

## Chapter 20

# Bacterial Pathogens in Acute Gastroenteritis via Contaminated Drinking Water in Developing Countries

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### ABSTRACT

*The public health of developing and undeveloped countries is in crisis due to an increased incidence of acute gastroenteritis via contaminated drinking water. Acute gastroenteritis is the third leading cause of mortality in the world. According to the World Health Organization, there were estimates of 4 billion cases of diarrhea and 2.2 million deaths annually in these countries due to consumption of unsafe drinking water. Generally, most acute gastroenteritis pathogens are transmitted via contaminated food, but waterborne transmission has been well documented for recreational and contaminated drinking water. Usually, gastroenteritis which is caused by poor sanitation and by contaminated water is part of those diseases in developing countries. Inadequate and unsafe drinking water supplies are continuing public health problems for most of the world's populations. The objective of this chapter is an attempt to determine the role of bacterial agents in acute gastroenteritis via drinking water in developing countries.*

DOI: 10.4018/978-1-7998-7356-3.ch020

## **INTRODUCTION**

Acute gastroenteritis is a universal infectious disease syndrome with the combined occurrence of nausea, vomiting, diarrhea, and abdominal pain out of infection and inflammation of the gastrointestinal tract, involving both the stomach and small intestine caused by a wide range of infectious agents (Fletcher et al., 2013). A variety of microorganisms including bacteria, viruses, and protozoa or their toxins are the infectious agents responsible for the disease (Gerba, 2015). Acute gastroenteritis is a major cause of mortality and morbidity in developing countries. It is also the third leading cause of mortality in the world (Salami et al., 2019). Recently it was estimated that children less than three years of age had three episodes of the infection per year in developing countries (Garcia et al., 2020). According to World Health Organization (WHO) statistics, gastroenteritis accounts for 3.2% of all deaths worldwide each year and has the 5<sup>th</sup> highest burden of diseases, expressed in DALY's (Anderson et al., 2020). Contaminated food is the major cause behind acute gastroenteritis even though water-borne transmission through recreational and contaminated drinking water also has been well documented (Ahmed et al., 2018). An estimated 94% of the gastroenteritis burden of disease is attributable to the environment and associated with risk factors such as unsafe drinking water, lack of sanitation, and poor hygiene (Cisse, 2019). Increasing incidents of infection via contaminated drinking water are now a major public health concern in both developing and undeveloped countries (Sharma et al., 2017). According to the World Health Organization (WHO), there were estimates of 4 billion cases of diarrhea and 2.2 million deaths annually in these countries due to consumption of unsafe drinking water (Osiero et al., 2019). In recent days viral gastroenteritis is much focused on, but bacterial acute gastroenteritis is underestimated. Changed etiology and continued outbreaks which increased antibiotic resistance may bring back acute gastroenteritis to the center. This review paper attempts to determine the role of bacterial pathogens in acute gastroenteritis via drinking water in developing countries.

## **METHODS AND METHODOLOGY**

### **Major Bacterial Etiological Agents of Gastroenteritis via Contaminated Drinking Water**

Many different bacterial pathogens have been associated with water-borne diseases (Castillo et al., 2015). The etiological agents associated with the bacterial water-borne diseases are transmitted through the fecal-oral route and these pathogens will enter drinking water sources and act as vehicles of transmitting diseases (Pandey et al., 2014). The infectious doses of some bacteria range between  $10^7$  to  $10^8$  cells, with some enteric bacteria which are able to cause infections at doses as low as  $10^1$  cells (Cabral et al., 2010). The major bacterial pathogens linked to the water-borne diseases via contaminated drinking water and recreational water are listed in

Several authors note that diarrheal diseases are of particular importance in developing countries, as they contribute significantly to the high mortality and morbidity rates typically associated with poor countries, which are largely derived from poor water quality and sanitation (Mokomane et al., 2018; Bain et al., 2014; Kotloff et al., 2013). The main factors associated with diarrheal disease are inadequate drinking water, sanitation, and hygiene practices (Prüss-Ustün et al., 2019; Olorunfoba et al., 2014). In particular, diarrheal diseases in low-income countries are mainly due to inadequate water and sanitation

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