How do water, sanitation and hygiene affect health?

Water, sanitation and health are closely related. Poor hygiene, inadequate quantities and quality of drinking water, and lack of sanitation facilities cause millions of the world’s poorest people to die from preventable diseases each year. Women and children are the main victims.

Water, sanitation and health are linked in many ways:
- Contaminated water that is consumed may result in water-borne diseases including viral hepatitis, typhoid, cholera, dysentery and other diseases that cause diarrhea.
- Without adequate quantities of water for personal hygiene, skin and eye infections (trachoma) spread easily.
- Water-based diseases and water-related vector-borne diseases can result from water supply projects (including dams and irrigation structures) that inadvertently provide habitats for mosquitoes and snails that are intermediate hosts of parasites that cause malaria, schistosomiasis, lymphatic filariasis, onchocerciasis and Japanese encephalitis.
- Drinking water supplies that contain high amounts of certain chemicals (like arsenic and nitrates) can cause serious disease.

Inadequate water, sanitation and hygiene account for a large part of the burden of illness and death in developing countries:
- Lack of clean water and sanitation is the second most important risk factor in terms of the global burden of disease, after malnutrition.
- Approximately 4 billion cases of diarrhea per year cause 1.5 million deaths, mostly among children under five.
- Intestinal worms infect about 10% of the population of the developing world, and can lead to malnutrition, anemia and retarded growth.

6 million people are blind from trachoma and the population at risk is about 500 million.
300 million people suffer from malaria.
200 million people are infected with schistosomiasis, 20 million of whom suffer severe consequences.

Access to Water and Sanitation

Approximately one sixth of the world’s population is without water and two fifths have no access to sanitation. Most of the unserved population lives in Asia and Africa, although even in Eastern Europe and Central Asia, poor water, sanitation and hygiene are among the ten most important risk factors for disease (Murray and Lopez, 1997).

| Water Supply Distribution of Unserved Population |
| Sanitation Distribution of Unserved Population |

- Total unserved: 1.1 billion
- Total unserved: 2.4 billion

Source: WHO / UNICEF 2000

Halving the proportions of people without water and sanitation by 2015 is one of the Millennium Development Goals. Taking population growth into account, this will require access to safe sanitation for 2.2 billion additional people (397 000 per day) and improved water services for 1.5 billion more people (292 000 people per day). The implied infrastructure costs are staggering — about US$23 billion per year.

Effectiveness of water supply, sanitation and hygiene interventions

Research findings on the relative public health importance of providing safe drinking water supplies, sanitation and hygiene education may seem counterintuitive. Improved hygiene (hand washing) and sanitation (latrines) have more impact than drinking water quality.
on health outcomes, specifically reductions in diarrhea, parasitic infections, morbidity and mortality, and increases in child growth (Esrey et al 1991; Hutley et al 1997). Furthermore, an increase in the quantity of water has a greater health impact than improved water quality, because an adequate water supply makes it possible (or at least more feasible) for people to adopt safe hygiene behaviors. Since a primary cause of contamination of water is inadequate or improper disposal of human and animal excreta, better water quality only improves health when sanitation is improved as well and when the quantity of water is sufficient (Esrey 1996). Experience shows that constructing water supply and sanitation facilities is not enough to improve health; key human behaviors must accompany the infrastructure investments.

The behaviors with the greatest potential health impact have been identified by WHO and UNICEF as hand washing with soap (or ash or other aid) after stool disposal and before preparing food; safe disposal of feces and use of latrines; and safe weaning food preparation, water handling and storage. A recent review of the evidence found that 12 hand washing interventions in 9 countries achieved a median reduction in diarrhea incidence of 35% (Hill, Kirkwood and Edmond, 2001). Many of the most successful interventions provided soap to mothers, explained the oral-fecal route for disease transmission, and asked mothers to wash their hands before preparing food, and after defecation. There are fewer studies of interventions to improve feces disposal that report results, but 9 studies reviewed by Hill et al all found a median reduction of diarrhea disease of 26% (range 0–68%), a median reduction of all-cause child mortality of 55% (6 studies, range 20–80%) and a median reduction in mortality from diarrhea of 65% (3 studies, range 43–70%).

