

# What is the effect of water source improvement interventions on malnutrition and the prevalence of waterborne diseases?

Efforts to improve water quality have been identified as promising interventions to reduce child mortality. Despite this, two billion people worldwide do not have access to safely managed drinking water, and half of them live in sub-Saharan Africa.<sup>1</sup> At least two billion people around the world rely on drinking water sources contaminated with feces.<sup>2</sup> Contaminated water can transmit diseases such as cholera, dysentery and polio. Recurrent infections can be a major cause of malnutrition and child stunting.<sup>3</sup> Conceptually, malnutrition encompasses all forms of poor nutrition, while undernutrition is limited to nutritional deficits, including stunting and wasting. Stunting is defined as abnormally short stature and wasting as low weight for height.

### Key findings

- Interventions improving water sources have mixed effects on malnutrition and the prevalence of waterborne diseases.
- Several studies show that access to safe water has no effect on malnutrition. One study showed that water treatment combined with treatment of severe acute malnutrition promotes recovery from acute malnutrition, but has no effect on overall malnutrition rates.
- Access to safe water, sanitation, and hygiene (WASH) interventions combined with nutrition interventions increase the height (HAZ score) and weight (WAZ score) of children under two.
- A meta-analysis of low-quality studies found that access to safe water reduces infant mortality. Therefore, further studies are needed.

### Key recommendations

- The elimination of a single source of contamination may not be sufficient to produce significant effects on health and well-being when other sources of contamination are present in households and communities.
- To be effective, safe water interventions should be combined with nutrition interventions and other sanitation and hygiene interventions which completely transform the standard WASH environment. In combination, these components can prevent infection and improve nutritional status.
- Actors in the nutrition system should work together to implement programs to improve child and household nutrition.
- To develop improved evidence, different actors should also harmonize nutrition data collection and measurement tools to better assess the effects of interventions. In addition, research is needed on interventions implemented on a large scale which can yield generalizable results.

## Context

In Côte d'Ivoire, stunting affects 26 percent of children aged 24-59 months and 12 percent of children aged 6-11 months. Wasting or acute malnutrition affects 14 percent of children aged 6-11 months and 5 percent of children aged 36-59 months.<sup>4</sup> Given these prevalence levels and the strong link between drinking water consumption and health, a policymaker in Côte d'Ivoire asked about the effect of access to safe water on waterborne diseases and malnutrition. Since independence, the Government of Côte d'Ivoire has worked to improve nutrition for households, children and women. The country's Multisectoral Nutrition Plan 2016-2020 outlines the following objectives: to promote good nutritional practices and preventive measures; to strengthen the management of malnutrition; to increase the availability of and access to nutritious and diversified foods for consumption; to strengthen food safety; to reinforce the resilience of households to food and nutritional crises; and to improve hygiene and access to drinking water and sanitation systems in areas with a high prevalence of malnutrition.

To improve access to safe drinking water, the Ivorian government offers both improved and basic water supply services. The improved service offers uncontaminated improved water sources (taps) in homes, neighborhoods, yards or plots. Basic service provides improved sources of water within a 30-minute round trip. These improved sources include public taps, standpipes, pumped wells, protected wells, boreholes, and bottled water. There are also unprotected water sources that are not protected from contamination. Nationally, 34.5 percent Ivorian households have access to improved water supply services while, 44.7 percent have access to basic water supply services, and 13.3 percent use unprotected water sources because they do not have access to water supply services. In terms of drinking water quality, 79.4 percent of Ivorian households consume improved water; 53.6 percent consume water contaminated at the source and 78.5 percent consume water contaminated in the household.<sup>5</sup> Thus, in Ivorian households, there are both improved and contaminated water sources, a situation which can limit the expected effects of interventions against malnutrition.

## Details of the interventions

This brief is based on six systematic reviews and a rapid evidence assessment, all relating to interventions that provided safe water. Only interventions targeting water sources, such as the provision of hand pumps, communal taps, or filtered community water sources, were considered. Point-of-use treatment interventions were not included, although in some cases they were presented with other interventions. The systematic reviews included 86 interventions, mostly related to the provision of covered water sources, piped water, chlorination, or filtration of water sources. The variables of interest were:

- anthropometric measures, such as weight, height, and mid-arm circumference;
- prevalence of acute and moderate malnutrition;
- non-diarrheal morbidity; and
- mortality.

Interventions were targeted at the community level, but outcomes were primarily measured for children under five.

