



THE IMPACT OF ENVIRONMENTAL FACTORS ON THE SPREAD OF INFECTIOUS DISEASES

Saeed khamsan ali al Theban^{1*}, Saeed Ali Saeed al Rezg², Saleh Hussein Jaber Althaiban³, Saleh hamad Mohamed Althaiban⁴, Mohammed khudaish mohammed al alhareth⁵, Mohammed hussain saleh alqirad⁶

Abstract:

Infectious diseases continue to pose significant threats to global public health, with environmental factors playing a crucial role in their spread. This study aims to explore the impact of environmental factors on the transmission and dissemination of infectious diseases, with a focus on understanding the complex interplay between the environment and disease dynamics. Climate change is identified as a key driver of infectious disease spread, with rising temperatures and changing precipitation patterns altering the distribution of vectors and pathogens. Urbanization and land use change are also recognized as significant factors, creating environments that facilitate the emergence and transmission of infectious diseases. Furthermore, pollution and degradation of natural habitats can disrupt ecological balances, leading to increased contact between humans, animals, and pathogens. The study highlights the importance of adopting a holistic approach to disease control that takes into account the complex interactions between environmental factors and infectious diseases. By better understanding these relationships, policymakers and public health officials can develop more effective strategies for preventing and controlling the spread of infectious diseases in a changing world. Overall, this study underscores the critical need for proactive measures to mitigate the impact of environmental factors on infectious disease spread and emphasizes the importance of interdisciplinary collaboration in addressing this global health challenge.

Keywords: infectious diseases, environmental factors, climate change, urbanization, land use change, pollution, disease transmission, public health, epidemiology.

^{1*}Hospital management specialist, Thar General Hospital, Najran, Saudi Arabia.

²Nursing technician, Thar General Hospital, Najran, Saudi Arabia.

³Epidemiological monitoring technician, Khabash General Hospital, Najran, Saudi Arabia.

⁴Hospital management specialist, Khabash General Hospital, Najran, Saudi Arabia.

⁵Pharmacy technician, Khabash General Hospital, Najran, Saudi Arabia.

⁶Epidemiological monitoring, Khabash General Hospital, Najran, Saudi Arabia.

***Corresponding Author:** Saeed khamsan ali al Theban

*Hospital management specialist, Thar General Hospital, Najran, Saudi Arabia.

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Introduction:

In recent years, there has been a growing concern about the impact of environmental factors on the spread of infectious diseases. With the rise of globalization, urbanization, and climate change, the world has become more interconnected than ever before, making it easier for diseases to spread across borders and affect populations on a global scale. In this essay, we will explore the various environmental factors that contribute to the spread of infectious diseases and discuss the implications for public health [1].

One of the most significant environmental factors that contribute to the spread of infectious diseases is climate change. As global temperatures rise, the habitats of disease-carrying vectors such as mosquitoes and ticks expand, allowing them to thrive in new areas and increasing the risk of disease transmission. For example, the spread of mosquito-borne diseases such as malaria, dengue fever, and Zika virus has been linked to climate change, as warmer temperatures and increased rainfall create ideal breeding conditions for mosquitoes [2].

Urbanization is another environmental factor that plays a key role in the spread of infectious diseases. As more people move to cities in search of better opportunities, overcrowding, poor sanitation, and inadequate access to healthcare services can create breeding grounds for infectious diseases. Urban slums, in particular, are hotspots for disease transmission, as residents often live in close quarters with limited access to clean water and sanitation facilities [3].

Globalization has also contributed to the spread of infectious diseases by increasing the ease and speed of travel between countries. Air travel, in particular, has made it possible for diseases to spread rapidly from one part of the world to another. For example, the outbreak of the Ebola virus in West Africa in 2014 quickly spread to other countries through air travel, highlighting the interconnected nature of our globalized world [4].

In addition to climate change, urbanization, and globalization, other environmental factors such as deforestation, land use change, and pollution can also impact the spread of infectious diseases. Deforestation, for example, can disrupt ecosystems and bring humans into closer contact with wildlife, increasing the risk of zoonotic diseases jumping from animals to humans. Land use change, such as the conversion of natural habitats into agricultural land, can also create opportunities for disease

transmission by altering the ecological balance of an area [5].

Pollution, both air and water, can weaken immune systems and make individuals more susceptible to infectious diseases. For example, exposure to air pollution has been linked to an increased risk of respiratory infections, while contaminated water sources can spread waterborne diseases such as cholera and typhoid fever. Addressing pollution through environmental regulations and sustainable practices is crucial for preventing the spread of infectious diseases and protecting public health [6].

