Tragedy in Paracambi-RJ: Analysis of the impacts of floods and floods from the perspective of mental health, infectious diseases, absence of socio-environmental intervention and public health in the scenario before and after flooding

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ABSTRACT

The city of Paracambi-RJ, developed along the Rio dos Macacos, a region susceptible to flooding. With a population of 41,375, inadequate infrastructure and lack of effective drainage increase the municipality's vulnerability to flooding. In February 2024, Paracambi faced one of the largest floods in recent years, exacerbated by the lack of warning systems and proper river management. Poor infrastructure, coupled with inefficient prevention measures, has aggravated outbreaks of infectious diseases such as Dengue, Chikungunya, Leptospirosis and diarrheal diseases. The need for an in-depth analysis of the impacts and responses of public authorities becomes crucial. The study seeks to analyze the causes and consequences of floods in Paracambi, evaluating the actions of local authorities and the measures adopted to mitigate these

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disasters. In addition, it is intended to review the global scientific literature on the relationship between floods and public health, correlating data on disease notifications with water quality in the municipality. The public health impacts of floods are vast and multifaceted, including communicable diseases, mental health problems, and direct physical harm. Underreporting of diseases and the lack of an efficient management system are significant barriers to mitigating impacts. The floods in Paracambi underscore the urgent need for improvements in drainage infrastructure and more effective urban planning. It is imperative that municipal management implement measures for prevention, health education and control of zoonoses. Strengthening epidemiological surveillance and continuous training of health workers are essential to prevent future catastrophes and protect public health.

Keywords: Health Surveillance, Arboviruses, Infectious Diseases, Flood, Paracambi.

INTRODUCTION

The city of Paracambi grew due to the installation of the Textile Company Brasil Industrial in 1871, visibly increasing the population of the then called Fazenda dos Macacos, which only in the following century was renamed Paracambi, thus giving rise to the Workers' Village, resulting from the occupation of employees who established residence in a place closer to the Company, on the banks of the river. The city of Paracambi (figure 1) is entirely crossed by the Rio dos Macacos (figure 2). This passes through the central area of the municipality, as well as its tributaries and other various channels that together flow into the Ribeirão das Lages, one of the sources of the Guandu River Basin. The Ribeirão has a considerable volume of water, given from the transposition of the Paraíba do Sul River. In this way, the municipality receives all the water load from the following municipalities: Paulo de Frontin, Piraí and Mendes. Studies of the Sepetiba Basin Macro-region indicate the great fragility of the municipality in terms of flooding, as it developed within the natural flooding area of the Rio dos Macacos, indicating that 43% of the urban area would be located there (Costa and Wilfried, 2001).

According to the Brazilian Institute of Geography and Statistics (IBGE), Paracambi is a municipality in the metropolitan region of the state of Rio de Janeiro (RJ), located 81 kilometers from the state capital, its population, according to the last statistics carried out in 2022 was 41,375 inhabitants in a territory of approximately 190,949 km², divided into 33 neighborhoods, with a demographic density of 216.68 inhabitants/km² (IBGE, 2022).

The Rio dos Macacos Sub-Basin, popularly known as Rio dos Macacos, cuts through the city of Paracambi entirely, and thus passes through the central area of the municipality. Being one of the main rivers in the region, it is one of the focuses of rainwater runoff in the city, however, there is neglect in the face of proper drainage and maintenance of the riverbeds that pass through the city, and debris that impairs the river flow is often observed. In addition, according to indicators from the National Sanitation Information System (SNIS), about 45.9% of the municipality's households are subject to flooding and there are no warning systems for hydrological risks. This scenario, added to the enormous amounts of rain, flood phenomena and flooding, caused a calamity in the region (SNIS, 2021).

Figure 1: Delimitation of the Municipality of Paracambi-RJ

Source: Google Maps, 2022

Figure 2: Macacos River Sub-Basin

Source: ANA, 2007.

Arboviruses are diseases caused by arboviruses - viruses transmitted by arthropods (***Arthropod-Borne viruses***) - and are of great importance for public health and the economy (GHASSEM *et al.*, 2023; YOUNG, 2018). In Brazil, the most clinically relevant arboviruses are Dengue, Zika and Chikungunya, however, other arboviruses have been shown to be potential reemerging threats, such as Mayaro Fever and Oropouche Fever. These diseases are similar in terms of vectors, hosts, and clinical symptoms, which ultimately makes diagnosis and clinical management difficult. (MORAIS *et al.*, 2023). Its transmission is via vector by the female mosquito *Aedes aegypti*, in this sense, linked to mosquito breeding foci related to standing water in tires, uncovered water tanks and any other object that favors the accumulation of water. The female *Aedes aegypti* lays her eggs on the edges of containers with standing water. After contact with the liquid and the

combination with high temperatures, the eggs hatch, and it is worth noting the increase in cases of arboviruses after flooding events (SES, 2021).

The dengue virus (DENV) is classified in the *Flaviviridae* family and *Flavivirus genus*, it is an RNA virus, transmitted by the bite of the female *Aedes aegypti*, a mosquito that usually bites during the day (early in the morning or late in the afternoon) and reproduces in places where there is standing water. There are four different serotypes of this virus (DENV-1, 2, 3 and 4) and the infection generates permanent immunity, but it is a specific serotype immunity. That is, it is possible to be infected by the four serotypes, regardless of age. People with chronic diseases, such as diabetes, hypertension, pregnant women, children up to 2 years of age, and people over 65 years of age have a higher risk of developing complications from the disease (Fiocruz, 2013).

The first symptoms of dengue are high fever, body aches and pains behind the eyes, redness of the skin and fatigue. At this stage, the disease is classified as classic dengue or dengue without warning signs. In severe dengue, the one that is most worrisome, there is a greater systemic inflammatory reaction, which alters blood clotting and leads to fluid loss. The consequence can be heavy bleeding and a sudden drop in blood pressure, responsible for the shock associated with dengue, the main cause of death (SES, 2021).

Chikungunya is an acute febrile disease, caused by the chikungunya virus (CHIKV), transmitted by the *Aedes aegypti mosquito*. CHIKV is an RNA virus that belongs to the genus *Alphavirus* of the *Togaviridae family*. Its transmission occurs through the bite of infected female mosquitoes. The mosquito acquires the virus by biting an infected person, during the period in which the virus circulates in the blood. There is no transmission between people. The virus can affect people of any age or gender, but the signs and symptoms tend to be more intense in children and the elderly. In addition, people with chronic diseases are more likely to develop severe forms of the disease. (Fiocruz, 2013).

