

SHIGELLA: A TINY BACTERIUM REVEALING BIG GAPS IN ONE HEALTH

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Abstract

Shigella is a microscopic bacterium that continues to pose a major public health challenge, particularly in regions with inadequate sanitation and limited access to safe drinking water. While it is widely recognized as a cause of shigellosis and dysentery, its impact extends far beyond human illness. This article explores *Shigella* through the lens of the One Health concept, emphasizing the interconnectedness of human, environmental, and ecosystem health. It explains how contaminated water, poor hygiene, overcrowding, and environmental degradation facilitate disease transmission and highlights the increased vulnerability of children and other high-risk populations. The article also discusses the growing threat of multidrug-resistant and extensively drug-resistant *Shigella* strains, underscoring antimicrobial resistance as a global One Health concern driven by inappropriate antibiotic use and environmental contamination. Rather than focusing solely on treatment, the article advocates for integrated prevention strategies, including improved sanitation, access to clean water, hygiene promotion, responsible antimicrobial stewardship, disease surveillance, and collaborative public health policies. By presenting *Shigella* as more than just a bacterial pathogen, this article demonstrates how addressing the environmental and social determinants of health is essential for sustainable disease prevention. A coordinated One Health approach offers the most effective path toward reducing the burden of shigellosis and safeguarding public health.

Introduction

When communities recover from heavy rainfall, there are high chances that water sources become contaminated, sanitation systems fail, and within a few days, children succumb to diarrhea, fever, and stomach cramps. We may think of this as an isolated health issue, but if not looked at, it may soon grow into a public health concern affecting communities, health care providers, and local authorities. Behind the reason for this outbreak is a microscopic bacterium called *Shigella*.

Although invisible to the naked eye, *Shigella* causes millions of infections worldwide each year and remains one of the leading bacterial causes of diarrheal diseases. Moreover, this pathogen brings an important lesson: Human health is closely related to environmental conditions and public health practices. This story highlights the importance of one health.

infectious diseases, including diarrhea, fever, abdominal pain, and in severe cases dysentery. This group of bacteria was discovered by Dr. Kiyoshi Shiga in 1897. So, in honour of him, the bacteria were named after him, hence the name *Shigella*. The disease can affect individuals of all ages, but it is most dangerous for young children, the elderly, and people with weakened immune systems. There are 4 major species of *Shigella*: *Shigella dysenteriae*, *Shigella flexnerii*, *Shigella sonnei*, and *Shigella boydii*. These bacteria are so harmful that only a small number of bacterial cells are well enough to cause an infection.

Shigellosis is especially common in areas where there is more access to contaminated water and contaminated sanitation. Outbreaks frequently occur in schools, hostels, refugee camps, and densely populated communities, wherein hygiene measures may be difficult to maintain.

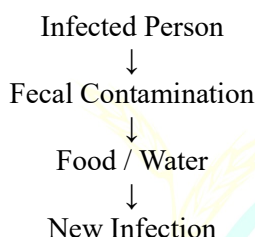
Meet *Shigella*; The hidden cause of dysentery:

Shigella is a group of broad-shaped gram-negative bacteria, responsible for Shigellosis and

How does *Shigella* spread?

Primary mode of transmission is the feco-oral route, which means the bacteria spread when microscopic traces of fecal matter from an infected person contaminates food, water surfaces, or hands and are ingested by another individual. Several factors contribute to the spread of *Shigella*:

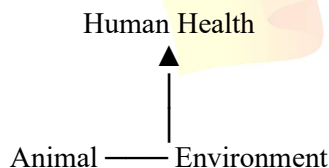
- Consumption of contaminated food or water
- Poor personal hygiene
- Inadequate sanitation facilities
- Overcrowded living conditions
- Contaminated water sources



This transmission cycle shows how closely disease outbreaks are linked to environmental conditions. A single contamination event can quickly affect an entire community if preventive measures are not implemented at the right time.

Observing *Shigella* through One Health:

The One Health concept reminds us that the health of humans, animals, and the environment is interconnected. Although *Shigella* is traditionally regarded as a human pathogen, its transmission and persistence are strongly influenced by environmental factors, proving why a One Health perspective is essential for this disease.