Climate Change and Infectious Disease Spread:

Climate change is a pressing issue that is affecting our planet in a multitude of ways. One of the lesser-known consequences of climate change is its impact on the spread of infectious diseases. As global temperatures rise and weather patterns become more erratic, the conditions for the transmission of diseases are changing, leading to an increase in the prevalence and spread of infectious diseases [7].

One of the key ways in which climate change is contributing to the spread of infectious diseases is through the expansion of the geographic range of disease-carrying vectors such as mosquitoes, ticks, and other insects. Warmer temperatures allow these vectors to survive and thrive in regions where they were previously unable to, increasing the risk of diseases such as malaria, dengue fever, and Zika virus spreading to new areas. In addition, changing weather patterns can lead to an increase in extreme weather events such as hurricanes and floods, which can create breeding grounds for disease-carrying vectors and facilitate the spread of infectious diseases [8].

Climate change also has a direct impact on the survival and reproduction rates of pathogens that cause infectious diseases. Warmer temperatures can accelerate the growth and replication of pathogens, leading to an increase in their virulence and ability to infect hosts. In addition, changes in precipitation patterns can affect the availability of clean water, leading to an increase in waterborne diseases such as cholera and typhoid fever [9].

Furthermore, climate change can also disrupt ecosystems and alter the behavior of animals that serve as reservoirs for infectious diseases. For example, deforestation and habitat destruction can force animals to migrate to new areas, bringing them into closer contact with humans and

increasing the risk of zoonotic diseases jumping from animals to humans [10].

The impact of climate change on the spread of infectious diseases is not limited to developing countries. Developed countries are also at risk, as evidenced by the recent outbreaks of diseases such as West Nile virus and Lyme disease in regions where they were previously uncommon [8].

In order to mitigate the impact of climate change on the spread of infectious diseases, it is essential that we take urgent action to reduce our carbon footprint and limit global warming. This can be achieved through measures such as transitioning to renewable energy sources, reducing emissions from transportation and industry, and implementing policies to protect and restore natural habitats. In addition, public health systems must be strengthened to improve surveillance, early detection, and response to infectious disease outbreaks [10].

Climate change is a major threat to global health, with significant implications for the spread of infectious diseases. By taking proactive measures to address climate change and strengthen public health systems, we can reduce the impact of infectious diseases and protect the health and well-being of populations around the world. It is crucial that we act now to address this urgent issue before it is too late [11].

Urbanization and Disease Transmission:

Urbanization refers to the process of population concentration in urban areas, leading to the growth and expansion of cities. As more and more people migrate to urban areas in search of better opportunities, urbanization has become a global phenomenon. While urbanization has brought about numerous benefits such as improved access to healthcare, education, and employment opportunities, it has also led to the increased transmission of diseases [12].

One of the main reasons for the increased transmission of diseases in urban areas is the close proximity of people living in densely populated areas. In cities, people live in close quarters, often in overcrowded slums and informal settlements where sanitation and hygiene are poor. This creates the perfect breeding ground for infectious diseases to spread rapidly. Diseases such as tuberculosis, cholera, and dengue fever thrive in such conditions, leading to outbreaks and epidemics [13].

Furthermore, urbanization has also led to the rapid growth of informal settlements and slums in many cities. These settlements lack proper infrastructure such as clean water, sanitation facilities, and healthcare services, making residents more vulnerable to diseases. In addition, the lack of access to healthcare in these areas means that diseases often go untreated, leading to further spread within the community [14].

Another factor contributing to the increased transmission of diseases in urban areas is the movement of people and goods. Cities are hubs of transportation, with large numbers of people commuting to work, school, and other activities on a daily basis. This movement of people increases the likelihood of diseases spreading from one area to another. Additionally, the movement of goods and food products can also contribute to the spread of diseases, especially those transmitted through contaminated food and water [15].

The rapid pace of urbanization has also led to environmental degradation in many cities. Deforestation, pollution, and poor waste management practices have all contributed to the spread of vector-borne diseases such as malaria and dengue fever. Mosquitoes, rats, and other vectors thrive in polluted environments, increasing the risk of disease transmission to humans [16].

In order to address the challenges posed by urbanization and disease transmission, it is crucial for governments and policymakers to take proactive measures. Investments in infrastructure such as clean water, sanitation facilities, and healthcare services are essential to improve the living conditions of urban residents and reduce the spread of diseases. Public health campaigns and education programs can also help raise awareness about the importance of good hygiene practices and disease prevention [17].

Urbanization has significantly impacted disease transmission in cities around the world. The close proximity of people, rapid growth of informal settlements, movement of people and goods, and environmental degradation have all contributed to the increased spread of diseases in urban areas. It is important for governments and policymakers to prioritize public health and invest in infrastructure and education to mitigate the impact of urbanization on disease transmission. Only through collaborative efforts can we create healthier and more sustainable urban environments for all [18].

