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Review IJI

Insects and Public Health

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Abstract

Insects have two roles in public health: they can spread disease and help with health treatments. This article looks at the complicated relationship between insects and public health, with a focus on how they spread diseases, including malaria, dengue, Zika, and Lyme disease. The ecology, behavior, and distribution of important vector species are looked at along with the social and environmental elements that cause outbreaks. The article also talks about how more people are interested in how insects might be used for good, including in sustainable food systems, waste management, and even medical treatments. There is talk about public health tactics for vector management, surveillance, and getting people involved in the community. These strategies stress the need for integrated, interdisciplinary approaches. As climate change and urbanization transform insect populations all over the world, it is more important than ever to understand how they affect human health. This review emphasizes the necessity for ongoing research and innovation in the management of the hazards and advantages that insects present to public health.

Keywords: Vector-borne diseases, insect ecology, public health monitoring, vector control, climate change and the spread of diseases

INTRODUCTION

Insects are some of the most varied and common living things on Earth. They are very important to ecosystems and to people. But they have a big and complicated effect on public health. Some insects are important pollinators that help keep food supplies safe and the environment in balance. Others, on the other hand, spread some of the deadliest infectious diseases in the world. Mosquitoes carry malaria, dengue fever, Zika virus, and chikungunya, which together infect millions of people every year and put a lot of strain on health systems, especially in low- and middle-income countries.

Changes in the environment, like global warming, urbanization, and deforestation, are making it even harder to understand how insects affect public health. These changes are making the habitats and breeding grounds of disease-carrying species bigger. These changes not only make outbreaks more likely, but they also make it harder to use traditional methods of vector management. At the same time, new research is looking into how insects might be used to improve health such as by being a source of sustainable food or by being used in new biomedical applications [1–17].

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This article looks at the important links between insects and public health, focusing on the problems they cause as disease carriers and the chances to use their potential to improve health and sustainability. We want to let public health professionals, policymakers, and researchers know that we need integrated strategies to deal with health risks caused by insects in a world that is always changing.

IMPORTANCE

To solve some of the biggest global health problems, we need to know how insects affect public health. The World Health Organization says

that vector-borne diseases spread by insects make up more than 17% of all infectious diseases and kill more than 700,000 people each year. Controlling these diseases is still hard, even if science and technology have come a long way. This is because of things like pesticide resistance, changing climatic patterns, and increased urbanization.

Insects are more than just disease carriers; they also have tremendous potential for improving public health. Researchers are looking into them more as long-term sources of protein, ways to break down biowaste, and even new compounds that can kill germs or help wounds heal. Acknowledging the dual role of insects – as both hazards and assets – expands the framework of public health initiatives and creates new opportunities for investigation and action.

This article stresses the importance of insects in both causing and fixing public health problems. It also stresses the need for people from different fields, such as entomology, epidemiology, environmental science, and public policy, to work together. To establish strong health systems and make sure that health and the environment last for a long time, we need to deal with health problems caused by insects in a comprehensive way.

STATEMENT OF RESEARCH

This article examines the complex relationship between insects and public health, emphasizing their role as disease vectors and their increasing significance in health-related advances. The study seeks to investigate the ecological, environmental, and social determinants affecting the transmission of insect-borne diseases, while also evaluating existing and prospective applications of insects in sustainable public health initiatives. This project aims to deliver a holistic comprehension of the influence of insects on health outcomes by integrating findings from entomology, epidemiology, and public health disciplines, while identifying solutions to mitigate risks and maximize benefits.

Framework for Research

The research is organized within an interdisciplinary framework that amalgamates concepts from entomology, epidemiology, environmental science, and public health policy. The framework aims to investigate the detrimental and beneficial activities of insects concerning human health through the following essential components.

Vector Ecology and the Spread of Disease

Looks at how the biology, behavior, and environment of insects help transmit vector-borne diseases such as malaria, dengue, Zika, and Lyme disease.

Concentrates on vector-host interactions, reproductive behaviors, and spatial distribution.

Factors that Affect the Environment and Society

- Looks examines how climate change, urbanization, deforestation, and socioeconomic factors affect insect populations and the risk of disease.
- Looks examines how well the public health system and community-level solutions work.

Vector Control and Strategies for Public Health

- Look at the different ways that vector control is done now, such as using pesticides, changing genes, biological control, and community-based initiatives.
- Looks at problems like developing resistance, affecting the environment, and putting policies into action.

New and Useful Ways to Use Insects

- Investigates novel applications, including insects in sustainable agricultural systems, waste management, wound healing, and antimicrobial research.

- Looks at the moral, cultural, and safety effects of these kinds of new ideas.