What can the public health sector do?

The public health sector can do several things, in collaboration with other sectors, to help ensure that investments in water supply and sanitation result in greater health impact. Public health promotion and education strategies are needed to change behaviors so as to realize the health benefits of improved water supplies. Programs to improve hand washing behavior appear to be feasible and sustainable especially when they incorporate traditional hygiene practices and beliefs. There is less experience with interventions that focus on changing feces disposal behavior and the results are mixed (Hill et al 2001). New, better approaches to behavior change are being developed, including a recent project that has shown excellent results through persuading the private sector (soap manufacturers and the media) to transmit health information by advertising soap and its appropriate use to prevent diarrhea (see The Story of a Successful Public-Private Partnership in Central America: Handwashing for Diarrheal Disease Prevention, 2001).

Handwashing is one of the most effective interventions for reducing diarrhea

Ten studies of hand washing were included in a review of interventions to prevent diarrhea (Hutley et al. 1997). All reported a positive relation between improved hand washing and diarrhea prevention, with a median reduction of 33% (range 11–89%). This finding was remarkably consistent in a variety of settings. For example, Black et al. (1981) cited reductions of 43% in diarrhea among day-care center children in the United States resulting from a simple hand washing intervention. In Indonesia, improved hand washing behavior by 65 mothers (who received soap and explanations of the fecal-oral route of diarrhea transmission) reduced diarrhea incidence in their children by 89% (Wilson et al. 1991). Hand washing and hygiene behavior interventions reduced diarrheal disease by up to 39% in rural Thai villages (Pinfold and Horan 1996). Hand washing interventions in urban Bangladesh reduced dysentery (shigella) by 35% and non-dysenteric diarrhea by 37% among all age groups (Khan 1982). In Myanmar, childhood diarrhea was reduced by 30% in urban households where the mother was given soap and hand washing education (Han and Hlaing 1989). A more recent review by Hill et al (2001) found that soap distribution with hand washing education was associated with a 33% decrease in childhood diarrhea in urban Bangladesh (Shahid et al 1996), with an earlier similar study reporting a 26% reduction (Stanton and Clements 1987). Soap distribution alone was associated with a 27% reduction in diarrhea in a refugee camp in Malawi (Peterson et al 1998). In the Gambia, education of rural mothers on hand washing, sanitation and skin hygiene achieved a 33% fall in diarrhea (Hoare et al 1999).
Additional roles for the public health sector include:
- work with other agencies that plan, develop and manage water resources and basic water and sanitation services to advocate and promote these investments, and to ensure that activities to promote hand washing, safe disposal of feces and continuous use and cleanliness of sanitation facilities are included
- work with the agency responsible for monitoring water quality and sanitation to help ensure that this monitoring is carried out
- provide other sectors with reliable data on water-associated diseases and effectiveness of interventions to facilitate better decisions with respect to water and sanitation projects
- provide leadership for action in hygiene education, including building coalitions with private sector agencies to achieve better results
- design, implement, and monitor hygiene education and promotion components of water supply and sanitation projects
- advocate for including water, sanitation and hygiene interventions in poverty reduction strategies and plans.

Do’s and Don’ts in promoting hand washing and hygienic behaviors

**DO** assess sanitation and hygiene beliefs and practices as the basis for planning, and involve community members/beneficiaries in planning and implementing interventions. Maximize the impact of hygiene promotion and education by using participatory techniques, targeting women and children, and using women as facilitators.

**DO** identify practices to be changed, targeting the four most critical: hand washing with soap (or ash or other aid) before food preparation and after dealing with feces; latrine use and safe disposal of children’s feces; safe weaning food preparation; and safe water handling and storage.

**DO** offer a range of technology options (e.g., different kinds of latrines) and explain associated costs, maintenance requirements, advantages and disadvantages. Public funds are better spent on promotional campaigns and training/establishing latrine artisan businesses than on subsidies for constructing latrines.

