



Dengue Fever: Recent Developments and Comprehensive Insight

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Abstract

Dengue fever, a viral infection caused by the bite of the *Aedes* mosquito, poses significant global health challenges, particularly in tropical and subtropical regions. This study examines the epidemiology of the disease, highlighting its increasing prevalence due to factors such as urbanization and climate change. Furthermore, the economic burden of dengue fever and prevention strategies, including vector control and community awareness initiatives, are crucial for reducing disease incidence. The symptoms and treatment perspectives are discussed, emphasizing supportive care since no specific antiviral treatment is available. The economic burden of dengue is also significant, impacting healthcare systems and economies in endemic areas. Finally, this commentary underscores the importance of public awareness for early symptom recognition and immediate medical care while discussing solutions to combat dengue fever, including enhanced surveillance, vaccine development, and community participation to reduce transmission risks.

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Introduction

Dengue fever cases have surged in recent decades, with around half the global population at risk. Annually, 100 to 400 million are infected (1). Dengue, spread by *Aedes* mosquitoes (2), is often mild but can lead to severe illness or death (3). As of April 30, 2024, about 6.7 million infections were reported, with 16,000 severe cases and over 3,000 deaths across 90 countries (3). Iran is a high-risk area for dengue due to favorable conditions and travel from endemic regions. On June 14, 2024, Iran confirmed its first two local cases in Bandar-Lengeh, Hormozgan Province. Statistics up to August 5 indicated that around 152 people had dengue, primarily linked to travel to the UAE and Pakistan (4).

Ways of Transmission of Dengue Fever

The disease caused by the dengue virus, which belongs to the Flaviviridae family, includes four

serotypes: DENV1 to DENV4 (5). Infection with one serotype confers long-term immunity to that specific serotype and only transient immunity to the others. Consequently, secondary infections with different serotypes increase the risk of severe dengue (3). The primary mode of dengue virus transmission between humans is through mosquito vectors. It usually transmits the virus in tropical and subtropical regions, primarily urban and semi-urban areas. The primary vector is the *Aedes aegypti* mosquito, while *Aedes albopictus* mosquitoes also play a lesser role in disease transmission. In some regions, such as Europe and North America, *Aedes albopictus* mosquitoes are more widespread. There is evidence of the possibility of dengue virus transmission from a pregnant mother to her baby, breast milk, sexual contact, as well as transmission through blood products, organ donation, and blood transfusion (6).

Additionally, transmission of the virus

through the ovary in mosquitoes has been reported. Notably, there is a significant overlap in the geographic distribution of dengue, chikungunya, and Zika viruses, all transmitted by *Aedes* mosquitoes and share similar clinical characteristics. This overlap can lead to misdiagnosis and misreporting without differential laboratory testing. For example, in a study conducted in the Brazilian state of Minas Gerais, 84.4% of 828,654 “suspected arbovirus” cases were suspected of dengue, while only 15.6% were suspected of chikungunya. However, the actual proportion among laboratory-confirmed cases was 65.9% chikungunya and 34.1% dengue (7).

Risk Factors of Dengue Fever

The rise in dengue cases, especially in previously unaffected countries, is due to various factors. Environmental changes like higher temperatures, heavy rainfall, and humidity contribute to rapid urbanization, leading to poor waste management and water storage. These conditions create more breeding sites for mosquitoes. Socio-economic factors, such as high population density in urban areas, travel, and migration patterns, the level of awareness, attitudes, and behaviors of the population toward dengue, previous infections with DENV, fragile health systems—especially amid the COVID-19 pandemic—and the lack of adequate public health infrastructure to control and manage the condition can also be considered risk factors for the increase in dengue. Furthermore, lack of access to reliable water sources, failure to use proper water storage methods, and political and financial instability in countries facing humanitarian crises and population displacement can notably contribute to an increase in the incidence of dengue fever.

Complications of Dengue Fever

Severe dengue fever can lead to internal bleeding, organ damage, high blood pressure, shock, and even death. Pregnant women with dengue fever may transmit the virus to the fetus during delivery. Additionally, babies born to women who contract dengue fever during pregnancy are at risk of premature delivery, low birth weight, and other fetal complications.

Prevention and Protection Against Dengue Fever

To reduce the risk of dengue fever, mosquito

bites should be avoided, especially during the day. Protective measures include wearing full-body clothing, using mosquito nets when sleeping during the day, installing screens on windows, and using mosquito repellents (containing DEET, Picaridin, or IR3535) and coils and vaporizers. Additionally, it is possible to prevent mosquito breeding by managing and modifying the environment. This includes proper disposal of solid waste, removal of artificial water-holding habitats, covering, draining, and cleaning household water storage containers weekly, and using appropriate insecticides in outdoor water storage containers.

