

Parasites and Public Health: Global Challenges and Emerging Insights

V. Basil Hans*

Abstract

Parasitic illnesses are still a big problem for health around the world, especially in developing nations where sanitation and access to healthcare are restricted. Protozoa, helminths, and ectoparasites are all types of parasites that can damage many organ systems and cause both short-term and long-term health problems. This article looks at how parasites affect human health in different ways, focussing on common infections including malaria, schistosomiasis, and toxoplasmosis. Parasitic infections can cause a wide range of problems, including starvation, anaemia, neurological problems, and a weakened immune system. Also, the way parasites interact with the host's immune system can make co-infections worse and affect how well immunisations work. We also talk about new findings on how parasites may cause autoimmune illnesses and how they might be used in immunotherapy. To make focused public health interventions, better diagnostic tools, and better treatment strategies, we need to know all the consequences of parasites.

Keywords: Parasites, human health, protozoa and Helminths, immune system effects on global health

INTRODUCTION

For thousands of years, parasites have infected people and continue to be a severe hazard to public health, especially in tropical and subtropical areas. Parasites are living things that live on or in a host and get food from the host. Protozoa (like Plasmodium), helminths (like Schistosoma and Ascaris), and ectoparasites (like lice and ticks) are only a few of the many types of parasites. These organisms are the cause of many diseases that can make people very sick and even kill them in some situations.

Parasites can have a lot of different effects on health. In addition to the acute signs of infection, like fever, stomach problems, and tiredness, many parasites cause long-term harm that can impact growth, cognitive development, and organ function. The effects can be especially bad for people who are already weak, like youngsters, pregnant women, and people with weakened immune systems. Some parasitic infections can also cause anaemia, malnutrition, and chronic inflammation, which are all secondary problems.

The goal of this essay is to look at the many ways that parasites can harm human health. It will look at how parasites infect people, talk about some of the most common diseases caused by parasites, and talk about what this means for public health and disease management in general. We want to stress how important it is to control and stop parasites to lower the global illness burden through this study.

*Author for Correspondence

V. Basil Hans

E-mail: vhans2011@gmail.com

Research Professor, Department of Management and Commerce, Srinivas University, Mangalore, Karnataka, India

Received Date: July 02, 2025

Accepted Date: July 22, 2025

Published Date: July 26, 2025

Citation: V. Basil Hans. Parasites and Public Health: Global Challenges and Emerging Insights. International Journal of Tropical Medicines. 2025; 2(2): 8–15p.

IMPORTANCE

To deal with a big but frequently ignored global health problem, we need to know how parasites affect human health. More than a billion individuals around the world have parasitic infections. The

worst effects are evident in low- and middle-income countries. These illnesses make people poor, hurt the economy, and put a lot of stress on healthcare systems. Even though they are common and have a big effect, parasitic infections don't get as much attention and money as other infectious diseases.

Parasites also affect the immune system in complicated ways, which can change the course of co-infections, the development of chronic diseases, and even how well immunisations work. Some parasites have been associated to developmental delays in kids, problems with reproduction, and a higher risk of getting other diseases including HIV and tuberculosis.

This article stresses the need for further research, better diagnostic methods, and easier access to treatment and prevention by showing how parasites can have a wide range of health impacts that are frequently not fully understood. Not only is it important for improving individual health outcomes, but also for reaching larger public health goals like ending diseases and making sure everyone has the same level of health.

Questions for Research

- What are the most prevalent parasites that infect people all around the world, and what diseases do they cause?
- How do parasite infections affect people's immune systems and overall health?
- What are the long-term health effects of persistent parasite infections, especially in groups that are more likely to get them, such children and pregnant women?
- How can public health, socioeconomic, and environmental factors affect how common and serious parasite infections are?
- What are the most recent problems and improvements in diagnosing, treating, and stopping parasite infections?

Objectives

- To find and talk about the main types of parasites that might harm human health, such as protozoa, helminths, and ectoparasites.
- To look at how parasite infections affect health in the short and long term, focussing on both physical and mental health.
- To investigate how parasite infections affect the human immune system, particularly what this means for co-infections and long-term sickness.
- To look at the social, environmental, and economic elements that make parasite infections more common and more severe.
- To look at present methods for preventing, diagnosing, and treating parasite illnesses and point out areas where more study and public health action are needed.

