International Journal of Asian Social Science
ISSN(e): 2224-4441
ISSN(p): 2226-5139
DOI: 10.55493/5007.v15i10.5637
Vol. 15, No. 10, 346-361
© 2025 AESS Publications. All Rights Reserved.
URL: www.aessweb.com

Pregnant women is the high-risk population on mosquito infestation: A systematic review

Li Ji Mei[1]
Shureen Faris Abdul Shukor[2+]
Mohd Sallehuddin bin Mat Noor[3]
Adam Aruldewan S.Muthuveeran[4]

[1,2,3,4]*Faculty of Design and Architecture, Universiti Putra Malaysia 43400, Serdang, Selangor, Malaysia.*
[1]*Email: gs60890@student.upm.edu.my*
[2]*Email: shureen@upm.edu.my*
[3]*Email: mohdsallehuddin@upm.edu.my*
[4]*Email: aruldewan@upm.edu.my*

(+ Corresponding author)

Article History
Received: 19 August 2025
Revised: 22 September 2025
Accepted: 26 September 2025
Published: 6 October 2025

Keywords
High-risk population
Mosquito infestation
Pregnant women
Southeast Asia
Systematic review
Vulnerability.

ABSTRACT

With globalization, mosquito infestation has become a serious public health concern, impacting human health. Identifying populations at greatest risk from mosquito infestation is crucial for guiding targeted protection strategies and optimizing resource allocation. However, current research on the impact of mosquito infestation on human health is fragmented and lacks systematic synthesis, making it difficult to identify populations at greatest risk. This review aimed to synthesize and compare evidence on the vulnerability of different populations to mosquito infestation. Based on the PRISMA 2020 guidelines, this study searched databases such as Scopus, Web of Science, and Cochrane between 2004 and 2025. Inclusion criteria were peer-reviewed studies examining the impact, risk, and burden of mosquito infestation. Of 187 initial records, 32 studies met the inclusion criteria. The results of this review indicate that pregnant women are at high risk of mosquito infestation. The reason is their vulnerability and susceptibility to mosquito-borne diseases. Moreover, compared to other populations, the physical and psychological health effects of the Zika virus on pregnant women and their fetuses continue after birth. Microcephaly can have a lasting impact on children and their caregivers. Furthermore, due to climate change, mosquito infestation in Southeast Asia is significantly higher than in other regions. Pregnant women in this region are the most at-risk population. The results of this study highlight the need for public health systems to prioritize mosquito control strategies targeting pregnant women in Southeast Asia.

Contribution/ Originality: This paper is the first to systematically review populations at high risk of mosquito infestation, specifically highlighting the vulnerability and susceptibility of pregnant women. The paper's primary contribution is to provide important evidence for public health strategies to protect maternal health in Southeast Asia.

1. INTRODUCTION

In recent years, with rapid global change and population growth, mosquito infestations have posed a serious health threat to 80% of the world's population, particularly those living in Southeast Asia (Yadav & Upadhyay, 2023). Mosquitoes, capable of transmitting infectious pathogens between humans and animals, are responsible for

© 2025 AESS Publications. All Rights Reserved.

10 mosquito-borne diseases, including dengue fever, malaria, filariasis, and Japanese encephalitis (WHO, 2024). As shown in Figure 1.

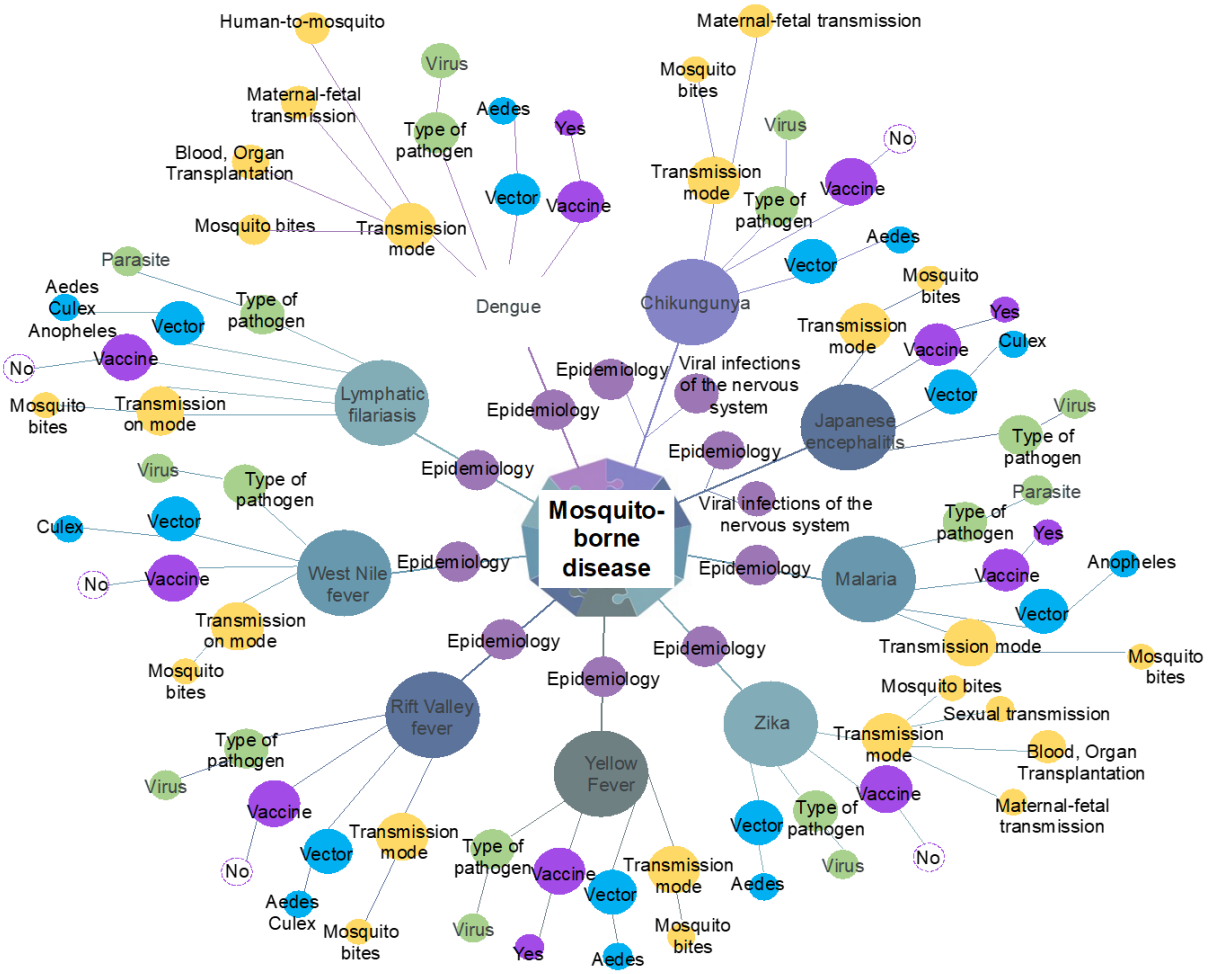

Figure 1. Mosquito-Borne Diseases (Based on WHO Data).

Source: WHO (2024).

There are still no vaccines or specific medicines available for most of these diseases. The 15 kHz sinusoidal wave signals emitted by mosquitoes can cause discomfort to humans (Lapshin & Vorontsov, 2021). Prolonged exposure to mosquito signals can negatively impact the quality of life. Mosquito infestation includes the dual health threats posed by mosquitoes, both physical and psychological. Despite significant advances in controlling mosquito infestation, the problem has not been fully resolved. It remains a major contributor to global morbidity and mortality.

