Integrating WASH Across Development Sectors:
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This document describes the positive effects of safe drinking water, sanitation, and hygiene (WASH) interventions across a variety of development priorities. This partial list\(^1\) of research findings demonstrates that incorporating WASH into public health, HIV/AIDS, food security/nutrition, education and other programming can make progress toward all of these efforts more successful initially--and more sustainable over the long run. The sections below detail the consequences of unsafe WASH across sectors, as well as the benefits gained from integration.

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I. Introduction

Child and maternal health, HIV/AIDS, Neglected Tropical Diseases, food security/nutrition, and other development efforts can be more successful initially and more sustainable over the long term if they include safe drinking water, sanitation, and hygiene (WASH). Approximately 1.5 million children under five years old die each year from diseases - including cholera and dysentery - that result from unsafe drinking water and sanitation. An estimated 50% of undernutrition is due not to lack of food but to diarrheal and worm infections caused by inadequate water and sanitation. Even pneumonia infections can be reduced by up to 25% with water and handwashing. Opportunistic infections, resulting from water and sanitation related diseases in people living with HIV, can accelerate the progression of HIV to AIDS. Ninety percent of people living with HIV/AIDS are affected by diarrheal disease, which reduces the absorption of antiretroviral medicines and essential nutrients, further exacerbating the consequences of HIV and AIDS.

Safe water and sanitation have the potential to prevent at least 9% of the global disease burden and 6% of all deaths. People with WASH-related diseases fill half the hospital beds in developing countries. Handwashing with soap can reduce the risk of diarrhea by up to 60%, while safe treatment and storage of drinking water at point of use reduces the risk of diarrhea by 30–40%. WASH reduces severity of diarrhea in people living with HIV/AIDS by 35%.

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\(^1\) Please note that some articles are listed in multiple categories due to their overlapping nature.
Development organizations can set and measure progress toward tangible WASH goals that will reinforce aid effectiveness objectives such as building effective partnerships, increasing innovation, using evidence-based programming, and reducing the need for development assistance over the long run. Specific actions include increased multi-year funding and programmatic support for integrated WASH access, incorporating WASH into regional and national plans and programs, expanding WASH human resources and advocacy efforts, and strengthening WASH-related collaboration with recipient countries.

II. Child/Maternal Health and WASH

Summary: Each year millions of children and women die from diseases that can be prevented by access to safe drinking water, sanitation, and hygiene (WASH). Young children are particularly vulnerable to the effects of poor WASH, as are women during pregnancy and birth. The effects of poor WASH are responsible for at least 20 percent of all child deaths. WASH’s overwhelmingly beneficial impact on child and maternal health is shown in part by the following documentation.

Birth attendant and maternal handwashing can reduce neonatal mortality by up to 41%.

Reductions in diarrheal disease, which could be achieved by providing improved sanitation and water supply, can prevent long term morbidity and at least 860,000 child deaths a year caused by malnutrition.

Episodes of diarrhea due to inadequate WASH had significant negative impacts on children’s cognitive development and their ability to function in school. A study in northeastern Brazil showed that impacts of early childhood diarrhea (ECD) extend beyond the acute phase of diarrheal illness to at least 5 to 7 years later. Occurrence of ECD may hinder both school readiness and school performance by impairing cognitive function.

WASH has the potential to prevent at least 9.1% of the global disease burden and 6.3% of all deaths.

A randomized control trial in Pakistan found that handwashing with soap reduced the number of pneumonia-related infections in children under the age of five by 50%. In the same study, simple handwashing resulted in a 53% lower incidence of diarrhea as well.
More than two-thirds of the population in Africa must leave their home to fetch water for drinking and domestic use. A recent study found that a 15-min decrease in one-way walk time to a water source is associated with a 41% average relative reduction in diarrhea prevalence and an 11% relative reduction in under-five child mortality. These results suggest that reducing the time cost of fetching water should be a priority for improving public health in Africa.


A citywide sanitation program in Northeast Brazil resulted in a reduction of intestinal parasites infection in young children of A. lumbricoides from 24.4% to 12.0%, T. trichuria from 18.0% to 5.0% and G. duodenalis from 14.1% to 5.3%. Most of these reductions appeared to be explained by the increased coverage of each neighborhood by the sewerage system constructed during the intervention.