REVIEW OF THE LITERATURE

There has been a lot of interest in the research on how parasites affect health, especially when it comes to the complicated connections between different parasites and their hosts. To understand how diseases spread and how they affect health, it is important to investigate these relationships.

We did a basic review [1] explain how soil-transmitted helminths (STHs) might change how malaria shows up by causing long-term infections and changing the immune system. They say that co-infections don't always have clear effects since the interactions between parasites and the host's immune system make the disease symptoms more complicated. This shows how important it is to look at parasites that live in tissues while studying malaria, since their interactions can have unanticipated effects on health.

Further on the idea of host interactions by looking at how the microbiome affects infections caused by parasitic protozoans. They stress that the microbiota can defend against disease, but imbalances can make the disease worse. This duality makes it clear that we need to know how the microbiome affects health outcomes when it comes to parasite diseases [2].

Add to this conversation by looking at how ecological conditions and helminth burdens affect the microbiota in the guts of wild hosts. They show that parasitism is different in males and females, which suggests that male hosts may have more infections, which could help us understand how health outcomes differ between genders [3].

Critically explore how climate change affects parasite diseases. They say that changing weather patterns can modify where and how often parasitic diseases occur, especially in tropical areas that are already weak. They point out that these changes have bigger effects on public health since new and returning parasitic diseases are major concerns to global health security.

Stresses the importance of using a variety of fields in parasitology, bringing together ecological, evolutionary, and health points of view. This broad view is necessary to deal with neglected tropical diseases and to comprehend how parasites and their hosts interact in a changing environment.

Look more closely at how gut microbiota and parasites affect each other in the environment. They show how these connections might affect the outcome of infections, showing that the interaction between microbiota and parasite diseases can either make host health problems worse or better.

Give us a better understanding of how parasites can fight each other and how these interactions can affect the course of sickness. This review shows how polyparasitism is complicated and what it means for the health of the host.

Give a systematic review that shows how helminth infections can have positive effects on metabolic outcomes. This goes against the common idea that parasitism is only harmful. Their results show that some parasitic infections may have health benefits that were not predicted, which makes the story about how parasites and hosts interact even more complicated.

Look at the link between parasite infections and neuroinflammation, stressing the possible use of gut microbiota modulation as a treatment option. Their results show that dysbiosis has a big effect on the health of the host, especially when it comes to neuroinflammatory illnesses.

Look at how helminth infections affect vaccine responses. They find that these infections can change how the immune system reacts to different types of vaccines. This study shows how important it is to look at parasitic illnesses when studying how well vaccines work, especially in places with few resources [4].

Lastly, investigates the co-infection facilitation theory, showing how interactions between parasites inside a host can have a big impact on health consequences. They stress how the features of the host affect these interactions, showing that genetic differences between hosts can cause parasite infections to have different effects on health.

This literature review brings together a wide range of studies that show how parasites can affect health in many ways. It stresses the need for more research to figure out how these interactions work and what they mean for public health [5].

Research Gaps

Limited understanding of how parasites affect the immune system: Many studies have looked at how the immune system reacts to parasites, but we still don't know much about how chronic parasitic infections change the immune system and make people more likely to get other diseases.

Not enough information on co-infections: A lot of people in places where these diseases are common have more than one infection at the same time (for example, malaria and helminths), but there isn't enough study on how these co-infections affect health outcomes.

Not enough research has been done on how parasite infections affect some groups, like pregnant women, babies, people with weak immune systems, and people with impairments.

Not enough good, easy-to-use diagnostic tools in places with few resources: Many current diagnostic procedures for parasite diseases are either too expensive, take too long, or aren't generally available, making it hard to find and treat them early.

There isn't enough study on how parasites affect mental and developmental health. More research is needed on how parasites affect neurodevelopment and cognitive function, especially in children who live in areas where they are common.

Not enough monitoring of new and re-emerging parasitic diseases because of climate change and migration: There isn't enough research on how changes in the environment are affecting how parasites spread and where diseases spread [6].

THEORETICAL FRAMEWORK

How Parasites Affect Human Health

This conceptual framework shows how parasite infections, host variables, environmental conditions, and health effects are all connected in a changing way. It helps us understand how different things work together to affect the overall effect of parasites on human health.

Agents That Are Parasitic

- Protozoa, like Giardia and Plasmodium.
- Helminths, such as Ascaris and Schistosoma.
- Ectoparasites, like lice and ticks.

