



# Guidelines for Recreation Water Quality in Brazil, USA and Canada: Enteric Viruses as Faecal Pollution Indicators

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## Abstract

Investigation of the quality of drinking waters and recreational has become an important research area in world. However, in most countries there is no consensus on what parameters should be analyzed to establish that quality. Article summarizes conceptual basis and principles that guided revision of Brazilian legislation, contextualizing with guidelines established for monitoring water quality in the US, Canada and Brazil. Brazilian potability standard is analyzed together with these countries, especially with regard to microbiological analysis, including group of enteric viruses. This evaluation, highlights huge disparities between standards in various countries, especially in terms of microbiological standards. In Brazil, only the Ministry of Health recommends that enteric viruses are monitored, but does not set limits for these pathogens, as the resolutions of the National Environmental Council does not cite the virus in their regulations. In US and Canada, health and environmental guidelines are more insightful and include a range of species of microorganisms in their monitoring, including group of enteric viruses.

**Keywords:** Microbiological standards; Pollution of aquatic ecosystems; Pathogens

## Short Communication

Pollution of aquatic ecosystems has become environmental problem increasingly common, mainly due to the disordered human occupation. Human communities poorer and with less knowledge end up contaminating the environment by discarding their sewage directly into rivers, beaches, bays and mangroves [1]. In some countries, concern about water quality by the government and private sector is relatively recent. In this scenario of growing degradation it is essential that the water for human consumption has conditions of physical-chemical and microbiological quality appropriate, being free of substances and microorganisms that can cause harmful effects to health [2].

Aquatic environments contaminated by sewage may have disease-causing microorganisms. Among these pathogens, highlights the enteric viruses, which are present in the gastrointestinal tract and causes gastrointestinal disease. These pathogens can be found in stool and sewers, contaminating body of water [3]. Research on viruses in drinking water and for entertainment has become an important line in recent years around the world, in order to guarantee the quality of water used by population [4]. Thus, this work it promoted a comparison on the laws that establish guidelines for environmental and health monitoring of body of water for the control of enteric viruses.

## Materials and Methods

A full protocol was written a priori specifying the search strategy, selection criteria, and data extraction and analysis strategies (data not shown, available upon request) descriptors used for search of articles were enteric viruses: drinking water, environmental water, potable, USEPA, Health Canada, CONAMA and guidelines. Databases consulted were PUBMED and government guidelines. To improve the search process in the online database were used strategies that matched keyword mentioned. Titles, keywords, and abstracts of articles included in the online databases were searched for these search terms. Articles in which it was not possible to consult the full texts or not had indexed citations, and articles without summary or irrelevant to the theme were excluded.

## Results and Discussion

Investigated countries adopt different quantitative patterns of

microbiological in its guidelines for determination of drinking water quality. In USA, the United States Environmental Protection Agency (USEPA) uses "Drinking Water Standards" and "Health Advisories" advising monitoring enteric viruses, total coliforms, *Cryptosporidium*, *Giardia lamblia*, *Legionella sp.* and *mycobacteria* [5]. For monitoring the quality of recreational waters the USEPA uses "Recreational Water Quality Criteria" which are not considered enterococci and *E. coli* [6].

In Canada, guidelines for monitoring the quality of drinking water considers the enteric viruses, total coliforms, enterococci, *Escherichia coli*, *Clostridium perfringens* and bacteriophages [7,8]. For monitoring the quality of recreational waters are considered fecal pollution indicators as *E. coli* and enterococci [9].

In Brazil, microbiological quality of drinking water is the responsibility of the Ministry of Health, the main tool Ordinance No. 2914, 2011, establishing the procedures and responsibilities concerning the control and surveillance of water quality for human consumption and its potability standards [10]. Resolution of the National Council of Environment (CONAMA) No 357, 2005, and its completion and update # 430, 2011, provide for the classification of water bodies and environmental guidelines for its framework and establish the conditions and release effluent standards [11]. Resolution No. 274, 2000, mentions the established levels for bathing, in order to ensure the necessary conditions for primary contact recreation [12]. Regulations cited above have maximum values allowed for thermo tolerant coliforms and *Escherichia coli*. According to the environmental resolution, you can use the *Escherichia coli* replacing thermotolerant coliform parameter, following limits established by the competent agency. Only the order

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Kind of water	Total coliforms	Thermotolerant coliforms	<i>Escherichia coli</i>	Enterococci	Enteric viruses	Others	Country	References
Sweet			X				USA	[13]
Saline	X	X		X			USA	[14]
Saline			X		X	X	USA	[15]
Brackish				X		X	USA	[16]
Sweet			X		X	X	Canada	[17]
Sweet						X	Canada	[18]
Sweet			X		X		Brazil	[19]
Sweet	X		X		X		Brazil	[20]
Saline		X	X		X		Brazil	[21]
Brackish			X		X		Brazil	[22]

**Table 1:** Microbiological parameters analyzed in studies of quality of recreational waters.

of Ministry of Health recommends that enteric viruses are monitored, but does not define parameters for these pathogens, since the CONAMA resolutions do not mention viruses in their regulations.

Monitoring of water with standards adopted by legislation is not sufficient to completely eliminate risk to the health of patrons of recreational water environments. It is necessary also the monitoring of other pathogens that are not covered by legislation. Table 1 shows a survey of recent studies on the quality of recreational waters, with other microbiological parameters, as well as the type of water analyzed.

In many cases problems related to pollution of aquatic environments occur by lack of guidance and awareness of the use of environmental resources, especially as regards participation of society. Since the dawn of human communities, there is a preference for coastal regions, in cities with plenty of water. Thus, it is expected that the present there biomes are subject to more severe environmental impacts due to human action. In the present study it was observed that there is no uniformity among the evaluated guidelines. Countries adopt different guidelines to determine potability and bathing of the water, making it difficult consensus among the microbiological parameters to be monitored.

## Author's Contributions

The authors conducted a literature search in databases and drafted the manuscript equally, making appropriate comments, suggestions and corrections.

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