



E-ISSN: 2278-4136  
P-ISSN: 2349-8234  
JPP 2018; SP1: 3165-3168

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## Microbial contamination in drinking water is a dangerous challenge for human health

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#### Abstract

Safe drinking-water defined as the water that does not represent any significant risk to health over a lifetime of consumption, including different sensitivities that may occur between life stages. Microbial water quality often varies rapidly and over a wide range. The great majorities of evident water-related health problems are the result of microbial contamination. The greatest risk of water borne disease is infant's children, young and elderly, people who are debilitated or living under unsanitary conditions. Short-term peaks in pathogen concentration may increase disease risks considerably and may trigger outbreaks of waterborne disease. Faces can be a source of pathogenic bacteria, viruses, protozoa and helminths. Pathogens are the principal concerns in setting healthbased targets for microbial safety protection of water resources, proper selection and operation of a series of treatment steps and management of distribution systems to maintain and protect water quality. The preferred strategy is a management approach that places the primary emphasis on preventing or reducing the entry of pathogens into water sources and reducing reliance on treatment processes for removal of pathogens.

**Keywords:** Pathogen, Microbial contamination, Water born disease

#### Introduction

The highest risk from microbes in water is associated with consumption of drinking water for human and animal health. Infectious diseases caused by pathogenic bacteria, viruses and parasites are the most common and widespread health risk with drinking-water. The public health burden is determined by the severity of the illness associated with pathogens, their infectivity and the population exposed (Bartram 2003, Ainsworth 2004). Breakdown in water supply safety may lead to large-scale contamination and potentially to detectable disease outbreaks. Breakdowns and low-level, potentially repeated contamination may lead to significant sporadic disease, but is unlikely to be associated with the drinking-water source by public health surveillance. Quantified risk assessment can assist in understanding and managing risks, especially those associated with sporadic disease.

Drinking-water safety is not related only to faecal contamination. Organisms grow in piped water distribution systems whereas others occur in source waters and may cause outbreaks. Certain serious illnesses result from inhalation of water droplets in which the causative organisms have multiplied because of warm temperatures and the presence of nutrients. Risk assessment commences with problem formulation to identify all possible hazards and their pathways from source to recipient. Human exposure to the pathogens and dose-responses of these selected organisms are then combined to characterize the risks. With the use of additional information (social, cultural, political, economic, environmental, etc.), management options can be prioritized. Pathogens more resistant to conventional environmental conditions or treatment technologies may be present in treated drinking-water in the absence of *E. coli*. retrospective studies of waterborne disease outbreaks and advances in the understanding of the behaviour of pathogens in water have shown that continued reliance on assumptions surrounding the absence or presence of *E. coli* does not ensure that optimal decisions are made regarding water safety. Having a safe drinking water is an internationally accepted human right (World Health Organization (WHO), 2004). One of the ten targets of the Millennium Development Goals Report (UN 2006) is the proportion of people without sustainable access of safe drinking water to halve by 2015. The issues of sustainability and maintenance of quality of drinking water supplied is, therefore, an area of concern for countries.

#### Microbial contamination water causal and its impact on human health

Infectious diseases caused by pathogenic bacteria, viruses and parasites are the most common and widespread health risk associated with drinking-water. Breakdown in water supply safety

may lead to large-scale contamination and potentially to detectable disease outbreaks. The major infectious diseases caused by pathogenic are given below

### **Bacterial Pathogens**

Waterborne bacterial pathogens, such as *E. coli*, *Acinetobacter*, *Aeromonas*, *Bacillus*, *Legionella*, *Burkholderiapseudomallei*, *Salmonella* and atypical mycobacteria, that can grow in water and soil. The routes of transmission of these bacteria include inhalation and contact (bathing), with infections occur in the respiratory tract, in skin lesions or in the brain.

#### ***Escherichia coli***

This bacterium is a diarrhoea disease producing bacteria. These are present in large numbers in the normal intestinal flora of humans and animals, where it generally causes no harm. But in other parts of the body *E. coli* infect cause serious disease, such as urinary tract infections, bacteraemia and meningitis. A limited number of enter pathogenic strains can cause acute diarrhoea. This disease ranges from mild and non-bloody to highly bloody, which is indistinguishable from haemorrhagic colitis. Children under 5 years of age are at most risk of developing haemolytic uraemic syndrome<sup>1</sup>.