INTEGRATED HEALTH POLICY AND WORKING TOGETHER ACROSS FIELDS

- Stresses the importance of having coordinated plans in the health, environment, and agriculture sectors.
- Promotes research and data sharing across disciplines to improve surveillance, readiness, and response.
- This approach enables a comprehensive examination of the intersection between insects and human health across various areas, facilitating the formulation of balanced solutions that reduce risk while fostering innovation.

Objectives of the Research

- To examine the function of insects as vectors in the dissemination of significant infectious illnesses.
- Concentrate on ailments including malaria, dengue, Zika, chikungunya, and Lyme disease.
- To investigate the environmental, ecological, and societal elements that cause insect-borne illness outbreaks:
  - Look at how climate change, urbanization, deforestation, and socioeconomic conditions affect things.
  - To assess existing vector control tactics and public health initiatives.
  - Evaluate the efficacy, constraints, and sustainability of chemical, biological, and community-oriented methodologies.
- To investigate how insects might be used to improve public health in new ways:
  - Include applications in sustainable food systems, medical biotechnology, and waste management.
  - To encourage the use of integrated and interdisciplinary methods to solve public health problems related to insects
  - Encourage cooperation between entomologists, environmental scientists, public health professionals, and policymakers.

REVIEW OF THE LITERATURE

There is a lot of research on the link between insects and public health. A lot of it looks at how insects can spread disease and how they might help with long-term health problems.

Insects as Vectors of Disease

An extensive study has shown that insects, especially mosquitoes, ticks, fleas, and sandflies, play a big role in spreading infectious diseases. The World Health Organization (WHO, 2022) says that vector-borne diseases account for more than 17% of all infectious diseases in the world [17]. Important research has looked at mosquito-borne diseases such as malaria, dengue, and Zika virus [5, 8]. These studies show how changes in the behavior of the vector, the climate, and the habitat can affect the spread of disease. Ticks have garnered attention for their involvement in the transmission of Lyme disease and other tick-borne diseases, especially in temperate areas [4].

Environmental and Socioeconomic Influences

Numerous researchers have investigated the impact of environmental transformations – such as global warming, deforestation, and urbanization – on insect dispersion and the heightened risk of human exposure to vector-borne diseases [9, 11]. Socioeconomic factors, such as healthcare access, sanitation, and education, are essential in influencing the prevalence and management of insect-borne diseases [10, 14]. These studies underscore the significance of place-based and equity-centered methodologies in public health planning.

Vector Control Strategies

The literature on vector control includes both old and new ways. Old methods include insecticide-treated nets (ITNs) and indoor spraying, while new methods include genetically engineered mosquitoes

[1, 3]. Although several interventions have demonstrated efficacy, resistance to insecticides and the ecological ramifications of innovative methodologies continue to be substantial issues [6]. Integrated Vector Management (IVM), supported by WHO, has become more popular as a more sustainable, evidence-based method [2].

Beneficial Roles of Insects in Health and Sustainability

Recent studies have shifted towards exploring the positive applications of insects in public health. Black army flies and mealworms are two types of insects that are being pushed as sustainable sources of protein that can help with food insecurity and malnutrition [15]. Maggot debridement therapy has demonstrated efficacy in wound healing within the realm of medical research, especially in chronic instances [12]. In addition, insects are becoming more well-known for their possible roles in biodegradation and bioconversion processes that are good for the environment.

Interdisciplinary Approaches and Policy Gaps

Despite advancements in the scientific understanding of insects in health contexts, researchers emphasize an enduring disparity between research and policy [7, 16]. The demand for multidisciplinary collaboration is reiterated in the literature, with an increasing agreement that successful public health initiatives necessitate contributions from entomologists, ecologists, social scientists, and policymakers.

The literature shows that the relationship between insects and public health is complicated and changing. Despite substantial advancements in comprehending and alleviating the problems associated with insects, new challenges – such as climate change and resistance – necessitate innovative, interdisciplinary approaches. At the same time, the possible benefits of insects in long-term health interventions need to be investigated more and included in legislative frameworks.

Examination/Analysis

This section offers a critical examination of the dual function of insects in public health, emphasizing disease transmission, environmental impacts, control measures, and novel advantageous applications. The approach utilizes contemporary literature, case studies, and global health data to investigate significant patterns, challenges, and opportunities.

How Diseases Spread

The study of vector-borne diseases demonstrates that insects are to blame for some of the worst public health problems in the world. Mosquitoes are the most studied vectors because they spread diseases like malaria, dengue, chikungunya, and Zika. These diseases hit tropical and subtropical areas with weak health systems the hardest.