Leptospirosis is an infectious disease caused by a bacterium called *Leptospira* present in the urine of rats and other animals, transmitted to humans mainly in floods. Cattle, pigs and dogs can also get sick and transmit leptospirosis to humans. The most frequent symptoms are similar to those of other diseases, such as flu and dengue fever, and there may be difficulty in diagnosis due to the symptomatological similarity. The main ones are: fever, headache, body aches, especially in the calves (gastrocnemius, soleus and plantar muscles), and vomiting, diarrhea and cough may also occur. In the most severe forms, jaundice (yellowish color of the skin and eyes) usually appears and there is a need for special care in the context of hospitalization. The patient may also have hemorrhages, meningitis, kidney, liver and respiratory failure, which can lead to death. The main form of transmission is by coming into contact with contaminated water. In situations of floods and floods, the urine of rats, present in sewers and storm drains, mixes with the runoff and mud from the

floods. Anyone who has contact with contaminated rainwater or mud can become infected. The *leptospira* present in water penetrates the human body through the skin, being in contact with the mucosa, especially if there is a scratch or wound. Contact with sewage water or mud, contaminated ponds or rivers, and vacant lots with the presence of rats can also facilitate the transmission of leptospirosis (Fiocruz, 2013).

Acute Diarrheal Diseases (ADD) correspond to a group of gastrointestinal infectious diseases characterized by a syndrome, in which there is a decrease in the consistency of the stool, an increase in the number of bowel movements (minimum of 3 episodes in 24 hours) and, in some cases, there is the presence of mucus and blood (dysentery). They are self-limiting, lasting up to 14 days. The clinical picture may progress to mild to severe dehydration. When treated incorrectly or not treated, they can lead to severe dehydration and hydroelectrolyte disturbance, and death can occur (SES, 2019). Infections can be caused by bacteria and their toxins, viruses, opportunistic intestinal parasites and natural toxins, examples are: *E. coli*, *Salmonella, Rotavirus, Giardia, Entamoeba.* Individuals of all ages can develop Acute Diarrheal Disease of infectious origin. However, children, the elderly and immunocompromised are more likely to develop dehydration. Newborns usually have a milder or asymptomatic infection, probably due to breastfeeding and antibodies transferred by the mother. ADD outbreaks, due to the many possible etiologies and sources of transmission, are also called Waterborne and Foodborne Illness (DTHA) outbreaks, mainly related to flooding and flooding.

The increase in the incidence of diarrhea is one of the impacts identified in studies carried out in affected areas (KONDO et al; 2002; WADE et al., 2004).

The impacts of a flood on the health of the affected population can be immediate (those that result in physical trauma and deaths) or long-term, when there is an increase in the incidence and prevalence of infectious diseases, a negative influence on mental health, worsening of pre-existing conditions and losses associated with malnutrition (AHERN et al., 2005). In this adverse context, the mental health of the population becomes an easy target, requiring psychosocial care workers to develop actions to deal with this condition. Nevertheless

> [...] the number of people trained in the subject is not always proportional to the needs presented, because for each person with physical injury, there are at least two hundred who need assistance (not treatment) in the area of mental health (BENIAKAR, et al., 2009).

The great potential impact of disasters on the population reveals the importance of action, in all spheres, based on knowledge in mental health to provide the population and the professionals themselves with activities that promote prevention, mitigation and treatment in mental health. In this way, seeking to understand people's subjective experiences in disaster contexts and post-disaster recovery denotes how those affected understand their social world after the experience of trauma, and allows them to be heard, legitimizing the suffering that emerges from these life situations,

providing opportunities to understand the suffering that is often marginalized and invisible over time (BENIAKAR et al., 2009).

Rodrigues (2019) highlights that hydrological disasters have among their primary causes the action of natural processes, which involve excess water in the affected system, these are usually related to extremes of precipitation and flooding, with deficiency in the urban drainage system, mainly affecting the population that occupies areas sensitive to drainage and with restrictions on use and occupation, such as flooded surfaces. Floods are caused by the increase in the water level in the river, causing the water to overflow and invade streets, homes and commercial enterprises, as well as causing financial losses to the local economy and generating a strong threat to public health by causing the spread of dirt, diseases and disorders to the health of residents (BARRA; TEIXEIRA, 2015). This has developed numerous challenges that involve the relationship of the human being and its influence on the environment in which he lives.

However, the difference in the phenomena stands out, being

> Flood or flood: It is the temporary increase in the water level, reaching its maximum quota, but without overflow (MinC, IPT, 2007).
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> Flooding: Refers to the overflow of water, reaching marginal areas and causing flooding in regions close to rivers (MinC, IPT, 2007).
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> Flooding: Occurs in urban perimeters, as a result of drainage problems, leading to the accumulation of water in inhabited areas (MinC, IPT, 2007).

According to Pires (2006), the ideal to seek to solve the characteristic problem of floods would be to promote the conservation of natural resources, such as green areas such as rivers, lagoons and forests without the presence of human action, in all cities, regardless of their size, in this way the environment would be able to maintain the process of development of ecosystems in a natural way.

When rainwater drainage in urban areas is insufficient, flooding and flooding phenomena occur. Due to the absence of proper drainage, stagnant water accumulates, resulting in pollution problems, increased spread of disease, and economic losses (BEZERRA et al. 2016).

JUSTIFICATION

On February 21, 2024, the municipality of Paracambi suffered, along with other municipalities in the Baixada Fluminense of the state of Rio de Janeiro, one of the largest episodes of flooding in recent years, reverberating in the different spheres of life of the residents of the region. The increase in rainfall evidenced in the period from January to February 2024, added to the precarious infrastructure for containing rivers and dams, in addition to pollution and inefficient public prevention measures, were the main catalysts for the problem that affected a large part of the

families in Paracambi (people born and living in the city of Paracambi), both in terms of housing and public health. In this scenario, there was flooding with enough water to reach 2 meters in height in several neighborhoods, many houses were destroyed and furniture and personal belongings were lost, leading residents to have to rebuild their homes practically from scratch, which mainly influenced the intensification of health problems due to stress and psychological disorders related to the experience of such a catastrophe, such as an increase in cases of anxiety, sleep disorders and panic syndrome. In addition, disease outbreaks, which were already occurring in the region, were intensified with the episodes of flooding. The increase in the number of cases of Dengue, Chikungunya Fever, Acute Diarrheal Disease, Leptospirosis has further aggravated the problem in question, extrapolating the individual sphere to a very serious public health case, with hospitals and medical clinics crowded due to intensified outbreaks in several neighborhoods of the municipality. In this scenario, it is essential to understand the short and long-term consequences that such a calamity generated for the residents of the municipality of Paracambi, in addition to debating the measures that were taken to circumvent such impacts by the public authorities in the region.

