambia showed that while children had diarrhea 7.3 percent of their first two years of life, they had EED during 76 percent of that period.¹⁶ Most research on the impact of improved WASH on EED is limited to animal-based studies; human-focused research is currently limited to observational studies that can only establish associations rather than attribution.¹⁷ An observational study from Bangladesh, for example, found that children from physically clean households had less severe EED and higher height-for-age Z-scores (and 22 percent lower stunting prevalence) than their peers from contaminated households.¹⁸

What is the impact of WASH *conditions* on nutrition outcomes? While the literature on each condition—poor quality of water, poor sanitation, and poor hygiene—is vast, there are few studies that look at their impact on nutrition. An ecological study of 140 Demographic and Health Surveys suggested that over half, or 54 percent, of the variation in average child height in 65 poor and middle-income countries could be attributed to frequency of open defecation. When open defecation occurred in densely populated areas, it accounted for 65 percent of the variation in child height.¹⁹ A study of 112 districts in India found that a 10 percent increase in open defecation was associated with a 0.7 percentage point increase in both stunting and severe stunting.²⁰

Research on the impacts of WASH *interventions* on nutrition is also scarce. A systematic review of 14 studies with varying study designs produced a meta-analysis of five randomized controlled trials, the gold standard in research. The analysis found no evidence of an effect of WASH interventions on

weight-for-age and weight-for-height Z-scores. It did find a borderline statistically significant effect of water quality and hygiene interventions on height-for-age, with the strongest effects in children under 24 months of age.²¹ Research focusing on low- and middle-income countries showed that access to improved sanitation was associated with lower child mortality and lower diarrhea.²² No study to date has looked at the impact of simultaneous water, sanitation, and hygiene interventions on nutrition, suggesting a need to probe the synergistic effect of these three types of interventions on nutrition ([Box 8.1](#)).²³

Useful lessons can be drawn from two recent experiences in WASH: community-led total sanitation in Mali and an array of promising WASH interventions in Bangladesh. These cases offer a glimpse of the great potential of WASH interventions to change behaviors in target populations, and thus contribute to improvements in indicators of nutrition such as child growth.

Community-led Total Sanitation in Mali

Community-led total sanitation (CLTS) is a participatory approach, initiated in Bangladesh in 1999, aimed at the complete elimination of open defecation. In contrast to supply-driven sanitation programs, CLTS relies on communities, usually in rural, homogenous villages of less than 2,000 people or 200 households, to take the initiative in tackling open defecation, without financial or capital assistance.²⁴ Research has suggested that providing subsidies to construct in-home sanitation facilities is not effective as a stand-alone intervention for curbing open defecation and is best combined with behavioral change. This finding supports the tenets of CLTS.²⁵

The CLTS process begins with a public community meeting, where education and awareness activities regarding open defecation are undertaken

BOX 8.1 WASH-nutrition research on the horizon

This is an exciting time to be studying the links among water, sanitation, and hygiene, and their synergistic effect on nutrition. A number of high-profile studies are underway that are helping to generate rigorous evidence on these relationships:

The WASH Benefits study is conducting trials in Bangladesh and Kenya with six different combinations of sanitation, water quality, handwashing, and nutrition treatments, looking at whether these interventions impact diarrhea, markers of environmental enteropathy, and growth and development in the first years of life.²⁶ The study is expected to be completed in 2016.

The MAL-ED Project (Interactions of Malnutrition & Enteric Infections: Consequences for Child Health and Development) is conducting WASH-nutrition research in eight countries that have especially high rates of undernutrition and diarrhea: Bangladesh, Brazil, India, Nepal, Pakistan, Peru, Tanzania, and South Africa. The project focuses on the impact of enteric infections on gut integrity, and subsequent physical and cognitive development during the first 1,000 days.²⁷ It is expected to be completed in 2017.