Important things that affect transmission are:

- Vector biology (e.g., life cycle, feeding behavior).
- The number of people living in an area and the number of hosts available.
- Changes in the weather and seasons, such as temperature and rainfall.
- How Aedes aegypti and other vectors adapt to living in cities.
- These variables make it hard to stop epidemics and make it harder to control diseases in the long term.

Drivers of the Environment and Society

An environmental study shows that climate change and the spread of disease-carrying vectors are directly related. Rising temperatures, changes in rainfall patterns, and severe weather events are allowing disease vectors to spread to new locations, even those that were thought to be low-risk (such as southern Europe and North America).

Urbanization, bad waste management, and differences in income and education are the perfect places for diseases to spread and make it hard to get good care or preventive measures. These situations are

especially clear in low-income neighborhoods and refugee camps, where public health institutions may be overworked.

Assessing Vector Control Strategies

- Some places have seen a big drop in disease burden thanks to current vector management methods like insecticide-treated nets (ITNs), indoor residual spraying (IRS), and larviciding. But there are still problems:
  - Resistance to insecticides is growing, making chemical control less effective.
  - There isn't enough research on how chemicals affect the environment, which is bad for biodiversity and human health.
  - Gene drives and sterile insect techniques are examples of genetic technologies that show promise yet are being looked at closely for ethical, ecological, and legal reasons.
  - IVM is a potential framework that uses chemical, biological, and environmental treatments in a way that is both cost-effective and long-lasting, based on the needs of each area.

Insects as Resources for Public Health

- Data is showing increasingly that insects are helpful. For instance:
  - Insects that you can eat are good for you and don't hurt the environment, so they can help with hunger and food poverty.
  - In modern wound care, maggot therapy is used to clean wounds and stop infections.
  - To cut down on organic waste and provide animal feed, urban sanitation programs are using more insects, such as black army flies, in waste management.
  - These new ideas not only help people's health directly, but they also assist the One Health concept by connecting human, animal, and environmental health.

Policy and Integration Across Disciplines

Even while scientists are coming to a consensus, it is still slow and patchy to implement policies. A lot of national health programs treat vector control as a separate issue, without fully including policies for the environment or agriculture. Furthermore, there is inadequate interdisciplinary collaboration among entomologists, public health professionals, and urban planners.

Global frameworks, such as the Global Vector Control Response (GVCR) by WHO, call for better integration, creating capacity, and getting communities involved. However, these things are not happening the same way in all countries.

Summary of Results

- Insects are still an important way for diseases to spread, especially in areas that are vulnerable to climate change.
- Environmental and social factors significantly exacerbate insect-related health concerns.
- Current control efforts encounter biological, ecological, and practical constraints.
- Using beneficial insects is an opportunity that isn't used enough.
- For long-lasting change, we need to move towards multidisciplinary and systems-based approaches.

DISCUSSION

The examination of insects' dual role in public health uncovers a multifaceted and dynamic environment. Insects are still the main carriers of many dangerous diseases, but more and more people are seeing how they could help with long-term public health practices. This dichotomy necessitates a sophisticated comprehension and a more cohesive response from the global health community.

Insects as Ongoing Threats to Public Health

Vector-borne diseases continue to cause a lot of illness and death, especially in tropical and subtropical areas, even though people have been trying to manage them for decades. The ongoing

presence of malaria, dengue, Zika, and other insect-borne diseases demonstrates the flexibility of insect vectors and the inadequacies of existing health infrastructure and disease preventive measures.

Insecticide resistance is also a developing worry that could make long-used techniques for controlling vectors less effective. Because fewer new pesticides are coming out, relying on chemical-based approaches may not be possible anymore. This makes it even more important to put money into IVM and other options that are better for the environment.

Changes in the Environment and the Rise of Disease

Climate change and urbanization are changing where insect vectors live. In cities with dirty water and insufficient sanitation, insects, like *Aedes aegypti*, are prospering. This increases the danger of dengue and chikungunya outbreaks. At the same time, warmer temperatures are allowing ticks and mosquitoes to travel into temperate areas, bringing diseases that are spread by these animals into places where they weren't before.

This environmental aspect makes it harder to predict diseases and means that public health planning needs to include climate modeling, environmental monitoring, and urban design to get ready for and reduce new health hazards.

Reframing Insects as Partners in Public Health

A lot of the research and news focuses on the dangers of insects, but increased information shows that they can be good for health and the environment. Insects are becoming more popular to address hunger and malnutrition since they are nutritious and low-emission food sources. In medicine, maggot therapy and chemicals made from insects look like they could be useful for wound care and making new antibiotics.