A Bangladeshi study found that risky behaviors such as disposal of child feces, defecation by adult family members in open spaces, and use of common source surface water for washing clothes and utensils were practiced by up to 83% of the cohort families studied. Bivariate analysis shows that disposal of child feces in a closed space resulted in a 35% reduction in helminth infestation, and use of tube well water in a 48% reduction.


A Ugandan randomized controlled trial of persons living with HIV using safe water system (SWS) found that they had 25% fewer diarrhea episodes, 33% fewer days with diarrhea, and less visible blood or mucus in stools. The same study found that among persons with HIV the presence of a latrine in a compound, compared with those without a latrine was associated with 31% fewer episodes of diarrhea, 37% fewer days with diarrhea, and 37% fewer days of work or school lost due to diarrhea.


Environmental enteropathy (EE), ubiquitous among people living in areas with inadequate water and sanitation, likely mediates two interlinked public health problems of childhood, stunting and anemia. The interacting effects of infection and enteropathy drive a vicious cycle that can propagate severe acute malnutrition, which underlies almost half of under-5 child deaths. Enteropathies are highly prevalent, interacting causes of morbidity and mortality in developing countries. Interventions—such as safe WASH—to prevent or ameliorate enteropathies have the potential to improve the health of millions of people in developing countries.
In countries with the poorest sanitation, mortality of children under five is nearly seven times higher than in countries with the best access to sanitation.


Arsenic contamination in drinking water affects more than 130 million people worldwide and is linked to anemia, putting pregnant women at greater risk for haemorrhage. Hygiene during the birthing process is essential to avoid infections and personal hygiene (frequent cleansing) is important to manage obstetric fistula which affects two million young women.


A randomized controlled trial of intensive handwashing promotion in Karachi, Pakistan found that children randomized to the handwashing promotion during their first 30 months of age attained global developmental quotients 0.4 standard deviations greater than those of control children at 5 to 7 years of age. These gains are comparable to those of at-risk children enrolled in publicly funded preschools in the United States and suggest that handwashing promotion could improve child well-being and societal productivity.


This paper combines 172 Demography and Health Survey data sets from 70 countries to estimate the effect of water and sanitation on child mortality and morbidity. The results show a robust association between access to water and sanitation technologies and both child morbidity and child mortality. The point estimates imply that water and sanitation infrastructure lowers the odds of children suffering from diarrhea by 7-17%, and reduces the mortality risk for children under the age of five by about 5-20%.


As diarrhoea causes undernutrition, it creates a vicious circle by also reducing a child’s resistance to subsequent infections.


People with WASH-related diseases fill half the hospital beds in developing countries.

Research shows that safe water and handwashing can reduce pneumonia infections significantly, e.g.:

- Washing hands with soap after defecation and before eating could **cut the pneumonia infection rate by about 25 percent**.
  
  Source: Ensink, J. WELL Fact Sheet at [http://www.lboro.ac.uk/well/resources/fact-sheets/factsheets-hmt/Handwashing.htm](http://www.lboro.ac.uk/well/resources/fact-sheets/factsheets-hmt/Handwashing.htm)

- A recent study in Pakistan found that **handwashing with soap reduced the number of pneumonia-related infections in children under the age of five by 50%**. In the same study, simple handwashing resulted in a 53% lower incidence of diarrhea as well.


Worldwide, millions of people are infected with neglected tropical diseases (NTDs), many of which are water and/or hygiene-related, such as Guinea Worm Disease, Buruli Ulcer, Trachoma, and Schistosomiasis. These diseases are most often found in places with unsafe drinking water, poor sanitation, and insufficient hygiene practices.


### III. Diarrhea and WASH

**Summary:** **Diarrhea due to unsafe WASH kills over 2 million people each year, and causes tremendous morbidity. One in five child deaths are due to diarrhea—the second largest killer of children worldwide. Use of safe water, adequate sanitation, and good hygiene can reduce the incidence of diarrhea by up to 60%. The following resources describe the benefits gained by integrating safe WASH into diarrheal disease control initiatives.**

Improved water supply is recognized to **reduce diarrhea morbidity by 21%** and improved **sanitation reduces diarrhea morbidity by 37.5%**. Improved sanitation is also shown to reduce schistosomiasis by up to 77%.