The SHINE Trial (Sanitation Hygiene Infant Nutrition Efficacy) is a Zimbabwe-based study investigating the effects of WASH and/or improved infant feeding on stunting and anemia among children 0–18 months of age who may have been exposed to high levels of mycotoxins, through possible ingestion of fecal microbes from, for example, open defecation or chicken droppings.²⁸ It is expected to be completed in 2017.

in an attempt to invoke disgust and shame, a controversial approach. Participants then commit to using proper defecation facilities. Monitoring is a key component of the CLTS approach, with follow-up visits conducted by program implementers. However, monitoring and evaluation need to be improved across many CLTS interventions. Reportedly, only one in ten organizations that promoted monitoring of CLTS worldwide has actually followed through.²⁹

CLTS has been implemented in an estimated 66 countries but is extremely diverse in practice.³⁰ The approach also suffers from a lack of rigorous evidence, with purported problems in verifying the number of open-defecation-free (ODF) communities in countries such as Bangladesh and Indonesia, and corruption in certifying villages as ODF in India as a way of qualifying for awards.³¹ With this disclaimer in mind, encouraging results have been reported from Ethiopia, Kenya, and Zambia, where sanitation coverage, defined as the ratio of number of toilets to number of households, in 12

pilot villages was reported to have increased from 23 percent to 88 percent in three months.³²

One particular success with CLTS can be found in Mali. The country's CLTS campaign was spearheaded by the government with support from UNICEF and the Bill & Melinda Gates Foundation in 2009. The intervention followed the common practice of CLTS but went further to motivate participants to construct private latrines themselves. Follow-up visits were conducted for up to three months; once it was deemed that all households had properly-equipped latrines and had eliminated open defecation, a celebration event was held.³³ Following an apparently successful pilot in 15 villages (preliminary findings suggest that all pilot villages became fully ODF, bringing the percentage of families with latrines from 30 to 100 percent), Mali's National Directorate of Sanitation incorporated CLTS in its National Strategy for Rural Sanitation, leading the way for scaling up the initiative throughout the country.³⁴ The implementation of CLTS is ongoing and

seems to have continued through political instability, including a military coup in 2012. The government is developing a national CLTS plan for 2015–2024, as well as a post-ODF strategy, CLTS implementation guide, and training manual. As of 2024, 1,400 villages had reportedly achieved ODF status, contributing to a 1 percent reduction in the national prevalence of open defecation.³⁵

A cluster-randomized controlled trial among 121 villages conducted in 2011–2013 showed that the CLTS campaign in Mali had a positive impact on improving access to latrines and decreasing open defecation.³⁶ Participating villages enjoyed 65 percent coverage of private, household latrines, compared to 35 percent in control villages. Open defecation, as reported by participants, decreased by 71 percent among adults; 49 percent among children of 5–10 years of age; and 51 percent among children younger than 5.³⁷

Impacts on health and growth outcomes were also positive. Young children (under five years) in participating villages had statistically significant 0.18 higher height-for-age Z-scores and were 13 percent less likely to be stunted. The effects were even larger (height-for-age Z-scores of 0.29) when restricting the sample to approximately 800 children younger than one year, signaling an impact within the critical 1,000-day window.³⁸ However, there were no significant impacts on the reduction of the proportion of children underweight or improvements in child weight.³⁹

WASH in Bangladesh

In 1995, 35 percent of people in Bangladesh defecated in the open. By 2012, that number had dropped to 2.5 percent.⁴⁰ Many lessons can be derived from Bangladesh's experiences in tackling poor sanitation and hygiene, a journey that continues today. The Government of Bangladesh has passed a number of policies and plans directed at



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An anganwadi worker helps a child properly wash her hands at a village center in Andhra Pradesh, India.

the water and sanitation sector, including the Water Act of 2013; the Sector Development Plan of 2010–2021, which calls for an integrated water and sanitation strategy; and, most notably, the National Water Supply and Sanitation Strategy 2014, which aims to increase WASH interventions and improve sector governance.⁴¹ In 2003, the government launched a National Sanitation Campaign, which aimed to achieve 100 percent sanitation coverage by 2010, later revised to 2013. The campaign used many of the principles of CLTS and emphasized the containment of feces, rather than pressure to build a sanitary latrine. To implement the program at scale, the government earmarked 20 percent of local development funds, most of which was spent

on procuring sanitation facilities and supplies for the ultra-poor, mostly in rural areas. (The intervention has failed to reach rural growth centers, urban slums, and remote areas.) An incentive scheme was also implemented: villages verified to have 100 percent household latrine coverage became eligible for cash grants of US\$3,000.⁴² Regional and local governments, as well as nongovernmental organizations, also joined the effort to mobilize communities to become ODF, as well as to help develop a decentralized sanitation model.⁴³ Sanitation coverage in the country increased by 9 percent annually, and by 2014, 57 percent of the population had access to improved sanitation facilities.⁴⁴ Research has suggested that the rapid reduction in open defecation is among the factors that are associated with long-term improvements in average child height, possibly through reduced incidence of EED.⁴⁵

