

# CHAPTER 3 Water and Health

Over the past decade, the definition of health has taken on broader dimensions. Health is not as limited as the health systems themselves, nor is it synonymous with the wide range of caregivers nor the tactics they utilize to detect and fight disease. Rather, today, health for the individual is a state of well-being that would allow each man or woman, each girl or boy, to reach her or his full potential as a human being. In its 1948 Constitution, the World Health Organization (WHO) defined health as “a complete state of physical, mental and social well-being, and not merely the absence of disease or infirmity” (WHO, 2002). Health on the larger national scale has become the leading edge of development, and as such eventually touches all other sectors, including food, energy, industry, ecosystems, cities and —of course— water.

As we have broadened our vision of health, the full meaning of water to the human race has begun to reveal itself. In the most concrete terms, our dependency on water is indisputable. We are literally 65% water. The average human consumes 2.3 liters of water a day — a half a liter goes to sweat, .3 liters is released through breathing, and 1.5 liters are eliminated as waste. If we lose 1% of our water, we become thirsty. If we lose 5%, a mild fever develops. Lose 10%, and we are immobilized. And if we lose 12%, we die (Figure 3.1) (Swanson, 2001). Our cells are able to communicate with each other through a network of nerve signals and hormone packages that travel on our bodies’ complex internal rivers and streams. Our various organs fulfill their responsibilities with the help of nutrients arriving within blood, lymph and other liquid

FIGURE 3.1

## Humans Need Water

## We are composed of 65% water.

- The average individual consumes 2.3 liters of water a day.
- This water is released as:
  - .5 liters of sweat,
  - .3 liters of respiration and
  - 1.5 liters of urine/feces.

## The effects of dehydration vary according to how much water is lost:

- 1% dehydration causes thirst.
- 5% dehydration causes fever.
- 10% dehydration causes loss of mobility.
- 12% dehydration causes death.

Source: Swanson, 2001.

secretions. Our bodies release toxins and poisons by transporting them through liver, kidneys and colon. Our fluids are in constant motion, elements added and removed, to energize functions, maintain order, support conscious and unconscious actions and sustain life.

Beyond staying alive, individuals and families require water to maintain a stable healthy household. With 5 liters a day, an individual can barely survive. With 20 liters a day, a family can marginally complete tasks that ensure health and sanitation. With 50 liters a day, one can lower the public health risks associated with poor hygiene; can clean clothes on-site near home; and can have fresh water available in proximity to living quarters. With 100 to 200 liters per day, you are most likely living in a developed economy, with multiple taps inside the home, shielded largely from hygiene-related illness (Figure 3.2) (UN, 2003).

The World Health Organization says that 75 liters of water a day is necessary to protect against household disease, and 50 liters a day necessary for basic family sanitation. But individual consumption varies widely around the globe. A member of the Masai Tribe in Africa survives on approximately 4 liters per day, while a typical resident of Los Angeles, California uses 500 liters per day (Swanson, 2001).

FIGURE 3.2

WHO Standards:  
Access to Water

	DISTANCE	VOLUME/ CAPITA/ DAY	HEALTH RISK
Optimal	in-house, multiple taps	100–200 liters	very low
Good	on property, 1 tap	50 liters	low
Basic	less than 1 km away	20 liters	high
Poor	more than 1 km away	5 liters	very high

Source:  
UN, 2003.

For many years, the clearest connection between water failure and poor health has been water-borne diseases (WHO, 2002). In 2005, 6,000 people, mostly young children, will die each day from diarrheal and infectious diseases. Adequate amounts of clean drinking water and basic sanitation services would dramatically impact these numbers. Improved systems would reduce disease burden by 17%. Perfect piped water and sanitation systems would decrease it by 70%. But the reality is that 1.1 billion people lack access to improved water and 2.4 billion — 42% of the world's population — lack access to improved sanitation (UN, 2005a).

