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COMMENTARY

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Dengue fever outbreak in Cook Island: A rising concern, efforts, challenges, and future recommendations

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Abstract

The Cook Island government has made several efforts to ensure zero confirmed cases and transmission of COVID-19, especially among visiting travelers. However, the Cook Island ministry of health has to deal with the new strain of dengue fever outbreak, known as dengue fever type 2 (DEN-2), by adopting several measures to control its spread, especially in the affected parts of the subtropical country. This paper aims to describe the dengue fever response taken in Cook Island and suggest recommendations to control the risk of transmission in endemic parts of the world.

KEYWORDS

Cook Island, COVID-19, DEN-2, dengue fever, endemic, outbreak, travelers

1 | INTRODUCTION

A famous quote from one of the great historians of all time, Jill Lepore, says "Epidemiologists study patterns in order to combat infection. Stories about outbreaks follow patterns, too. Stories aren't often deadly, but they can be virulent: spreading fast, weakening resistance, wreaking havoc."

Cook Island faces widespread agitation over the dengue fever outbreak since its detection in 2007, and recent cases have been steadily climbing since it was declared by the Cook Island Ministry of Health in early February 2021. Between January 1st and May 25th, 2021, a total of 200 dengue cases with no deaths were reported. Among the reported cases, there are 153 probable cases that are positive for the NS1 antigen (NS1 Ag+), and 47 cases confirmed to have DENV-2 infection based on PCR testing.[1] The Centers for Disease Control and Prevention have specifically warned travelers going to the islands, but if they do, they should avoid mosquito bites.[2]

Cook Island, a subtropical country near New Zealand, is comprised of smaller islands, namely Mauke, Aitutaki, Mangaia, Rarotonga, and others, but unfortunately, most cases have been found in Rarotonga. The government, together with public health specialists, have been working together to reduce the risk of transmission and infection in the country by trying to eradicate mosquito breeding sites using regular spraying of insecticides.[1]

2 | EPIDEMIOLOGY

The World Health Organization estimates that there are over 100 million recorded cases of dengue infection worldwide every year, and nearly half of the world's population is at risk.[3] The dengue fever

outbreaks usually occur in the summer or during the rainy season when the population of the vector mosquitoes is at its zenith.[3]

Although the mortality rate associated with dengue fever is low, severe dengue fever, because of complications, may be fatal if left untreated.[3]

Cook Island is one of the known endemics of South Pacific islands in Oceania with a subtropical climate and an estimated number of 300 reported cases as of mid-2021, yet with no fatality reports.[1]

Ratoranga is noted to be the area with the highest number of confirmed cases of dengue fever in Cook Island—over 200 cases; this is largely attributed to the numerous breeding sites for the Aedes and Culex species of mosquitoes found in Ratoranga.[1] The other affected areas are Ngatangiia, Titikaveka, Aitutaki, Mauke, and Mangaia (Figure 1).

3 | ETIOLOGY

Dengue fever is typically of four viral serotypes (DENV-1, DENV-2, DENV-3, and DENV-4). It is a vector-borne disease and is transmitted through the bites of infected *Aedes* mosquitoes that can thrive in standing water (e.g., puddles, ponds, rain waters, water tanks, reservoirs, and old tires).[3] The *Aedes aegypti* mosquitoes have been strongly linked as a primary vector to the etiology of the dengue fever outbreak.[3]

4 | RELATIONSHIP BETWEEN COVID-19 AND DENGUE FEVER

In other subtropical and tropical regions of the world, such as Central and South America, Africa, Asia, and Oceania where the high risk of dengue fever outbreak can be accompanied with COVID-19, several similarities between the two diseases symptoms exist at early stages. Quick diagnosis of cases and treatment can become even more complicated amidst the COVID-19 pandemic, as seen in other countries.[4–7]

Table 1 briefly describes the similarities and differences between COVID-19 and dengue fever.[8]

5 | EFFORTS

Several efforts are being carried out by the Cook Islands Ministry of Health and the government to control the outbreak. Some of them include:

Disease case surveillance and notification: To recognize and assess the duration pattern of the dengue fever outbreak in affected areas, report feedback to local, national, and international health authorities for taking urgent action to control the outbreak; and offer supportive treatment to effectively manage infected individuals.

Early detection: Through serology, immunological assays of antibodies, and rapid testing point-of-care devices.

Vector control: Clearing mosquito breeding sites, bushy vegetation, and treatment of stagnant water.

However, disparities in the distribution of health resources among affected regions in the Cook Islands and those at risk have limited the rapid intervention of these measures. It is recommended that the local and national health authorities, Ministry of Health, and development partners unite to make available the health resources needed to effectively control the outbreak and strengthen health systems and their response.

