Overseas Security Advisory Council
Bureau of Diplomatic Security
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I'm Drinking What in My Water?

Summary

According to the World Health Organization (WHO), over one billion people globally do not have access to safe, potable drinking water. According to a WHO report, one-third of the world lives with water stress, and this could rise to two-thirds by 2025. Nearly 50 percent of developing populations are at high risk for waterborne disease exposure. Exposure to contaminated water is likely to lead directly to disease.

Contamination of the potable water supply can occur for various reasons. Some locations simply do not have active chemical contamination or infectious disease surveillance systems in place that alert epidemiologists of water treatment or waste management failures. The globalization of the food market can bring traditionally localized diseases to a broader audience. International and adventure travel can bring new human hosts in contact with contaminated water or indirectly contaminated products. Deforestation and animal husbandry practices -- including free-range farming and animal transport -- can affect water flows and bring animal byproduct into water supplies. Finally, severe weather conditions, like hurricanes and floods, can affect water treatment facilities and cause comingling of clean and unclean water.

While unsafe water is not an issue in many of the most common destinations for U.S. travelers, the risks are real and global – and the consequences are serious enough to warrant precautionary measures against toxic elements, zoonoses, and cross-contamination.

Toxic Elements

Most toxic elements, including arsenic, occur naturally, and exposure at small doses is often inconsequential. Humans can ingest toxic elements through drinking, food consumption, and inhalation. Arsenic is common in groundwater in Argentina, Bangladesh, Chile, China, India, and Mexico, among others. Acute poisoning symptoms include vomiting, abdominal pain, diarrhea, numbness/tingling of the extremities, muscle cramping, leading to death in extreme cases.

Nitrates in water causes Methaemoglobinaemia, which is the reduced ability of blood to carry oxygen. It causes "blue baby syndrome," in which the mouth, hands, and feet turn blue. This most often affects bottle-fed infants. Nitrates are found in fertilizer and manure, often associated with farming and agriculture and can be found in shallow well water; however, nitrates are also found in some vegetables.

Ingesting too much fluoride, called fluorosis, can impact teeth and bones over long periods. Symptoms of chronic fluorosis on the teeth include staining and pitting, but symptoms on the skeletal system include stiffness and joint pain and possibly calcification. Acute high levels of fluoride can be found in contaminated water after fires or explosions; it can also be released into the air as industrial waste. Fluorosis is often reported at mountain bases and at geological deposits where water minerals deposit.

The Pakistan Council of Research in Water Resources issues a quarterly report on bottled water quality. The most recent edition (January-March 2015) underscored eight unsafe brands of bottled water due to toxic element (arsenic, sodium, and potassium) contamination and three unsafe brands due to microbiologic (fecal matter and E coli) contamination.

Zoonoses and other 'Water-Washed' Diseases: Protozoa, Bacteria, and Viruses

Zoonoses are diseases that manifest in humans but originate from microorganisms, like protozoa, bacteria, and viruses (see Appendix A in attached doc). These zoonoses are a serious threat to potable water. Moreover, 75 percent of infectious diseases are zoonotic, including the causes of recent outbreaks (Ebola, MERS, swine flu, SARS, etc.) Other common water-borne conditions including cholera and other enteric diseases (diarrhea); water is also a key breeding ground for the mosquitoes that carry malaria, dengue, and other infectious.

Cross-Contamination

In some countries, medical waste and pharmaceutical dumping has contaminated the water system. This often occurs in more developed nations -- e.g. Germany, the Netherlands, and Italy -- where research and development centers exist. This may also happen with individuals who inappropriately dispose of medications by flushing them down the toilet. Drinking water can also be sullied during inclement weather conditions (hurricanes, floods), making it unpotable for periods. To date, there is no standardization for sampling or analysis to test for pharmaceuticals, so the risks to exposure are unknown.

Various terrorist and extremist organizations have expressed interest in malicious water contamination or sabotage in the form of bioterrorism. None has proven attempted or successful. However, many water works systems have heightened security protocols and testing procedures to thwart attempts. Implementing security measures in open water systems is more challenging, but contaminants would likely be diluted in larger bodies of water.

Case Studies

Although many water-borne diseases are associated with sub-Saharan Africa and subtropical climates, Western societies also experience water contamination.

