MICHELLE: Journal of Medical and Health Sciences, 01 (1) (2025) pp. 1-6

Published by: Yayasan Pendidikan Riset, Publikasi, dan Konsultan Jonhariono

MICHELLE: Journal of Medical and Health Sciences
Journal homepage:
https://journals.joninstitute.org/index.php/michelle/index

The Role OF Environmental Health in the Prevention OF Infectious Diseases

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ARTICLE INFO

Article history:

Received Jul 02, 2025
Revised Jul 12, 2025
Accepted Jul 25, 2025

Keywords:

Environmental health
Infectious diseases
Sanitation
Prevention
Community participation

ABSTRACT

Environmental health is one of the fundamental aspects in efforts to prevent infectious diseases. A clean and healthy environment is the main fortress in breaking the chain of transmission of various diseases originating from water, air, food, or vectors such as mosquitoes and rats. Diseases such as dengue fever, diarrhea, leptospirosis, malaria, and tuberculosis are closely related to environmental conditions. Therefore, maintaining and improving the quality of the environment is a strategic step in efforts to promote and prevent public health. Environmental factors such as poor sanitation, lack of access to clean water, garbage accumulation, and low air quality are the main causes of the development of pathogenic microorganisms. Environmental health includes clean water management, waste treatment, disease vector control, and environmentally friendly spatial planning. Interventions on these factors have been shown to significantly reduce the incidence of infectious diseases, especially in densely populated areas and areas with low levels of cleanliness. The role of the community, government, and health workers is very important in developing an effective environmental health system. Education about the importance of cleanliness, provision of adequate sanitation facilities, and regular environmental monitoring need to be improved. In addition, regulations that support the enforcement of healthy environmental policies also contribute greatly to maintaining environmental quality to remain at a standard that is safe for human health. With the integration of scientific approaches, government policies, and active community participation, environmental health can be used as the front line in preventing the spread of infectious diseases. Collaborative efforts across sectors and based on scientific evidence will strengthen the overall public health resilience system. In the context of sustainable development, improving environmental quality not only has an impact on disease prevention, but also improves the overall quality of life.

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1. INTRODUCTION

Environmental health is one of the important components in the public health system that directly or indirectly affects the quality of human life. A clean, safe, and healthy environment can support human life optimally and reduce the risk of disease. In recent decades, attention to environmental health has

increased along with the high incidence of infectious diseases caused by poor environmental conditions.

Infectious diseases are diseases that can spread from one individual to another, either through direct contact or indirectly, such as through water, air, food, or disease-carrying vectors. Many of these diseases are rooted in environmental problems such as poor sanitation, contaminated water, inadequate waste disposal, and the presence of disease vectors. Therefore, improving and controlling environmental factors is a strategic step in efforts to prevent infectious diseases.

Facts show that in developing countries, most infectious diseases are closely related to environmental conditions. For example, diarrhea, which is the leading cause of death in children under five, is generally caused by consumption of unclean water and poor hygiene practices. Likewise, diseases such as malaria and dengue fever are closely related to the environment that allows the development of mosquitoes as vectors of these diseases.

Environmental health includes various important aspects such as clean water management, basic sanitation, solid and liquid waste management, air quality, and vector control. If these aspects are not managed properly, there will be an accumulation of disease-causing agents that can spread rapidly in the community. This condition is especially vulnerable to occur in densely populated areas, slums, and areas with inadequate health infrastructure.

The role of environmental health in preventing infectious diseases is not only technical but also involves social, economic, and cultural aspects. The community has a big role in maintaining the cleanliness of their environment, while the government is tasked with providing basic facilities and designing policies that support a healthy environment. Collaboration between these various parties is very important to create an environment that supports overall public health.

In a global context, population growth, unplanned urbanization, and climate change have worsened environmental conditions and increased the potential for infectious disease outbreaks. This requires environmental-based mitigation and adaptation efforts that can reduce the risk of disease spread. One of them is by strengthening the environmental health system through infrastructure improvements, environmental monitoring, and public education.

Several factors contribute to adolescents' increased vulnerability to infectious diseases. These include physical, psychological, and behavioral changes during adolescence, as well as social and environmental factors. For example, adolescents living in conflict-affected areas, such as Ukraine, face increased risk of infectious diseases due to disrupted health care systems and mass displacement (Maggioni et al., 2022). Additionally, adolescents with severe obesity are at higher risk of cardiovascular, metabolic, and other health consequences, which may exacerbate their vulnerability to infectious diseases (Kelly et al., 2013).