Evidence on the impact of other WASH interventions in Bangladesh is now being weighed. The first phase of the SHOUHARDO Project (Strengthening Household Ability to Respond to Development Opportunities, funded by the US Agency for International Development and designed and implemented by CARE and the Government of Bangladesh), for example, served 2 million people between 2006 and 2010 (see Chapters 2 and 12). SHOUHARDO promoted WASH actions such as handwashing, food preparation, latrine use, and hygiene practices, combined with health education, exclusive breastfeeding, and supplementation.⁴⁶ A mixed-methods non- and quasi-experimental study found that during this first phase, the percentage of households with access to a sanitary latrine increased from 13.8 percent to 54.6 percent.⁴⁷ Chronic malnutrition among children 6–24 months of age in project areas declined from 56 percent to 40 percent; in contrast, in rural Bangladesh as a whole during this period there was no decline in stunting, and

even an increase in later years, although many confounding factors are possibly at play. For households in the project, dietary diversity also increased by 25.7 percent.⁴⁸ Isolating the effect of sanitation alone on children's height-for-age Z-scores revealed no significant difference between the participating and control groups. However, the impact on children's height seemed to double when sanitation was combined with other maternal and child health and nutrition interventions, suggesting that sanitation and direct nutrition interventions had strong synergistic impacts.⁴⁹ The project's second phase (2010–2015) is due to release its findings soon.

Lessons Learned

These experiences from Mali and Bangladesh highlight a few lessons. First, all levels of government and civil society, notably the communities themselves, played key roles in many of these initiatives. Both government and civil society are likely integral to success, with government providing strategic direction, funding, and coordination among multiple actors, and communities adapting models such as CLTS to their own unique environments, improving sustainability.

Second, behavior change is critical for the success of WASH (see [Box 8.2](#)). Improved hygiene and sanitation practices in particular (unlike water quality improvements) are difficult to achieve without appealing to individuals, households, and whole communities to change. Behavior change communication that can deliver WASH messages, while highlighting the positive impact of WASH on nutrition and health, is thus integral to better outcomes.

At the same time, there are some challenges. The fact that WASH depends on behavior change makes measuring its impact on nutrition difficult. Evaluations rely on the ability of interventions to change behavior, first and foremost—only after this

BOX 8.2 An unexpected entry point for WASH

The Alive & Thrive Project, which operated in Bangladesh in 2011–2014, aimed to reduce child stunting and anemia among 8.5 million households with children under 2 years of age. Initially, the project focused its intervention and media campaign on improved infant and young child feeding practices (see Chapter 3). But in light of research that uncovered high rates of child diarrhea and poor hygiene practices, it soon integrated handwashing with soap, training community workers to communicate the importance of WASH for health and nutrition. Project results suggested a 67 percentage point increase in improved handwashing behavior by mothers before food preparation and child feeding, with nearly two-thirds of participating households installing soap and water near food preparation and feeding areas.⁵⁰ However, participants were also observed using the handwashing materials for other purposes, making the long-term benefits of the project difficult to assess. Nevertheless, these results highlight the importance of behavior change communication to both WASH and nutrition.

has been achieved can interventions' specific impact on nutrition be measured.⁵¹ Apart from a few recent exceptions, most large-scale WASH interventions have achieved only small improvements in sanitation behavior, making research conclusions difficult to derive.⁵² Even when behavior has successfully been altered, nutrition and health outcomes are rarely the focus of WASH program evaluations.

The different objectives of WASH and nutrition interventions creates another challenge. WASH aims for universal application: universal access to water, sanitation, or hygiene. Nutrition interventions, on the other hand, are more varied. Some, such as exclusive breastfeeding or fortification, are universal; but others, such as supplementation in young children, are more

targeted.⁵³ Development practitioners and local communities must take these differences into account when designing effective programs and interventions.

WASH and nutrition are both high on the global political agenda. The Rome Declaration on Nutrition and the Framework for Action, adopted at the second International Conference on Nutrition in November 2014, recommends “actions on water, sanitation and hygiene.” And the Sustainable Development Goals, adopted by the United Nations in 2015, identify the clear goal of “ensur[ing] availability and sustainable management of water and sanitation for all.”⁵⁴ The time is ripe to collaborate across sectors and bring past lessons to bear on future WASH-nutrition interventions.