The World Health Organization reports that 249 million people are infected with malaria each year, resulting in more than 608,000 deaths (WHO, 2024). Approximately 3.9 billion people worldwide are at risk of dengue fever infection, with an estimated 100 million to 400 million people infected each year (WHO, 2024). With rapid global environmental change, the impact of this issue on health is becoming increasingly severe (De Souza & Weaver, 2024). Although existing studies have explored the threat of the problem to human physical and mental health, its impacts have not been integrated. High-risk populations are more susceptible to the serious impacts of mosquito infestation due to their socioeconomic conditions, immunity levels, or living environments (Shaw, 2024). Although existing studies have explored the impact of mosquito infestation on some specific populations, such as pregnant women, people over 65 years old, children aged 0-5 years old, and people with weakened immune systems, there are no studies that integrate the results of different studies and directly compare the vulnerability of various

© 2025 AESS Publications. All Rights Reserved.

populations to identify high-risk populations for mosquito infestation. This gap limits the precise allocation of public health resources and the development of targeted intervention strategies. Therefore, accurately identifying high-risk populations for mosquito infestation is crucial for developing targeted public health policies.

This systematic literature review aimed to identify the populations most at risk from mosquito infestation and explore the causes of their vulnerability by systematically searching, screening, and analyzing existing research. This review specifically focused on the performance of high-risk populations to provide evidence-based guidance for public health decision-making. The research questions include:

1. What are the impacts of mosquito infestation in the existing literature?
2. What are the specific effects of mosquito infestation on pregnant women?
3. What is the reason for the highest risk to pregnant women?

2. METHODS

2.1. Review Strategy

This systematic review was conducted in accordance with the 2020 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Page et al., 2021). A systematic search of peer-reviewed studies was conducted in Scopus, Web of Science, ProQuest, Google Scholar, and the Cochrane Library databases. Additionally, a search of the grey literature, including sources from the World Health Organization, the Centers for Disease Control and Prevention (CDC), and the National Health Service (NHS), was performed to gather comprehensive information on the impact of mosquito infestations on humans. The search period for this study was from June 18, 2004, to March 1, 2025. The starting date of June 18, 2004, was selected based on the World Health Organization's publication of the Global Strategic Framework for Integrated Vector Management, which aims to guide countries in developing integrated vector control strategies to improve cost-effectiveness, ecological sustainability, and resource optimization (World Health Organization, 2004). The search was conducted up to March 1, 2025, to ensure the timeliness and completeness of the results.

2.2. Search Strategy

The search strategy for this study included a comprehensive database search and a manual search of grey literature. Search terms were a combination of Medical Subject Headings (MeSH) and free text. Search terms were developed targeting themes such as symptoms, vulnerability and susceptibility, and protective measures for mosquito-borne diseases in different populations, as shown in Table 1.

Search terms for mosquito-borne diseases include “Vector-borne disease caused by mosquitoes” OR “Insect-borne disease” OR “Mosquito-borne infection”. Search terms for high-risk populations include "At-risk population" OR "At risk population" OR "High-risk population" OR "Susceptible population" OR "Minority population" OR "Disadvantaged population" OR "Underserved population" OR "Socially disadvantaged population”. Search terms for protective measures include "Infection control practices" OR "Infection prevention strategies" OR "Medical protective measures" OR "Medical prevention measures" OR "Protective medical practices" OR "Healthcare protection measures" OR "Epidemic measures" OR "Hospital protective measures" OR "Personal protective equipment" OR "Protective policies" OR "Policy interventions" OR "Health protection policies".

These search terms were combined using Boolean logic and the proximity operators "OR" and "AND." "OR" was used to combine search terms related to a specific topic, while "AND" was used to combine search terms related to different topics. Subsequently, the search strategy underwent peer review according to the Peer Review of Electronic Search Strategies 2015 Guideline Statement (McGowan et al., 2016). Following peer review, the search strategy was corrected for any suggestions or errors. Once the search strategy was updated, all databases were updated simultaneously.

© 2025 AESS Publications. All Rights Reserved.

Table 1. Keywords for Boolean search strings.

Question keywords	Mosquito-borne diseases	Vulnerability and susceptibility	Protective measures
Alternative keywords/phrases	"Mosquito-borne diseases" OR "Vector-borne disease caused by mosquitoes" OR "Insect-borne disease" OR "Mosquito-borne infection"	"At-risk population" OR "At risk population" OR "High-risk population" OR "Susceptible population" OR "Minority group" OR "Disadvantaged population" OR "Underserved population" OR "Socially disadvantaged group"	"Infection control practices" OR "Infection prevention strategies" OR "medical protective measures" OR "Medical safety measures" OR "Protective medical practices" OR "healthcare protection measures" OR "Epidemic prevention measures" OR "hospital protective measures" OR "Personal protective equipment" OR "Protective policies" OR "policy interventions" OR "Health protection policies"

2.3. Inclusion and Exclusion Criteria

The inclusion and exclusion criteria for the literature were developed by the author team and continuously improved through three meetings. This review included relevant peer-reviewed studies on the impacts of mosquito infestations on humans published between June 18, 2004, and March 1, 2025, in English. Studies that were not published in English and were non-academic were excluded; unpublished working papers or industry reports were excluded; dissertations, journals, or textbooks were excluded; studies lacking sufficient details to determine the vulnerability of specific populations; articles lacking original data; studies focused only on non-human subjects; and studies not related to mosquito-borne diseases were excluded. The inclusion and exclusion criteria are shown in Table 2.

Table 2. Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
Academic articles written in English	Non-English articles
Peer-reviewed scholarly journal article	Nonacademic articles
Published between June 18, 2004, and March 1, 2021	Unpublished working papers or industry reports
Reported disease burden or risk of mosquito-borne diseases in humans	Dissertations, magazines, or textbooks
Medical treatments for mosquito-borne diseases	Published prior to June 18, 2004
Mosquito-borne disease prevention policies implemented by governments or institutions	Studies lacking sufficient detail to determine the vulnerability of specific populations
Research relevant to the research question	Articles lacking primary data (Editorials, commentaries)
	Studies focusing solely on non-human subjects
	Studies not related to mosquito infestation
	Review articles

2.4. Journal Article Screening

Three researchers independently screened titles, abstracts, and full-text articles; any disagreements were resolved through discussion or by a fourth reviewer. Data were extracted into a standardized format, including population details, study design, sample size, and factors influencing mosquito infestation. Study results were summarized thematically to identify vulnerable populations to mosquito infestation, as shown in Figure 2.

© 2025 AESS Publications. All Rights Reserved.

