

## **Evidence Brief**

# What Works in Addressing Global Poverty – Water and Poverty

Jenna Davis

Professor, Department of Civil and Environmental Engineering, Stanford University  
Director, Stanford Program on Water, Health & Development



## Key Points

1. Extreme poverty and lack of access to clean water supplies are closely linked.
2. At the national level, the availability of fresh water is not correlated with the share of the population that has access to water services.
3. Inadequate water supply service contributes to diarrheal disease, imposes large time and human energy costs particularly on women, and limits opportunities for education, income generation, and quality childcare.
4. Considerable progress has been made in extending basic water services over the past 30 years. Many of these investments fail to improve health because they have little impact on either the quantity of water used or the quality of water at the point of consumption.
5. In addition to getting better quality water closer to households, effective water supply investments need to ensure post-construction maintenance of installed infrastructure, and use valid and relevant indicators to evaluate results.

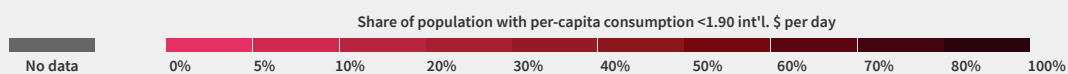
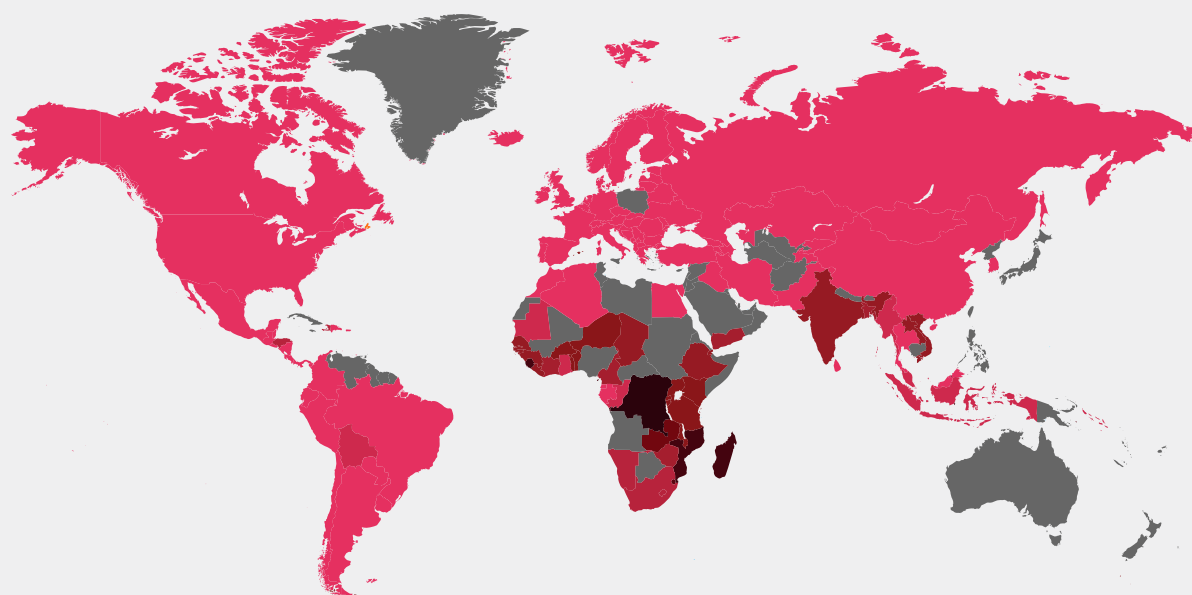
## The Problem

The United States Agency for International Development defines extreme poverty as an “inability to meet basic consumption needs on a sustainable basis.” The United Nations uses a yardstick of consumption under 1.90 U.S. international dollars per day to identify those suffering from extreme poverty. Evidence suggests that the share of the global population in extreme poverty is declining dramatically in most world regions. In 1990, 36% of the world population lived in extreme poverty. By 2015, that share had fallen to 9.9%. The one exception is Africa, where the number of poor people continues to rise. Sub-Saharan Africa is home to about 16% of the global population, but

well over half of all people who are living in extreme poverty. By 2030, nearly 90% of the 535 million expected to be living in extreme poverty will be in sub-Saharan Africa.