Improved access to safe water sources and better hygiene practices can reduce morbidity by 27%.


As diarrhoea causes undernutrition, it creates a vicious circle by also reducing a child’s resistance to subsequent infections.


A study of sanitation interventions in Yunnan Province China found that going from open defecation to a basic pit latrine reduced the incidence of diarrheal disease by 36% and going from open defecation to a sanitation option with full isolation or treatment reduced diarrheal incidence by 56%. This is before including the benefits from any other hygiene intervention. Source: WSP. (2012). Economic Assessment of Sanitation Interventions in Yunnan Province, People’s Republic of China. The World Bank Group, Washington, D.C. Retrieved from [http://www.wsp.org/wsp/sites/wsp.org/files/publications/WSP-EAP-ESI2-Yunnan-Province-China-Technical-Paper_0.pdf](http://www.wsp.org/wsp/sites/wsp.org/files/publications/WSP-EAP-ESI2-Yunnan-Province-China-Technical-Paper_0.pdf)


Twenty-five studies investigated the association between sewerage and diarrheal or related outcomes, including presence of intestinal nematodes. Pooled estimates show that sewerage systems typically reduce diarrhea incidence by about 30%, and up to 60% when starting sanitation conditions are very poor. Source: Norman, G., Pedley, S., & Takkouche, B. (2010). Effects of sewerage on diarrhoea and enteric infections: a systematic review and meta-analysis. The Lancet Infectious Diseases 10(8): 536-544. Retrieved from [http://www.thelancet.com/journals/laninf/article/PIIS1473-3099(10)70123-7/fulltext](http://www.thelancet.com/journals/laninf/article/PIIS1473-3099(10)70123-7/fulltext)

IV. Nutrition/Food Security and WASH

Summary: A lack of safe drinking water, sanitation, and hygiene (WASH) can have far-reaching effects on child health. Inadequate WASH inhibits nutrient absorption, leading to under-nutrition, underweight and stunting. Safe WASH plays a critical role in achieving adequate nutritional levels and averting child mortality and morbidity – saving an estimated 860,000 child deaths a year caused by malnutrition.

An estimated 50% of undernutrition is due to inadequate water and sanitation. 

Childhood underweight causes about 35% of all deaths of children under the age of five years worldwide. An estimated 50% of this underweight or malnutrition is associated with repeated diarrhea or intestinal nematode infections as a result of unsafe water, inadequate sanitation or insufficient hygiene. 

Reductions in diarrheal disease, which could be achieved by providing improved sanitation and water supply, can prevent long term morbidity and at least 860,000 child deaths a year caused by malnutrition. 

An Ethiopian study found that a WASH intervention showed a significant increase in mean height-for-age, with a 12.1% decrease in the prevalence of stunting, compared with the baseline group. This group also showed significant improvements in mothers' knowledge of causes of diarrhea and hygiene practices. 

The World Health Organization states that one of the three pillars of food security is the “appropriate use [of food] based on knowledge of basic nutrition and care, as well as adequate water and sanitation”.
A recent article in the Lancet suggests that the value of WASH interventions in preventing childhood malnutrition resulting in stunting is significantly undervalued. Safe sanitation and hygiene are needed to prevent tropical enteropathy, a condition where children experience a hyperactive immune response as a result of a large pathogens load at a young age. This condition is suspected to chronically shift much-needed nutrients from growth to instead focus on synthesis of antibodies. Children might also experience reduced nutrient absorption due to decreased surface area of the small intestine. The chronic nature of enteropathy might well mean that its sum impact on nutrition dwarfs that of diarrheal disease, which occurs in short, acute spells.


In an analysis of demographic and health survey data from eight countries in Sub-Sahara Africa, Asia, North Africa, and the Americas, improvements in sanitation were associated with increases in height ranging from 0.8cm to 1.9cm. These height increases are similar to those gained from dietary interventions such as nutrient-dense feeding or infant feeding behavior-change strategies.


As diarrhoea causes undernutrition, it creates a vicious circle by also reducing a child’s resistance to subsequent infections.


V. Neglected Tropical Diseases and WASH

Summary: Millions of people are infected with neglected tropical diseases (NTDs), many of which result from exposure to unsafe water and sanitation or poor hygiene. Research shows that WASH is essential to eliminate the prevalence of NTDs such as schistosomiasis and trachoma within a population. The following resources review research findings related to NTDs and WASH.