In addition, insects are being used in circular economy models, where species, like black army flies, turn organic waste into useful protein and fertilizer. These new ideas fit with the One Health paradigm because they connect the health of the environment to the health of people.

But these usages do come with certain problems. To make sure that insects are used in a safe and responsible way for health and sustainability, we need to think about public acceptance, safety rules, cultural factors, and ethical issues.

The Necessity for Cohesive, Multidisciplinary Strategies

A common topic is that different fields and sectors don't work well together. Vector control is frequently isolated from more comprehensive health and environmental efforts. When it comes to insect-borne diseases, public health programs tend to react instead of being proactive.

- To deal with the problems and challenges that insects provide, you need to:
  - Collaboration across sectors, including health, agriculture, and environmental agencies
  - More money spent on getting people involved in their communities and teaching them
  - Involving entomologists, climate scientists, and urban planners in decisions about health
  - Such integration is crucial for transitioning from reactive illness management to robust, prevention-oriented public health systems.

Things to Think About for Global Health Equity

Lastly, it's vital to remember that not everyone has the same amount of insect-related health problems. Low-income countries have more problems since their health infrastructure is weaker, they have fewer resources, and they are more likely to be near vector habitats. To fix these unfair situations, we need to:

- Building capacity.
- Moving technology.

- Support for international finance and policy.
- For world health to move forward, it is important to make sure that the dangers and benefits of insect interactions are handled fairly.
- The confluence of insects and public health poses persistent issues and novel opportunities. Seeing insects as both risks and perhaps contributors to long-lasting health systems is a big change in thinking. To effectively manage the various roles that insects play in human health, future policies must be interdisciplinary, forward-looking, and equity driven.

Limitations

This article offers a thorough examination of the connection between insects and public health; nevertheless, certain limitations must be recognized:

- *Scope of Literature:* The review mainly uses research and reports that are already published and available to the public. This could cause publication bias. New or unpublished research, especially from places with few resources, may not be properly represented.
- *Geographical Focus:* Most of the data and case studies that are accessible are from tropical and subtropical areas, where vector-borne diseases are most common. This makes it harder to apply some of the results to temperate or dry areas where the effects of insects can be different.
- *Rapidly Changing Context:* The dynamics of insect-borne diseases and insect-related inventions are changing quickly because of things like climate change, urban growth, and new technologies. This means that some ideas may not be true anymore as fresh data comes in.
- *Complex Interactions:* The multidimensional character of insect-related public health issues – encompassing ecological, social behavior, economics, and policy – complicates the isolation of individual variable impacts, resulting in potential oversimplifications.

Limited Focus on Cultural and Ethical Dimensions

Although the article mentions the cultural acceptance and ethical issues of using insects in food and medicine, it doesn't go into much into on these issues. Further investigation is necessary to enhance comprehension of community viewpoints and ethical frameworks.

Recognizing these constraints emphasizes the necessity for continued, interdisciplinary research into the roles insects play in public health.

SUGGESTIONS

The investigation and findings have led to the following suggestions for how to best deal with the problems and take advantage of the benefits insects bring to public health.

Make IVM Stronger

Support vector control tactics that are long-lasting and use a variety of methods, such as chemicals, biology, the environment, and community-based approaches, that are specific to each area.

To make sure that insecticides work for a long time, keep a close eye on and control resistance.

Improve Surveillance and Data Integration

Make strong, real-time surveillance systems that combine data on insects, diseases, the environment, and the weather to help with early warning and reaction to epidemics.

Encourage data sharing between countries and sectors to help public health efforts work together.

Put Money into Research and New Ideas

Support research into new ways to manage vectors, including genetic approaches and ecologically benign ones.

Increase research on how insects can be used safely and culturally accepted in nutrition, medicine, and waste management.

Encourage Collaboration Between Different Fields

Promote collaboration between legislators, urban planners, entomologists, public health experts, and environmental scientists.

Encourage people in the community to get involved and learn so that interventions are culturally and socially acceptable.

Take Care of Social and Environmental Factors

Add climate change adaptation and sustainable urban design to public health efforts to cut down on places where vectors can breed.

Focus on making housing, sanitation, and health infrastructure better, especially in poor and vulnerable populations.

Support Fairness and Building Capacity

Give low- and middle-income countries technical and financial help to improve their public health systems and vector control programs.

Support policies that make sure everyone can get insect-based health advances and interventions.

To put these suggestions into action, people at the local, national, and global levels will need to work together, with strong political will and ongoing funding. This integrated strategy will be essential for diminishing the costs of insect-borne diseases while leveraging the beneficial aspects of insects in public health.