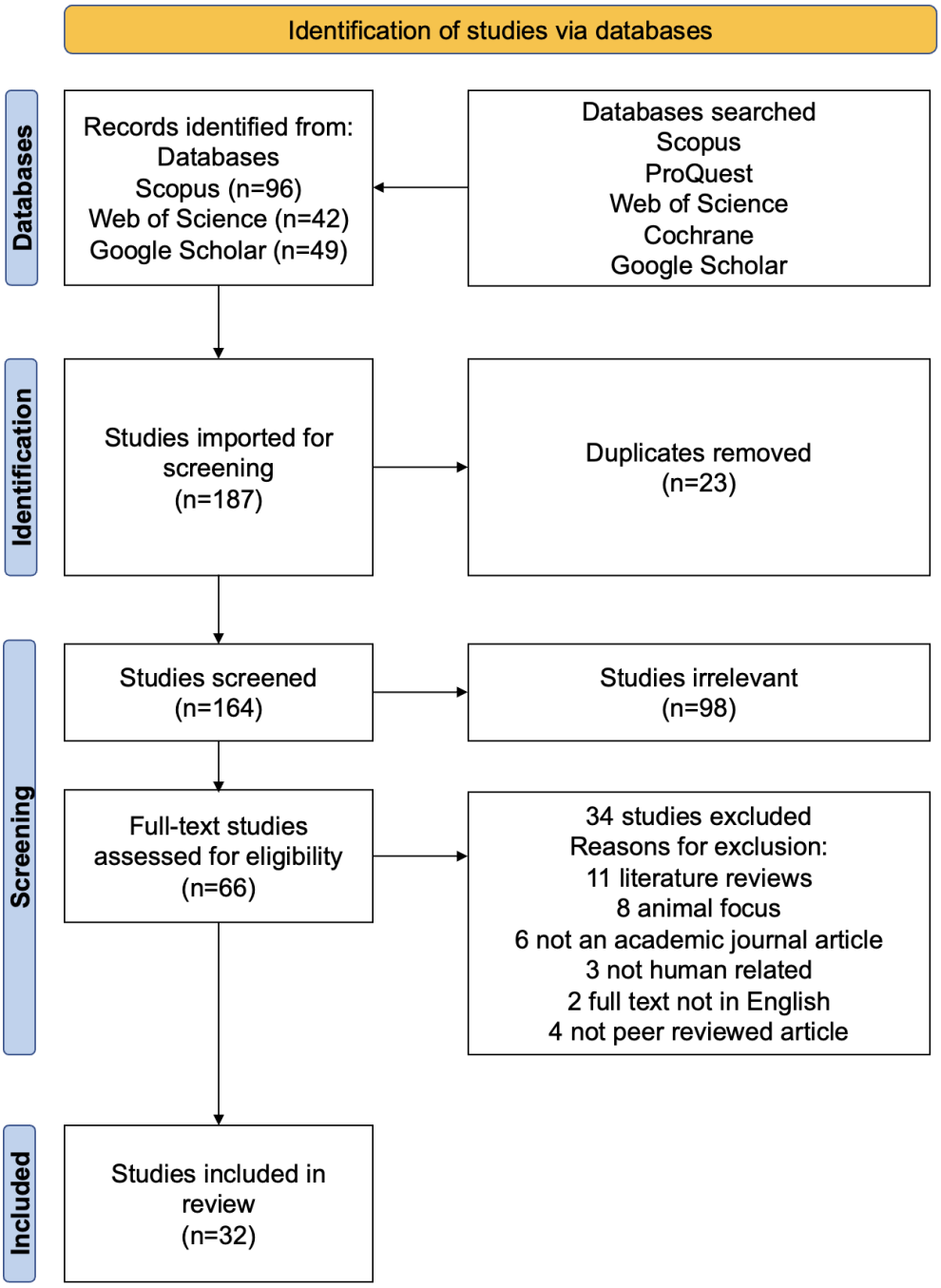

Figure 2. Flow diagram for article selection.

3. RESULTS

A preliminary search of Scopus, Web of Science, ProQuest, Google Scholar, and the Cochrane Library databases retrieved 187 records. After removing 23 duplicates, 164 records were screened based on title and abstract, and 98 records that did not meet the inclusion criteria were ultimately excluded. Sixty-six full-text articles were assessed for eligibility, of which 34 were excluded. Exclusions were due to the following reasons: 11 were review articles; 8 focused not on mosquito-borne diseases in humans but on animal-to-animal transmission; 6 were non-scientific articles; 3 were not clearly relevant to humans; 2 were not in English; and 4 were not peer-reviewed. Ultimately, the researchers used strict inclusion and exclusion criteria to include a total of 32 studies. The included studies were published between 2004 and 2025. The study population included children aged 0-5 years, pregnant women, people aged 65 years and older, and immunocompromised individuals.

© 2025 AESS Publications. All Rights Reserved.

3.1. The Threat of Mosquitoes to Humans

Conclusions were drawn based on the research questions proposed. For Research Question 1, the selected articles identified that the threats posed by mosquito infestation to humans mainly include disease and nuisance.

Mosquitoes are vectors of mosquito-borne diseases, posing a serious threat to global human health. Mosquitoes are distributed worldwide, except for Antarctica (Moonen, Schinkel, van der Most, Miesen, & van Rij, 2023). Due to their widespread geographic distribution and the wide variety of diseases they carry, mosquito-borne diseases are contagious and prevalent worldwide (Duval, Antonelli, Aschan-Leygonie, & Valiente Moro, 2023). According to the World Health Organization, over 3.9 billion people (48.75%) in 132 countries are at risk of contracting dengue fever (WHO, 2024). The global spread of mosquito-borne diseases has posed a serious public health threat. In addition, Southeast Asia's climate is conducive to mosquito breeding, making mosquito-borne diseases perennially prevalent. Dengue fever and malaria infections are likely to increase in the region (Colón-González et al., 2021; Khezzani, Baymakova, Khechekhouche, & Tsachev, 2023). The burden of mosquito-borne diseases is highest in Southeast Asia. Even more concerning, multiple pathogens of mosquito-borne diseases not only coexist in human hosts but also combine with other diseases to increase the risk of infection. Imran et al. (2025) showed that co-infection of dengue and malaria increased the prevalence of the disease (Imran et al., 2025). Co-infection with pathogens carried by mosquitoes makes mosquito-borne diseases more complex and severe. Furthermore, there is a link between mosquitoes, infectious diseases, and cancer (Marcondes & Benelli, 2019). Roberds, Ferraro, Luckhart, and Stewart (2021) evidence indicates that coinfection with malaria and HIV-1 has become a significant public health issue in tropical regions (Roberds et al., 2021). This finding indicated that humans face more serious health threats.

Despite the continuous development and expansion of drugs and vaccines related to mosquito-borne diseases, there is still a lack of safe and effective treatment and protection measures against infection with mosquito-borne diseases. Regarding treatment options, although the World Health Organization recommends rest, electrolyte rehydration, and the use of analgesics (acetaminophen) and antipyretics for mosquito-borne diseases (WHO, 2024) there is still a lack of targeted treatments. In terms of protective measures, only vaccines for dengue fever, yellow fever, and Japanese encephalitis are available (Centers for Disease Control and Prevention, 2025a). There are no vaccines for the other nine mosquito-borne diseases. This lack of protective measures means the risk of infection from mosquito-borne diseases remains high. Additionally, Bello et al. (2025) focused on the safety issues, production process, and logistical difficulties in the distribution of these vaccines (Bello et al., 2025). Vaccines still face various challenges in their practical application. Although existing medical research focuses on medical measures and preventive measures for most mosquito-borne diseases, vaccines and drugs do not cover all types.

Although public health systems have introduced policies to reduce the impact of mosquito infestations, there is still a lack of effective surveillance systems, response strategies, and cost-effectiveness for the large-scale global spread of mosquito-borne diseases. On the one hand, Zeller's research shows that mosquito-borne disease surveillance in Europe is imperfect and lacks timely information updates (Zeller, Marrama, Sudre, Van Bortel, & Warns-Petit, 2013). On the other hand, the COVID-19 pandemic has exposed the limited capacity of public health surveillance and laboratory systems in some countries to respond to public health emergencies Filip, Gheorghita Puscaselu, Anchidin-Norocel, Dimian, and Savage (2022). This information lag and insufficient capacity to respond to public health emergencies can lead to delayed responses. Furthermore, public health systems in some regions are underfunded for mosquito control (Jordan, Eisen, & Schulze, 2024). Funding limits the ability of public health departments to assume responsibility for mosquito-borne disease management.

Mosquitoes are a serious nuisance to humans and affect people's quality of life. However, there are currently no effective mosquito control measures to reduce this nuisance. On the one hand, the noise made by mosquitoes is a nuisance to humans. When mosquitoes fly, they produce an annoying high-frequency buzzing sound as they flap their wings. Seo, Hedrick, and Mittal (2021) found that mosquito wingbeats are approximately 3.4 times louder than those of fruit flies (Seo et al., 2021). Hearing buzzing animals evokes a fear-like response, which is a negative

© 2025 AESS Publications. All Rights Reserved.

interaction with nature (Gaston & Soga, 2020). This suggests that mosquito sounds lead people to perceive sensory interaction with nature as negative. On the other hand, even in non-endemic areas, respondents reported that fear of mosquito bites caused them to reduce outdoor activities (Duval, Aschan-Leygonie, & Valiente Moro, 2023). Respondents reported experiencing high levels of mosquito nuisance both during the day and at night (Canali et al., 2024). The prolonged exposure to mosquitoes in people's daily lives has reduced their quality of life. Carrieri et al. (2022) showed that each Italian household spends more on mosquito control annually than the public administration does (Carrieri et al., 2022). Despite investments in mosquito prevention, increased spending on mosquito control has not reduced the frequency of mosquito nuisances.