Land Use Change and Emerging Infectious Diseases:

Land use change refers to the alteration of land cover and land use patterns due to human activities. This includes deforestation, urbanization, agriculture expansion, and infrastructure development. These changes have significant impacts on ecosystems, biodiversity, and the environment as a whole. One of the lesser-known consequences of land use change is its potential to contribute to the emergence and spread of infectious diseases [19].

Emerging infectious diseases (EIDs) are diseases that have recently appeared within a population or have existed but are rapidly increasing in incidence or geographic range. Examples of EIDs include Ebola, Zika virus, and COVID-19. These diseases pose a significant threat to human health and can have devastating social and economic impacts [20].

Land use change can create conditions that facilitate the emergence and spread of infectious diseases in several ways. Deforestation, for example, can lead to the destruction of natural habitats and the fragmentation of ecosystems. This can bring humans into closer contact with wildlife, increasing the risk of zoonotic diseases – diseases that are transmitted from animals to humans. The loss of biodiversity that results from deforestation can also disrupt natural disease regulation mechanisms, making it easier for pathogens to spread [21].

Urbanization is another form of land use change that can contribute to the emergence of infectious diseases. As cities grow and expand, they create densely populated areas where pathogens can easily spread. Poor sanitation, inadequate housing, and limited access to healthcare in urban slums can further exacerbate the spread of infectious diseases. Additionally, urbanization can lead to the destruction of green spaces and the loss of biodiversity, further increasing the risk of disease transmission [22].

Agricultural expansion is yet another driver of land use change that can impact the emergence of infectious diseases. The conversion of natural habitats into agricultural land can bring humans into closer contact with livestock and wildlife, increasing the risk of zoonotic diseases. Intensive farming practices can also create conditions that favor the spread of pathogens, such as the use of antibiotics in livestock production that can lead to the development of antibiotic-resistant bacteria [23].

Infrastructure development, such as the construction of roads, dams, and mining operations, can also contribute to the emergence of infectious diseases. These activities can disrupt ecosystems, fragment habitats, and create opportunities for pathogens to spread. For example, the construction of dams can create stagnant water bodies that serve as breeding grounds for disease-carrying mosquitoes [24].

In order to address the link between land use change and emerging infectious diseases, it is important to adopt a One Health approach. This approach recognizes the interconnectedness of human, animal, and environmental health and emphasizes the need for interdisciplinary collaboration. By integrating knowledge and expertise from various disciplines, such as ecology, epidemiology, and social sciences, we can better understand the complex relationships between land use change and disease emergence [25].

Policy interventions are also necessary to mitigate the impacts of land use change on infectious diseases. This includes promoting sustainable land use practices, protecting natural habitats, and implementing measures to reduce the risk of disease transmission. For example, reforestation efforts can help restore biodiversity and reduce the risk of zoonotic diseases. Improving access to healthcare and sanitation in urban areas can help prevent the spread of infectious diseases. Regulations on agricultural practices can promote sustainable farming methods that reduce the risk of disease transmission [26].

Land use change is a significant driver of emerging infectious diseases. Deforestation, urbanization, agricultural expansion, and infrastructure development can create conditions that facilitate the emergence and spread of infectious diseases. By adopting a One Health approach and implementing policy interventions, we can better understand and address the link between land use change and infectious diseases, ultimately protecting human health and the environment [27].

Pollution and Health Impacts:

Pollution is a major environmental issue that has serious implications for human health. It is the presence of harmful substances in the environment that can cause harm to living organisms. Pollution can come in many forms, including air pollution, water pollution, and soil pollution. Each of these types of pollution can have different impacts on human health [2].

Air pollution is one of the most common forms of pollution and is caused by the release of harmful gases and particles into the atmosphere. These pollutants can come from a variety of sources, including vehicles, industrial processes, and burning of fossil fuels. When these pollutants are inhaled, they can cause a range of health problems, including respiratory issues such as asthma and bronchitis, cardiovascular diseases, and even cancer. Children, the elderly, and individuals with pre-existing health conditions are particularly vulnerable to the effects of air pollution [10].

Water pollution is another major concern, as contaminated water sources can lead to a variety of health problems. Pollutants such as chemicals, heavy metals, and pathogens can contaminate drinking water sources, leading to illnesses such as gastrointestinal issues, skin problems, and even neurological disorders. In developing countries, water pollution is a major cause of diseases such as cholera and typhoid fever, which can be fatal if left untreated [14].