Enterotoxigenic *E. coli* (ETEC) produces heat-labile or heat-stable *E. coli* enterotoxin, or both toxins simultaneously, and is an important cause of diarrhoea in developing countries in young children. Symptoms of ETEC infection include mild watery diarrhoea, abdominal cramps, nausea and headache. Infection with Enteropathogenic *E. coli* (EPEC) has been associated with severe, chronic, non-bloody diarrhoea, vomiting and fever in infants. Waterborne transmission of pathogenic *E. coli* has been well documented for recreational waters and contaminated drinking-water (O'Connor 2002). A well-publicized water borne outbreak of illness caused by *E. coli* occurred in the farming community. According to the World Health Organization (WHO) approximately 3.5 million deaths each year are attributable to diarrhoea. 80% of those deaths occur in children under the age of 5 years. Children are more susceptible to the complications of diarrhoea because a smaller amount of fluid loss leads to dehydration, compared to adults.

#### ***Acinetobacter***

*Acinetobacter* spp. cause occasionally infections, predominantly in susceptible patients in hospitals. They are opportunistic pathogens that may cause urinary tract infections, pneumonia, bacteria, secondary meningitis and wound infections (Bartram 2003, Borchardt 2003).

#### ***Aeromonas***

*Aeromonas* spp. can cause in humans wound infections, respiratory tract infections and gastrointestinal illness, but epidemiological evidence is not consistent (Borchardt 2003). This Bacteria is found in most fresh waters, and they have been detected in many treated drinking-water supplies, mainly growth in water supply systems. This can be control by treatment to optimize organic carbon removal, restriction of the residence time of water in distribution systems and maintenance of disinfectant residuals (Bartram 2003, WHO 2004).

#### ***Bacillus***

*Bacillus* spp. causes occur food poisoning like staphylococcal food poisoning. Some strains produce heat-stable toxin in

food that is associated with spore germination and gives rise to a syndrome of vomiting within 1-5 hours of ingestion. Other strains produce a heat-labile enterotoxin after ingestion that causes diarrhoea within 10-15 hours. *Bacillus anthracis* causes anthrax in humans and animals. This is largely due to the resistance of spores to disinfection processes.

#### **Melioidosis**

Melioidosis is the most common cause of community-acquired pneumonia. Cases appear all the year but peak during the rainy season (Currie 2001). Many patients present with milder forms of pneumonia, which respond well to appropriate antibiotics, but some may present with a severe septicaemia pneumonia (Currie 2000). Other symptoms include skin abscesses or ulcers, abscesses in internal organs and unusual neurological illnesses, such as brainstorm encephalitis and acute paraplegia. The detection of the organisms in drinking water supply replacement of water pipes and chlorination water supply (Ainsworth 2004, Inglis 2000).

#### **Salmonella**

*Salmonella* infections cause four clinical manifestations: gastroenteritis (ranging from mild to fulminant diarrhoea, nausea and vomiting), bacteraemia or septicaemia (high spiking fever with positive blood cultures), typhoid fever or enteric fever (sustained fever with or without diarrhoea) and a carrier state in persons with previous infections (Angulo 1997, Koplán 1978). Symptoms of nontyphoidal gastroenteritis appear from 6 to 72 hours after ingestion of contaminated food or water. Diarrhoea lasts 3-5 days and is accompanied by fever and abdominal pain (Escartin 2002). The incubation period for typhoid fever can be 1-14 days but is usually 3-5 days. Typhoid fever is a more severe illness and can be fatal. Typhoid is uncommon in areas with good sanitary systems, it is still prevalent elsewhere, and there are many millions of cases each year (Angulo. 1997).

#### **2-Viral pathogens**

Viruses associated with water borne transmission are predominantly those that can infect the gastrointestinal tract. With the exception of hepatitis A and hepatitis E, humans are considered to be the only source of human infectious species. Enteric viruses typically cause acute disease with a short incubation period. Water may also play a role in the transmission of other viruses with different modes of action.

#### **Adenoviruses**

This virus cause infections of the gastrointestinal tract (gastroenteritis), the respiratory tract (acute respiratory diseases, pneumonia, pharyngoconjunctival fever), the urinary tract (cervicitis, urethritis, haemorrhagic cystitis) and the eyes (epidemic keratoconjunctivitis, also known as "shipyard eye"; pharyngoconjunctival fever, also known as "swimming pool conjunctivitis") (D'Angelo 1979). Different serotypes are associated with specific illnesses. Adenoviruses are an important source of childhood gastroenteritis. In general, infants and children are most susceptible to adenovirus infections, and many infections are asymptomatic (Puig 1994).

#### **Astroviruses**

Astrovirus cause predominantly diarrhoea, mainly in children under 5 years of age but in some cases, it may be adults (Nadan 2003). The illness is self-limiting, is of short duration

and has a peak incidence in the winter (Pinto 2001). Astrovirus are the cause Hepatitis A and Hepatitis A infections. Drinking-water supplies should be protected from contamination during supplies (Grabow2001).