A recent comprehensive systematic review and meta-analysis using data from over 36 publications found that sanitation availability and use combined resulted in a 49% reduction for T. trichiura, 46% reduction of hookworm, and a 40% reduction of A. lumbricoides.


Trachoma is the world’s leading cause of preventable blindness and results from poor hygiene and sanitation. Approximately 41 million people suffer from active trachoma and nearly 10 million people are visually impaired or irreversibly blind as a result of trachoma. Trachoma infection can be prevented through increased facial cleanliness with soap and clean water, and improved sanitation.

After confirming that vaccinations alone would not break the cycle of schistosomiasis transmission in high-risk communities in Egypt, researchers explored the use of an integrated approach via primary health care to increase sanitation use. Although large-scale vaccination campaigns are an affordable and feasible strategy, integrated control strategies provide permanent improvement to address NTDs such as schistosomiasis in endemic locales.


In a case-control study to evaluate schistosomiasis mitigation in China, routine vaccinations were supplemented by new interventions including sanitation. Infection rates decreased from 11.3% to 0.7% in one village and from 4.0% to 0.9% in the other.


A Bangladeshi study showed that risky behaviors such as disposal of child feces, defecation by adult family members in open spaces, and use of common source surface water for washing clothes and utensils were practiced by up to 83% of the cohort families studied. Bivariate analysis shows that disposal of child feces in a closed space resulted in a 35% reduction in helminth infestation, and use of tube well water in a 48% reduction.


A study found that the impact of a citywide sanitation program in Northeast Brazil on intestinal parasites infection in young children reduced the prevalence of A. lumbricoides from 24.4% to 12.0%, T.trichuria from 18.0% to 5.0%, and G. duodenalis from 14.1% to 5.3%. Most of this reduction appeared to be explained by the increased coverage of each neighborhood by the sewerage system constructed during the intervention.


More than 1 billion people are infected with soil-transmitted helminths (STH), some of whom suffer severe consequences, such as cognitive impairment, massive dysentery, or anemia. STH are associated with at least 12,000 deaths each year. Improved WASH has been shown to reduce illness from Ascaris (one of the STH worms) by a median of 28%.

Guinea worm disease (GWD) is one of the few infectious diseases spread only by contaminated water. Before recent improvements made by the Guinea Worm Eradication Program, GWD caused millions of dollars in economic losses per year and decreased school attendance by 60% in some villages with widespread infection. 

Worldwide, millions of people are infected with neglected tropical diseases (NTDs), many of which are water and/or hygiene-related, such as Guinea Worm Disease, Buruli Ulcer, Trachoma, and Schistosomiasis. These diseases are most often found in places with unsafe drinking water, poor sanitation, and insufficient hygiene practices. 

An increasing body of evidence indicates that NTDs may threaten the health of the poor as much as HIV/AIDS, tuberculosis, or malaria. Furthermore, new evidence points to substantial geographic overlap between the neglected tropical diseases and the big three, with emerging data suggesting that control of the neglected tropical diseases could actually become a powerful tool for combating HIV/AIDS, tuberculosis, and malaria. Safe WASH provides a powerful opportunity to mitigate the impacts of all of these diseases. 

VI. HIV/AIDS and WASH

**Summary:** Ninety percent of people living with HIV/AIDS (PLHIV) suffer from WASH-related diseases such as diarrhea. Access to safe WASH is crucial for maintaining the quality of life of people living with HIV and for successful home-based care. PLHIV that use unsafe water to take antiretroviral drugs can subsequently suffer from diarrhea. Safe WASH decreases diarrheal and other opportunistic infections in PLHIV and associated morbidity and mortality. The following resources review research findings in the WASH and HIV/AIDS nexus.

A Ugandan randomized controlled trial of persons living with HIV using safe water system (SWS) found that they had 25% fewer diarrhea episodes, 33% fewer days with diarrhea, and less visible blood or musus in stools. The same study found that among persons with HIV, the presence of a latrine in a compound - compared with those without a latrine - was associated with 31% fewer episodes of diarrhea, 37% fewer days with diarrhea, and 37% fewer days of work or school lost due to diarrhea. 