In summary, mosquitoes bring a serious disease burden and nuisance to humans. However, current medical protection measures and public health systems still lack a complete response plan. Due to the wide distribution of mosquitoes around the world and the wide variety of pathogens they carry, mosquitoes pose a threat to global health. Moreover, co-infections with mosquito-borne diseases increase the disease burden. As well, the buzzing of mosquitoes continues to nuisance to humans, and people reduce outdoor activities for fear of being bitten, seriously affecting their quality of life. Although prevention and control measures for mosquito-borne diseases are constantly developing, there is still a lack of specific treatment options and a complete vaccine system. What's more, the imperfection of the public health system has limited the ability to monitor and respond to mosquito-borne diseases. The current impact of mosquito infestations on humans still faces challenges.

3.2. The Special Impact of Mosquito Infestation on Pregnant Women

For question 2, the system identified the special impact of mosquito infestation on the physical and mental health of pregnant women.

Compared with the general population, the physiological health effects of mosquitoes on pregnant women include susceptibility to mosquito-borne diseases and adverse pregnancy outcomes.

Firstly, pregnant women are susceptible to mosquito-borne diseases. Because the special physical state of pregnancy makes them attractive to mosquitoes, the risk of contracting mosquito-borne diseases is higher. Heart rate and metabolic rate are higher during pregnancy. Some volatile organic compounds that are particularly relevant to pregnancy are attractants to mosquitoes (Lindsay et al., 2000). Ellwanger, da Cruz Cardoso, and Chies (2021) found that pregnant women are approximately 3.5 times more attractive to mosquitoes than non-pregnant women (Ellwanger et al., 2021). Secondly, pregnancy makes the infection of mosquito-borne diseases more complicated. Mosquitoes pose a serious threat to the physiological health of pregnant mothers and fetuses. The pathogens of mosquito-borne diseases are transmitted to the fetus through the placenta (Watanabe & Vasudevan, 2023). Once a pregnant woman is infected with a mosquito-borne disease, it may lead to a series of adverse pregnancy outcomes. The threat of mosquito-borne diseases to maternal health is the increase in the rate of miscarriage and cesarean section (Sondo et al., 2019). What's more, pregnant women infected with mosquito-borne diseases may also suffer from iron deficiency anemia and postpartum hemorrhage caused by anemia (Zahavi et al., 2024). The health threats to the fetus are malformations, premature birth, preeclampsia, and neonatal death (O'Kelly & Lambert, 2020).

Among all mosquito-borne disease pathogens, Zika virus has a significant impact on the fetus. The teratogenic mechanism of Zika virus not only causes fetal microcephaly but also leads to complications such as Guillain-Barré syndrome, transverse myelitis, and acute meningoencephalitis (Cao-Lormeau et al., 2016). It is worth noting that the health threat of the Zika virus to the fetus does not end with the conclusion of pregnancy (Panchaud, Stojanov, Ammerdorffer, Vouga, & Baud, 2016). Coutinho et al. (2021) pointed out that fetuses infected with Zika virus during pregnancy appear asymptomatic after birth, but subclinical symptoms appear at 3 months of age (Coutinho et al., 2021). Borba et al. (2024) found that children with congenital Zika syndrome exhibit asymmetry and abnormal posture patterns due to neurological and visual impairments (Borba et al., 2024). Congenital Zika virus

© 2025 AESS Publications. All Rights Reserved.

infection acquired during pregnancy has long-term negative effects on the physical development of children at all stages.

Although current research focuses on the treatment and prevention of mosquito-borne diseases, there is still a lack of safe medicines and vaccines available for pregnant women. Strategies to reduce the threat posed by mosquitoes to pregnant women are still lacking. In terms of medicine, mosquito-borne diseases during pregnancy not only have diagnostic difficulties and drug restrictions but also exclude pregnant women from the research process (Mulik, Dad, & Buhmaid, 2021). There is still a lack of safe mosquito-borne disease treatments during pregnancy. Regarding vaccines, although current medical research focuses on development, only three categories of vaccines are available: Yellow fever, Dengue fever, and Japanese encephalitis. Vaccines cannot cover all types of mosquito-borne diseases. So far, no vaccine has been developed for the Zika virus.

For pregnant women, safe vaccines are available before pregnancy and after delivery. Al-Osaimi et al. (2024) didn't recommend sharing vaccines with the fetus during pregnancy (Al-Osaimi et al., 2024). Taken as a whole, the criteria for vaccines during pregnancy are strict. However, pregnant women are currently excluded from the development and use of vaccines for mosquito-borne diseases. In the Capeding et al. (2014) experiment, pregnancy was an explicit exclusion criterion (Capeding et al., 2014). Furthermore, the conditions under which the vaccine was used were even more stringent. Hills, Wong, and Staples (2023) reported that even though clinicians may consider vaccinating pregnant women, individual maternal risks and underlying diseases still need to be considered (Hills et al., 2023). Therefore, the use of mosquito-borne disease vaccines during pregnancy is not suitable for all pregnant women. Currently, there are no medicines or vaccines for mosquito-borne diseases that are safe for use during pregnancy. There is still a lack of effective measures to reduce the threat of mosquito infestation to pregnant women.

The mental health threats posed by mosquitoes to pregnant women exist at all stages before, during, and after pregnancy. Although current research focuses on the particularity of psychology during pregnancy, there is still a lack of strategies to alleviate stress and depression during pregnancy. Before pregnancy, concerns about contracting mosquito-borne diseases are heightened. Previous studies have highlighted the increased fear, anxiety, and depression among expectant mothers regarding the potential impact on fetal health (Marbán-Castro et al., 2020; Tirado, Morales Mesa, Kinsman, Ekström, & Restrepo Jaramillo, 2020). For example, the fear of contracting Zika virus infection often leads to compounded psychological stress in pregnant women (Horan, Cheyney, Nako, & Bovbjerg, 2020). However, effective strategies to reduce fear have been neglected. Although some countries have introduced protective measures, further efforts are necessary to address the underlying causes and improve public confidence. Linde Arias, Tristan-Cheever, Furtado, and Siqueira (2020) pointed out that the complexity of the protective measures has increased the pain and worries of pregnant women (Linde Arias et al., 2020). There is a gap between the expectations of pregnant women and the relevant departments regarding the implementation of government policies. The simplicity and effectiveness of the solution strategy still need to be further improved.

Generally, pregnant women are advised to take multiple protective measures to avoid contracting mosquito-borne diseases (Jasper & Aiken, 2024). More seriously, if the Zika virus infects a pregnant woman, termination of pregnancy may be recommended (Marbán-Castro et al., 2020). Mosquito infestation led to excessive pressure to prevent and consider termination of pregnancy, which is inconsistent with personal values. After childbirth, Azevedo, Freire, and Moura (2021) showed that in families with infants with Zika virus congenital syndrome, pain, uncertainty, and burden were the hallmarks of the parental experience (Azevedo et al., 2021).