One half of all hospital beds in the developing world are occupied by individuals suffering from water-borne diseases. If you are part of a village of 1,000 in Africa, here's what you'll see. Over 600 will have no access to a latrine; 20 on any given day will suffer from diarrhea, with 15 under the age of 5. For a family of six, hauling water from a distant location will eat up 3 hours a day. Most children will not have time between water hauling and chores to attend school. Conditions will be filthy and disease will spread rapidly. As desperate as a situation like this can be, it is by no means hopeless. A 2005 study demonstrated that improved water supply reduced death from diarrheal illness up to 25%. Better hygiene, including education and promotion of disposal of infant feces, hand washing and safe storage and protection of

domestic water supply, reduced diarrheal cases 45%. And household water treatment, for example chlorination and proper home water storage, decreased cases by up to 39% (UN, 2003).

That said, the real difference in the past five years is the context within which we consider the water challenge. It is not generally accepted, nor properly understood, that success with water will speed achievement of seven additional United Nations Millennium Development Goals. These include helping to “eradicate extreme poverty and hunger; achieving universal primary education; promoting gender equality and empowering women; reducing child mortality and improving maternal health; combating HIV/AIDS, tuberculosis, malaria and other diseases; ensuring environmental sustainability and developing a global partnership for development.”

“Squalor, poverty, and disease”: These are the enemies and the reflections of poor water policy. And the targets above appear financially feasible with an excellent return on investment. A well-documented WHO study says it would cost an additional \$11.3 billion a year. In return there are \$7 billion in direct health care savings, \$3.5 billion in productivity increases, \$3.5 billion in family earnings preserved by averting untimely death and \$63 billion in time savings attributable to immediately accessible water and sanitation. In sum, the \$11.3 billion investment delivers a \$77 billion payback (Figure 3.3) (UN, 2003).

FIGURE 3.3

#### Water Development: A Sound Investment

Meeting the UN Millennium Goals for improved water and sanitation would result in:

- An annual investment of \$11.3 billion.
- An annual savings of \$77 billion, including:
  - An additional 272 million school attendance days
  - An additional 320 million productive work days
  - An additional 1.5 billion healthy days for children under age 5.

Source: UN, 2003.

Definitions of what is “safe water” and “basic sanitation” have been all over the map. The WHO and UNICEF clearly have defined what is and is not acceptable (WHO/UNICEF, 2005). For water, unprotected wells and springs and uncertified vendor water, tanker truck water and surface water are unimproved approaches. In contrast, piped water, public taps, boreholes (synonym for drilled wells, especially outside North America), protected wells and springs, rainwater collection and certified bottled water are improved techniques. For sanitation, public or shared latrines, hanging latrines, bucket latrines and absent facilities are unacceptable. Flush systems to sewers, septic tank or latrine, ventilated improved pit latrines, and pit latrines with slabs and composting toilets all represent advances.

Beyond these standards, it’s critical to understand that creating infrastructure for water and sanitation implies continued investment to maintain these systems. Otherwise, the gains are short-lived. For example, estimates in Africa are that 30% of the water and sanitation systems do not function properly. In Asia, the estimate is 20%. Within individual countries, extreme outliers have more than 50% of facilities requiring repair or replacement. One additional point: one can no longer presume that surface and ground water are safe. This requires that sufficient investment and systems be in place to regularly sample, analyze and monitor water quality (WHO/UNICEF, 2000).

Water management or mismanagement impacts multiple generations. For the very young, the burden of disease is extraordinarily high, with 90% of water-related deaths occurring in children age 5 and under. For those age 5 to 14 years, disease, domestic responsibility for hauling water or working the fields or lack of private latrines, especially for schoolgirls, translates into poor school attendance and a limited future (WHO, 2002).