### **Hepatitis A virus**

Hepatitis A virus disease, commonly known as "infectious hepatitis." Like other members of the group enteric viruses. Particularly 90% of cases in children liver damage and the infection passes without clinical symptoms and elicits lifelong immunity (Cuthbert 2001). The severity of illness increases with age. The damage also results in the failure of the liver to remove bilirubin from the bloodstream; the accumulation of bilirubin causes the typical symptoms of jaundice and dark urine. This has substantial burden of disease implications. Mortality is higher in those over 50 years of age. Person-to-person spread is probably the most common route of transmission, but contaminated food and water are important sources of infection. There is stronger epidemiological evidence for waterborne transmission of HAV than for any other virus. Foodborne outbreaks are also relatively common, with sources of infection from contaminated water and contaminated produce. Travel of people from areas with good sanitation to those with poor sanitation provides a high risk of infection (WHO 2004).

### **Hepatitis E virus**

The HEV incubation period tends to be longer (average 40 days), and infections have a mortality rate of up to 25% in pregnant women (Pina 1998). In endemic regions, first infections are typically seen in young adults rather than young children. In many of these areas, HEV is the most important cause of viral hepatitis. The reason for the lack of clinical cases in the presence of the viruses is unknown (Van der Poel 2001).

### **3. Protozoan pathogens**

Protozoa are among the most common causes of infection and disease in humans and other. The transmission of this group of pathogens may increase substantially in importance and complexity as human and animal populations grow and the demands for potable drinking-water escalate.

#### **Acanthamoeba**

This is a rare but usually fatal disease. Early symptoms include drowsiness, personality changes, intense headaches, stiff neck, nausea, vomiting, sporadic low fevers, focal neurological changes, hemiparesis and seizures. Death follows within a week to a year after the appearance of the first symptoms, usually as result of bronchopneumonia (Yagita1999). Acanthamoebic keratitis is a painful infection of the cornea and can occur in healthy individuals, especially among contact lens wearers. It is a rare disease that may lead to impaired vision, permanent blindness and loss of the eye (Backer 2002). The prevalence of antibodies to Acanthamoeba and the detection of the organism in the upper airways of healthy persons suggest that infection may be common with few apparent symptoms in the clear majority of cases.

#### **Entamoeba histolytica**

Entamoeba histolytica is the most prevalent intestinal protozoan pathogen worldwide and belongs to the superclass Rhizopoda in the subphylum Sarcodina. About 85-95% of human infections with E. histolytica are asymptomatic. Acute

intestinal amoebiasis has an incubation period of 1-14 weeks. Clinical disease results from the penetration of the epithelial cells in the gastrointestinal tract by the amoebic trophozoites. Symptoms of amoebic dysentery include diarrhoea with cramping, lower abdominal pain, low-grade fever and the presence of blood and mucus in the stool. The ulcers produced by the invasion of the trophozoites may deepen into the classic flask-shaped ulcers of amoebic colitis. Entamoeba histolytica may invade other parts of the body, such as the liver, lungs and brain, sometimes with fatal outcome.

### **Helminth pathogens**

The word "helminth" comes from the Greek word meaning "worm" and refers to all types of worms, both free-living and parasitic. The major parasitic worms are classified primarily in the phylum Nematode (roundworms). Helminth parasites infect many people and animals worldwide. Helminths have drinkingwater and other significant route of transmission. Dracunculiasis and fascioliasis both require intermediate hosts to complete their life cycles but are transmitted through drinking-water by different mechanisms.

### **Summary and Conclusion**

Water plays an important role in the transmission of diseases pathogens. The diseases are a major problem of public health and socioeconomic impact. The disease pathogens/organisms cause "emerging diseases," In the last 25 years, the most notable example of an emerging disease caused by bacteria, viruses, parasites, protozoan, helminths and Cyanobacteria pathogen is cryptosporidiosis. The role of water in the transmission of this group of pathogens may increase substantially in importance and complexity as human and animal populations grow and the demands for potable drinking-water. Further information on emerging diseases is provided in Emerging Issues in Water Infectious Disease like, diarrhoea, pneumonia, typhoid fever, hepatitis A, hepatitis E, urinary tract infections, wound infections, respiratory tract infections, gastrointestinal disorders, fever, irritations of the skin, ears, eyes, throat, acanth amoebic keratitis is a permanent blindness and loss of the eye., (WHO, 2003) and associated texts. Other examples are diseases caused by microsporidia and Cyclospora. The control of waterborne transmission presents real challenges, because most of the pathogens produce cysts, oocysts or eggs that are extremely resistant to processes generally used for the disinfection of water and in some cases, can be difficult to remove by filtration processes. As evidence for waterborne transmission of "emerging diseases" has been reported relatively recently, some questions about their epidemiology and behaviour in water treatment and disinfection processes remain to be elucidated.

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