What's more, Bailey and Ventura (2018) pointed out that mothers who take care of deformed children are often discriminated against and abandoned by their partners, relatives, and communities (Bailey & Ventura, 2018). More importantly, Lima et al. (2022) paid attention to the fact that children with Zika virus congenital syndrome need special care from their mothers. This leads to the loss of family labor (Lima et al., 2022). As a result, mothers of children born with Zika virus malformations face family, social, and economic pressures. This may lead to a higher

© 2025 AESS Publications. All Rights Reserved.

risk of anxiety and depression in mothers. Although previous studies have focused on the various mental health threats posed by mosquito infestation to pregnant women, no feasible solutions have been proposed.

In summary, pregnant women are more vulnerable to mosquito infestation. The physiological state during pregnancy makes it easier to attract mosquitoes. However, pregnant women infected with mosquito-borne diseases will face a series of adverse outcomes. Not only does it threaten the health of the mother, but it may also cause fetal malformations. Additionally, from the beginning of pregnancy preparation to after delivery, fetal malformations caused by mosquito-borne diseases increase the stress of pregnant women to varying degrees. However, due to the safety concerns of medication during pregnancy, there are no safe treatment solutions or vaccines available. Previous studies have focused on reporting the threat of mosquito infestation to the physical and mental health of pregnant women. However, the exploration of measures to reduce the impact of mosquito infestation on pregnant women has been neglected. There is still a lack of research on safe prevention and control strategies to mitigate the impact of mosquito infestation on pregnant women.

3.3. Pregnant Women Are a High-Risk Population for Mosquito Infestation

For research question 3, definitions from different institutions were systematically identified, and the definitions of high-risk populations for mosquito infestation were integrated and narrowed.

The World Health Organization, the Centers for Disease Control and Prevention, and the National Health Service have each defined vulnerable populations to mosquito infestation. WHO defines infants, children under 5 years old, pregnant women, people with HIV infection, and immunocompromised individuals who migrate to malaria-prone areas as susceptible to malaria (WHO, 2024). Children under 5 years old, adults over 65 years old, people with weakened immune systems, and pregnant women are susceptible to zoonotic diseases (Centers for Disease Control and Prevention, 2025b). Pregnant women, young children, people over 65 years old, individuals with weakened immune systems, and those without a spleen are at high risk of malaria, according to the National Health Service (National Health Service, 2025). These institutions define vulnerable populations differently. However, all three include pregnant women among the vulnerable populations to mosquito infestation. Additionally, for the general population, mosquito-borne diseases often cause fever, headache, and muscle pain (Centers for Disease Control and Prevention, 2025a). Compared with other populations, pregnant women are particularly susceptible and vulnerable to mosquito-borne diseases. For example, pregnant women are highly attractive to mosquitoes (Ellwanger et al., 2021). Infection with mosquito-borne diseases during pregnancy can lead to premature birth, miscarriage, fetal malformation, and fetal viral infection (National Health Service, 2025). It can even cause severe bleeding during childbirth, leading to the death of pregnant women (O'Kelly & Lambert, 2020). Compared with other populations, the impact of mosquito infestation on pregnant women is more serious, as shown in Table 3.

Table 3. Comparison of the effects of mosquito infestation on pregnant women and the general population.

Disease	General populations	Target populations- Pregnant women
Yellow fever	Fever, headache, jaundice, muscle pain, nausea, vomiting, and fatigue. A small percentage of patients infected with the virus develop severe symptoms, and about half of them die within 7 to 10 days.	1. Prohibition of vaccination 2. Vaccination can cause fetal abortion.
Chikungunya	Fever and severe joint pain. Other symptoms include muscle pain, joint swelling, headache, nausea, fatigue, and rash.	Preterm birth, fetal distress rate, and miscarriage. Newborns diagnosed with encephalopathy or encephalitis after perinatal acquisition of Chikungunya.
Dengue	High fever (40°C/104°F) with headache, nausea, and vomiting during the febrile phase (2-7 days).	Dengue infection in the mother during pregnancy is highly likely to cause fever in the pregnant woman. It may also lead to problems such as premature birth and low birth weight of the baby.

© 2025 AESS Publications. All Rights Reserved.

Disease	General populations	Target populations- Pregnant women
Zika	Fever, rash, conjunctivitis, muscle and joint pain	Infants born with microcephaly and other congenital malformations. Premature birth and miscarriage.
Malaria	Fever, headache, and chills. If left untreated, P. falciparum malaria can progress to severe illness and death within 24 hours.	1. No vaccination.
		2. There are safety issues with preventive chemotherapy.
		3. lead to anemia during pregnancy. Anemia can easily lead to hemorrhage during delivery.
		4. Studies show that 10,000 pregnant women die from malaria every year.
Japanese encephalitis	Fever and headache	There is a high risk of miscarriage.
Lymphatic filariasis	Damage to the lymphatic system can lead to abnormal enlargement of body parts, causing pain, severe disability, and social stigma.	There are safety issues with prophylactic chemotherapy.
		No drugs are available to treat.
West Nile fever	Headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, and paralysis.	An infected pregnant woman can transmit the virus to her baby through breast milk. The virus can also be transmitted vertically through the placenta.

Source: Compiled by the author with reference to WHO data, 2024.

4. DISCUSSION

This systematic literature review aims to identify high-risk populations for mosquito infestation and further analyze their physical and mental vulnerability to mosquito infestation. Comparing studies across different populations, we found that pregnant women are the most vulnerable. This conclusion is consistent with numerous previous public health studies and provides a basis for the development of targeted prevention strategies. This discussion section will focus on three research questions: the health threat posed by mosquito infestation, its unique impact on pregnant women, and the vulnerable position of pregnant women in societal health protection. Based on existing research findings, explanations and countermeasures will be proposed.

Mosquito infestation is a global public health issue, and its epidemiological characteristics suggest a potential threat to all age populations. The literature included in this review shows that mosquito infestation can lead to higher mortality and morbidity rates in pregnant women, children under 5 years old, immunocompromised individuals, malnourished individuals, and the elderly. For example, immunocompromised individuals often experience a longer course of mosquito-borne diseases and slower recovery (Darrigo Jr, de Sant'Anna Carvalho, & Machado, 2018); and the elderly, due to a higher burden of underlying medical conditions, may experience complications from mosquito-borne diseases (Lee, Halverson, & Ezinwa, 2018). Despite this, the results of this study show that, from a comprehensive comparison of morbidity, mortality, and disease burden, mosquito infestation still poses the highest risk to pregnant women, suggesting that public health resources should be prioritized for this population.

The results of this study suggest that pregnant women's physiological characteristics and the stress of pregnancy place them at greater risk from mosquito infestation. This is consistent with previous research. Physiologically, susceptibility is reflected in the increased attractiveness of volatile organic compounds emitted by pregnant women to mosquitoes compared to the general population (Ellwanger et al., 2021). Mosquitoes are more likely to transmit mosquito-borne diseases to highly susceptible pregnant women. Vulnerability is reflected in the threat posed to the health of both pregnant women and their fetuses by mosquito infestation. First, infection with mosquito-borne diseases during pregnancy can lead to miscarriage, increased cesarean section rates, iron deficiency anemia, and postpartum hemorrhage (Oberlin & Wylie, 2023; Rohatgi & Grover, 2022). Second, mosquito-borne diseases can cause fetal malformations, fetal distress, premature birth, preeclampsia, and neonatal death (Diouf &

© 2025 AESS Publications. All Rights Reserved.

Nour, 2017; Jahan, Alam, & Akter, 2024; Panchaud et al., 2016; Yu, Hu, & Cao, 2022). What's more, the Zika virus not only causes fetal microcephaly and other complications but also affects the growth and development of deformed children at all stages after birth (Devakumar et al., 2018). Psychologically, it is noteworthy that pregnancy stress, including prenatal distress and trait anxiety, is common among pregnant women (Liébana-Presa, García-Fernández, Martín-Vázquez, Martínez-Fernández, & Hidalgo-Lopezosa, 2024). Furthermore, in areas with high mosquito infestations, pregnant women experience fear, anxiety, and even depression when considering the potential impact of the Zika virus on their babies' health (Horan et al., 2020). In addition, women with higher levels of education understand the limitations of available information, government actions, and healthcare services, ultimately leading to higher levels of distress and worry (Linde Arias et al., 2020). Therefore, the negative impact of stress and anxiety during pregnancy on mental health cannot be ignored.