## Findings

### Does access to clean water reduce the prevalence of waterborne diseases?

Existing studies show that access to safe water is not sufficient to reduce waterborne disease prevalence. A 2015 systematic review found insufficient evidence on whether improving water sources reduced diarrhea (Clasen et al 2015). However, a more recent review found that providing piped water reduced the incidence of diarrhea (Wolf et al 2018). This review was based on 22 studies conducted in Bangladesh, Vietnam, the Philippines, Ghana, Thailand, Morocco, India, Argentina, Rwanda, Mozambique, Puerto Rico, Pakistan, Yemen, South Africa, Côte d'Ivoire, Egypt, the Democratic Republic of Congo, and China. Results were highly variable across studies. Another meta-analysis found no effect of interventions to improve water quality at the source on diarrhea incidence in Afghanistan, Bangladesh, Pakistan, Panama, and Uzbekistan (Darvesh et al. 2017).

In a set of five studies in Ethiopia, Rwanda, Vietnam, Bangladesh, and Cuba, the use of piped water was associated with reductions in specific waterborne parasites, but not with reductions in waterborne parasites overall (Strunz 2014). Municipal water chlorination in the Philippines, Indonesia, Turkey, Montenegro, and Yemen had mixed effects on communicable diseases (Prasad 2020). A review that included five studies on improving water quality and supply found a reduction in mortality, but the authors cautioned that the studies were of low quality (Gera et al. 2018). Only one study in this review examined the effects of a water supply intervention on cough, fever, ocular chlamydia, and active trachoma; it found no effect.

### Does access to clean water reduce malnutrition?

The evidence on the effects of access to safe water on malnutrition remains mixed. A systematic review with studies on improvements in water quality and supply could identify only one study that considered anthropometric measures (Gera et al. 2018). It reported no significant improvements in children's weight. Similarly, another systematic review found no effect of improved drinking water sources on the height of children under age five in Bangladesh or Ethiopia (Dangour et al 2013).

Patlán-Hernández et al (2022) showed that there is no relationship between WASH interventions and the prevention or treatment of acute malnutrition. Two experimental studies included in the review, however, showed that water treatment combined with treatment of severe acute malnutrition promoted recovery from acute malnutrition but had no effect on reducing overall malnutrition rates. Bekele et al (2020) showed that access to safe water, combined with sanitation, hygiene and nutrition (WASH and nutrition interventions) increased the height (HAZ score) and weight (WAZ score) of children under two years of age.

## Recommendations

The evidence linking improved water sources to reductions in waterborne disease is mixed. It does not indicate that these interventions effectively improve the nutritional status of children. The studies used for this brief do not consider large-scale interventions or interventions treating water in households or at sources of use. The latter type of intervention reduces the possibility of contamination between the water source and consumption, which could increase positive effects on anthropometric measures and nutritional status.

The existence of other sources of contamination besides drinking water sources (taps) may explain the mixed results reported in this note. In addition, improved water quality may not be sufficient if sanitation and hygiene practices are not good. Therefore, combining safe water interventions with sanitation and hygiene interventions may be more effective in preventing infections and improving the nutritional status of children.

Actors in the nutrition system should coordinate their interventions and harmonize nutrition data collection and measurement tools to better assess the effects of interventions. Common indicators measuring nutrition are needed, and data collected on the variables like access to water, sanitation and hygiene should be linked to each other.

In terms of generating scientific evidence, studies on interventions implemented on a large scale, such as nationwide, will allow the results of studies measuring their effects to be generalized. In addition, the collection of location data (GPS) is necessary to visualize (map) the coverage of safe water, sanitation, hygiene and nutrition interventions in a geographic area or territory.



**This rapid response brief is based on the following systematic reviews and rapid evidence assessment**

Patlán-Hernández, A. R., Stobaugh, H. C., Cumming, O., Angioletti, A., Pantchova, D., Lapègue, J., ... & N'Diaye, D. S. (2022). Water, sanitation and hygiene interventions and the prevention and treatment of childhood acute malnutrition: A systematic review. *Maternal & child nutrition*, 18(1), e13257.

Bekele, T., Rawstone, P., & Rahman, B. (2020). Effect of water, sanitation and hygiene interventions alone and combined with nutrition on child growth in low- and middle-income countries: a systematic review and meta-analysis. *BMJ open*, 10(7), e034812.

