

COMBATING DENGUE: A NARRATIVE REVIEW BEYOND VACCINES

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Abstract: INTRODUCTION: Dengue is an endemic disease characterized by high morbidity and mortality rates, with significant economic impact, particularly in underdeveloped countries. Historically, research institutions and governments have sought to implement public policies to combat the disease, while maintaining the belief that the development of a vaccine would serve as the ultimate solution to this challenge. OBJECTIVES: To analyze the current epidemiology of dengue, discuss existing methods for combating the disease, elucidate the costs associated with scientific vaccine research, and examine Brazil's current government plan for reducing the incidence of dengue. METHOD: A literature review was conducted using national and international research platforms, professional media sources, and official government data. RESULTS: The costs associated with both scientific research into vaccine development, production, and distribution, as well as with the implementation of quality basic sanitation, are substantial. Brazilian municipalities that prioritize basic sanitation not only achieve a reduction in dengue incidence but also see improvements in combating other neglected diseases. CONCLUSION: The eradication of dengue remains an unresolved issue. However, it is evident that basic sanitation policies, particularly in impoverished areas, are crucial for the sustained reduction of the disease.

Keywords: Dengue, basic sanitation, dengue vaccines, health policy

INTRODUCTION

Dengue is a viral disease caused by the dengue flavivirus, which can be subdivided into DENV-1 to DENV-4, an RNA virus transmitted mainly by mosquitoes of the genus *Aedes*, which can be either *Aedes aegypti* or *Aedes albopictus*. The former is endophilic and needs environments with water to reproduce. The latter is exophilic and can reproduce in natural conditions in the countryside. The incidence of the disease, which affects more than 100 countries, especially in tropical and subtropical regions, is due to the proliferation of contaminated mosquitoes. This pathology is directly related to public spending and has an impact on human development indices, since public health systems are more willing to contain morbidity and mortality. As a result, year after year science has searched for preventive methods such as the discovery of a vaccine, a fact that was much celebrated by scientists in 2024 after the publication of the study of the tetravalent live attenuated virus vaccine - Butantan-Dengue. The robust study proved the need for and importance of vaccination, but since this is a neglected and multifactorial disease, it is essential to question the feasibility of mass vaccination in terms of financial commitment.¹⁻⁴

There are around 400 million cases a year, with a death toll of 22,000. In 2016 there were a record 2.3 million cases worldwide, with Brazil being the biggest contributor with 1.5 million patients. Between 1970 and 2015, the countries with the most dengue outbreaks were India, China and Brazil, all in their tropical and subtropical regions. *Aedes aegypti* is the main transmitter and, being endophilic, there is a direct correlation with periods of rain in the affected regions. It is noteworthy that the literary description of rural outbreaks only occurred after the 2000s, where until then it was mostly an urban disease. The improvement in transportation

in various regions of the world, combined with agricultural expansion in rural areas, was a risk factor for this incidence. The proliferation of the mosquito takes place in unfavorable basic sanitation conditions, a fact that is justified by the fact that the countries and regions where outbreaks occur most often have low socioeconomic levels and high population densities.²⁻³

METHODOLOGY

The search was carried out in the Google Scholar and Pubmed databases, both by selecting the following words in the titles and abstracts: “dengue”, “vaccine”, “basic sanitation”, “neglected diseases”, prioritizing articles published in the last five years. News articles from the websites of research institutes, the press and the government were also used.

OBJECTIVES

Dengue fever is an endemic disease in many countries around the world. Despite the various discussions about combating it, basic sanitation is a method primitively recognized by science as significantly reducing its incidence. In view of this, understanding the current epidemiology, the artillery in place to combat it and the costs of the most recently discovered mechanisms is essential to elucidate the obstacles in the fight against dengue. It is also important to assess the cost-benefit of public policies in the debate in question.

