

## Q&A on recreational water quality in Rio de Janeiro, Brazil

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### **1. What affects water quality and how can water quality be controlled?**

Recreational water quality is highly variable and can be influenced by a number of contamination sources including the discharge of waste (such as sewage) to the environment. Human sewage, in particular, can be a major concern for recreational water quality as it can carry numerous pathogens which can cause illness. Factors such as weather and water flow can increase or decrease the level of contamination. Rainfall, for example, is known to worsen water quality, as it can trigger the discharge of stormwater overflows and can also wash off contamination from the land. Warm temperatures and sunlight, on the other hand, can inactivate many waterborne microorganisms, including viruses and antimicrobial resistant bacteria and their genes (so called super bacteria).

Measures can be put in place to reduce/limit the amount of pollution reaching the recreational water. These may include wastewater treatment, removal or diversion of stormwater overflows and treatment of river water. . In addition, as water contamination may be triggered by specific and predictable conditions (e.g. rainfall), local management actions, such as notices advising against bathing, can be employed to reduce or prevent exposure at such times. Temporary treatment measures can also be used to improve water quality.

### **2. How is recreational water quality assessed?**

In terms of faecal pollution, World Health Organization (WHO) guidelines for safe recreational water environments recommend that water quality is assessed using a combination of sanitary inspection (to determine possible sources of pollution) and microbial water quality testing (to give numerical information on the actual level of pollution). Microbial tests for recreational water quality rely on measuring bacterial indicator bacteria (intestinal enterococci in fresh and marine water and *Escherichia coli* in fresh water), that are commonly found in human faeces in order to assess the presence of sewage or other types of faecal contamination, rather than specific pathogens including viruses and anti microbial resistant bacteria and their genes.

While the bacteria measured are not the causative agents of illness in swimmers, epidemiological studies have demonstrated that in sewage-impacted waters their concentrations are predictive of the level of human health risk (e.g. stomach upsets and respiratory infections) and provide an estimate of the risk of illness per exposure. A recreational water which, for example, consistently has concentrations of less than 40 intestinal enterococci per 100ml of water would be expected to result in a gastrointestinal illness risk of less than 1% per swimming exposure. Specific pathogens are not routinely measured as the pathogen concentration will depend on the level of the illness circulating

in the population at the time and many of the methods of analysis are difficult, expensive and time-consuming. The presence of indicator bacteria, however, is suggestive of a potential wide range of pathogens including protozoa and viruses and bacteria (as well as anti microbial resistant bacteria and their genes) that are commonly found in faecally contaminated water.

The combination of regular water quality testing and the sanitary inspection results allows recreational waters to be classified, in WHO terms, as very good, good, fair, poor or very poor. Many countries use the WHO guidelines as the basis for their own standards and regulations.

### **3. Why are virus levels not used as a marker of water safety and quality?**

Although it is likely that much of the illness caused by polluted recreational water results from infection with viruses, pathogenic waterborne viruses are not generally used as markers of water quality. To date, no consistent relationship between water quality assessed using measures of human/animal viruses and health in bathers has been identified from epidemiological studies. A number of studies have suggested that concentrations of an indicator of viral pathogens called bacteriophages (viruses which infect bacteria) may be associated with illness levels in swimmers. While the US Environmental Protection Agency is considering developing water quality monitoring recommendations for bacteriophages, no standards or guidelines currently exist.

Many of the methods for measuring concentrations of human enteric viruses in water rely on molecular techniques of analysis (typically polymerase chain reaction – PCR), which detect and sometimes determine the amount of viral genetic material present in the water. Although some of these methods are quantitative they do not give an indication of how much of the genetic material detected is actually infective (i.e. present in viruses capable of causing infection). Warm water and sunlight (among other things) will inactivate viruses, but PCR methods will still show the presence of the genetic material of these non-infectious viruses. Thus, although high counts of viruses in recreational water detected using molecular methods may seem alarming, without knowing how much is infective, it is difficult to draw any meaningful conclusions about the health risk of using the water. As such, bacterial indicator organisms remain the globally accepted method to determine recreational water quality.

### **4. What illnesses have been associated with recreational water exposure?**

The most common type of pollution in urban recreational waters is untreated or partially treated sewage. Human and sometimes animal faeces can transmit a wide range of illnesses, but the most common is mild gastroenteritis, which is usually short-lived and self-limiting in healthy people. The organisms responsible for these infections include viruses, bacteria and protozoa. Many of the same microorganisms that are responsible for recreational water illnesses can also be transmitted through contaminated food, drinking-water, person-to-person contact or contact with contaminated objects and, as a result, it can be difficult to directly attribute these illnesses to a distinct exposure. Other illnesses that are less commonly caused by recreational water exposure include respiratory infections, skin and ear infections. In addition to microorganisms introduced to recreational waters

through human or animal faecal contamination, a number of pathogenic microorganisms are indigenous to such areas or, once introduced, are capable of colonizing the environment. Illnesses caused by free-living microorganisms are uncommon but can include severe wound infection and leptospirosis (fresh water only).