The results of this study are consistent with previous research on the long-term impact of mosquito infestation on maternal mental health. Children born with Zika syndrome not only face neurological and visual impairments but also experience multiple medical complications (Araujo, Silva, & Araujo, 2016). For pregnant women, caring for a child with a deformity presents uncertainty and burdens. Moreover, they face discrimination and abandonment from partners, relatives, and the community (Marban-Castro et al., 2022). Furthermore, the loss of family labor due to mothers caring for a child with a deformity indirectly creates an economic burden for the family (Shahat & Greco, 2021). Therefore, Zika virus infection has long-term effects on the physical and mental health of pregnant women and their fetuses. Not only do mothers face the stress of pregnancy and the uncertainty of miscarriage during pregnancy and planning, but even after childbirth, the long-term physical and mental health consequences for mothers of children with deformities are unpredictable. In summary, mosquito infestation poses a serious threat not only to the physical health of pregnant women and their fetuses but also to the growth and development of the fetus at all stages after birth. This evidence indicates that pregnant women are a high-risk population for mosquito infestation. The findings of this review are consistent with those of the WHO, CDC, and NHS, all of which highlight the vulnerability of pregnant women to mosquito infestation. Our results suggest that the unique physiological state of pregnancy, the long-term physical and mental health impacts of mosquito infestation on both mother and fetus, and the exclusion of pregnancy from specific treatments and vaccines contribute to the fact that pregnant women are at the highest risk of mosquito infestation compared to other populations. Additionally, some included studies suggest that climate change and travel may increase the risk of mosquito infestation among pregnant women. This presents new challenges for future public health prevention and control strategies.

5. IMPLICATIONS

The results of this review clearly indicate that pregnant women are the most vulnerable population to mosquito-borne diseases. This finding has important implications for public health policy, clinical interventions, and the development of prevention and control measures. First, at the public health level, mosquito control for pregnant women should be a priority strategy, especially in public areas with high epidemic rates, with strengthened management to reduce the transmission of mosquito-borne pathogens. Second, the medical community should increase research and development of clinical interventions for mosquito-borne diseases during pregnancy to reduce the probability of adverse pregnancy outcomes. Finally, at the prevention and control level, safe mosquito control measures should be provided to pregnant women to reduce their risk of contracting diseases.

6. LIMITATIONS

While this systematic literature review adhered to PRISMA guidelines and conducted an extensive search across multiple databases, several limitations remain. First, although the literature search encompassed mainstream databases and some gray literature, language restrictions limited the inclusion to studies written in English, potentially leading to language bias and the omission of important information from excluded local studies. Second,

© 2025 AESS Publications. All Rights Reserved.

the included studies varied significantly in design, sample size, mosquito infestation definitions, and diagnostic methods, limiting the comparability of results and the ability to pool data for analysis. Third, the definition of "high-risk populations" was inconsistent across studies. Some studies relied solely on age, failing to consider multidimensional factors such as socioeconomic and nutritional factors, which could underestimate the social determinants of mosquito infestation risk. Fourth, most included studies were cross-sectional or retrospective, limiting the ability to infer causality. Finally, some data spanned a long timeframe and may not fully reflect epidemiological changes following current health policies and vaccine rollout. Therefore, caution is warranted in interpreting and applying the conclusions of this study. Future research should mitigate bias by standardizing definitions, expanding data sources, and conducting high-quality prospective studies.

7. CONCLUSION

This systematic literature review, through systematic retrieval and rigorous screening of multiple databases, comprehensively analyzed the differences in the occurrence and impact of mosquito infestation among different populations, and ultimately clearly pointed out that pregnant women are the most vulnerable high-risk population. The results show that pregnant women are more susceptible to viruses and parasites of mosquito-borne diseases due to their physiological state. At the same time, adverse pregnancy outcomes caused by mosquito-borne diseases not only affect the mother but also the fetus. What's more, congenital Zika syndrome has long-term effects on the physical and mental health of pregnant women and fetuses. The findings of this review not only supplement the existing evidence-based medicine but also provide a clear direction for public health intervention. Mosquito prevention and control for pregnant women should be an important priority in global and national health policies. It is recommended that Southeast Asia, where mosquito infestation is severely affected, should combine maternal and child health management, maternal health care services, and infectious disease prevention and control to form a comprehensive mosquito protection system. In conclusion, this study highlights the importance of prioritizing the protection of pregnant women from mosquitoes in the global health agenda. Through scientific prevention, timely diagnosis, and treatment, and improved social support systems, maternal and fetal morbidity, mortality, and negative psychological impacts can be significantly reduced, thereby improving maternal health and overall public health. Future research should further emphasize the safety and sustainability of mosquito prevention strategies for pregnant women.

Funding: This study received no specific financial support.
Institutional Review Board Statement: The Ethical approval for this study was given by the Medical Research and Ethics Committee of Malaysia has granted approval for this study on 10 November 2023(Ref: 23-02989-OBO) and the Medical Research Ethics Committee of Universiti Putra Malaysia (JKEUPM) on 12 December 2023(Ref: JKEUPM-2023-1304).
Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

REFERENCES

Al-Osaimi, H. M., Kanan, M., Marghlani, L., Al-Rowaili, B., Albalawi, R., Saad, A., . . . Shrwani, R. (2024). A systematic review on malaria and dengue vaccines for the effective management of these mosquito borne diseases: Improving public health. *Human Vaccines & Immunotherapeutics*, *20*(1), 2337985. https://doi.org/10.1080/21645515.2024.2337985

Araujo, A. Q. C., Silva, M. T. T., & Araujo, A. P. Q. C. (2016). Zika virus-associated neurological disorders: A review. *Brain*, *139*(8), 2122-2130. https://doi.org/10.1093/brain/aww158

Azevedo, C. d. S., Freire, I. M., & Moura, L. N. d. F. (2021). Family restructuring in the context of baby's care with Zika virus congenital syndrome. *Interface-Comunicação, Saúde, Educação*, *25*, e190888. https://doi.org/10.1590/interface.190888

© 2025 AESS Publications. All Rights Reserved.

Bailey, K. A., & Ventura, M. J. (2018). Mothers of children with disabilities: Discrimination, abandonment, and resilience in caregiving. *Journal of Family and Community Studies, 12*(3), 45–59.

Bello, M. B., Alsaadi, A., Naeem, A., Almahboub, S. A., Bosaeed, M., & Aljedani, S. S. (2025). Development of nucleic acid-based vaccines against dengue and other mosquito-borne flaviviruses: The past, present, and future. *Frontiers in Immunology, 15*, 1475886. https://doi.org/10.3389/fimmu.2024.1475886

Borba, R., Rodrigues, A., Ventura, C. V., Marques, C., Nóbrega, L., Higino, T., . . . Ventura, L. O. (2024). Postural abnormalities in children with congenital Zika syndrome-related neurological and visual impairment. *Viruses, 16*(12), 1959. https://doi.org/10.3390/v16121959

Canali, M., Vici, L., Rivas Morales, S., Donati, L., Matrangolo, C., Venturelli, C., . . . Carrieri, M. (2024). Household expenditure on control of urban mosquitoes Aedes albopictus and Culex pipiens in Emilia-Romagna, Northern Italy. *PLoS Neglected Tropical Diseases, 18*(10), e0012552. https://doi.org/10.1371/journal.pntd.0012552

Cao-Lormeau, V.-M., Blake, A., Mons, S., Lastère, S., Roche, C., Vanhomwegen, J., . . . Larre, P. (2016). Guillain-Barré Syndrome outbreak associated with Zika virus infection in French Polynesia: A case-control study. *The Lancet, 387*(10027), 1531-1539. https://doi.org/10.1016/S0140-6736(16)00562-6

Capeding, M. R., Tran, N. H., Hadinegoro, S. R. S., Ismail, H. I. H. M., Chotpitayasunondh, T., Chua, M. N., . . . Nallusamy, R. (2014). Clinical efficacy and safety of a novel tetravalent dengue vaccine in healthy children in Asia: A phase 3, randomised, observer-masked, placebo-controlled trial. *The Lancet, 384*(9951), 1358-1365. https://doi.org/10.1016/S0140-6736(14)61060-6

Carrieri, M., Albieri, A., Angelini, P., Venturelli, C., Matrangolo, C., & Bellini, R. (2022). Monitoring of the Tiger Mosquito in Emilia-Romagna. In D. Luca (Ed.), Mosquito Surveillance in Italy. In (pp. 116–130). Rome: National Institute of Health Reports.

