Many of you asked about this topic

- Water borne disease: The largest water quality problem in developing countries.
Hi! I’m Ascaris_lumbricoides and I’ll be your intestinal parasite today!
Systemic diseases

- **Leptospirosis.** Characterized by fever, chills headache, nausea, vomiting and diarrhea
  - **agent:** *Leptospira interrogans* (a bacterium)
  - **epidemiology:** most humans are infected by contaminated water used for drinking, washing or bathing

- **Schistosomiasis.** Characterized by a rash (swimmers itch), fever (in acute cases) hypertension and tissue destruction (in chronic cases).
  - **agent:** blood flukes, aquatic snails serve as an intermediate host
  - **epidemiology:** water contact

- **Typhoid fever.** Characterized by fever and anorexia
  - **agent:** several species of *Salmonella* bacteria
  - **epidemiology:** contact with contaminated water and with raw fruit and vegetables washed with contaminated water.
**Gastrointestinal disease**

- **Amebiasis.** Characterized by diarrhea and dysentery
  - *agent*: *Entamoeba histolytica* (an amoeba)
  - *epidemiology*: ingestion of water or food contaminated with feces.

- **Cholera.** Characterized by severe diarrhea and vomiting
  - *agent*: *Vibrio cholerae* (a bacterium)
  - *epidemiology*: the Ganges delta is regarded as the classical home of cholera because epidemics of 1000’s of cases occur each year. Individuals are infected by exposure to water contaminated with fecal material.

- **Chryptosporidiosis.** Characterized by diarrhea
  - *agent*: *Chryptosporidium* (a protozoa)
  - *epidemiology*: ingestion of water or food contaminated with feces.
Gastrointestinal diseases

Characterized by liver and lung dysfunction caused by growth of embryonic cysts.

*Echinococcosis.* various *Echinococcus* species (a tapeworm)
epidemiology: ingestion of soil, vegetables or water contaminated

- **Giardiasis.** Characterized by diarrhea
  - agent: *Giardia lamblia* (a protozoan)
  - epidemiology: drinking unfiltered water

- **Hepatitis.** Characterized by malaise, nausea, abdominal discomfort, fever, and jaundice.
  - agent: *Hepatitis* A and B (virus)
  - epidemiology: transfer from human feces to hands food or water

- **Shigellosis.** Characterized by dysentery
  - agent: various subgenera of *Shigella* (bacteria)
  - epidemiology: transfer from human feces to hands food or water
Still more ways to get sick

- **Botulism**  Dry mouth, blurred vision, difficulty swallowing and breathing, muscle weakness, slurred speech, vomiting. Death is usually caused by respiratory failure.
  - **agent**: *Clostridium botulinum* (a bacterium)
  - **epidemiology**: consuming contaminated drinking water

- **E. coli infection**  Diarrhea. Can cause death in immunocompromised individuals, the very young, and the elderly due to dehydration from prolonged illness.
  - **agent**: Certain strains of *Escherichia coli* (a bacterium)
  - **epidemiology**: consumption of contaminated water

- **Poliomyelitis (Polio)**  90-95% of patients show no symptoms, 4-8% have delirium, headache, fever, and occasional seizures, 1% have symptoms of non-paralytic meningitis. The rest have serious symptoms resulting in paralysis or death
  - **agent**: Poliovirus
  - **epidemiology**: Enters water through the feces of infected individuals
Although it’s not “waterborne” River Blindness is associated with the proximity to water

River blindness is a tropical worm infection that causes blindness. Worm larvae are carried by black flies and transmitted by fly bites.

Mature worm excised from an infected individual
Prevention?

- **Filtration** of water supplies.
- **Disinfection** of drinking water.
- **Collect and treat** domestic wastewater.
- When traveling abroad, avoid ingestion of untreated water or uncooked foods.
Use of groundwater vs. river water

- Groundwater passes through a porous medium and is therefore “filtered”.
- Recommended by world health authorities in Bangladesh to avoid the recurring acute illness and death associated with drinking contaminated surface water.
  - Unfortunately the delta sediments that constitute the aquifer material in Bangladesh contain high natural levels of arsenic (As).
  - The result is exposure of over 100 million people to As levels that are 10 to 100x greater than the 10μg/L that is deemed to be safe in the U.S.
Many villages in Bangladesh are already affected by arsenicosis; i.e., debilitating skin lesions, skin and internal cancers, diabetes and vascular disease.

Characterized by some as the worst environmental health disaster of the 20th century.
The US National Academy of Engineering has issued scientists with a million-dollar challenge: to develop a cheap and sustainable method of removing arsenic from contaminated water.

This is the first $1 million Grainger Challenge Prize for Sustainability.

The winning system must "be technically robust, reliable, maintainable, socially acceptable and affordable, be manufactured and serviced in a developing country, and must not degrade other water quality characteristics".

Cornell’s AguaClara program expects to soon be building water treatment systems in India. We are starting research on approaches for As removal.