Thus, it is important to emphasize that the effects of floods in Paracambi-RJ have the possibility of worsening due to the precarious situation of the environmental sanitation system, especially for population groups excluded from sanitation infrastructure that do not have access to sanitary infrastructure. Regarding infectious diseases, the fact that Paracambi is already facing outbreaks of vector-borne diseases even before the floods raises doubts about the effectiveness of public health policies. In addition, such flood events represent a threat to the advances achieved by the country in recent decades, especially with regard to the reduction of infant mortality, life expectancy and quality of life. It is essential to emphasize that dealing with these impacts is not the exclusive responsibility of the public health sector, but rather of the whole society, which needs to engage in the promotion of healthy and sustainable environments, as well as in the reduction of social disparities. In this context, the importance of the United Nations global strategy on the Sustainable Development Goals (SDGs) is highlighted, which aims to commit, mobilize and propose effective means to achieve sustainable development for all. Among the 17 goals established, SDG 3: "Ensure a healthy life and promote well-being for all, at all ages"; SDG 6: "Ensure the availability and sustainable management of water and sanitation for all", and SDG 11: "Make cities and human settlements inclusive, safe, resilient and sustainable" are fundamental for reducing the impacts of natural disasters on human health. In addition, it is also worth mentioning the importance of the role of the National Council for the Environment (CONAMA), which aims to advise, study and propose to the Brazilian Government Council and other environmental agencies guidelines and government policies for the environment and to deliberate, within the scope of its competences, on norms and standards for the environment.

Among all catastrophic natural phenomena, floods stand out for being the most common and for causing a large number of problems in both southern and northern nations, sometimes with devastating consequences, such as the events recorded in China in 1959 and in Bangladesh in 19743. In 2017 in Texas, flooding resulting from Hurricane Harvey impacted millions of people and caused significant financial losses. Concomitantly, severe flooding in India, Nepal and Bangladesh affected more than 10 million individuals (WHO, 2013). The effects of flooding on the health of the affected population are both immediate and long-lasting, resulting from displacement and deteriorating living conditions.

OBJECTIVES

The main objective of this book chapter is to analyze how the city of Paracambi-RJ is dealing with floods, floods and floods that occurred on 02/21/2024, investigating the causes and consequences of these events in the municipality. The performance of local political management will be examined, analyzing the measures adopted and planned to prevent and combat these avoidable natural phenomena. In addition, an exploratory literature review will be carried out to understand the current state of global scientific research on floods and public health, seeking to identify trends and patterns of approach in the articles. The study will map unprecedented information, obtained through the perception of residents of the affected areas and the global panorama of scientific research, in order to contribute to the public debate and assist managers and society in improving the planning and formulation of public policies. A cross-analysis will be carried out in the Brazilian Health and Information Platform (DATASUS) between the data of notifications of diseases such as Dengue, Chikungunya Fever, Leptospirosis and Acute Diarrheal Disease (ADD) and the microbiological parameters of the water, in order to assess whether there is a correlation between the notifications of disease and water quality.

GENERAL OBJECTIVE

To analyze how the Municipal Health, Environment and Civil Defense Managers and the Academy (scientific production) have been dealing with the problem in the post-flood scenario in Paracambi and how the responses to the adversities that occurred (public policies, planning, disease prevention programs, clinical care, epidemiology, health surveillance, combat and mitigation) have been developed at the municipal level.

SPECIFIC OBJECTIVES

1. To analyze, through a bibliographic review, the state of scientific productions that deal with the relationship between floods and public health, having as an axis of analysis the

causes, consequences and responses adopted to the problems of floods as well as on the concepts/conceptions about key words that permeate the universe of natural disasters avoidable or caused by human action.

2. Investigate the impact of flooding and flooding, on the health of residents and the notification of cases of Leptospirosis, Dengue and Acute Diarrheal Disease (ADD), after avoidable floods in the municipality of Paracambi in February 2024. And evaluation of the microbiological parameters of the water collected at the time of flooding in a local residence.
3. To carry out a survey of the environmental and anthropogenic changes introduced in the microbasin of the Rio dos Macacos, in the Municipality of Paracambi (RJ), which led to the flood, causing great economic and social damage. It was sought to emphasize the dynamics of floods in this municipality, from the perspective of the physical and ecological characteristics of the Rio dos Macacos Sub-Basin.

THEORETICAL FRAMEWORK

THE IMPACT OF FLOODS, FLOODS AND FLOODS ON THE HEALTH OF AFFECTED POPULATIONS

Among natural disasters, floods are the most common and result in the highest number of deaths, affecting countries in both the northern and southern hemispheres. Floods have immediate and long-term impacts on the health of affected populations, due to displacement and deteriorating living conditions. According to Paterson et al. (2018), the health risks arising from floods can be categorized according to time, as shown in Chart 1.

Table 1: Health risks of floods after their occurrence.

Tempo após o evento	Risco
Imediatos	Afogamento Trauma Hipotermia Eletrocussão Intoxicação aguda por monóxido de carbono
<10 dias depois do evento	Infecção cutânea Pneumonias Infecções respiratórias virais Gastrenterites
>10 dias depois do evento	Leptospiroses Doenças associadas a mosquitos Infecções cutâneas de organismos atípicos (fungos, microbactérias) Hepatite A ou E Problemas mentais e/ou emocionais, incluindo estresse pós-traumático e depressão Outras doenças crônicas

Fonte: Adapted from PATERSON et al., 2018.

MORBIDITY MORTALITY ASSOCIATED WITH FLOODS

Flood-related mortality has become so worrisome that it has been the subject of study in a large number of countries, regardless of income and level of development. Most deaths are associated with drowning, being more frequent in rapid floods, when large volumes of water invade communities with high speed and power (MALILAY, 2000). Some studies also indicate deaths from physical and emotional stress, which increase the likelihood of heart attacks or cardiorespiratory arrests in people with preexisting conditions.