Scotland has one of the highest rates of E.coli cases in the world, and 15 zoonotic diseases are reported regularly. This high zoonotic infection rate is primarily due to the close living proximity of humans and farm animals, a lack of public water works in rural farm areas, and is through both direct and indirect contact. Scottish epidemiologists have worked to vaccinate animals to thwart some of the transmission vectors, and occupational health campaigns have also reduced infection in at-risk sectors.

Similarly, New Zealand’s animal stock far outnumbers its human population, particularly on the South Island. Campylobacteriosis infections are common and seem to be increasing. In New Zealand, they are statistically higher than countries of similar socio-economic status. These infections seem to be due, at least in some part, to human – not animal – waste in recreational water ways. However, pastoral agriculture and irrigation practices likely contribute to contamination of fresh water catchments.

Pre-Departure Guidance

Read the OSAC Crime and Safety Report (CSR) and the State Department's Country Information Sheet for your destination. The Medical Emergencies section of the CSRs often highlights potability concerns.

During medical visits for pre-departure vaccinations, inquire about the potability of water. Note that an increasing number of diseases are becoming drug resistant or simply do not have a vaccine.

Consider water purification options:
• Commercially-available kits are expensive and may not completely disinfect water.
• Home water filters, either portable hand-pumps or gravity drip pumps, will likely eliminate particulates that could cause illness but not viruses. Generally “reverse osmosis” filters can remove Cryptosporidium but not viruses, and micro-filtration or –straining generally does remove parasitic cysts and bacteria but may not remove viruses. The U.S. Centers for Disease Control and Prevention (CDC) offers guidance on water filters. Caution should be taken when changing filter cartridges to avoid contamination.
• Chemical disinfectant with chlorine (sodium hypochlorite) is the most common means of purifying water globally. Iodine (halogen) purification tablets will chemically disinfect water but will not kill certain parasites, including Cryptosporidium and Giardia. Iodine overdoses can also be fatal and cause thyroid complications; consequently, the European Union recommends against iodine. Some travelers have found success with chlorine dioxide drops/tablets. However, parasites that form cysts are often resistant to chlorination.
• Ultraviolet (UV) light can be used to disinfect non-particulate (i.e. clear) water from bacteria, viruses, and cysts. UV irradiation and heating via UVA sunlight can be used in emergency situations but takes hours of direct sunlight.

In-Country Guidance

While you can ask hotel staff if the water is safe, know that local populations may have immunities or tolerances that visitors do not. Similarly, consider any language barriers that may complicate understanding risks fully.

Opt for sealed bottled or pasteurized water, and carry safe water with you. Even if water is clear and free of particulates, it may still contain contaminants. Hotels may offer a boiler in the room; boil water for no less than one minute (three minutes in high altitudes) before consuming. Do not use ice. Ensure juice, tea, and coffee are made from bottled or purified water, not tap. Instead, opt for unopened, sealed, factory produced cans/bottles or commercially prepared beverages. Brush teeth with bottled or boiled water. Do not inhale water while

bathing, and protect any open wounds from contact with water.

Avoid recreational activities in most bodies of water, particularly lakes, rivers, streams, and oceans, as they may be contaminated with human excrement or be home to a variety of disease vectors.

As some countries use “night soil” (human excrement) to fertilize crops, it is generally not advised to consume raw fruits/vegetables, even if rinsed. It is safer to select freshly prepared and hot (i.e. well cooked) food whenever possible.

Avoid opening windows without screens, and keep lighting down during evenings, and eliminate standing water, to avoid attracting insect vectors. Use insect repellant and netting.

Post-trip Guidance

Primarily, self-monitoring goes a long way in detecting emerging diseases. Diarrhea and acute gastroenteritis are often an indicator of contamination. The severity of the disease and the patient’s health status will drive treatment and therapy options. Seek professional health care and share specifics from recent travels and dietary choices should any symptoms manifest. Generally speaking, infants, elderly, pregnant women, and the immunocompromised experience more severe symptoms and suffer from longer term chronic health consequences.

For Further Information

The CDC offers extensive guidance on drinking water.

For additional information on health and pandemics, please contact OSAC’s Health and Disease Analyst. For country-specific concerns, please reach out to the appropriate regional analyst.

Attachments

Water Safety.pdf
