

Original Article

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Overview of Water Quality and Challenges

Ahmad Khan, MD, MS¹ , Soma Fahim², Hadisa Faizi³, Meena Sadat⁴, Sulaiman Laeeq⁵

¹A T Still Health Sciences University

^{2,3,4,5}Afghanistan Open University Organization



Abstract

Water is an essential component of life sustainability, and worldwide, nations have different challenges to access high-quality water that ranges from accessibility, availability, and contamination. Many countries suffer from water-associated diseases and gastrointestinal diseases that have burdened public health and negatively impacted life longevity.

In the 21st century, the development and urbanization in different parts of the world have directly or indirectly posed a danger to water quality and resources. Worldwide, governments at national and international levels need to collaborate on multifaceted strategies to ensure water safety. This paper will elaborate on water quality and critical points vital in drinking water management.

Keywords: *water management, wastewater, infectious, strategy, policy*

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Introduction

The earth accommodates approximately 332 million cubic miles of water - most water on the planet is reserved in oceans, which are salty and not drinkable. Only 2% of the water reservoir on the planet is freshwater, and approximately 2/3 of that water is not accessible to humans (George, 2008). For life sustainability, humans need access to affordable, available, accessible, and high-quality water. All countries worldwide have different access to clean and sufficient water. People have not had access to high-quality drinking water for decades in low-middle-income countries. Howard et al. (2003) estimated that an individual needs 7.5 liters of water daily for basic requirements such as drinking, cooking, and

personal hygiene. To suffice these needs, an individual should have access to 50 liters of water per day to facilitate adequate personal hygiene, washing the dishes, cooking food, and washing clothes.

The World Health Organization (WHO) and UNICEF Joint Monitoring Program for Water-Supply and Sanitation (2010), which supervise the improvements of Millennium Development Goal (MDG) water resources goals, classify water for consumption into three classes that include hosed water supplies, uncovered water resources (open to contamination), and covered water resources.

A critical goal of MDG 7 was to decrease by 50 percent the proportion of the population without

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continuous access to clean drinking water by 2015 (UN, 2005). Access to clean water resources is an essential precursor to other MDGs, such as decreasing poverty, increasing education, and reducing child mortality (Fewtrell & Bartram, 2001).

Approximately 1 billion people do not have appropriate access to purified or clean drinking water sources, and nearly 2.5 million do not have access to enhanced sanitation (WHO, 2010). Poor-quality water and unsanitary environments account for approximately 9.1% of the disease burden and 6.3% of all mortalities worldwide (Pruss-Ustun & WHO, 2008). Poor quality water and unsanitary conditions are the significant contributors to diarrhea worldwide, leading to nearly 1.4 million child deaths annually (WHO, 2014b).

Children's immune, respiratory, and digestive systems are not well developed. As a result, they are more susceptible to diseases from unrefined water and unsanitary conditions (Fayehun, 2010). Multiple studies have indicated that access to purified water and sanitary conditions decreases children's mortality and diarrhea among children.

Furthermore, a cross-sectional study from 38 low-middle-income countries illustrated that access to refined, high-quality water and a clean environment could decrease childhood mortality by about 20% and annually can prevent about 2.2 million deaths in children under the age of five years old (Aiello et al., 2008; Gunther & Fink, 2011). Access to clean and high-quality water can prevent waterborne diseases by approximately 90%. Waterborne disease prevention can enhance the population's health, reduce poverty, foster social, and economic development (Walker et al., 2012).

Besides microbial contamination of water being contaminated by chemicals that can negatively affect population health, it can lead to diseases such as cancer, cardiovascular disease, and miscarriages (Calderon, 2000). Persistent exposure to toxins in water can lead to the accumulation of toxins in lipid tissues. Once the accumulation of toxins reaches an impactful level, it can lead to cellular malfunction in human tissues. In the long term, toxic chemicals in the water can impact different life stages. For

example, in the uterus, it can damage mitochondrial function, decreasing sufficient energy production. In later stages of life, the accumulation of toxins from water in the human body can contribute to neurodegenerative disorders (Bondy & Campbell, 2018).

History of Water Contamination Diseases

Waterborne diseases have been documented historically in ancient documents. For example, in The Vedas, an Indian religious book, a waterborne disease similar to cholera was documented in nearly 500 BC (Colwell, 1996). According to the WHO, cholera is the most predominant waterborne disease in developing countries. Annually, the WHO records approximately 3 to 5 million cholera cases, with 10,000 to 120,000 deaths (Colwell, 1996). Over decades, both in low-middle-income and wealthy nations, cholera has led to millions of deaths, with an uncontrolled outbreak in London in 1849 (Snow, 1854).