RESULTS

According to news published in 2017 on the website of the National Development Bank (BNDES), the initial partnership between the BNDES itself and the Butantã Institute generated a contract worth 97.2 million reais to carry out clinical trials, in addition to providing for a total investment of approximately 1 billion reais until the

completion of the tetravalent vaccine (4). A recent study showed the economic impact of dengue fever in Brazil, estimating a loss of 27 billion reais in the first half of 2024 alone, highlighting that 2024 was the worst year in the historical series, with more than 6.1 million cases up to July 1 and more than 4,250 deaths, making it the world leader in incidence and number of deaths. These losses include direct costs of the disease, from examinations and hospital treatment to the economic impact in terms of labor losses due to time off work as a result of the disease.⁵⁻⁶

There are exquisite social determinants that predispose Brazil to its precarious dengue situation. These include basic sanitation - a set of actions aimed at sanitary sewage, drinking water, urban drainage and solid waste collection - where around 16% of the population has household access to water from their own sources, such as artesian wells, groundwater, rainwater or river sources. In this context, the water consumed by around 12% of the Brazilian population is not fit for human consumption, exposing them to various infectious diseases, such as intestinal parasites, which also fall into the group of neglected diseases. In turn, dengue fever is exacerbated by this reality, as the means of storage do not guarantee adequate isolation of the water to prevent the proliferation of mosquitoes. This reality is further elucidated when we note that the regions where this weakness is concentrated are the poorest economically, with the highest demographic density and the least favored in terms of schooling, where in the social and domestic environment there is a greater accumulation of garbage and disposal of objects that are potential sources of mosquito breeding sites, a higher concentration of people in potentially contaminated homes, as well as poorer adherence to preventive measures.⁶

The absence of adequate water pipes

generates an endless cycle of dissemination of viral infectious diseases such as hepatitis A, rotavirus and enterovirus; as well as bacterial diseases such as *Escherichia coli*, *Shigella*, *Salmonella*; even protozoa such as *Giardia*, *Toxoplasma gondii* and *Entamoeba*. Exposure to these agents not only raises public health costs, but also generates serious damage such as child malnutrition - agents of acute and chronic diarrhea - and increased infant mortality - primary infection of *Toxoplasma gondii* in pregnant women.⁸

A survey published in 2022 shows that in the municipality of Camboriú, in the state of Santa Catarina, the neighborhoods with the highest incidence of dengue fever between 2019 and 2021 were those with the least access to the factors that generate quality basic sanitation. Similarly, another survey based on official government data showed the alignment with the problem in the city of Imperatriz, state of Maranhão, where deficiencies in solid waste collection, urban cleaning and sewage disposal are flawed and contribute to the dengue endemic in the region.⁹⁻¹⁰

In 2019, the Ministry of Regional Development drew up the National Basic Sanitation Plan (PLANSAB) as a mechanism to remedy the problem. The main goals of PLANSAB are the provision of drinking water and sanitation. By 2033, 99% of urban and rural households will be supplied with water through a distribution network, well or spring; 93% of the population will have adequate sewage collection; and 92% of urban

and rural households will have a sewage system or septic tank. In order to achieve this goal, 142.150 billion reais will be invested in water supply between 2019 and 2033, and 215 billion reais in sewage, for a total of 357 billion reais. Brazil's Gross Domestic Product (GDP) in 2023 was 10.3 trillion reais, where the previous amount represents only 0.23% of the value of this GDP diluted over the 15 years of investment to achieve the targets.¹¹⁻¹²

Despite the advent of some vaccines, the Ministry of Health recommends fighting the mosquito as a priority in the fight against dengue. The economic outlay for acquiring vaccines for the entire population could result in an immeasurable reduction in the incidence of the disease in the country. However, reflection on the etiology of the disease, its factors and risks and the social determinants can instigate the production of public policies that contribute not only to the reduction of dengue but also of various neglected diseases.

CONCLUSION

The ongoing outbreaks do not reflect a lack of vaccination, but they do highlight the lack of prioritization of public policies that favour basic sanitation, housing structuring and modern and safe water systems. The incessant and incongruous search for vaccines that can prevent and even eradicate some diseases can divert the focus from real preventive actions that reduce the incidence of countless neglected diseases - not just dengue.

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