Prevention of chronic non-infectious diseases, social and psychological support, and improved access to health services reduce long-term post-flood mortality.

INJURIES AND EXPOSURES TO TOXIC PRODUCTS

Injuries can occur at all stages of flooding, but there is little documentation available on these incidents (WHO, 2013). Often, these injuries occur when people strive to rescue their belongings, save themselves, family members, or pets from currents or drowning. Floods, especially unexpected ones, have the ability to sweep away vehicles, trees, furniture, and utensils, as well as cause ruptures in pipes and tanks that store hazardous chemicals.

Fractures, twists and cuts by contaminated objects are also common after returning to homes or businesses and during cleaning. Bites from snakes and insects displaced by the water are also a risk.

Depending on the characteristics of the flood (nature of the flood, land use and associated infrastructure), the chemicals can be diluted in the water, reducing its toxicity; they can react with water to form toxic clouds; they can disperse over extensive areas, contaminating soils, streets, homes and agricultural areas, as is the case with fossil fuels that are not very soluble in water; or they can contaminate water supply systems. Flammable chemicals released during floods also present a risk of fires and explosions, causing immediate damage to people's lives and health (WHO, 2018).

LONG-TERM MENTAL HEALTH AFTER EXPERIENCING DISASTERS

Psychological stress is a consequence of calamitous events is quite common, such as floods. Symptoms such as discouragement, depression, distress, exacerbated anxiety, hyperactivity, and difficulty sleeping, among other physical and emotional signs, are frequently observed in affected individuals (HEALTH PROTECTION AGENCY, 2010). Although these symptoms are generally considered normal after trauma, if they persist for more than a month or affect people's quality of life, it is necessary to seek specific precautions and treatments (WHO, 2013).

Epidemiological studies on mental health after floods have significant methodological limitations, making evaluation difficult. Several resources have been used, but they are not directly

comparable, and the lack of studies prior to the disaster on the incidence and prevalence of symptoms makes it difficult to estimate the specific consequences of the occurrence of floods. Despite these limitations, it is widely recognized that disasters, especially floods, have a significant impact on the mental health and well-being of the affected population. They conducted a case-control study with residents of households directly and indirectly affected by flooding and found that 75% of these people experienced mental health effects, the most severe of which were observed among the elderly (GREEN et al., 1985).

In general, the magnitude of the damage caused by the flood, the duration and intensity of the disruption to people's daily lives, and the extent of loss and damage and the resources available in the community to cope with the event, are critical determinants of health impacts over subsequent years.

FREQUENT DISEASES DUE TO FLOODS

Respiratory diseases, mainly due to the temporary stay in accommodations and shelters, with a large number of people living in the same space, are part of this group, with this we can cite as examples: influenza, meningitis, diphtheria, pertussis, chickenpox, tuberculosis, covid-19 and/or others. And, also, Waterborne and Foodborne Diseases (DTHA), due to the contamination of water in the public supply networks, as the consumption of (contaminated) water can occur, which is a basic need, often the population ends up using contaminated water, exposing themselves to the risk of diarrhea, cholera, typhoid, meningitis by enterovirus and hepatitis A and E.

The transmission of infectious and foodborne diseases represents a significant challenge to global public health, characterized by the spread of pathogens through the consumption of contaminated food. These diseases, often caused by bacteria, viruses, parasites, or toxins present in poorly handled or prepared foods, manifest with a wide range of symptoms ranging from mild gastroenteritis to more severe conditions such as acute intestinal infections. Vulnerable groups, such as children, the elderly, and immunocompromised individuals, are particularly susceptible to these diseases, which can result in significant impacts on health and well-being.

Water-related diseases, especially those that depend on access to water and are transmitted by water, are influenced by environmental conditions. Therefore, it is possible that variations occur in the seasonality, frequency, and even virulence and adaptability of waterborne microorganisms. Chart 2 exemplifies some pathogens associated with water.

Table 2: Examples of pathogens from the different classifications of water-related diseases.

Classificação	Potenciais causas	Exemplos de micro-organismos
Transmissão hídrica	Contaminação de águas de abastecimento público	*Cryptosporidium* spp., *Giardia* spp., *Vibrio cholerae*
	Contaminação de águas recreacionais (doces e costeiras)	Adenovírus, *Cryptosporidium* spp.
	Inundação	*Leptospira* spp.
	Formação de biofilmes em redes de abastecimento de água	*Mycobacterium* não-tuberculose
	Contaminação de águas para irrigação agrícola	*Salmonella* spp.
Privação hídrica	Higiene precária decorrente de secas	*Chlamydia trachomatis*
Criação hídrica	Criadouros de mosquitos	Vírus da dengue
Base hídrica	Criação de novos ambientes	*Schistosoma mansoni*, *Legionella* spp.

Fonte: LAU et al., 2010; FLAHAUT et al., 2016; LEVY et al., 2016; NICHOLS et al., 2018.

Heavy rainfall and subsequent surface runoff are considered crucial elements in the transport of pathogenic microorganisms to water sources, both surface and groundwater, intended for public supply and primary contact recreation (LAU et al., 2010; LEVY et al., 2016; ANDRADE et al., 2018).

It is crucial to note that climate change contributes to favorable conditions for the emergence of new diseases and the resurgence of others caused by emerging and reemerging pathogens, such as known arboviruses (WHO, 2003; WOOLHOUSE, 2006).

HOW UNDERREPORTING OF DISEASES IMPACTS THE HEALTH OF AFFECTED RESIDENTS

It is observed that the poorer the area, the greater its underreporting may be, and due to the number of patients this number is very high, that is, the number of patients is not equal to the number of notifications made, that is. Sometimes there is a difference between the information in the system and the information recorded in the patient's medical record. Therefore, it significantly alters the number of cases and alters the goals of eradication of the disease. With this underreporting, the quality of information is unreliable and therefore national policies aimed at improving the quality of life are not satisfactory and the desired effect is not achieved.

This study shows a strong underreporting in the system, which can cause serious damage because underreported diseases threaten public health. Knowledge of them and their problems is essential to promote control measures.

For any disease or health problem, the notification follows a dynamic process (e.g., mentioning the uniqueness of the subject) and thus increases the possibilities of responding to the needs of the disease reporting community and ensures that the majority of cases are; reported and that we know the reality of the place. Health information is important because it helps us make

decisions about public policies and improve the quality of life of the population. Information on the profile of morbidity and mortality, common risk factors and factors that influence them, demographic characteristics, and health services are essential for the planning, implementation, monitoring, and evaluation of health interventions and services.