↓ Infect →

Factors in the Human Host

- The state of the immune system (healthy or immunocompromised).
- Age, gender, and health status.
- Presence of other illnesses, such as HIV or TB.
- Genetic predisposition.

↓ How likely and how bad it is to have an effect →

Factors in the Environment and Society

- Bad hygiene and sanitation.
- Water sources that aren't safe.
- The weather and the land.
- Poverty and not being able to have good healthcare.

↓ Allow the spread of parasites →

Results for Health

- *Short-term effects:* diarrhoea, fever, anaemia, and skin lesions.
- Long-term effects include damage to organs, cognitive impairment, and developmental delays.
- Indirect impacts include poor diet, a weakened immune system, and lower productivity.

↓ Have a bigger effect on society →

Public Health and Policy Reaction

Watching and Diagnosing

- Getting treatment and medication resistance.
- Ways to stop things from happening (such cleaning up, controlling pests, and teaching).
- Efforts to improve health around the world [7].

THE EMPIRICAL STATUS

There is a lot of new research in tropical medicine, epidemiology, and immunology that supports the study of parasite diseases and how they affect health. Many field investigations and clinical trials have shown how common parasites like *Plasmodium* spp. are, how they spread, and what consequences they have on health. *Schistosoma* spp., soil-transmitted helminths, and malaria are all common in areas where they are found, especially in sub-Saharan Africa, Southeast Asia, and Latin America.

There is a lot of evidence that parasite infections are linked to several bad health effects, including as anaemia, slow growth, cognitive problems, and problems between the mother and foetus. Longitudinal cohort studies have shown that these infections are a long-term problem for school-aged children and pregnant women. Also, experimental and immunological research have shown that parasitic organisms and the host immune system interact in complicated ways, which helps us understand how parasites avoid and change the immune system.

But there are still gaps in the empirical literature. There isn't enough research on co-infections and how they work together, and data from high-income nations is generally hard to get by or incomplete because parasitic diseases are less common there. Also, researchers are still looking at how new elements, like climate change, urbanization, and antibiotic resistance, affect the patterns of parasitic diseases, and they don't have any clear data yet.

To fill in these gaps, educate public health policy, and help create better diagnostic tools, treatments, and preventive measures, further research is needed.

Analysis

Parasitic infections have a lot of different and complicated consequences on human health, and these effects are affected by biological, environmental, and social factors. This analysis brings together important results from previous studies and points out important trends and what they mean [8].

Biological Effects on the Body

Plasmodium, *Ascaris*, and *Schistosoma* are examples of parasitic organisms that mess up regular body functions. For instance,

Plasmodium spp. causes malaria, which destroys red blood cells, causes organs to fail, and, in severe cases, causes problems in the brain.

Helminth infections can cause long-term loss of blood and nutrients, which can lead to malnutrition, stunted growth, and tiredness.

Neurotropic parasites, like *Toxoplasma gondii*, can cause neurological and psychological problems, especially in people with weak immune systems.

These health problems are typically made worse by inadequate immune responses or co-infections, which make the disease worse.

Dimensions of the Economy and the Environment

Poor sanitation, not enough water, and not enough access to healthcare are all examples of environmental circumstances that make it easier for parasites to spread. Socioeconomic characteristics,

such as being poor or having a low level of education, make it much harder for people to get or seek early care.

The study shows that parasitic infections hit rural and marginalised people harder than others, making them sick and poor.

What this Means for Public Health and Policy

Even though parasite infections are quite common, they are generally left out of global health financing and policy plans. The analysis shows that:

Mass deworming, insecticide-treated bed nets, and water sanitation projects are all examples of intervention programs that have worked but need ongoing funding.

Drug resistance, especially in malaria and other helminths, is a new problem that could slow down development.

Trends and Gaps

More people are realising how climate change, urban migration, and globalisation are changing the way parasitic illnesses spread. New trends show that parasites that used to only live in tropical areas are now showing up in temperate areas as well. This means that we need to be more vigilant and ready for them.

Parasites can have a lot more effects on health than just making you sick. They hurt both physical and mental growth, lower economic productivity, and put a load on public health systems. To lower the global burden of parasite disease, effective interventions must come from several sectors, including healthcare, education, infrastructure, and research and development [9].