A new field study in Zambia assessed the impact of water filtration and safe storage in households with HIV positive mothers. Households were randomly assigned to intervention and control groups and followed for one year to assess filter use, drinking water quality and diarrheal disease. Results found that water filtration
and safe storage resulted in a 53% reduction of diarrhea among children under two years and a 54% reduction among all household members.


In the Democratic Republic of Congo, HIV positive infants are 11 times more likely to die of diarrheal disease than uninfected infants.


Ninety percent of people living with HIV/AIDS (PLHIV) are affected by diarrheal disease.


Evidence suggests that diarrheal disease reduces the absorption of antiretroviral medicines and essential nutrients, further exacerbating the consequences of HIV/AIDS.

Source: Bushen, O. et al. (2004). Diarrhea and Reduced Levels of Antiretroviral Drugs: Improvement with Glutamine or Alanyl-Glutamine in a Randomized Controlled Trial in Northeast Brazil. *Clinical Infectious Diseases*. 38(12): 1764-70. Retrieved from [http://cid.oxfordjournals.org/content/38/12/1764.full.pdf](http://cid.oxfordjournals.org/content/38/12/1764.full.pdf)

Infectious diseases associated with exposure to human excreta are very common among PLHIV, affecting an estimated 90%, resulting in significant morbidity and mortality.


Opportunistic infections, resulting from water and sanitation related diseases in people living with HIV, can accelerate the progression of HIV to AIDS. The frequency of those infections is closely tied to the level of water and sanitation services available to households affected by HIV/AIDS as well as the hygiene practices of household members.

A study in Ngamiland, Botswana found that caregivers with HIV patients suffering from diarrheal disease needed an average of 20 liters more water per day to wash soiled clothes and sheets as well as sterilize contaminated areas.


VII. Education/Schools and WASH

Summary: A lack of safe water, sanitation, and hygiene (WASH) facilities turns schools into unsafe places where diseases are transmitted with recurring negative impacts on children, their families, and communities. WASH in schools advances the health of students, families, and communities; improves the quality of learning; enhances opportunities for girl children; and provides a safe environment to ensure all children receive a quality education. The benefits of WASH in schools are illustrated in the following articles.

Recent UNICEF surveys found that 51% of all schools do not have access to adequate water sources and 45% lack adequate sanitation facilities. These are data averages from 50 least developed countries and other low-income countries.


Episodes of diarrhea due to inadequate WASH had significant negative impacts on children’s cognitive development and their ability to function in school. A study in northeastern Brazil showed that impacts of early childhood diarrhea (ECD) extend beyond the acute phase of diarrheal illness to at least 5 to 7 years later. Occurrence of ECD may hinder both school readiness and school performance by impairing cognitive function.


According to the United Nations and UNICEF, one in five girls of primary-school age are not in school, compared to one in six boys. One factor accounting for this difference is the lack of sanitation facilities for girls reaching puberty. Girls are also more likely to be responsible for collecting water for their family, making it difficult for them to attend school during school hours. The installation of toilets and latrines may enable school children, especially menstruating girls, to further their education by remaining in the school system.


In Egypt, an intensive campaign to promote hand hygiene in 30 primary schools reduced school absenteeism caused by laboratory confirmed influenza by 50%, influenza-like illness by 40%, diarrhea by 30% and conjunctivitis by 67%.

In Ghana, a study of Demographic and Health Surveys from 1993-2008 shows that a 15-minute reduction in collection time increases the proportion of girls attending school by 8-12%.

A detailed analysis of studies conducted in educational facilities in developed countries indicates that good hand-washing practices can reduce the frequency of respiratory infections among school populations by 16%.

The “Fit for School” is a program that introduces simple hygiene measures into everyday school life, such as washing hands with soap and brushing teeth with toothpastes containing fluoride. Today the program has reached about a million children in the Philippines in more than 3,850 schools. In addition to a 20-25% increase in school attendance, early program results suggest that the rate of diarrheal and respiratory diseases among schoolchildren could be reduced by some 30-50%, caries prevalence decreased by 40-50%, and the rate of infection from worms lowered by 80%.

In a randomized controlled trial in China, an expanded hand-washing program in primary schools provided continuous free soap, resulting in a 42% reduction in absenteeism.