Human Health

From a human health point of view, shigellosis remains a relevant public health challenge. Severe diarrhea can lead to dehydration, hospitalization, and in some extreme cases, death. Children under 5 years of age are the most susceptible to this disease, especially in regions with underdeveloped health care resources. Outbreaks can cause difficulty in healthcare systems and may disrupt schools, workplaces, and community

activities. This disease also influences economic loss through medical expenses and lost productivity.

Environmental Health

The Environment plays a critical role in the transmission of *Shigella*. Contaminated water sources, inadequate sewage treatment, and poor waste disposal system creates ideal conditions for the bacteria to spread. Natural disasters such as floods can further increase the frequency of outbreaks by contaminating drinking water supplies. As climatic changes lead to more frequent extreme weather events in many parts of the world, environmental factors may increase the occurrence of water-borne diseases. Access to safe drinking water and proper sanitation is, therefore, not only an environmental issue but also a fundamental public health priority.

Animal and Ecosystem Health:

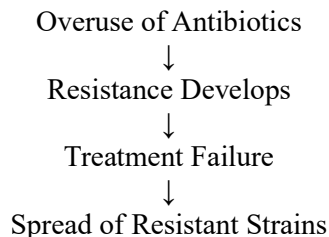
Although humans are the primary reservoir of *Shigella*, related infections have been reported in non-human primates and other wildlife under certain circumstances. Environmental contamination can also affect ecosystems and contribute to the persistence of pathogenic bacteria. More importantly, the One Health framework reminds us that human health cannot be viewed alone. Protecting ecosystems, maintaining environmental quality, and reducing contamination are all essential components of disease prevention.

The Silent Threat: Antimicrobial Resistance:

One of the most concerning developments in recent years is the rise of antimicrobial resistant shigella strains. Antibiotics have long been used to treat severe cases of Shigellosis. However, the misuse of these medications has contributed to the emergence of multidrug-resistant (MDR) and extensively drug-resistant (XDR) strains. When bacteria become resistant to commonly used antibiotics, treatment becomes more difficult, more expensive, and less effective. Patients may experience prolonged illness, while healthcare providers face increasing challenges in selecting appropriate therapies.

Antimicrobial resistance is a classic One Health issue because resistant genes in bacteria can spread across humans, animals, and the environment. Wastewater contaminated with

resistant bacteria, improper disposal of pharmaceuticals, and widespread antibiotic use all contribute to this rising global problem. The rise of resistant *Shigella* strains serves as a reminder that antibiotic supervision is essential for protecting public health in this era.



Fighting back through a One Health approach:

Preventing Shigellosis requires coordinated action at several levels.

At the individual level:

Simple practices can drastically reduce the risk of infection, such as:

- Washing hands thoroughly with soap and water, before eating and after going to the toilet.
- Drinking safe, treated water.
- Practicing proper food hygiene.
- Seeking medical care when symptoms occur.

At the Community level:

Communities can help prevent outbreaks by:

- Improving Sanitation Infrastructure.
- Ensuring access to clean water.
- Promoting hygiene education.
- Assessing the water quality.

At the Health Care Professional Level:

Healthcare providers play a vital role by:

- Early diagnosis and treatment.
- Disease surveillance.
- Public health education.
- Responsible antibiotic use.

At the Research and Policy maker level:

Researchers continue to investigate vaccine development, genomic surveillance, and new treatment strategies. Policy makers can support these efforts through investments in sanitation, disease monitoring systems, and antimicrobial resistance control programs. Only through collaboration among multiple sectors can the burden of shigellosis be effectively reduced.

Conclusion

Shigella may be a microscopic organism, but its impact is very big. From contaminated water supplies and inadequate sanitation to the growing threat of antimicrobial resistance, this bacterium highlights the complex connections between people, the environment, and public health systems. The challenges created by *Shigella* cannot be solved by health care professionals alone. They require collaboration among public health experts, environmental scientists, researchers, policy makers, and communities.

By accepting the one health approach, we can address not only the disease itself but also the underlying conditions that allow it to spread. In an increasingly interconnected world, the story of *Shigella* reminds us that protecting human beings begins with protecting environmental health.

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