Challenges with Poor-quality Water

Even though waterborne diseases are common in low- and middle-income countries, they can also create challenges to public health in developing countries. Various viruses, bacteria, and protozoa can lead to waterborne diseases, for example, amebiasis, giardiasis, and other gastrointestinal diseases. In low-middle-income countries, millions of people get infected with waterborne diseases due to the consumption of poor-quality water (Craun et al., 2006). A study that analyzed data from 1986 to 2000 in the United States indicated that waterborne infections caused 48 outbreaks of gastrointestinal disorders, and *Cryptosporidium parvum* contributed to 95.89% of the recorded cases (Arnone & Walling, 2007).

Also, another study that encompassed data from 1920 to 2002 indicated approximately 23 water-associated disease outbreaks per year in the United States (Craun et al., 2006). On the other hand, in malaria-endemic countries, unprotected water reservoirs enhance the environment for malaria mosquito breeding, infecting 300-500 million people with more than one million deaths, and over 90% of deaths occur in African countries (Pandey et al., 2014).

Strategies to Improve the safety and Quality of Water

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Water is a vital element for life's sustainability on Earth. Having access to adequate, affordable, clean water can positively impact population health. According to the WHO, **safe drinking water** is when water consumption over lifetime does not endanger human health (WHO, 2014a). Threats that compromise water safety vary from country to country. As a result, it is more challenging to have a universal strategy for water safety. One strategy might be helpful in one region, and it might not be applicable in another region. However, according to the WHO (2014b), a strategy must include the following factors to enhance water safety for the population:

1. Financial resources: When generating policy to ensure water safety, it is critically important to have appropriate financial resources. With financial resources, it is easier to implement water-improving strategies. Adequate financial resources can easily facilitate piping water to residential areas and wastewater management installation facilities.

2. Infrastructures: It is critically important to have steady and structured urbanization. Unstructured and unorganized growth leads to poor wastewater infrastructure that threatens water quality.

3. Implementing and imposing regulation: It is crucial to make comprehensive policies to prevent bacterial, chemical, and environmental contamination of water.

4. Coordination and collaboration: Policy related to water quality, availability, and accessibility requires a multidisciplinary integration and collaboration of different industries such as agriculture, energy, trade, and other relevant sectors.

5. Preventing water pollution: It is critically important to have structured and organized urbanization with adequate wastewater management. Globalization should not outpace policies and infrastructures for clean water and wastewater management.

Impact of Population Education on Water Management

Humans are the planet's primary water users, so their active engagement in water management is essential. People's engagement with water-related problems is multidimensional and

requires emotional, cognitive, and behavioral engagement. As the governing bodies enhance ordinary people's awareness, they will actively participate in programs to save the quality of water and adhere to the policy for water management in society (Dean et al., 2016; Hurlimann & Dolnicar, 2010). Furthermore, multiple studies have indicated that awareness and knowledge can influence environment-friendly behaviors in people (Carmi et al., 2015; Dolnicar et al., 2012).

Role of Community Health Worker to Promote Awareness

People need help accessing high-quality piped water in low-middle-income countries and rural areas. They often transport and store water at home for daily needs. In low-income countries, unsafe water transportation predisposes water to contamination, leading to diarrhea in children and adults (WHO, 2012). According to the WHO (2007), 94% of diarrhea cases can be avoidable through environmental alteration, improving sanitary conditions, and hand hygiene practices. A community health worker can increase people's awareness of the importance of hand hygiene while handling water pots and safely storing water at home. Low and middle-income countries and rural areas suffer from a shortage of healthcare professionals. Community health workers efficiently promote preventive behaviors in the community with lower costs (Kwak & Ko, 2015).

Conclusion

Water is an essential component of life on Earth, and the lack of clean and accessible water can endanger life on Earth. Maintaining the quality and quantity of water resources is a critical challenge worldwide. It requires global, regional, and comprehensive local initiatives to manage water-related issues such as decreasing air pollution and chemical spillage into the environment and wastewater management. Also, it is vital to educate people in communities to adhere to water management and safety policies. Every country must change its policies and regulations in different paradigms that can negatively impact water quality to avoid endangering water sustainability.

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- Data sharing statement:

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