Centers for Disease Control and Prevention. (2025a). *About a dengue vaccine. In Dengue*. Atlanta, GA, USA: U.S. Department of Health & Human Services.

Centers for Disease Control and Prevention. (2025b). *Chikungunya vaccines. In Chikungunya*. Atlanta, GA, USA: U.S. Department of Health & Human Services.

Colón-González, F. J., Sewe, M. O., Tompkins, A. M., Sjödin, H., Casallas, A., Rocklöv, J., . . . Lowe, R. (2021). Projecting the risk of mosquito-borne diseases in a warmer and more populated world: A multi-model, multi-scenario intercomparison modelling study. *The Lancet Planetary Health, 5*(7), e404-e414. https://doi.org/10.1016/S2542-5196(21)00132-7

Coutinho, C. M., Negrini, S. F. B. M., Araujo, D. C. A., Teixeira, S. R., Amaral, F. R., Moro, M. C. R., . . . Caldas, C. A. C. T. (2021). Early maternal Zika infection predicts severe neonatal neurological damage: Results from the prospective Natural History of Zika Virus Infection in Gestation cohort study. *BJOG: An International Journal of Obstetrics & Gynaecology, 128*(2), 317-326. https://doi.org/10.1111/1471-0528.16490

Darrigo Jr, L. G., de Sant'Anna Carvalho, A. M., & Machado, C. M. (2018). Chikungunya, dengue, and Zika in immunocompromised hosts. *Current Infectious Disease Reports, 20*(4), 5. https://doi.org/10.1007/s11908-018-0612-2

De Souza, W. M., & Weaver, S. C. (2024). Effects of climate change and human activities on vector-borne diseases. *Nature Reviews Microbiology, 22*(8), 476-491. https://doi.org/10.1038/s41579-024-01026-0

Devakumar, D., Bamford, A., Ferreira, M. U., Broad, J., Rosch, R. E., Groce, N., . . . Alexandre, P. (2018). Infectious causes of microcephaly: Epidemiology, pathogenesis, diagnosis, and management. *The Lancet infectious Diseases, 18*(1), e1-e13. https://doi.org/10.1016/S1473-3099(17)30398-5

Diouf, K., & Nour, N. M. (2017). Mosquito-borne diseases as a global health problem: Implications for pregnancy and travel. *Obstetrical & Gynecological Survey, 72*(5), 309-318. https://doi.org/10.1097/OGX.0000000000000433

Duval, P., Antonelli, P., Aschan-Leygonie, C., & Valiente Moro, C. (2023). Impact of human activities on disease-spreading mosquitoes in urban areas. *Journal of Urban Health, 100*(3), 591-611. https://doi.org/10.1007/s11524-023-00732-z

© 2025 AESS Publications. All Rights Reserved.

Duval, P., Aschan-Leygonie, C., & Valiente Moro, C. (2023). A review of knowledge, attitudes and practices regarding mosquitoes and mosquito-borne infectious diseases in nonendemic regions. *Frontiers in Public Health*, *11*, 1239874. https://doi.org/10.3389/fpubh.2023.1239874

Ellwanger, J. H., da Cruz Cardoso, J., & Chies, J. A. B. (2021). Variability in human attractiveness to mosquitoes. *Current Research in Parasitology & Vector-Borne Diseases*, *1*, 100058. https://doi.org/10.1016/j.crpvbd.2021.100058

Filip, R., Gheorghita Puscaselu, R., Anchidin-Norocel, L., Dimian, M., & Savage, W. K. (2022). Global challenges to public health care systems during the COVID-19 pandemic: A review of pandemic measures and problems. *Journal of Personalized Medicine*, *12*(8), 1295. https://doi.org/10.3390/jpm12081295

Gaston, K. J., & Soga, M. (2020). Extinction of experience: The need to be more specific. *People and Nature*, *2*(3), 575–581. https://doi.org/10.1002/pan3.10118

Hills, S. L., Wong, J. M., & Staples, J. E. (2023). Arboviral vaccines for use in pregnant travelers. *Travel Medicine and Infectious Disease*, *55*, 102624. https://doi.org/10.1016/j.tmaid.2023.102624

Horan, H., Cheyney, M., Nako, E., & Bovbjerg, M. (2020). Maternal stress and the ZIKV epidemic in Puerto Rico. *Critical Public Health*, *32*(2), 241-251. https://doi.org/10.1080/09581596.2020.1808189

Imran, M., McKinney, B. A., Butt, A. I. K., Palumbo, P., Batool, S., & Aftab, H. (2025). Optimal control strategies for Dengue and Malaria co-infection disease model. *Mathematics*, *13*(1), 43. https://doi.org/10.3390/math13010043

Jahan, I., Alam, L. C. D. M. F., & Akter, S. (2024). Dengue in pregnancy a systemic review and meta analysis of maternal and perinatal outcomes. *IAR Journal of Medicine and Surgery Research*, *5*(6), 41-49.

Jasper, B., & Aiken, C. (2024). International travel during pregnancy: A review of current literature and guidelines. *Obstetrics, Gynaecology & Reproductive Medicine*, *34*(12), 338-343. https://doi.org/10.1016/j.ogrm.2024.08.009

Jordan, R. A., Eisen, L., & Schulze, T. L. (2024). Willingness and ability of existing mosquito control and public health agencies in New Jersey to assume responsibilities for management of ticks and tick-borne disease. *Journal of Medical Entomology*, *61*(4), 1054-1063. https://doi.org/10.1093/jme/tjae054

Khezzani, B., Baymakova, M., Khechekhouche, E. A., & Tsachev, I. (2023). Global warming and mosquito-borne diseases in Africa: A narrative review. *Pan African Medical Journal*, *44*(70), 1-15. https://doi.org/10.11604/pamj.2023.44.70.37318

Lapshin, D. N., & Vorontsov, D. D. (2021). Frequency tuning of swarming male mosquitoes (Aedes communis, Culicidae) and its neural mechanisms. *Journal of Insect Physiology*, *132*, 104233. https://doi.org/10.1016/j.jinsphys.2021.104233

Lee, H., Halverson, S., & Ezinwa, N. (2018). Mosquito-borne diseases. *Primary Care: Clinics in Office Practice*, *45*(3), 393-407. https://doi.org/10.1016/j.pop.2018.05.001

Liébana-Presa, C., García-Fernández, R., Martín-Vázquez, C., Martínez-Fernández, M. C., & Hidalgo-Lopezosa, P. (2024). Anxiety, prenatal distress, and resilience during the first trimester of gestation. *Revista da Escola de Enfermagem da USP*, *58*, e20230290. https://doi.org/10.1590/1980-220X-REEUSP-2023-0290en