Cumming, O., Arnold, B. F., Ban, R., Clasen, T., Esteves Mills, J., Freeman, M. C., ... & Colford, J. M. (2019). The implications of three major new trials for the effect of water, sanitation and hygiene on childhood diarrhea and stunting: a consensus statement. *BMC medicine*, 17(1), 1-9.

Dangour AD, Watson L, Cumming O, Boisson S, Che Y, Velleman Y, Cavill S, Allen E, Uauy R. (2013). Interventions to improve water quality and supply, sanitation and hygiene practices, and their effects on the nutritional status of children (Review). *The Cochrane Library* 2013, Issue 8.

Gera T., Shah D., & Sachdev H.S. (2018). Impact of Water, Sanitation and Hygiene Interventions on Growth, Non-diarrheal Morbidity and Mortality in Children Residing in Low and Middle-income Countries: A Systematic Review. *Indian Pediatrics*. Volume 55 May 15, 2018.

Darvesh N., Jai K. Das, Tyler Vaivada, Michelle F. Gaffey, Kumanan Rasanathan, Zulfiqar A. Bhutta. Water, sanitation and hygiene interventions for acute childhood diarrhea: a systematic review to provide estimates for the Lives Saved Tool. *BMC Public Health* 2017, 17(Suppl 4):776.

Prasad S., Charlotte Lane and Douglas Glandon. Rapid evidence assessment of the impacts of sewerage, drainage, and piped water chlorination in urban settings of low- and middle-income countries. *Journal of Water, Sanitation and Hygiene for Development*. 11.2. 2021.

## What is the WACIE Helpdesk

The WACIE helpdesk provides rapid synthesis and evidence translation to help policymakers in West Africa understand what evidence exists for specific policy questions. The helpdesk can also connect interested policymakers with further resources to meet additional needs. It is staffed by the WACIE Secretariat with engagement from the wider 3ie technical staff and other experts as needed.

To submit a policy question, or for additional information, contact [wacie@3ieimpact.org](mailto:wacie@3ieimpact.org).

## What is WACIE?

The West Africa Capacity Building and Impact Evaluation (WACIE) program, a partnership between 3ie and the Government of Benin, was launched to help build evaluation capacity in the eight countries that comprise the West African Economic and Monetary Union (WAEMU): Benin, Burkina Faso, Cote d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo. Program goals include increasing evaluation capacity in targeted countries, ensuring that policymakers have access to relevant evidence and promoting take-up of high-quality evidence by relevant stakeholders.

## Endnotes

<sup>1</sup> <https://unstats.un.org/sdgs/report/2021/The-Sustainable-Development-Goals-Report-2021.pdf>

<sup>2</sup> <https://unstats.un.org/sdgs/report/2021/The-Sustainable-Development-Goals-Report-2021.pdf>

<sup>3</sup> <https://www.fao.org/3/cb4474en/cb4474en.pdf>

<sup>4</sup> EDS – CI : Enquête Démographique et de Santé réalisée en 2021 en Côte d'Ivoire (EDS-CI 2021)

<sup>5</sup> Ces statistiques proviennent des résultats de la 5ème enquête par grappes à indicateurs multiples sur la situation des femmes et des enfants en Côte d'Ivoire. [https://mics-surveys-prod.s3.amazonaws.com/MICS5/West%20and%20Central%20Africa/C%3%B4te%20d%27Ivoire/2016/Final/Cote%20d%27Ivoire%202016%20MICS\\_French.pdf](https://mics-surveys-prod.s3.amazonaws.com/MICS5/West%20and%20Central%20Africa/C%3%B4te%20d%27Ivoire/2016/Final/Cote%20d%27Ivoire%202016%20MICS_French.pdf)



The International Initiative for Impact Evaluation (3ie) develops evidence on how to effectively transform the lives of the poor in low- and middle-income countries. Established in 2008, we offer comprehensive support and a diversity of approaches to achieve development goals by producing, synthesizing and promoting the uptake of impact evaluation evidence. We work closely with governments, foundations, NGOs, development institutions and research organizations to address their decision-making needs. With offices in Washington DC, New Delhi and London and a global network of leading researchers, we offer deep expertise across our extensive menu of evaluation services.

 [3ieimpact.org](https://3ieimpact.org)

June 2023

 [@3ieNews](https://twitter.com/3ieNews)

 [/3ieimpact](https://facebook.com/3ieimpact)

 [3ieimpact](https://instagram.com/3ieimpact)

 [/company/3ieimpact](https://linkedin.com/company/3ieimpact)

 [/3ievideos](https://youtube.com/3ievideos)