MATERIALS AND METHODS

(1.1) To carry out an observational case-control study with fieldwork in the neighborhoods affected by the floods, the action of the Municipal Health, Environment and Civil Defense Managers regarding health negligence, underreporting of diseases, absence of socio-environmental intervention, and the performance of municipal management through the response of the population, investigating the notifications of diseases and resolution of the problem that devastated the city.

(1.2) 1000mL of water was collected from inside a residence affected by the flood and sent to the Chemistry Laboratory of the University of the State of Amazonas for microbiological analysis. Clinical and epidemiological data were collected in loco in the neighborhoods affected by the floods and environmental assessment of the Rio dos Macacos Sub-Basin where there was no drainage and cleaning in the last 7 years. The DATASUS platform was used in this period to cross-reference data on cases of Leptospirosis, Dengue, Chikungunya Fever and ADD.

(1.3) A Literature Review addressing the relationship between Floods, Public Health, Mental Health, Infectious Diseases and Environmental Interventions. A literature review was carried out on articles available in PubMed, SciELO, and Scopus until the year 2024, as they are more comprehensive bibliographic databases and at the same time specific to public health. As it is a bibliographic database in English, the following terms "floods" and "public health" were chosen as general descriptors. The objective was to capture the largest number of articles that addressed the topic of floods, and at the same time restrict those that established a more direct link between these events and public health, understood here as a response of the state to health needs. A total of 114 articles were identified, which were submitted to two groups of inclusion criteria. The first group was to be in a language that could be read by the authors, namely: English, Portuguese or Spanish. From this criterion, 9 articles were not included (5 in Chinese, 2 in French, 1 in Norwegian and 1 in Russian). The second group was the article that addresses in the abstract at least one of the items selected for analysis, which were: (1) causes; (2) consequences; (3) responses and actions: forwarding proposals and solutions for the prevention and/or mitigation of flood risks and impacts. 74 articles were selected and another 28 were excluded, which addressed very specific topics of investigations of flood-related diseases. In the end, there are 48 articles left for analysis, the first published in 1985 and the last in 2024.

Three local residents were interviewed respecting the legality and conduct of the Informed Consent Form (ICF) of the National Health Council, Resolution 466/12 and 510/16.

RESULTS AND DISCUSSION

According to Brasil (2018), the effects of floods on health can be direct or indirect, short, medium and long term, and affect the individual and the community as a whole, being considered a public health problem. The abrupt or linear nature of the occurrences also has repercussions on the behavior and volume of damage, with greater emphasis on fatalities by drowning or trauma, communicable diseases (water and food), electric shocks, accidents with venomous animals, and psychosocial issues, among others. other. The most susceptible groups are children, the elderly and people with disabilities or limited movement, as well as pregnant women.

It is known that through drainage systems, excess water in the soil is directed to strategic locations, such as rainwater galleries and wells, for example. This, in turn, prevents flooding, flooding, landslides, low agricultural productivity, deaths, among other problems. However, the municipality of Paracambi-RJ had the city's main river drained in 2017, and even after the catastrophe the Rio dos Macacos remains undrained.

Figure 3: Last Drainage of the Rio dos Macacos Sub-Basin in December 2017.

Source: Paracambi City Hall, 2017.

Figure 4: Rio dos Macacos Sub-Basin in 2024.

Source: Author, 2024.

The Barcelos study; Sabrozza (2001) highlights the strong link between high rainfall, the occurrence of flooding and the increased incidence of leptospirosis in urban spaces, especially during periods of seasonal rainfall.

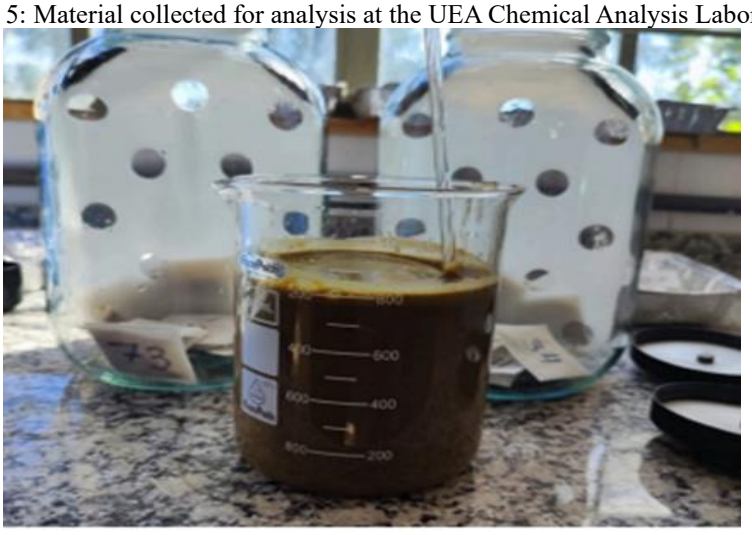
Genovez (2009) believes that the occurrence of leptospirosis is closely related to environmental factors. The most common way to contract the disease is during floods and floods, when rat urine in sewers and drains mixes with runoff and mud from floods. Therefore, flooding is a major risk factor for disease outbreaks in urban areas, especially during the rainy season. Despite being a common disease in these cases, the flooding of Paracambi -RJ did not notify any cases during this period of the disaster.

The magnitude of these impacts is directly related to the conditions of vulnerability that exist in the affected areas and the ability of the agents involved in emergency response to take timely action. In the health sector, discussions about the need to expand the capacity for timely action in emergencies and disasters are not new and have grown after the release of a report by the Intergovernmental Panel on Climate Change, which observed that extreme weather events will occur more and more frequently and will be increasingly recurrent, according to a study by Caruso (2017).

Ahern et al., (2020) elucidates that studies on epidemiological evidence on the effects of floods on health have produced a series of results, the most obvious being the occurrence of death (drowning, electric shock or trauma); injuries (bruises, lacerations or fractures); communicable diseases (fecal-oral and vectors), deaths in high-income areas are related to car drownings and when recorded in homes, most are elderly.

