Foundations of Global Health
Environmental Health: Part 3

Water and Sanitation is one of the primary drivers of public health. I often refer to it as “Health 101,” which means that once we can secure access to clean water and to adequate sanitation facilities for all people, irrespective of the difference in their living conditions, a huge battle against all kinds of diseases will be won.

- Dr. Lee Jong-Wook, Director-General, WHO

It is still just unbelievable to us that diarrhea is one of the leading causes of child deaths in the world.

- Melinda Gates

Learning Objectives
• Identify regions with least access to sanitation
• Define sanitation, hygiene
• Identify the 6 “Fs” of sanitation
• Describe the sanitation ladder
• Identify examples of sanitation facilities used in developing world
• Describe how behavior impacts hygiene

Sick Water

• 2 million tons of sewage, industrial and agricultural waste is discharged into waterways
• In developing countries, 90% of all wastewater is untreated & discharged directly into rivers, lakes, or oceans
  – Rapid growth of de-oxygenated dead zones occurring in seas & oceans

Discharge of untreated wastewater can lead to dead zones (bottom). A Pacific Ocean dead zone killed aquatic life, such as these crabs that washed up along the Oregon coast (top).

• 2.6 billion people do not have access to adequate sanitation
  – Majority live in Asia
• Each year, 1.8 million children <5 die from water related diseases
  – 1 child every 20 seconds

Women gather drinking water, bath, and wash their laundry in same water source, Indonesia.

Sick Water

Sanitation & Hygiene

Sanitation definition:
1. Formulation and application of measures designed to protect public health
2. Disposal of sewage

Hygiene definition:
1. A science of the establishment and maintenance of health
2. Conditions or practices (as of cleanliness) conducive to health

Wastewater, a global problem with differing regional issues

Source: Water-related disease: may be due to the 500 million people who die each year of waterborne diseases. The Lancet, 2008. (A) water-related deaths.

Figure 3: Regional distribution of the 2.6 billion people not using improved sanitation facilities in 2005, populations (millions)
Sanitation

- Disposal of human excreta
- Improved sanitation facilities:
  - Improved pit latrine (outhouse)
  - Composting toilets
  - Septic systems
  - Sewage systems
- Unimproved: street, field, river, bucket, bag, flushing to street
- In developing countries, 50% of people do not have access to basic sanitation system → lack of privacy, safety

Sanitation and Health

- “6 Fs”
  - Feces
  - Fields
  - Fluid
  - Fingers
  - Food
  - Flies
- Risk: diarrhea and worm infections
- Solution: improve water access, excreta disposal, and hygiene practices

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Sanitation and Health
Sanitation Ladder

- **Improved**
  - Piped sewer system
  - Pit latrine
- **Shared**
  - Public toilets shared between 2 or more houses
- **Unimproved**
  - Buckets, pit latrine without slab
- **Open Defecation**
  - Field, water

Population Coverage

- 2.5 billion people are without improved sanitation

Access to Sanitation

- 62% of population has access to improved sanitation
- Only 31% live in houses connected to a sewer
- Rest of global population uses:
  - Septic system
  - Pour-flush latrine
  - Simple pit latrine
  - Ventilated improved pit latrine

That’s REALLY a lot of people...

How many people need to gain access to an improved sanitation facility to meet the MDG sanitation target?

Access to sanitation facilities

Population to gain access to an improved sanitation facility annually by 2015 to meet the MDG sanitation target.

Source: WHO (2006) based on data from UNICEF, UNHabitat, WIN能, and World Bank

The cartogram and the names shown on the cartogram exist in these maps do not imply official endorsement or acceptance by the United Nations.
Shared Sanitation Facilities

- 8% of population shares a toilet
- Improved sanitation shared by 2 or more households
- Public toilets
- Less than 50% of primary schools in UNICEF priority countries have adequate water or sanitation facilities

Unimproved Sanitation Facilities

- Does NOT ensure hygienic separation of human excreta from human contact
  - Pit latrines without a slab or platform, hanging or bucket latrines
- Improved facilities that lack adequate disposal
  - Pour-flush toilets discharge directly into open drains, ditches or water
- First step up the sanitation ladder - user no longer defecates in the open
- Shows demand for sanitation

Worst Practice: Open Defecation

- Majority live in rural areas
- However, rapid population growth led to increased rates in urban areas
- Overall, this practice is on the decline in ALL world regions since 1990

China & India: Great Strides

Nearly half of world population gaining access to improved sources of drinking-water in 1990-2008 live in China and India

Four out of 16 people gaining access to 1990-2008 to improved sanitation live in China and India
Most to Least Expensive Toilets

Behavior + Poor Hygiene
- Improved health NOT guaranteed with access to improved water and sanitation facilities
- Hygienic behavior is extremely important to prevent diarrheal illness
- Hand washing with soap at critical times
  - After defecating
  - Before eating or preparing food
  - After changing poopy diapers & before handling children

Good Hand Hygiene
- Diarrhea is 2nd leading cause of death in children <5 years old
- Hand washing with soap at critical times reduces number of diarrhea episodes by 50%
  - Also reduces incidence of pneumonia, trachoma, scabies, skin and eye infections
- Need to increase practice of hand washing
  - Promote behavioral change through education, media campaigns, hygiene lessons in schools
  - NOTE: hygiene difficult without water

Behavior Change

Global Handwashing Day
The first-ever Global Handwashing Day was launched on 19th October 2008. This multi-partner global awareness-raising initiative was celebrated in 85 countries, with large and small events often involving the participation of children. The focus of Global Handwashing Day was on schools and school children. Many countries used it as an opportunity to raise awareness and to launch year-round programmes in schools. Global Handwashing Day is now set to become an annual event.