In 2002, 500 million of these school-aged children lacked proper sanitation and 230 million had compromised water. Worldwide, 28% of boys and 28% of girls did not attend primary school in

2002. Regional numbers were worse. 39% of boys and 44% of girls in the least-developed countries did not attend primary school (WHO/UNICEF, 2005). This then is a double hit. Lacking education, lifespan options contract. But in addition, one valuable source of health education, including basic hygiene — the school — is no longer a community platform for programs. In some locations, the strategic connection between health and school is being fully leveraged. The School Sanitation and Hygiene Education Program ([http://www.unicef.org/wes/index\\_schools.html](http://www.unicef.org/wes/index_schools.html)) is a good example. In Nigeria, teachers are prepared in life skills education, parent involvement, village participation in hygiene and sanitation projects and formation of children hygiene clubs. The result: a 20% increase in school enrollment and 77% decrease in water-borne worms (UN, 2003).

For adults, women continue to literally “carry the load” for inaccessible water, and both men and women are made more susceptible to diseases like HIV/AIDS, malaria and tuberculosis by lack of water and under-nourishment. And as they pass age 60, this susceptibility grows with each year. The clear reality and immediate impact of poor water and sanitation is lost productivity and work. Life comes to a halt as families drudge buckets of water for miles to support planting, cleaning and preparing food. If they are fortunate enough to survive beyond the age of 60, they will join the ranks of 1 billion global citizens by 2025. By then, water-borne infection death rates in those over age 60 in the developing world will exceed water-borne infection death rates of the age 0 to 5 population in their countries. This reflects elder susceptibility to water-borne pathogens arising from declining hygiene, poorly maintained services, absent vigilance, more underlying chronic disease, reduced immune function, under-nutrition and increased poverty with increasing age (WHO/UNICEF, 2005).

For women around the world, water is a lifelong health headache. To begin with, they and their daughters are the source and

utilizers of most water. It has fallen on women to provide most water and food, to support bathing, cooking, household hygiene and cleansing of infants, children, the sick and the elderly. In India, the national cost to women of fetching water is estimated at 150 million women workdays per year. On average they walk 6 kilometers a day carrying 20 liters of water. Sick children consume an enormous portion of maternal productivity. Pregnancy presents special demands, and poor water and sanitation places mother and fetus at risk before, during and after birth. As a target for HIV/AIDS, women are often innocent victims. Demands never stop for women. Household gardens must be seeded, watered and tended; livestock fed, milked and harvested. Even care and repair of dwellings with homemade bricks and mud are water-dependent. While women are charged with gathering and wisely managing water in most of the world, their voices and opinions, until recently, have been excluded from overall water and sanitation management policy making. As a result, in many communities the best knowledge source has been sequestered, and the knowledge itself lost to the community (UN, 2003).

If we were to fully access women and ask what would be of greatest help, what would they say? First, meet basic requirements for sanitation. Second, significantly increase access to safe water. Third, focus on promoting basic hygiene education. Fourth, adopt simple techniques for disinfecting drinking and cooking water in the home, including chlorination, disinfection and filters. Fifth, adequately resource health care. Of course, to respond would require governments to establish the right policies, planning and follow-through, which in turn requires enlightened legislation, regulation, strong institutions, well-trained workers, right choices in technology, excellent educational and behavioral programming and continuous learning and improvement.

Integrated responses are very specific and customized from a cultural point of view. However various lessons and principles are



highly transferable. For example, Nepal has customized a UNICEF program on sanitation, incorporating it into their school health curriculum. It has five major components, including hygiene habit-formation, building sanitary facilities at schools, maintaining these facilities in working order, organizing extracurricular events around good sanitation and transferring learning from school to community. In Peru, the emphasis has been squarely focused on hand washing, with significant reductions in illness. Their approach: form a local team, enlist community leaders, pretest promotional/educational materials, develop appropriate measures and surveys to define success and develop and stick to timelines (WHO/UNICEF, 2005).