RESULTS

- *High Prevalence of Parasitic illnesses:* Parasitic illnesses are still common over the world, affecting more than a billion people, especially in low- and middle-income nations. Plasmodium and Giardia are two examples of protozoan and helminth parasites that are very common. People who are infected often have anaemia, malnutrition, slowed cognitive development, and persistent weariness. Pregnant women and children are especially at risk because they are more likely to have a miscarriage, have a baby with a low birth weight, or have developmental difficulties.
- *Immune System Modulation:* Parasites can change how the host's immune system works, which can cause long-term infections and make people more likely to get other diseases like tuberculosis and HIV. This change in the immune system can also alter how well vaccines work.
- *Environmental and Socioeconomic Drivers:* Parasites spread more easily when people don't have access to clean water, good sanitation, and money. Changes in the environment, such as fluctuations in climate, are changing where parasites live and making endemic areas bigger.
- *Effectiveness of Control Measures:* In many areas, mass drug delivery, better sanitation, vector control (such insecticide-treated nets), and health education have all made things easier. But there are still problems, such drug resistance and holes in the healthcare system.
- *Research and Diagnostic Gaps:* There aren't enough sensitive, cheap diagnostic techniques in places with few resources, which makes it harder to find and address problems early. There is still a lot of research to be done on co-infections and the long-term impact of parasites on the nervous system.

Implications

- *Public Health Policy and Resource Allocation:* The fact that parasitic diseases are such a big health problem shows how important it is to put more money into parasite control initiatives, especially in areas where they are common. To lower the number of deaths and illnesses, policymakers need to make financing for prevention, diagnosis, and treatment a top priority.

- *Integrated Disease Management:* To effectively control a disease, you need to take a whole-person approach that includes better sanitation, access to clean water, vector control, health education, and regular mass medicine administration. Outcomes will be better if this program is linked to other health programs, like those for mothers and children.
- *Research and Innovation:* We need to quickly build sensitive, low-cost diagnostic technologies that work in places with few resources and keep an eye on drug resistance as it grows. More research into how hosts and parasites interact can help scientists make new vaccines and treatments.
- *Addressing Socioeconomic Determinants:* To lower the number of parasitic diseases, we need to deal with the root causes of these diseases, like poverty, lack of education, and poor infrastructure. Improving living circumstances and giving people more authority via knowledge will lower the hazards of exposure.
- *Global Health Security:* Climate change and globalisation are changing where parasites live, therefore surveillance systems need to shift to keep an eye on and deal with new parasitic dangers. To stop outbreaks and keep them from spreading, countries need to work together and share information.
- *Focus on Vulnerable Populations:* It's important to safeguard high-risk groups, such youngsters, pregnant women, and people with weak immune systems, by giving them special help and making it easier for them to seek healthcare [10].

Limitations

- *Data Quality Issues:* A lot of research on parasitic infections uses data from areas with poor healthcare systems, which could mean that disease prevalence and outcomes are not reported correctly or consistently.
- *Focus on Certain Parasites:* A lot of research focusses on well-known parasites, like Plasmodium and soil-transmitted helminths, while the impacts of less common or new parasites are still not well understood.
- *Cross-Sectional Study Designs:* A lot of the information that is out there is cross-sectional, which makes it hard to figure out what causes what or what the long-term health effects of parasite infections are.
- *Limited Geographic Scope:* Most of the real-world data comes from tropical and subtropical areas, and there isn't enough information about health problems caused by parasites in temperate zones or among migrant populations.
- *Challenges in Diagnosis:* Current diagnostic techniques have different levels of sensitivity and specificity, especially in places with few resources. This can lead to wrong diagnoses or delayed treatment.
- *Co-illnesses and Immune Interactions: That Haven't Been Studied Enough:* The complicated ways that different infections interact with one other and how they affect health are still not well understood, which makes it hard to come up with complete management plans [11].

NEXT STEPS FOR RESEARCH

- *Longitudinal Studies on Chronic Effects:* Do long-term cohort studies to learn more about the long-term health effects of chronic parasite infections, notably on cognitive development, growth, and immunological function.
- *Investigating Co-illnesses:* Look at how different parasite infections and other infectious diseases (such HIV and tuberculosis) affect one other to come up with better ways to treat and prevent them.
- *Making Better Diagnostic Tools:* Focus on making diagnostic methods that are cheap, accurate, and quick enough to be used in places with few resources so that problems can be found and treated earlier.
- *The Effects of Climate Change on Parasite Distribution:* Investigate how changes in the environment and the way people move around affect the appearance and spread of parasitic infections in new areas.