A dengue fever vaccine is available for some people living where dengue viruses are prevalent, specifically for those aged 6 to 60. However, the World Health Organization emphasizes that the vaccine alone is not an effective tool for reducing dengue fever; preventing mosquito bites and controlling the mosquito population should also be considered. If an individual contracts dengue fever, it is recommended that they get plenty of rest and drink lots of fluids. The use of acetaminophen (paracetamol) is suitable for pain relief, but non-steroidal anti-inflammatory drugs such as ibuprofen and aspirin should be avoided. If severe symptoms develop, such as intense abdominal pain, persistent vomiting, difficulty breathing, or blood in the nose, gums, vomit, or stool, the individual should contact their doctor immediately.

Economic Burden of Dengue Fever

The global incidence of dengue has increased significantly in recent decades. A comprehensive understanding of the economic consequences of dengue is crucial for developing informed and evidence-based policies. Using a macroeconomic model, economic calculations of dengue in 141 countries and regions show that dengue fever will impose an economic burden of \$306 billion on the global economy between 2020 and 2050. This economic impact is equivalent to a tax of 0.009 percent of global gross domestic product (GDP). The highest economic burdens are projected in India (\$125 billion), Indonesia (\$45 billion), China (\$31 billion), the Philippines (\$21 billion), South Korea (\$20.5 billion), Malaysia (\$7.8 billion), Pakistan (\$4.4 billion), Thailand (\$4.4 billion), Mexico (\$4.3 billion), Brazil (\$3.8 billion), Bangladesh (\$2.9 billion), Vietnam (\$2.9

billion), France (\$2.7 billion), Colombia (\$2.3 billion), and Sri Lanka (\$1.8 billion).

Among income groups, most are projected to bear the brunt of dengue's impacts on global health (90.2%) and economic (68.8%). India, Indonesia, and the Philippines will experience the highest number of years lived with disability. Upper-middle-income countries, including China, Malaysia, Thailand, Mexico, Brazil, and Colombia, are expected to experience significant—albeit minor—economic losses (18.9 percent of global economic losses). The macroeconomic burden of dengue is unevenly distributed across countries, world regions, and income levels, emphasizing the urgent need for global investment to reduce dengue disease's health and economic burden (8).

Community Awareness and Attitude about Dengue Fever

In viral disease epidemics, the awareness and attitudes of the population become doubly important. Dengue fever, one of these viral infections, brings much conflicting information. Despite the available knowledge, misconceptions about the breeding grounds of *Aedes* mosquitoes are still common (9). Another important point is the correct distinction of dengue fever symptoms from those of other seasonal diseases; the knowledge and attitudes of educated individuals also vary in this regard (10-12).

Misconceptions that dengue fever spreads through flies (50.3%), direct contact (43.2%), or contaminated food/water (46.5%) can negatively impact prevention efforts (13). Social media's broad reach makes it a powerful tool for sharing correct disease information. It can boost dengue prevention by engaging the public and raising awareness (14). Posts and social media campaigns effectively control *Aedes* mosquito breeding grounds (15). Furthermore, openly sharing data on dengue cases and affected areas on platforms like Facebook can build public trust in the media, improve understanding of the disease's spread, and enhance public health information (16).

There are different beliefs about preventive measures. According to some people, using mosquito nets, keeping the surrounding environment clean, avoiding dirty and stagnant water, using insecticide sprays, vaccination, and applying kerosene oil can be effective in prevention (1).

Suggestions

In the context of diseases caused by insect bites, health systems need extensive support from global communities, governments, charities, and the private sector. This support includes mobilizing domestic resources to build resilient health systems and communities against diseases like dengue fever. In recent years, especially after the COVID-19 pandemic, cases of dengue fever have increased sharply and spread to new areas, including Iran, due to the weakening of health systems in various countries and climate change. Despite significant research in dengue fever treatment, there is still no specific antiviral treatment; the available treatments are mainly supportive. It is suggested that control methods be used based on the One Health approach for better control of dengue fever. This includes improving the quality of household water storage, developing specific and sensitive tests for rapid disease diagnosis, investigating the impact of increasing urbanization and climate change on dengue epidemiology, and preventing the indiscriminate use of insecticides.

Additionally, absorbent traps, insect repellents, and appropriate insecticides should be used in infested areas. It is also important to produce a quadrivalent dengue fever vaccine, considering its effectiveness, determining target priorities, improving and cleaning environments, and utilizing the experiences of prosperous countries in controlling *Aedes* mosquitoes and related diseases. Extensive information dissemination through mass media to increase public awareness and prevent dengue fever without creating fear in public opinion should be prioritized by the Ministry of Health.

Authors' Contribution

MGH conceived the commentary. Zz selected references and drafted the manuscript. FSJ selected references and substantively revised the manuscript. All authors read and approved the final manuscript.

Conflict of Interest

There are no conflicts of interest.

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