In Afghanistan, for example, children promoted handwashing in television spots; in Bolivia, community handwashing fairs were held; and in Yemen, mobile phone messages reached a million people. In India, over 100 million children signed pledges to wash their hands with soap before their midday meal. And in Bangladesh, in one school, 1213 school children set the Guinness World Record for simultaneous handwashing with soap.

More Behavior Change: H2O
- Even if water is collected from an improved source, it may still become contaminated at home
  - Placed into dirty container, contact with dirty hands, dispers
- Need not only improved water sources, but also simple water treatment and safe storage
- Behavior change—people must be motivated to treat their drinking water
  - Boiling
  - Filtration
  - Chlorination
  - PUR packets
- Treatments must be inexpensive, effective and manageable
WASH Program

UNICEF’s 60 Priority Countries for WASH Programming

Based on the United Nations world map. The boundaries shown on this map do not imply official endorsement or acceptance by the United Nations.

WASH Success

WASH interventions significantly reduce diarrhoea morbidity

<table>
<thead>
<tr>
<th>Handwashing with soap</th>
<th>44%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household water treatment</td>
<td>39%</td>
</tr>
<tr>
<td>Sanitation</td>
<td>32%</td>
</tr>
<tr>
<td>Water supply</td>
<td>25%</td>
</tr>
<tr>
<td>Source water treatment</td>
<td>11%</td>
</tr>
</tbody>
</table>

% reduction in morbidity from diarrhoeal disease

Reaching MDG 7...

- Economic benefit
- Increased health
- Leads to economic development, interrupts poverty cycle

Achieving the MDG targets for water supply and sanitation has wide-ranging benefits. Below are some examples of the benefits expected from achieving the MDG targets for water supply and sanitation:

Economic benefits
- Total payroll of US $1.44 per year for each US $1 per year invested
- 520 million productive days gained each year due to improved health
- Time savings of 20 billion working days per year from more convenient water supply and sanitation services

More healthy days for children
- 461 million school attendance days gained each year due to improved health
- 1.6 billion additional healthy days per year for children under five

Improved vs Unimproved

An improved drinking water source is defined as a drinking water source in delivery point that, by nature of its construction and design, is likely to protect the water source from excreta contamination, in particular from faecal matter, and uses practices and products that have been demonstrated to improve from unimproved drinking water sources.

Plastic water holes, dewelling plot or yard
Tablet tap
Tablet tap with faucet
Tablet tap with faucet protected
Protected spigot
Refrigerator

Unimproved drinking water sources
- Unprotected tap
- Indoor water source
- Unprotected well
- Surface water (river, stream, lake, pond, springs, canals, irrigation channel)
- Bunded water

Cost-Benefit Analysis

<table>
<thead>
<tr>
<th>TABLE 4: COST-BENEFIT RATIO BY INTERVENTION</th>
<th>DEVELOPING REGIONS AND EURASIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>Annual benefits in US dollars</td>
</tr>
<tr>
<td>Delivering the proportion of people without access to improved water sources by 2015</td>
<td>18,942</td>
</tr>
<tr>
<td>Delivering the proportion of people without access to improved water sources and improved sanitation by 2015</td>
<td>84,480</td>
</tr>
<tr>
<td>Chemical access to improved water and sanitation services by 2015</td>
<td>262,879</td>
</tr>
<tr>
<td>Chemical access to improved water and improved sanitation and water distribution as of 2013</td>
<td>944,390</td>
</tr>
<tr>
<td>Chemical access to a regulated piped water supply and sewerage connection by 2013</td>
<td>555,981</td>
</tr>
</tbody>
</table>

* To calculate a benefit-cost ratio, the total benefits are divided by the total costs. Projects with a benefit-cost ratio greater than 1 have greater benefits than costs. The higher the ratio, the greater the benefits relative to the costs.

Source: (7)

International Year of Sanitation

- Without improved sanitation, people suffer from ill health, lost income, indignity
- Urgent need for greater political awareness and action
- UN declared 2008 as the International Year of Sanitation

Five key messages:
- Sanitation is vital for human health
- Sanitation generates economic benefits
- Sanitation contributes to dignity and social development
- Sanitation helps the environment
- Sanitation is achievable
Practice Questions
- Define sanitation, hygiene.
- What are the 6 Fs?
- Describe the sanitation ladder.
- What percent of population has improved sanitation?
- What region has least access to sanitation facilities?
- Is the world on track to reach the MDG for sanitation?
- Name the critical times for hand hygiene.

In Summary
- World is not on track to meet MDG targets for sanitation
- Need to implement low-cost sanitation and behavior change
- Need to enhance knowledge and practice of hygiene and hand washing
- Access to basic water and sanitation has impact on economic development & poverty cycle