Over the past 10 years, progress has been made in both water and sanitation. Focusing on Africa, Asia, Latin America and the Caribbean, it is clear that small changes have occurred and in the right direction (Figure 3.4) (WHO/UNICEF, 2002). Yet, the

FIGURE 3.4

**Geographic Population Without Safe Water and Sanitation**

	YEAR	WATER	SANITATION
Africa	1990	41%	41%
	2000	36%	40%
Asia	1990	27%	71%
	2000	19%	53%
Latin America/Caribbean	1990	18%	28%
	2000	13%	22%

Source: WHO/UNICEF Joint Monitoring Programme, 2002.

remaining unserved populations are remarkable (Figure 3.5). Geography makes a difference as well when you compare rural and urban areas. Overall, urban populations will continue to grow through 2025, while rural populations remain relatively flat. As for the unserved portion of the population, projections suggest urban areas will outperform rural, and water provision will outperform

FIGURE 3.5

**2002 Unserved Individuals**

	WATER	SANITATION
Global Total	18% (1.1 billion)	42% (2.6 billion)
Asia	65%	80%
Africa	27%	13%
Latin America/Caribbean	6%	5%
Europe	2%	2%
Total	100%	100%

Source: UN Water for People, 2002.  
WHO/UNICEF, 2002.

the extension of sanitation facilities. In general, the pace of progress will need to quicken in these areas to keep in step with health needs and population growth. Sanitation progress will lag behind in part because it “suffers from lack of natural demand.” Compared with fresh water, the poor can more easily survive without sophisticated piped sewage systems which require high investment. Yet, as we’ve seen, absent good hygiene practices and sanitation, the water you get may not be clean.

Developed nations are not without water and sanitation health risk. All one need do is scan the local news to detect regular outbreaks of bacterial or parasitic infections, high mercury or lead levels in fish or drinking water or outbreaks of red tide affecting shellfish. Some crises are related to system contamination of piped water or non-point-of-source urban or agricultural runoff (EPA, 2005). Others are caused by careless food preparation. Others are the result of contaminated food imports and manufacturing practices. Hurricane Katrina in 2005 dramatically demonstrated that citizens of the developed world are just as vulnerable as those in developing nations in the face of poor water disaster preparedness. Even for our human populations who are adequately resourced, water consumption and contamination both from the standpoint of quantity and quality and careful disaster preparedness and

management must be carefully monitored literally on a day to day basis.

Today our human population finds itself in a different place than in 1970. At that time, the focus was on affirming our human population's basic needs, and of course water was at the top of the list. By the 1990s the notion of sustainable development took hold and wise management of water was clearly viewed as essential for the attainment of a wide range of social goals, from eliminating poverty to maintaining peace and security. Now Integrated Water Resource Management (IWRM) is front and center — the “multiple health dimensions of water for people, for food, for the environment.” Suddenly water and sanitation are not stand-alones, but part of a broad development plan inclusive of the fight against poverty and the challenge of economic development. In philosophic terms, the WHO Committee on Economic, Social and Cultural Rights in 2000 put it this way, “Water is fundamental for a life of human dignity. It is a prerequisite to the realization of all other human rights.”

The right to water then is the right to health. How best to implement that right is now up for debate. Certainly the need for integration is broadly accepted. Decentralization of planning and efficient execution are also on the rise. The advantages: creation of programs and priorities that consider local need, community mobilization and local maintenance and quality control. The challenges: building adequate capacity, overcoming local resistance and addressing a resource decision-making process which is still highly centralized. The loss of centralization also spells the loss of reliable epidemiologic surveillance, reliable monitoring and crisis response. Knowledge of the links between water and sanitation cause and disease effect can be difficult to access locally. On the other hand, done well, knowledge can accumulate locally and solutions can be customized. In fact, we are learning that “major health gains can be achieved at the household level through personal protection.” Communities of

health workers, sanitation engineers and environmental inspectors, each with a water role, may more easily interface on a local level, with their community at stake, than on a national level.

Still, there remain two critical points of focus that require a high level of empowerment if global health objectives are to be achieved. First, “keeping pace with a net population growth” means investing more and applying it more wisely and efficiently in the next decade. Second, we must recognize that sanitation lags behind water—and without good sanitation, long term, we can not ensure that the water we do have will be reliably clean and safe.