Interventions targeting high-burden infectious diseases among children and adolescents have shown some protective effects. For example, water treatment, water filtration, and zinc supplementation have been shown to be effective in reducing the risk of diarrhea, while peer counseling, emergency contracts, and health worker training have increased tuberculosis detection and treatment completion (Khan et al., 2022). However, further research and targeted intervention strategies are needed to address the multiple health risks adolescents face, including those related to infectious diseases (Zhou et al., 2022).

Implementing environmental health principles can also be a long-term strategy in strengthening public health resilience. Not only does this approach prevent infectious diseases, it also improves the quality of life and general well-being of the community. For example, access to clean water and proper sanitation has been shown to increase productivity and reduce the economic burden of medical costs.

The role of environmental health workers is very important in this process. They not only carry out inspections and supervision, but also act as community educators in implementing clean and healthy living behavior (PHBS). In addition, support from the education sector and mass media is also needed to build collective awareness about the importance of protecting the environment to prevent disease.

Along with the development of technology and science, now there are many innovations that can be applied in environmental health management. Starting from an early detection system for

environmental-based diseases, environmentally friendly waste processing technology, to the use of geospatial data for mapping disease-prone areas. These innovations provide great opportunities in strengthening the prevention of infectious diseases through an environmental approach.

Thus, it is important for all parties to view environmental health as a long-term investment in creating a healthy and disease-resilient society. Improving environmental quality is not only the responsibility of the health sector, but is a shared task that must involve all elements of the nation. Awareness, concern, and real action in protecting the environment are the main keys to breaking the chain of transmission of infectious diseases.

2. METHOD

This article is written using a literature review method and an analytical descriptive approach. Sources of information are obtained from various scientific journals, official reports of health organizations such as WHO and the Ministry of Health, as well as national and international scientific articles relevant to the topic of environmental health and infectious diseases.

The inclusion criteria in the literature study were articles published in the last 10 years, in Indonesian and English, and discussing the direct relationship between environmental aspects and infectious diseases. The collected data were analyzed qualitatively with an emphasis on the causal relationship between environmental conditions and disease prevalence. In addition, a conceptual approach was used to explain environmental health interventions and their impact on reducing infectious diseases in the community, taking into account aspects of policy, implementation, and challenges in the field.

3. RESULTS AND DISCUSSION

The Relationship between Environmental Health and Infectious Diseases

The study results show that there is a strong correlation between environmental conditions and increased cases of infectious diseases. Environments with poor sanitation, contaminated water, and irregular waste disposal tend to be breeding grounds for vectors such as mosquitoes and rats, as well as media for the spread of disease-causing bacteria and viruses.

For example, WHO states that around 88% of diarrhea cases worldwide are caused by unsafe water access and poor sanitation. Likewise, dengue fever, which increases significantly in urban areas with poor waste management and drainage.

According to WHO, environmental health is an aspect of human health that is influenced by external physical, chemical and biological environmental factors. Its scope includes:

a) Clean water and sanitation management
b) Solid and liquid waste management
c) Disease vector control
d) Air quality
e) Healthy housing and settlements
f) Food safety and environmental hygiene

Environmental Health Intervention Strategies

Environmental health-based interventions have proven effective in reducing the incidence of infectious diseases. Programs such as Community-Led Total Sanitation (CLTS), handwashing with soap campaigns, and sustainable provision of clean water have had a significant impact on reducing environmental-based diseases.

In addition, vector control programs, such as fogging and draining water reservoirs, are routine efforts to overcome the spread of Aedes aegypti mosquitoes. Good residential environmental planning also helps reduce the risk of transmission.

Environmentally Influenced Infectious Diseases

Various studies and field data show a strong correlation between poor environmental conditions and high incidence of infectious diseases. In areas with poor sanitation, for example in densely populated settlements that do not have access to clean water and adequate waste disposal facilities, the

incidence of diseases such as diarrhea, leptospirosis, and skin diseases is much higher. Research by the Indonesian Ministry of Health (2022) found that 60% of diarrhea cases in Indonesia occur in areas with inadequate sanitation.
Some infectious diseases are closely related to environmental conditions, including:

Disease	Environmental Trigger Factors
Diarrhea	Contaminated drinking water, poor sanitation
Dengue Hemorrhagic Fever	Stagnant water as a breeding ground for mosquitoes
Malaria	Humid environment and presence of ponds/aquatic plants
TB	Poor ventilation and overcrowding
ISPA	Indoor and outdoor air pollution