According to Freitas; Ximenes (2012) contact with contaminated water can cause a variety of diseases, especially diseases of fecal-oral origin (diarrhea, rotavirus, hepatitis, gastroenteritis). In this study, a microbiological analysis of water collected inside a residence affected by the flood in Paracambi-RJ was carried out, with laboratory results presented in the figure and table below:

Figure 5: Material collected for analysis at the UEA Chemical Analysis Laboratory



Source: Author (2024)

Table 1: Microbiological analysis (performed in duplicate) of 1000mL of water collected inside a residence affected by the flood in Paracambi-RJ. Carried out at the Chemical Analysis Laboratory of the University of the State of Amazonas, respecting the parameters of CONAMA.

Local	Collection Date	Totais coliforms	E.Coli
01 Residence affected by the flood	21/02/2024	Present	Present

Source: Author, 2024.

The occurrence of diarrheal diseases involves a series of factors related to an individual's health status, as well as social, economic, cultural, and environmental determinants. During floods, drinking water networks can be affected, damaging the supply systems of families and health services, leading to a lack of drinking water, or even the contamination of water reserves with infectious agents, according to Davies et al., (2015).

According to Paz et al., (2012) outbreaks of diarrhea associated with extreme weather phenomena have occurred all over the world, particularly after floods and floods, which corroborates the results of this study in which all the individuals studied presented ADD (acute diarrheal disease) in the flooding of Paracambi -RJ.

According to Marcondes; Ximenes (2016) the Aedes aegypti mosquito is the main vector of arboviruses (dengue, Zika and Chikungunya), this mosquito adapts easily to urban environments due to the higher population density and the greater number of artificial breeding sites. The link between Aedes aegypti and the quality of life of the urban population is strong and is based on the planning conditions surrounding urban areas, the presence of basic sanitation, efficient garbage disposal and hygienic behavior. As a result, it is necessary to understand the urbanization process, the association between the process and health to try to prevent the associated problems.

Dengue and Chikungunya are caused by the same vector, the Aedes aegypti mosquito. Although Chikungunya and dengue have similar symptoms, including fever, headaches, joint pain, nausea and rash (red spots on the body), there are significant differences in the symptoms that differentiate them. The main clinical sign of Chikungunya, such as severe joint pain, arthralgia, is usually accompanied by fever. This condition can occur in any joint, but it is especially common in the feet and hands, such as the fingers, ankles, and wrists. In Chikungunya, these symptoms are caused by inflammatory reactions in the joints, these symptoms can also involve edema and stiffness.

According to the Department of Information and Informatics of the Unified Health System of the Ministry of Health of Brazil (DATASUS), in 2024 to date, 265 cases of Dengue have been reported in the municipality of Paracambi-RJ. During the months of February to May, 8 cases of Chikungunya Fever were registered.

This type of pain can also occur in dengue, but experts say that the difference is in the intensity of the pain. Patients with dengue may experience mild to moderate pain, while those

infected with Chikungunya experience high levels of pain, leading to reduced work productivity and quality of life. In the subacute or chronic phases of the disease, it can persist for months or even years, especially in older patients.

According to Few et al., (2004) mental health can also be affected by flooding, including incidents of post-traumatic stress syndrome, irritability, anxiety, aggression, depression, insomnia, and suicide. However, establishing the relationship between floods and disease occurrence is complicated because data are underestimated and records are scarce. The immediate risks of trauma and death are often obvious, but the long-term effects, especially on mental health, are detrimental and have led to an increase in the dispensation of prescription drugs.

Diseases and syndromes resulting from emotional factors, such as sleep disorders, are identified. Most of these consequences manifest themselves after floods and especially during the rainy season, but they are also associated with the breakdown of domestic and social routines and during reconstruction (cleaning, repairs, insurance activation, indemnities). According to Mendonça et al (2009), these mental and emotional consequences can persist for months or years after a flood, reappearing whenever heavy rains or other floods have occurred again.

CONCLUSION

It became possible to understand that the floods, floods and floods that occurred in the municipality of Paracambi-RJ on 02/21/2024, are social, political, environmental and public health issues, that is, if there was a regularity of drainage of the Rio dos Macacos Sub-Basin, especially due to the considerable volume of material damage and in particular, of countless lives that were physically impacted, intellectually and spiritually and material losses as a result of poor planning and even the absence of any planning in numerous risk areas in the municipality, since 18,299 inhabitants comprise the population without water, 14,713 without sewage, 1,000 without garbage collection, 7,023 households, are subject to flooding and there is no alert system for hydrological risks in the city.

Despite the prominent position occupied by these phenomena that directly affected the community, they tend to be repeated as long as there are causes that contribute to their occurrence, thus listing the need for corrective and/or preventive measures, avoiding that new events may occur every year. It is emphasized, in such a way, that it is essential to carry out urban planning and at the same time to carry out infrastructure works that enable the drainage of rainwater, with several areas of knowledge and a multidisciplinary team as fundamental in conducting this process, enabling necessary activities and processes that contribute to the balance between man and nature. This does not exclude the possibility that, mainly due to the inability to develop prevention and mitigation strategies, events with a large number of infectious diseases may occur, as in explicit cases. An

example of this is Bill No. 3350/2024 proposed in the Legislative Assembly of Rio de Janeiro (ALERJ) by the State Deputy of Rio de Janeiro, Andrezinho Ceciliano, which provides for: "the adoption of sustainable rainwater management mechanisms for the purpose of controlling floods and flooding, applying the concept of Sponge City in the State of Rio de Janeiro."

The current trends of population growth and concentration in urban areas, without adequate infrastructure, and with environmental degradation and social inequalities already point to the growth of exposed populations and economic losses related to floods, even without considering that the intensification of climate change will represent an increase in the frequency and severity of events like these. In this scenario, it is expected that the most vulnerable and least prepared populations will increasingly suffer the consequences.

The drainage density correlates the total length of the outflow channels with the area of the watershed, however, a study carried out in 2009 by LEMOS et al., found that the Rio dos Macacos Sub-basin has low values (0.08 m), which is indicative of a greater tendency to flood occurrences. The local evaluation showed constant modifications of the physical environment of the Rio dos Macacos Sub-basin due to anthropogenic influence. Allied to this and other factors, the omission of the public power, underreporting of diseases, worsens the environmental and health care situation and becomes explicit in the lack of an efficient management system and environmental planning mechanisms.