Episodes of diarrhea due to inadequate WASH had significant negative impacts on children’s cognitive development and their ability to function in school. A study in northeastern Brazil showed that impacts of early childhood diarrhea (ECD) extend beyond the acute phase of diarrheal illness to at least 5 to 7 years later. Occurrence of ECD may hinder both school readiness and school performance by impairing cognitive function.

VIII. Environmental Conservation and WASH

Summary: Untreated wastewater is a major contributor to environmental degradation, causing significant harm to aquatic life. Destruction of natural ecosystems such as forested wetlands eliminates some of the best water treatment systems available to local populations. Both droughts and floods will result from rising global temperatures, both of which will make access to clean water harder for the poor. The world’s poor,
because they already have the least access to WASH and have the fewest resources to adapt, will be the most affected by the changing rainfall patterns caused by global warming.


Drought and flood in water poor contexts leads directly to increased incidence of diarrheal disease. Two studies in islands of the Pacific found that average temperatures had a positive correlation with diarrheal disease and rainfall at either extreme was correlated with more diarrheal disease. Source: Singh, RB et al. (2001). The influence of climate variation and change on diarrheal disease in the Pacific Islands. Environmental Health Perspectives. 2001 February; 109(2): 155–159. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1240636/

The Global Burden of Human Disease, caused by sewage pollution of coastal waters is estimated at 4 million lost ‘man-years’ every year, which equals an economic loss of approximately 16 billion US$ a year. Source: UNEP, “Sanitation and Wastewater.” Retrieved from http://gpa.unep.org/content.html?id=246


At least one-third of the world’s largest cities obtain a significant portion of their drinking water directly from forested protected areas. Source: Secretariat of the Convention on Biological Diversity. 2010. Drinking Water, Biodiversity and Development: A Good Practice Guide. Montreal, 41 + iii pages.

IX. Economic Growth/Aid Independence/Return on Investment and WASH

Summary: Safe drinking water, sanitation, and hygiene (WASH) is a good investment with significant economic and social returns measured in decreased healthcare costs and increased economic productivity. The following citations review several of the economic benefits gained through safe WASH.


A randomized controlled trial of intensive handwashing promotion in Karachi, Pakistan found that children randomized to the handwashing promotion during their first 30 months of age attained global developmental quotients 0.4 standard deviations greater than those of control children at 5 to 7 years of age. These gains are comparable to those of at-risk children enrolled in publicly funded preschools in the United States and suggest that handwashing promotion could improve child well-being and societal productivity. Source: Bowen, A. et al. (2012) Association Between Intensive Handwashing Promotion and Child Development in Karachi, Pakistan. Arch Pediatr Adolesc Med. 2012;166(11):1-8.. Retrieved from http://archpedi.jamanetwork.com/article.aspx?articleid=1360890#tab1

A study done by the World Bank’s Water and Sanitation Program in Vietnam found that improved sanitation is a highly profitable investment. Pit latrines in rural areas have an economic return of at least 6 times the cost, and off-site treatment options in urban areas have an economic return of at least 3 times the cost. Net benefits from low-cost sanitation options are especially high, offering an affordable option to poor households. The annual economic rate of return was more than 100 percent, requiring less than one year to recover the economic value of the initial investment costs.
A study done by the World Bank’s Water and Sanitation Program on sanitation interventions in the Philippines found that improved sanitation is a socially profitable investment. Pit latrines in rural areas have an economic return of at least 5 times the cost, and off-site treatment options in urban areas have an economic return of at least 4 times the cost.


Using household survey data, this paper estimates that full household coverage with water and sanitation infrastructure could reduce child deaths in developing countries by 2.2 million per year. Combining this analysis with cost data for water and sanitation infrastructure, the authors estimate that the average cost per life-year saved ranges between 65 and 80% of developing countries' annual gross domestic product per capita.


A study conducted by the World Bank’s Water and Sanitation Program in Cambodia found that the economic returns of sanitation interventions have very favorable socio-economic returns to households and society, contributing improved health, clean environment, dignity and quality of life, among many other benefits. Economic returns are potentially high—in excess of US$2 return per dollar invested—especially in rural areas where low cost on-site solutions are feasible.


The impact of clean water technologies on public health in the U.S. is estimated to have had a rate of return of 23 to 1 for investments in water filtration and chlorination during the first half of the 20th century.