Environmental Health-Based Prevention Strategies

a. Clean Water Provision

Clean water is a vital component of environmental health. Access to safe drinking water can reduce the risk of diarrhea by up to 58% (WHO, 2021). The use of clean water for daily needs also reduces the risk of gastrointestinal infections and skin diseases. Observations in several assisted villages show that clean water provision interventions have a significant effect on reducing the number of diarrheal diseases, especially in children under the age of five.
Clean water is very important to prevent diarrhea, cholera, and typhoid. Efforts that can be made:
a) Installation of safe water sources (deep wells, PDAM pipes)
b) Use of filters or heating of water before consumption

b. Sanitation and domestic and health waste management

Vector control, especially Aedes aegypti and Anopheles sp. mosquitoes, is key to preventing diseases such as dengue fever and malaria. Field studies have shown that routine mosquito nest eradication (PSN) can reduce the number of dengue fever cases by up to 40%. Environmental interventions such as eliminating stagnant water and educating the community about 3M (draining, covering, and recycling) have proven effective and sustainable.
Management of household waste and fecal waste:
a) Construction of healthy toilets
b) Integrated waste treatment system
c) Use of septic tanks that meet standards

c. Vector Control

Mosquito nest eradication (PSN) and public education regarding:
a) Draining, covering and recycling water containers
b) Fogging in dengue fever endemic areas

d. Air Quality

Reducing air pollution through:
a) Good ventilation in the house
b) Use of environmentally friendly fuels
c) Planting trees in dense areas

e. Decent Housing

Good ventilation, adequate lighting, and low housing density are positively correlated with low transmission of ARI and TB. In an observational study in slum areas of Jakarta, it was found that houses with poor ventilation had twice the prevalence of TB compared to houses with adequate ventilation. Therefore, healthy home design is an integral part of disease prevention strategies.
An ideal healthy home has:

a) Adequate lighting and ventilation
b) Waterproof floor
c) Sufficient distance between houses
d) Good drainage

The Role of Environmental Health Workers

Prevention of infectious diseases through an environmental health approach requires cross-sector collaboration. The involvement of health services, public works services, local governments, and NGOs is essential. The Community-Based Total Sanitation (STBM) Program is a real example of the success of multi-sector collaboration in increasing access to sanitation and reducing environmental-based diseases.

Environmental health officers have important duties, including:

a) Environmental risk factor surveillance
b) Public education about PHBS (Clean and Healthy Living Behavior)
c) Water and food quality monitoring
d) Rapid intervention in outbreak conditions

They also play a role in advocating for healthy environmental policies at the local and national levels.

The Role of Society in Environmental Health

Community empowerment is the key to success:

a) Through health cadres, community leaders, and local organizations
b) Mutual cooperation campaign to clean the environment
c) Participation in communal sanitation management and waste banks

Collective awareness and a clean culture are crucial to the success of a healthy environment program.

Implementation Challenges

Some of the main challenges in implementing environmental health programs are lack of funds, low public awareness, and limited environmental health workers. Therefore, it is necessary to strengthen policies, train officers, and increase community participation. Investment in the environmental health sector has proven to be cost-effective and has long-term health impacts.

Although many policies and intervention programs have been implemented, implementation in the field often faces obstacles, such as budget constraints, low community participation, and lack of coordination between sectors. Lack of education also causes the community to not realize the importance of their role in maintaining a healthy environment.

Challenges and Solutions

Challenge:

a) Lack of budget for sanitation infrastructure
b) People's behavior that is not yet aware of the importance of cleanliness
c) Lack of environmental health human resources

Solution:

a) Cross-sector collaboration (health, education, public works)
b) Implementation of environmentally friendly technology
c) Community-based program innovation (CLTS, digital waste bank)

4. CONCLUSION

Environmental health plays a very important role in preventing the spread of infectious diseases. Various interventions such as improving sanitation, clean water management, and vector control have been proven effective in reducing the incidence of disease. However, the success of these efforts is highly dependent on cross-sector collaboration and active community participation. Strong commitment from the government, health workers, and all elements of society is needed to create a

healthy environment as part of the public health resilience system. With an integrated and sustainable approach, efforts to prevent infectious diseases through improving environmental health can have a significant positive impact on the quality of life of the community. Environmental health plays a strategic role in preventing infectious diseases. Without environmental-based interventions, curative efforts will not be maximized. Synergy is needed between the government, health workers, and the community to create a clean, safe, and healthy environment. That way, the burden of infectious diseases can be reduced and the quality of life of the community will increase sustainably.

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