CONCLUSIONS

Insects play a crucial and multifaceted role in public health, both as vectors for some of the most consequential infectious diseases globally and as potential partners in sustainable health initiatives. The ongoing threat of vector-borne diseases highlights the critical necessity for novel, cohesive, and contextually tailored control techniques, particularly in response to environmental transformations such as climate change and urban expansion.

At the same time, recognizing and using the good uses of insects, which range from sustainable diet to medical cures, could lead to better health and a more sustainable environment. To deal with the many problems and challenges, we need to work together across disciplines, improve surveillance, and make policies that are fair and encourage community involvement.

A balanced and forward-thinking approach to insects and public health can help health systems become more robust, lower the number of diseases, and support long-term growth around the world.

REFERENCES

1. Alphey L. Genetic regulation of mosquitoes. Annu Rev Entomol. 2014;59:205–24. https://doi.org/10.1146/annurev-ento-011613-162044.
2. Beier JC, Keating J, Githure JI, Macdonald MB, Impoinvil DE, Novak RJ, et al. Integrated vector management for controlling malaria. Malar J. 2008;7(Suppl 1):S4. https://doi.org/10.1186/1475-2875-7-S1-S4.
3. Carnevale P, Robert V, Wirth DF. Mosquitoes and Malaria: The Biology of Vectors and how to control them. CRC Press; 2012.
4. Eisen RJ, Eisen L. The blacklegged tick, Ixodes scapularis, is becoming a bigger public health problem. Trends Parasitol. 2018;34(4):295–309. https://doi.org/10.1016/j.pt.2017.12.006.

5. Gubler DJ. Dengue, urbanisation, and globalisation: The evil trinity of the 21st century. Trop Med Health. 2011;39(4 Suppl):3–11. https://doi.org/10.2149/tmh.2011-S05.
6. Hemingway J, Ranson H, Magill A, Kolaczinski J, Fornadel C, Gimnig J, et al. Preventing a malaria catastrophe: May pesticide resistance impede malaria management? Lancet. 2016;387(10029):1785–8. https://doi.org/10.1016/S0140-6736(16)30552-6.
7. Lambrechts L, Scott TW, Gubler DJ. Consequences of the increasing global spread of Aedes albopictus on dengue virus transmission. PLoS Negl Trop Dis. 2010;4(5):e646. https://doi.org/10.1371/journal.pntd.0000646.
8. Musso D, Gubler DJ. Zika virus. Clin Microbiol Rev. 2016;29(3):487–524. https://doi.org/10.1128/CMR.00072-15.
9. Patz JA, Campbell-Lendrum D, Holloway T, Foley JA. The effect of regional climate change on human health. Nature. 2005;438(7066):310–7. https://doi.org/10.1038/nature04188.
10. Reiter P. The relationship between climate change and diseases spread by mosquitoes. Environ Health Perspect. 2001;109(Suppl 1):141–61. https://doi.org/10.1289/ehp.01109s1141.
11. Ryan SJ, Carlson CJ, Mordecai EA, Johnson LR. Climate change is causing the danger of Aedes-borne virus transmission to spread around the world and shift where it happens. PLoS Negl Trop Dis. 2019;13(3):e0007213. https://doi.org/10.1371/journal.pntd.0007213.
12. Sherman RA. Maggot therapy for diabetic foot ulcers that don't respond to standard treatment. Diabetes Care. 2003;26(2):446–51. https://doi.org/10.2337/diacare.26.2.446.
13. Amratia P, Kabaria CW, Fornace KM, Noor AM. The evolving boundaries and prevalence of malaria in Africa: 1939–2009. Adv Parasitol. 2017;94:225–75. https://doi.org/10.1016/bs.apar.2016.09.001.
14. Tatem AJ, Rogers DJ, Hay SI. Global transportation systems and the transmission of infectious diseases. Adv Parasitol. 2013;62:293–343. https://doi.org/10.1016/S0065-308X(05)62009-X
15. van Huis A, Van Itterbeeck J, Klunder H, Mertens E, Halloran A, Muir G, et al. Edible insects: Future prospects for food and feed security. FAO Forestry Paper 171. Rome: Food and Agriculture Organisation of the United Nations; 2013.
16. Wilson AL, Courtenay O, Kelly-Hope LA, Scott TW, Takken W, Torr SJ, et al. The significance of vector control in managing and eradicating vector-borne diseases. PLoS Negl Trop Dis. 2020;14(1):e0007831. https://doi.org/10.1371/journal.pntd.0007831.
17. World Health Organisation (WHO). Diseases that are spread by vectors [Internet]. 2022 [cited 2025 Sep 20]. Available from: https://www.who.int/news-room/fact-sheets/detail/vector-borne-diseases.