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### Millennium Development Goal

<table>
<thead>
<tr>
<th>Millennium Development Goal</th>
<th>Intermediate mechanism</th>
<th>Target group</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce infant and child mortality by 2/3 by the year 2015</td>
<td>Reduce diarrhea morbidity and mortality</td>
<td>Children under 5</td>
<td>% children under 5 with diarrhea in the past 2 weeks (diarrhea is defined as more than 3 loose stools in 24 hours)</td>
</tr>
</tbody>
</table>

### Key behaviors

<table>
<thead>
<tr>
<th>Hand washing with soap</th>
<th>Interventions</th>
<th>Target group</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Demonstrate good hand washing</td>
<td>People caring for children and preparing food</td>
<td>% child caregivers and food preparers with appropriate hand washing behavior*</td>
</tr>
<tr>
<td></td>
<td>Educate on when to wash</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hygiene education</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Provide soap</td>
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</table>

<table>
<thead>
<tr>
<th>Sanitation</th>
<th>Interventions</th>
<th>Target group</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Build toilets and pit latrines</td>
<td>Population</td>
<td>% population who use toilet or pit latrine**</td>
</tr>
<tr>
<td></td>
<td>Promote use of toilets and latrines</td>
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<td>Promote defecation in designated areas</td>
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<td>Promote burial of feces</td>
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<tr>
<td></td>
<td>Clear feces from homes and yards</td>
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</table>

* “appropriate” hand washing behavior includes time of washing — after handling feces and before food preparation; and the technique used — using soap, ash or other aid, for long enough, using clean water

**Toilets or pit latrines must be hygienic; that is, no feces on the floor or seat

Data for these indicators are collected in the standardized Demographic and Health Surveys (DHS) conducted in over 100 countries around the world. (DHS website url: [http://www.measuredhs.com/](http://www.measuredhs.com/) ) A second source of these data are the Multiple Indicator Cluster Surveys (MICS) and modules supported by UNICEF, and used in 100 countries since 1998 (full information and MICS data available at [www.unicef.org](http://www.unicef.org), search for MICS). Indicators for other water and sanitation interventions are described in “Water and Sanitation Indicators Measurement Guide”, Billig et al 1999.
DO incorporate programs to change hygiene practices in water supply, sanitation and health projects. In order for water supply projects to achieve positive health benefits, they need to include sanitation and hygiene components. Health sector involvement can contribute to the success of water and sanitation projects. Don't provide hardware (water pipes and latrines) without the software (hygiene promotion) and community training and organization to sustain/maintain services.

DO include education and information to increase community demand for improved sanitation facilities.

DO establish partnerships to stretch resources, e.g. public/private partnerships with private soap manufacturers to achieve complementary goals.

DO monitor and evaluate interventions, and collect baseline data. Don't claim health benefits without measuring and documenting the impact of water and sanitation activities.

DO carry out pilot projects to test new technologies or mechanisms such as costrecovery.

DO ensure that adequate water and sanitation are provided in schools and health facilities.

For more information

People (World Bank contacts)

Jennifer Sara and Rita Klees (Water and Sanitation), Joana Godinho (Public Health)

Key Documents and References


Klees R, J Godinho, M Dawson-Loe 2000, Sanitation, Health and Hygiene in World Bank Rural Water Supply and Sanitation Projects, Washington DC, World Bank (includes key design principles for community water supply and sanitation projects)


Web sites


IRC International Water and Sanitation Center: http://www.irc.nl

IRC Community Water Supply Management: http://www.irc.nl/ manage/ index.html


UNICEF water, environment and sanitation (W ES): http://www.unicef.org/ programme/ wes

World Bank Water and Sanitation Program: http://www.wsp.org


W EL Project, Water and Environmental Health at London and Loughborough: http://www.lboro.ac.uk/ well

W HO Water, Sanitation and Health: http://www.who.int/ water_sanitation_health/ index.htm

Expanded versions of the “at a glance” series, with e-linkages to resources and more information, are available on the World Bank Health-Nutrition-Population web site: www.worldbank.org/hnp