Lima, L. H. d. S. S., Mendes, R. C. M. G., Monteiro, E. M. L. M., Marinus, M. W. d. L. C., Linhares, F. M. P., & Cavalcanti, A. M. T. d. S. (2022). Congenital Zika syndrome in the light of the theorist Betty Neuman: Family stressors. *Acta Paulista de Enfermagem*, *35*, eAPE01997. https://doi.org/10.37689/acta-ape/2022AO01997

Linde Arias, A. R., Tristan-Cheever, E., Furtado, G., & Siqueira, E. (2020). "Too much to ask, too much to handle": Women's coping in times of zika. *International Journal of Environmental Research and Public Health*, *17*(12), 4613. https://doi.org/10.3390/ijerph17124613

Lindsay, S., Ansell, J., Selman, C., Cox, V., Hamilton, K., & Walraven, G. (2000). Effect of pregnancy on exposure to Malaria mosquitoes. *The Lancet*, *355*(9219), 1972. https://doi.org/10.1016/S0140-6736(00)02334-5

Marban-Castro, E., Enguita-Fernàndez, C., Romero-Acosta, K. C., Arrieta, G. J., Marín-Cos, A., Mattar, S., . . . Bardají, A. (2022). "One feels anger to know there is no one to help us!". Perceptions of mothers of children with Zika virus-associated microcephaly in Caribbean Colombia: A qualitative study. *PLoS Neglected Tropical Diseases*, *16*(4), e0010328. https://doi.org/10.1371/journal.pntd.0010328

© 2025 AESS Publications. All Rights Reserved.

Marbán-Castro, E., Villén-Gonzalvo, A., Enguita-Fernàndez, C., Marín-Cos, A., Menéndez, C., Maixenchs, M., & Bardají, A. (2020). Uncertainties, fear and stigma: Perceptions of Zika virus among pregnant women in Spain. *International Journal of Environmental Research and Public Health*, *17*(18), 6643. https://doi.org/10.3390/ijerph17186643

Marcondes, B. C., & Benelli, G. (2019). Mosquitoes, infectious diseases, and cancer: A connection to study? *International Journal of Environmental Research and Public Health*, *16*(23), 4859. https://doi.org/10.3390/ijerph16234859

McGowan, J., Sampson, M., Salzwedel, D. M., Cogo, E., Foerster, V., & Lefebvre, C. (2016). PRESS peer review of electronic search strategies: 2015 guideline statement. *Journal of Clinical Epidemiology*, *75*, 40-46. https://doi.org/10.1016/j.jclinepi.2016.01.021

Moonen, J. P., Schinkel, M., van der Most, T., Miesen, P., & van Rij, R. P. (2023). Composition and global distribution of the mosquito virome-A comprehensive database of insect-specific viruses. *One Health*, *16*, 100490. https://doi.org/10.1016/j.onehlt.2023.100490

Mulik, V., Dad, N., & Buhmaid, S. (2021). Dengue in pregnancy: Review article. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, *261*, 205-210. https://doi.org/10.1016/j.ejogrb.2021.04.035

National Health Service. (2025). *Malaria*. London, England: NHS.

O'Kelly, B., & Lambert, J. S. (2020). Vector-borne diseases in pregnancy. *Therapeutic Advances in Infectious Disease*, *7*, 2049936120941725. https://doi.org/10.1177/2049936120941725

Oberlin, A. M., & Wylie, B. J. (2023). Vector-borne disease, climate change and perinatal health. *Seminars in Perinatology*, *47*(8), 151841. https://doi.org/10.1016/j.semperi.2023.151841

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., . . . Moher, D. (2021). Updating guidance for reporting systematic reviews: Development of the PRISMA 2020 statement. *Journal of Clinical Epidemiology*, *134*, 103-112. https://doi.org/10.1016/j.jclinepi.2021.02.003

Panchaud, A., Stojanov, M., Ammerdorffer, A., Vouga, M., & Baud, D. (2016). Emerging role of Zika virus in adverse fetal and neonatal outcomes. *Clinical Microbiology Reviews*, *29*(3), 659-694. https://doi.org/10.1128/cmr.00014-16

Roberds, A., Ferraro, E., Luckhart, S., & Stewart, V. A. (2021). HIV-1 impact on Malaria transmission: A complex and relevant global health concern. *Frontiers in Cellular and Infection Microbiology*, *11*, 656938. https://doi.org/10.3389/fcimb.2021.656938

Rohatgi, A., & Grover, A. (2022). Maternal malaria, dengue, and chikungunya. In Infections and pregnancy. In (pp. 219–246). Singapore: Springer.

Seo, J.-H., Hedrick, T. L., & Mittal, R. (2021). Mosquitoes buzz and fruit flies don't-a comparative aeroacoustic analysis of wing-tone generation. *Bioinspiration & Biomimetics*, *16*(4), 046019.

Shahat, A. R. S., & Greco, G. (2021). The economic costs of childhood disability: A literature review. *International Journal of Environmental Research and Public Health*, *18*(7), 3531. https://doi.org/10.3390/ijerph18073531

Shaw, J. A. (2024). Vector-borne/zoonotic diseases. In Historical diseases from a modern perspective. In (pp. 65–100). Cham, Switzerland: Springer Nature Switzerland

Sondo, K. A., Ouattara, A., Diendéré, E. A., Diallo, I., Zoungrana, J., Zémané, G., . . . Poda, A. (2019). Dengue infection during pregnancy in Burkina Faso: A cross-sectional study. *BMC Infectious Diseases*, *19*(1), 997. https://doi.org/10.1186/s12879-019-4587-x

Tirado, V., Morales Mesa, S. A., Kinsman, J., Ekström, A. M., & Restrepo Jaramillo, B. N. (2020). Women's reluctance for pregnancy: Experiences and perceptions of Zika virus in Medellin, Colombia. *International Journal of Gynecology & Obstetrics*, *148*(S2), 36-44. https://doi.org/10.1002/ijgo.13046

Watanabe, S., & Vasudevan, S. G. (2023). Clinical and experimental evidence for transplacental vertical transmission of flaviviruses. *Antiviral Research*, *210*, 105512. https://doi.org/10.1016/j.antiviral.2022.105512

WHO. (2024). *Vector-borne diseases. Who.int*. Retrieved from https://www.who.int/news-room/fact-sheets/detail/vector-borne-diseases

© 2025 AESS Publications. All Rights Reserved.

World Health Organization. (2004). *Global strategic framework for integrated vector management*. Geneva, Switzerland: World Health Organization.

Yadav, N., & Upadhyay, R. K. (2023). Global effect of climate change on seasonal cycles, vector population and rising challenges of communicable diseases: A review. *Journal of Atmospheric Science Research*, *6*(1), 21-59. https://doi.org/10.30564/jasr.v6i1.5165

Yu, W., Hu, X., & Cao, B. (2022). Viral infections during pregnancy: The big challenge threatening maternal and fetal health. *Maternal-Fetal Medicine*, *4*(1), 72-86. https://doi.org/10.1097/FM9.0000000000000133

Zahavi, I., Fons, M., Meir, M., Volevich, M., Guasch, E., Nunnally, M., & Einav, S. (2024). Anesthetic approach to pregnant patients with malaria: A narrative review of the literature. *Journal of Anesthesia, Analgesia and Critical Care*, *4*(1), 48. https://doi.org/10.1186/s44158-024-00185-z

Zeller, H., Marrama, L., Sudre, B., Van Bortel, W., & Warns-Petit, E. (2013). Mosquito-borne disease surveillance by the European centre for disease prevention and control. *Clinical Microbiology and Infection*, *19*(8), 693-698. https://doi.org/10.1111/1469-0691.12230

Views and opinions expressed in this article are the views and opinions of the author(s), International Journal of Asian Social Science shall not be responsible or answerable for any loss, damage or liability etc. caused in relation to/arising out of the use of the content.

© 2025 AESS Publications. All Rights Reserved.