6 | CONCLUSION AND RECOMMENDATIONS

The clinical diagnosis of dengue fever is erratic, because of the nonspecificity of the clinical presentations of the viral infection. Isolation of the virus is best done through serological analysis of blood

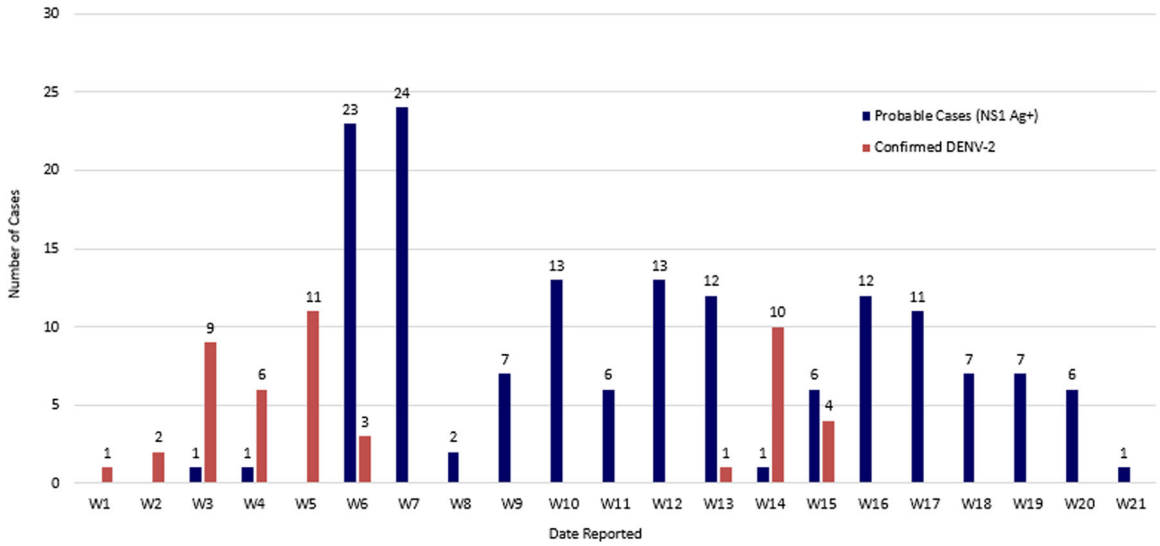

FIGURE 1 Dengue cases reported monthly in 2021. *Source*: Ministry of Health, Cook Islands

TABLE 1 Similarities and differences between COVID-19 and dengue fever

	COVID-19	Dengue fever
Incubation period	2–14 days	4–10 days
Symptoms	Fever, headache, body pains, nausea, and fatigue	Fever, headache, body pains, nausea, and fatigue
Prognosis	May progress to a severe illness if left untreated	May progress to a severe illness if left untreated
Virus	SARS-CoV-2	Dengue virus 1, 2, 3, or 4
Transmission	Aerosols or respiratory droplets	Bites of infected *Aedes aegypti* or *Aedes albopictus* mosquitoes
Warning signs	Difficulty in breathing, persistent pain in the chest, confusion, inability to wake or stay awake, bluish lips or face	Persistent vomiting, mucosal bleeding, difficulty in breathing, lethargy, postural hypotension, liver enlargement, blood cells volume progressive increase
Vulnerable population	People above 65 years old	Infants and children

samples. The most preferred laboratory investigation for the confirmatory diagnosis of dengue fever is the nucleic acid amplification test; in which the reverse transcription polymerase chain reaction test (RT-PCR) is the most preferred principal test for early detection and identification of the various serotypes of the virus with very high sensitivity and specificity.

The nonstructural protein 1 (NS1) antigen detection test through enzyme-linked immunosorbent assay can also be used for confirmatory early diagnosis of the virus. The NS1 antigen test is highly sensitive and specific during the acute phase of dengue virus (during the first 7 days after the onset of symptoms) before antibodies against the NS1 antigen appear and are fully detectable and loses its high sensitivity and specificity; therefore, the NS1 antigen test is only efficient for the early detection of recent dengue virus infection. The limitations of the NS1 antigen detection test include: the capability of the test to produce false-negative results in recently exposed infected individuals, inaccurate diagnostic results during the febrile, critical, and convalescent/recovery phases of the dengue virus infection, and its failure to distinguish between the serotypes of the virus (DEN-1, DEN-2, DEN-3, and DEN-4).[9]

In cases of an outbreak, rapid diagnostic tests for dengue virus is the most preferred test for accurate confirmatory diagnosis because it reduces the turn-around time, easily detects recent infection by identifying NS1 antigen, IgM, and IgG antibodies in the components of the blood sample and can distinguish primary from secondary infection. Thus, early diagnosis of the virus may offer effective therapeutic interventions that may be life-saving and prevent complications. However, the financial implications of carrying out these laboratory investigations by suspected individuals or individuals at risk may be a major limitation to the early detection of the virus; that is why it is recommended that the local, national and international health authorities properly fund these endemic areas; and subsidize the cost of seeking medical care, laboratory investigations and getting vaccines for dengue fever.

In addition to strengthening the health systems and response to this outbreak, several measures should be adopted by travelers and in the endemic areas to effectively control the outbreak.

6.1 | For travelers

Routine vaccination before traveling to the endemic areas.

Prevent insect bites; especially by the mosquito vectors of the dengue fever, by wearing protective clothing and footwear, using mosquitoes repellent (20% or more *N,N*-diethyl-meta-toluamide, picaridin/icaridin/KBR3023/Bayrepel), paramethanediol/oil of lemon eucalyptus, 2-undecanone or IR3535, and sleeping under mosquito nets, when necessary.

Drink safe and clean water.

6.2 | For endemic areas

Massive spraying of pesticides.

Environmental sanitation—effective waste management through routine garbage collection and disposal.

In conclusion, public health resources should be made available to support vaccines against dengue fever that will be beneficial to both the inhabitants of the endemic regions and visiting travelers.

CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

AUTHOR CONTRIBUTIONS

Conceptualization, project administration, writing-review, and designing: Olivier Uwishema. *Reviewed and edited the first draft*: Helen Onyeaka. *Manuscript writing and final approval of manuscript*: All authors.

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