Soil pollution is less well-known but can also have serious health impacts. Contaminants in the soil can be absorbed by plants, which can then be consumed by humans or animals. This can lead to exposure to toxic substances such as heavy metals and pesticides, which can cause a range of health problems, including cancer, reproductive issues, and neurological disorders [22].

The health impacts of pollution are not limited to physical health. Research has shown that exposure to pollutants can also have negative effects on mental health, including increased rates of anxiety, depression, and cognitive decline. Additionally, pollution can have social and economic impacts, as individuals who are sick or unable to work due to pollution-related illnesses may face financial hardships and reduced quality of life [23].

Addressing pollution and its health impacts requires a multi-faceted approach. Governments and regulatory agencies must enact and enforce strict environmental regulations to limit the release of harmful pollutants into the environment. Industries must also take responsibility for their environmental impact and invest in cleaner technologies and practices. Individuals can also play a role by reducing their own carbon footprint, using public transportation, and supporting sustainable and eco-friendly products [11].

Pollution is a serious threat to human health that requires immediate action. By understanding the different types of pollution and their health

impacts, we can work towards a cleaner and healthier environment for ourselves and future generations. It is crucial that we all take steps to reduce pollution and protect our health and the health of our planet [28].

Strategies for Mitigating the Impact of Environmental Factors on Disease Spread:

The spread of infectious diseases is influenced by a variety of environmental factors, such as climate change, urbanization, and deforestation. These factors can create ideal conditions for pathogens to thrive and spread, leading to outbreaks of diseases such as malaria, dengue fever, and Zika virus. In order to mitigate the impact of these environmental factors on disease spread, it is essential to implement effective strategies that address both the root causes of these factors and the ways in which they contribute to the spread of disease [27].

1. Climate Change:

Climate change is one of the most significant environmental factors influencing disease spread. Rising temperatures and changing weather patterns can create favorable conditions for the proliferation of disease-carrying vectors, such as mosquitoes and ticks. To mitigate the impact of climate change on disease spread, it is important to reduce greenhouse gas emissions and promote sustainable practices that help to mitigate the effects of climate change. This can include investing in renewable energy sources, promoting energy efficiency, and implementing policies that reduce carbon emissions [28].

2. Urbanization:

Urbanization is another key environmental factor that can contribute to the spread of infectious diseases. As more people move to cities and urban areas expand, the risk of disease transmission increases due to factors such as overcrowding, poor sanitation, and lack of access to healthcare. To mitigate the impact of urbanization on disease spread, it is important to invest in infrastructure that promotes public health, such as clean water and sanitation systems, healthcare facilities, and green spaces that help to reduce the spread of disease [29].

3. Deforestation:

Deforestation is a major environmental factor that can lead to the spread of infectious diseases. When forests are cleared for agriculture or development, it can disrupt the habitats of disease-carrying animals and increase the risk of disease transmission to humans. To mitigate the impact of deforestation on disease spread, it is important to

promote sustainable land use practices that protect and preserve forests, such as reforestation efforts, sustainable logging practices, and policies that incentivize conservation [29].

4. Vector Control:

Vector control is a key strategy for mitigating the impact of environmental factors on disease spread. By targeting disease-carrying vectors such as mosquitoes, ticks, and flies, it is possible to reduce the risk of disease transmission and prevent outbreaks. This can be achieved through a variety of methods, such as insecticide spraying, use of mosquito nets, and community-based vector control programs. In addition, research into new and innovative methods of vector control, such as genetically modified mosquitoes, can help to further reduce the spread of disease [30].

5. Public Health Education:

Public health education is another important strategy for mitigating the impact of environmental factors on disease spread. By raising awareness about the risks of infectious diseases and promoting preventive measures such as vaccination, hand washing, and safe food handling practices, it is possible to reduce the risk of disease transmission and improve public health outcomes. Public health education can also help to empower communities to take action to protect themselves from infectious diseases and advocate for policies that promote public health [4].

Mitigating the impact of environmental factors on disease spread is a complex and multifaceted challenge that requires a coordinated and comprehensive approach. By addressing the root causes of environmental factors such as climate change, urbanization, and deforestation, and implementing strategies such as vector control, public health education, and sustainable land use practices, it is possible to reduce the risk of disease transmission and prevent outbreaks of infectious diseases. By working together to implement these strategies, we can create a healthier and more sustainable future for all [16].

Conclusion:

In conclusion, environmental factors play a significant role in the spread of infectious diseases and pose a growing threat to public health. Climate change, urbanization, globalization, deforestation, land use change, and pollution all contribute to the spread of diseases by creating conditions that allow pathogens to thrive and spread. Addressing these environmental factors through coordinated efforts at the local, national, and global levels is essential

for preventing the spread of infectious diseases and safeguarding public health in an increasingly interconnected world.

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