It is up to the Management of the Municipality of Paracambi, and all the competent bodies, in reinforcement of the Municipal Epidemiological Surveillance, Municipal Health Secretariat, Social Assistance Secretariat, Zoonoses Surveillance Unit, the constant evaluation of health indicators and determinants. Such a circumstance could have a different impact if there was drainage of the Rio dos Macacos Sub-Basin. In view of the results exposed, it is imperative to implement drainage measures in the Rio dos Macacos, scientific updating and training for health professionals and local political authorities, health education and control of zoonoses for the population and environmental intervention. It is possible to offer essential contributions to the prevention of floods and floods, because the municipality of Paracambi-RJ continues to be a potential for future catastrophes, but since 2009 there have been scientific reports of the need for prophylaxis and care for the population, but there was a lack of scientific preparation on the part of the municipal management, in the face of an unexpected catastrophe, but with potential scientifically described. Furthermore, the reduction of waterborne and foodborne diseases, health surveillance, social assistance, professional training and environmental intervention, must be done frequently, all support must happen perennially, and in cases of events like this, all management must have control. In the observational study, it was found that before the floods and floods, the inhabitants of Paracambi felt helpless and without resources on the part of the municipality and the current management. The city must be increasingly prepared to

reduce current and future risks. Thus, taking as a reference the document of the United Nations Secretariat for Rio+20, on Disaster Risk Reduction and Building Resilience, it was considered that the reduction of the causes and consequences of floods in the health sector must involve integrated responses with broad policies for sustainable development, reducing the vulnerability of certain localities and populations. Making the relationship between management and citizens closer to the reality that marks the existence of man in society.

REFERENCES

1. ALERJ - Assembléia Legislativa do Estado do Rio de Janeiro. (n.d.). Disponível em: <http://www3.alerj.rj.gov.br/lotus_notes/default.asp?id=161&url=L3NjcHJvMjMyNy5uc2YvMThjMWRkNjhmOTZiZTNlNzgzMjU2NmVjMDAxOGQ4MzMvNjc4MDc0ZTk3MzFlODMzZjAzMjU4YWVkMDA2NDZlNTU/T3BlbkRvY3VtZW50>. Acesso em: 15 jul. 2024.

2. Ahern, M., Kovatz, S., Wilkinson, P., Few, R., & Matthies, F. (2005). Global health impact of floods: Epidemiologic evidence. *Epidemiologic Reviews, 27*, 36-46. https://doi.org/10.1093/epirev/mxi004

3. Ahern, M., Kovats, R. S., Wilkinson, P., Few, R., & Matthies, F. (2005). Global health impacts of floods: Epidemiologic evidence. *Epidemiologic Reviews, 27*, 36-46.

4. ANA - Agência Nacional de Águas. (2005). *Conservação e Reuso da Água em Edificações*. São Paulo: Prol Editora Gráfica.

5. Andrade, L., et al. (2018). Surface water flooding, groundwater contamination and enteric disease in developed countries: A scoping review of connections and consequences. *Environmental Pollution, 236*, 540-549.

6. Barcelos, C., & Sabroza, P. C. (2001). Dengue: um desafio para a saúde pública. *Cadernos de Saúde Pública, 17*(1), 77-89.

7. Barcelos, C., & Sabroza, P. C. (2001). The place behind the case: Leptospirosis risks and associated environmental conditions in a flood-related outbreak in Rio de Janeiro. *Cadernos de Saúde Pública, 17*(Supl. 1), 59-67.

8. Bezerra, I. M. P., & Sorpreso, I. C. E. (2016). Concepts and movements in health promotion to guide educational practices. *Journal of Human Growth and Development, 26*(1), 11.

9. Beniaikar, M., & Collazo, C. (2009). Salud mental em desastres: Problemáticas, paradojas y perspectivas clínicas. In M. Benikar, J. T. Thomé, & I. H. Taralli (Eds.), *Intervenção em situações limite desestabilizadoras: Crises e traumas* (pp. 115-135). Rio de Janeiro: ABP.

10. Brasil, Ministério da Saúde. (2018). *Desastres naturais e saúde: Análise do cenário de eventos hidrológicos no Brasil e seus potenciais impactos sobre o Sistema Único de Saúde*. Bol Epidemiológico da Secretaria de Vigilância em Saúde.

11. Brasil, Ministério da Saúde. Secretaria de Vigilância em Saúde, Departamento de Vigilância Epidemiológica. (2024). *Sistema de Informação de Agravos de Notificação - Sinan*. Brasília: Editora do Ministério da Saúde.

12. Brasil, Ministério do Desenvolvimento Regional. (2021). *Sistema Nacional de Informações sobre Saneamento (SNIS). Diagnóstico dos Serviços de Água e Esgotos - 2021*. Brasília: SNIS. Disponível em: http://www.snis.gov.br/diagnostico-agua-e-esgotos/rj/paracambi

13. Caruso, G. D. (2017). The legacy of natural disasters: The intergenerational impact of 100 years of disasters in Latin America. *Journal of Development Economics, 127*, 209-233.

14. Costa, H., & Wilfried, T. (2001). *Enchentes no estado do Rio de Janeiro: Uma abordagem geral*. Projeto Planágua Semads/GTZ. Rio de Janeiro.

15. Davies, G. I., et al. (2015). Water-borne diseases and extreme weather events in Cambodia: Review of impacts and implications of climate change. *International Journal of Environmental Research and Public Health, 12*(1), 191-213. https://doi.org/10.3390/ijerph120100191

16. De Avila-Pires, F. D. (2006). Leptospirose e enchentes: Uma falsa correlação? *Revista de Patologia Tropical/Journal of Tropical Pathology, 35*(3), 199-201. Disponível em: https://www.revistas.ufg.br/iptsp/article/view/1880/1793

17. Distrito Federal, Secretaria Estadual da Saúde. (2023). *Doenças diarreicas agudas (DDA) - 2023*. Distrito Federal: Secretaria Estadual da Saúde. Disponível em: https://www.saude.df.gov.br/doen%C3%A7as-diarreicas

18. El Ghassem, A., et al. (2023). Arthropod-borne viruses in Mauritania: A literature review. *Pathogens, 12*(11), 1370. https://doi.org/10.3390/pathogens12111370

19. EM-DAT: The Emergency Events Database – Université Catholique de Louvain (UCL). (n.d.). Disponível em: https://www.emdat.be/. Acesso em: 13 dez. 2018.