#### **5. Is recreational water in Rio de Janeiro safe?**

It is known that the recreational water around Rio de Janeiro receives significant inputs of untreated sewage from the surrounding urban area, and the microbial quality of the recreational water varies from site to site. The activity that has a significant risk of water intake is swimming which will take place in Copacabana beach. This is a suitable location for such a practice where the levels of *Escherichia coli* and enterococci in water are within the standards for primary contact recreation.

Activities such as rowing and canoeing on the brackish Lagoa de Freitas, and to some extent sailing at Guanabarra Bay, have a lower risk as there is a lower risk of ingestion. Routine monitoring to date has shown that, some of these sites (especially near the Marina da Glória and Lagoa de Freitas) fail to meet Brazilian water quality standards and would be classed under WHO guidelines as poor or very poor.

A large interceptor sewer to collect stormwater, which impacts the water quality at Marina da Glória, has recently been completed and now diverts it to a wastewater treatment plant. Temporary treatment measures are also planned for the Lagoa de Freitas. These improvements are likely to lead to better water quality and in these locations in the near future.

For much of the time, sites in Guanabarra Bay are of acceptable water quality (based on measurements of enterococci and *Escherichia coli*), however some athletes, using these sites at times of poor water quality, may suffer from illnesses such as stomach upsets and respiratory tract infections.

#### **6. What can the public and athletes do to avoid illness from poor recreational water quality?**

The WHO (International Travel and Health) recommends a number of vaccinations (routine, selective and required) for travellers to Brazil, depending on the areas to be visited. A number of these, including typhoid and hepatitis A, will also reduce risks of illness from exposure to poor recreational water quality. Cholera vaccine is generally not recommended for travellers unless they are emergency relief workers in close contact with patients.

The public can look for recreational water sites which are classed under Brazilian legislation as suitable ('Própria'). They should also cover cuts with waterproof plasters prior to exposure, try to avoid swallowing water, wash/shower after exposure and avoid going in the water for several days after heavy rainfall.

The degree of exposure experienced by athletes (splashing, water ingestion, full body contact) will depend upon the sport, and the options available for minimising the risks will depend on the degree

of inherent exposure. It is suggested that all athletes should cover cuts and grazes with waterproof plasters prior to exposure, try to avoid swallowing the water, wash/shower as soon as possible after exposure and, as far as possible, minimise their time in the water and avoid going in the water after heavy rainfall if possible. Sports where there is little contact with the water will be taking place on sites not recommended for full body contact with the water, so it is recommended that people don't jump in the water or throw people in.

### **7. What is WHO/PAHO's role?**

WHO, including its Regional Office for the Americas at the Pan American Health Organization (PAHO), provides technical advice on matters of public health to national authorities in Brazil. WHO has a long history of providing expertise in health planning for mass gatherings and advises the International Olympic Committee and local organizing committee on possible health issues associated with visitors and athletes attending the 2016 Olympic Games.

### **References and additional reading**

- Guidelines for safe recreational water environments. Volume 1: Coastal and fresh water ([http://www.who.int/water\\_sanitation\\_health/bathing/srwe1/en/](http://www.who.int/water_sanitation_health/bathing/srwe1/en/))
- Bartram and Rees (2000) Monitoring Bathing Waters ([www.who.int/water\\_sanitation\\_health/bathing/bathing3/en/](http://www.who.int/water_sanitation_health/bathing/bathing3/en/))
- International Travel and Health ([www.who.int/ith/en/](http://www.who.int/ith/en/))
- Links to Instituto Estadual do Ambiente (INEA) who are publishing the results of the testing according to national regulations by CONAMA  
[www.inea.rj.gov.br/Portal/MegaDropDown/Monitoramento/Qualidadedaagua/Praias/BalneariedadeporMunicpio/RiodeJaneiro/index.htm&lang](http://www.inea.rj.gov.br/Portal/MegaDropDown/Monitoramento/Qualidadedaagua/Praias/BalneariedadeporMunicpio/RiodeJaneiro/index.htm&lang)  
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- WHO (2015) Briefing Note - Antimicrobial Resistance: An Emerging Water, Sanitation and Hygiene Issue [www.who.int/water\\_sanitation\\_health/emerging/WASH\\_AMR/en/](http://www.who.int/water_sanitation_health/emerging/WASH_AMR/en/)