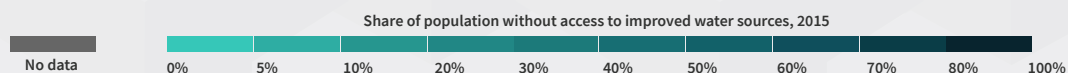
A global map of water supply shows a remarkable correspondence between poverty and lack of access to clean water. Some 44% of those without access to safe and convenient water live in sub-Saharan Africa. People who are extremely poor are often the same ones who don't have safe, easily accessible water supplies. And 80-85% of these people live in rural communities that are often difficult to reach. Compared to urban areas where economies of scale can be exploited, rural communities can have per-capita costs of service provision that are much higher.

## Where are people living in extreme poverty?



Source: World Bank

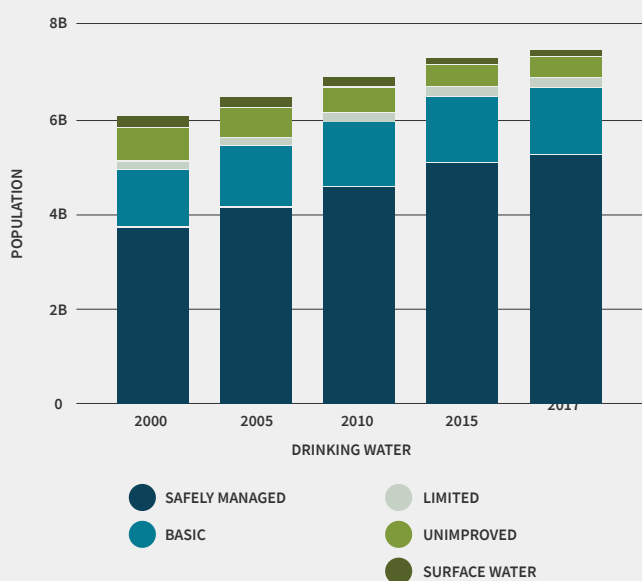
## Access to water supply services



Source: World Bank

Development specialists use a water services ladder to categorize water supply services:

Household date - World - Service Levels



Source: WHO/UNICEF JMP

*Safely managed* service includes water that is delivered to the house or yard, is available when needed, and is free of fecal and priority chemical contaminants.

*Basic* water service is similar to *limited service* (below), but water can be collected from the source in fewer than 30 minutes round trip.

*Limited* service delivers water from an ‘improved’ source that offers some protection against contamination – a shared or public tap, a borehole with a manual or mechanical pump, a protected spring or well, or a rainwater collection system – and that requires a road trip of more than 30 minutes to fetch water.

*Unimproved* service includes use of a water source that offers little or no protection against contamination, such as a hand dug well, river, pond, or irrigation canal.

Currently about 90% of the global population has access to either a safely managed or basic water system. Improving water access can lead to poverty alleviation through several possible channels:

*Health.* Inadequate water and sanitation results in diarrheal diseases that are transmitted via the fecal-oral route, meaning that a small particle of one person’s waste is ingested by another person. Exposure can occur through contaminated food and water, and also through inadequate handwashing. Diarrheal illness imposes significant costs that contribute to poverty, including time taken from education and income generation (both those who care for the ill and those who are sick themselves), as well as direct medical expenses. In the past few decades, the number of children dying from diarrheal diseases has fallen from about 4 million to 500,000 per year (Reiner, et al., 2018). The reduction in mortality reflects improvements in water services, but also improved nutrition, education, and preventative and curative health care.

*Time and energy.* In many low- and middle-income countries, traveling to a water source to bring water home is time consuming and physically burdensome. In sub-Saharan Africa, 20 billion person-hours per year are devoted to fetching water, a task that falls mostly to women and girls. Water fetching also consumes substantial human energy. Recent research in Mozambique found that, on average, women expended 48% of their available caloric energy hauling water (Russel, 2019). Time spent collecting water cannot be used for other beneficial purposes, such as getting adequate rest, pursuing educational or livelihood activities, or caring for children.

*Livelihoods.* When rural households have access to reliable supplies of water close to home, they have the opportunity to engage in water-using activities that enhance nutrition and/or livelihoods, such as irrigating a kitchen garden, making bricks, or operating service-oriented enterprises such as restaurants or hair salons.