- *Host-Parasite Immune Dynamics*: Do further research on how parasites change the immune system over time, which changes how often people are to get infections, how well vaccines work, and how autoimmune illnesses develop.
- *Socioeconomic and Behavioural Studies*: Investigate the socioeconomic factors that lead to parasite infections and see how well community-based interventions work to stop the spread of the disease.
- *Drug Resistance Monitoring*: Set up strong procedures to watch for and deal with new drug resistance in parasites so that current therapies stay effective.

CONCLUSIONS

Parasitic illnesses are still a big problem for people's health around the world, especially for those who are weak and live in places with few resources. Their effects go beyond short-term illness to include long-term health issues, developmental delays, and heavy social and economic costs. This article talks about how parasites, host variables, and environmental conditions all work together in complicated ways to affect the outcome of diseases. Even while control methods have gotten better, there are still gaps in diagnosis, treatment, and knowledge of long-term impacts.

To deal with the health effects of parasite diseases, we need to work together across several fields to increase healthcare access, sanitation infrastructure, research innovation, and public health policy. Putting parasite management at the top of the list is important not just to ease people's pain, but also to promote global health equity and long-term growth. To get rid of parasitic diseases over the world, we need to keep doing research and putting money into it.

REFERENCES

1. Onkoba WN, Chimbari MJ, Mukaratirwa S. Malaria endemicity and co-infection with tissue-dwelling parasites in Sub-Saharan Africa: A review. 2015. Available from: <https://www.ncbi.nlm.nih.gov>.
2. Bär AK, Phukan N, Pinheiro J, Simoes-Barbosa A. The interplay of host microbiota and parasitic protozoans at mucosal interfaces: Implications for the outcomes of infections and diseases. 2015. Available from: <https://www.ncbi.nlm.nih.gov>.
3. Newbold L, Burthe S, Oliver A, Gweon HS, Barnes CJ, Buesching CD, et al. Helminth burden and ecological factors associated with alterations in wild host gastrointestinal microbiota. *ISME J*. 2017;11:663–75. doi:10.1038/ismej.2016.153.
4. Short EE, Caminade C, Thomas BN. Climate change contribution to the emergence or re-emergence of parasitic diseases. *Infect Dis (Auckl)*. 2017 Sep 25;10:1178633617732296. doi:10.1177/1178633617732296. PMID: 29317829; PMCID: PMC5755797.
5. Stothard JR, Littlewood DTJ, Gasser RB, Webster BL. Advancing the multi-disciplinarity of parasitology within the British Society for Parasitology: Studies of host-parasite evolution in an ever-changing world. *Parasitology*. 2018;145(13):1641–6. doi:10.1017/S0031182018001476.
6. Leung JM, Graham AL, Knowles SC. Parasite-microbiota interactions with the vertebrate gut: Synthesis through an ecological lens. 2018. Available from: <https://www.ncbi.nlm.nih.gov>.
7. Shen SS, Qu XY, Zhang WZ, Li J, Lv ZY. Infection against infection: parasite antagonism against parasites, viruses and bacteria. 2019. Available from: <https://www.ncbi.nlm.nih.gov>.
8. Rennie C, Fernandez R, Donnelly S, McGrath KCY. The impact of helminth infection on the incidence of metabolic syndrome: A systematic review and meta-analysis. 2021. Available from: <https://www.ncbi.nlm.nih.gov>.
9. Alloo J, Leleu I, Grangette C, Pied S. Parasite infections, neuroinflammation, and potential contributions of gut microbiota. *Front Immunol*. 2022 Dec 8;13:1024998. doi:10.3389/fimmu.2022.1024998. PMID: 36569929; PMCID: PMC9772015.
10. Natukunda A, Zirimenya L, Nassuuna J, Nkurunungi G, Cose S, Elliott AM, et al. The effect of helminth infection on vaccine responses in humans and animal models: A systematic review and meta-analysis. 2022. Available from: <https://www.ncbi.nlm.nih.gov>.
11. Rodgers ML, Bolnick DI. Opening a can of worms: A test of the co-infection facilitation hypothesis. 2023. Available from: <https://www.ncbi.nlm.nih.gov>.