20. Few, R., Ahern, M., Matthies, F., et al. (2004). Floods, health and climate change: A strategic review.

21. Fiocruz. (n.d.). *Glossário de doenças*. Disponível em: https://agencia.fiocruz.br/gloss%C3%A1rio-de-doen%C3%A7as. Acesso em: 12 jul. 2024.

22. Flahault, A., Castaneda, R. R., & Bolon, I. (2016). Climate change and infectious diseases. *Public Health Reviews, 37*(21).

23. Freitas, C. M., & Ximenes, E. F. (2012). Enchentes e saúde pública: Uma questão na literatura científica recente das causas, consequências e respostas para prevenção e mitigação. *Ciência & Saúde Coletiva*.

24. Genovez, M. E. (2009). Leptospirose: Uma doença de ocorrência além da época das chuvas. *Biológico, 71*(1), 1-3.

25. Green, C., et al. (1985). The health effects of flooding: Survey at Uphill, Avon. Enfield, Middlesex Polytechnic, Flood Hazard Research Centre.

26. Health Protection Agency. (2010). *Microbial risk assessment. Incidence of vector borne diseases in Europe*. Porton Down, Wiltshire: Emergency Response Department.

27. IBGE – Instituto Brasileiro de Geografia e Estatística. (2022). *Cidades e estados*. Brasília, DF: IBGE.

28. Kondo, H., Seo, N., Yasuda, T., Hasizume, M., Koido, Y., Ninomiya, N., & Yamamoto, Y. (2002). Post-flood epidemics of infectious diseases in Mozambique. *Prehospital and Disaster Medicine, 17*(3), 126-133.

29. Lau, C. L., et al. (2010). Climate change, flooding, urbanization and leptospirosis: Fuelling the fire? *Transactions of the Royal Society of Tropical Medicine and Hygiene, 104*, 631-638.

30. Lemos, R. M. A. (n.d.). *Dinâmica de enchentes na bacia hidrográfica do Rio dos Macacos, RJ, Brasil*. Disponível em: <https://www.seb-ecologia.org.br/revistas/indexar/anais/2009/resumos_ixceb/1929.pdf>. Acesso em: 15 jul. 2024.

31. Levy, K., et al. (2016). Untangling the impacts of climate change on waterborne diseases: A systematic review of relationships between diarrheal and temperature, rainfall, flooding, and drought. *Environmental Science & Technology, 50*(10), 4905-4922. https://doi.org/10.1021/acs.est.5b06186

32. Malilay, J. (2000). Inundaciones. In E. K. Noji (Ed.), *Impacto de los desastres en la salud pública* (pp. 21-34). Bogotá, Colombia: Organización Panamericana de la Salud.

33. Marcondes, C. B., & Ximenes, M. F. F. M. (2016). Zika virus in Brazil and the danger of infestation by Aedes (Stegomyia) mosquitoes. *Revista da Sociedade Brasileira de Medicina Tropical, 49*(1), 4-10. https://doi.org/10.1590/0037-8682-0121-2016

34. Mendonça, F. A., Veiga, S., Souza, A., & Dutra, D. A. (2009). Saúde pública, urbanização e dengue no Brasil. *Sociedade & Natureza, 21*(3), 257-269. https://doi.org/10.1590/S1413-81232009000300007

35. Ministério das Cidades/Instituto de Pesquisas Tecnológicas. (2007). *Mapeamento de riscos em encostas e margens de rios*. Brasília: Ministério das Cidades. Disponível em: http://www.capacidades.gov.br/biblioteca

36. Morais, V. d. S., et al. (2023). Detecção de coinfecção com Eritroparvovírus 1 e arbovírus primatas (DENV, CHIKV e ZIKV) em indivíduos com doença febril aguda no estado do Rio Grande do Norte em 2016. *PLoS Neglected Tropical Diseases, 17*(11), e0011701. https://doi.org/10.1371/journal.pntd.0011701

37. Nichols, G., Lake, I., & Haevicide, C. (2018). Climate change and water-related infectious diseases. *Atmosphere, 9*(1), 1-60. https://doi.org/10.3390/atmos9010001

38. Paz, M. G. A., Almeida, M. F., & Gunther, W. M. R. (2012). Prevalência de diarreia em crianças e condições de saneamento e moradia em áreas periurbanas de Guarulhos, SP. *Revista Brasileira de Epidemiologia, 15*(1), 188-197. https://doi.org/10.1590/S1415-790X2012000100016

39. Paterson, D. L., Wright, H., & Harris, P. N. A. (2018). Health risk of flood disasters. *Clinical Infectious Diseases, 67*(10), 1450-1454. https://doi.org/10.1093/cid/ciy496

40. Rodrigues, T. A. (2019). Impactos ambientais hidrológicos ocasionados pelo desflorestamento metropolitano, Rio de Janeiro. *Sustinere*, 8-9. Disponível em: https://www.epublicacoes.uerj.br/index.php/sustinere/article/view/188327/12845

41. São Paulo, Secretaria Estadual da Saúde. (2021). *Relatório anual de saúde - 2021*. São Paulo: Secretaria Estadual da Saúde. Disponível em: http://www.saude.sp.gov.br/coordenadoria-de-controle-de-doencas/noticias/22032024-conheca-os-sintomas-da-dengue-as-fases-da-doenca-e-os-sinais-de-alerta

42. Silva, E. (2015). Modernização, sanitarismo e cotidiano (Jacobina - BA 1955-1959). *Campina Grande – PB*, 17-18. Disponível em: http://dspace.sti.ufcg.edu.br:8080/jspui/bitstream/riufcg/1172/1/EDSON%20SILVA%20%e2%80%93%20DISSERTA%c3%87%c3%83O%20%28PPGH%29%202015.pdf

43. World Health Organization. (2018). *Chemical releases caused by natural hazards events and disasters – Information for public health authorities*. Geneva: World Health Organization.

44. World Health Organization. (2013). *Floods in the WHO European Region: Health effects and their prevention*. The Regional Office for Europe of the World Health Organization. Copenhagen, Denmark.

45. Woolhouse, M. E. J. (2006). Where do emerging pathogens come from? *Microbe, 1*(11), 511-515. https://doi.org/10.1128/microbe.1.11.511-515.1

46. Young, P. R. (2018). Arboviruses: A family on the move. In R. Hilgenfeld & S. Vasudevan (Eds.), *Dengue and Zika: Control and antiviral treatment strategies* (Vol. 1062, pp. 1-11). Springer. https://doi.org/10.1007/978-981-10-8727-1_1