## What We've Learned

The obvious solution to the problem of contaminated and distant water sources is to replace them with safe sources and pipe the water to households. In the United States and other high-income countries, construction of piped networks with filtration and chlorination in the first half of the 20th Century dramatically reduced infant and child mortality rates. By contrast, in Sub-Saharan Africa from 2000 to 2015, most gains in access to water service were the result of installing shared community boreholes to transition people from unimproved water sources like unlined wells or ponds.

Over the past two years, results from two large, cluster randomized trials (called WASH Benefits and SHINE) have found negligible impacts of improved water and sanitation services on key child health indicators including stunting and wasting (Cumming & Curtis, 2018; Humphrey, et al., 2019; Pickering, et al., 2019). This is consistent with broader evidence suggesting that, on average, the transition from an unimproved water source to an improved, shared (community) source does not reduce child diarrheal disease.

One reason for the small impact is that, although water may be clean at the point of collection, it is challenging to keep it clean in resource-constrained settings. The water must be carried home and stored, which provides opportunities for contamination both from the container and from household members who use contaminated cups and hands to dispense it. A study in Tanzania found that water from community boreholes had undetectable levels of the fecal indicator bacteria *E. coli* at the point of collection, but reached on average 35 colony forming units (CFU) per hundred ml after a few hours storage at home (against a national standard of 0 CFU) (Davis, et al., 2011).

A second reason that improved, shared water sources don't yield significant health benefits is that water is heavy—more than 44lbs. for one standard 20 liter container—and carrying it home is arduous. Household members understandably want to make the fewest possible number of trips to the water source, which limits the volume of water collected. Fifty liters per person per day is a widely used norm for how much water is needed to ensure people have enough for drinking, cooking, washing and bathing. However, empirical evidence suggests that once a water source is located more than a few minutes' walk away from the home, households use only about 14 liters per person per day (Batteson, Davey, & Shaw, 1998). In such cases the water available is insufficient to support good personal hygiene, increasing exposure of household members to disease-causing pathogens.

The failure to generate perceptible health improvements contributes to the sustainability crisis in rural water infrastructure. Currently about a third of hand pumps in sub-Saharan Africa are temporarily or permanently out of service (Banks & Furey, 2016). In some cases this may be because community members conclude they are getting little benefit from the time, effort, and money they are spending on improved water supplies. They may not be willing to continue contributing to operate and maintain the system and opt instead for unimproved alternatives that, while providing lower quality water, are typically free to use.

## Implications

Amplifying the poverty alleviation potential of water supply investments is most likely to happen when strategies seek to:

1. **Deliver water closer to households.** If water is available near where people live, they spend less time and energy hauling it. More water can be used for hygiene and for supporting income-generating activities.
2. **Concentrate on maintenance.** Shifting focus from construction to improving the reliability of existing sources can interrupt the positive feedback loop of deteriorating service and willingness to pay while also reducing the lifetime costs of a system and freeing up funds to reach those currently, unserved.
3. **Facilitate healthful behaviors.** Technology and infrastructure are important elements in tackling diarrheal disease, but behavior such as handwashing at critical times is equally important for realizing the potential benefits of technology. Evidence suggests that education alone is a less effective motivational approach than appeals to emotion or aspiration, as well as by efforts to make behaviors like handwashing more convenient and low-cost.
4. **Choose the right metrics.** The indicators that are chosen to evaluate a water investment will receive the greatest attention during implementation. Measure what matters, not simply what's easy to measure or what has been measured in the past.

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## About Jenna Davis



Jenna Davis is professor of Civil and Environmental Engineering, the Higgins-Magid Senior Fellow at the Stanford Woods Institute for the Environment, and the director of the Stanford Program on Water, Health & Development. Her research

and teaching are focused on the ways in which and conditions under which water contributes to human well-being, particularly in low- and middle-income countries. She has conducted field research in more than 20 countries, including most recently Zambia, Bangladesh, and Uganda.

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**Stanford** | King Center on  
Global Development

kingcenter@stanford.edu

(650) 725-8730

John A. and Cynthia Fry Gunn Building  
366 Galvez Street, Stanford, CA 94305

[kingcenter.stanford.edu](http://kingcenter.stanford.edu)

