Showing the impact of climate change on human pathogenic diseases

Dengue fever epidemic sweeps through Latin America

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The unprecedented wave of dengue fever continues to sweep across Latin America and the Caribbean with nearly five million people infected thus far in 2024, nearly two-thirds of them in Brazil, which is the epicenter of the epidemic.

Next worst affected among other countries in the hemisphere, Argentina has recorded over 233,000 cases in its summer, a figure eight times higher than last year. Other countries reporting high figures include Colombia, Costa Rica, Guatemala, Guadeloupe, French Guiana, Martinique, Mexico, Paraguay, and Peru. In late March, even Puerto Rico declared a public health emergency as cases surpassed the highs seen in the entire previous year.

Brazil has thus far registered a record 3.14 million cases with health experts soberly noting that the tally could top 4.2 million, a figure approximating the total number of dengue cases in all the Americas in the full year 2023. The country's health ministry, on its dengue dashboard, indicated 1,344 people have already died and another 1,872 deaths are under investigation. By comparison, 1,094 deaths were attributed to dengue in 2023.

There are four serotypes of dengue viruses (DENV 1-4) that cause the mosquito-borne illness known as dengue (breakbone) fever that is currently circulating in the Americas this year.

Approximately half the world's population (across 129 countries) live in areas—tropical and subtropical—at risk for dengue. Health experts estimate that up to 400 million people get infected with dengue each year. Upwards of 100 million have symptomatic infections and 40,000 die from complications caused by severe infections, which include hemorrhagic shock.

In the South and Southeast Asia regions, Bangladesh and Thailand, among others, reported similar surges in dengue cases. By November 2023, health authorities reported to the World Health Organization (WHO) that cases for the year had topped nearly 310,000 compared to just 62,400 in 2022. Thailand saw a three-fold rise over the preceding year with 136,655 dengue infections in 2023. As the WHO noted, India, Indonesia, Myanmar, Sri Lanka, and Thailand rank among the world's 30 most affected countries for endemic dengue fever.

Among the WHO Western Pacific Region, Vietnam (150,000 cases and 36 deaths) and the Philippines (167,000 infections and 575 deaths) were hardest hit by the disease. Australia, Cambodia, China, Lao People's Democratic Republic, Malaysia and Singapore are other countries reporting impacts of dengue. As the report notes, "Member states with endemic transmission continue to report longer seasonal dengue epidemics with increasing magnitude and geographic spread. However, disease incidence is less reliable due to underreporting of cases, particularly in the Pacific Island Countries and territories …"

Winter tends to prevent year-round infections with mosquito-borne diseases. However, the rise in global temperatures has made the temperate climates more susceptible for dengue virus transmission, as higher rates of precipitation from torrential rain falls lead to floods and stagnant water pools, conditions favorable for these mosquitos.

As the December 21, 2023, WHO report on the dengue global situation remarked, "The global incidence of dengue has markedly increased over the past two decades, posing a substantial public health challenge. From 2000 to 2019, the WHO documented a ten-fold surge in reported cases worldwide, increasing from 500,000 to 5.2 million. The year 2019 marked an unprecedented peak, with reported instances across 129 countries."

After a slight dip during the onset of the COVID pandemic, dengue fever began to spread even more widely in 2023, and the outbreak in 2024 in the Americas eclipses any previous epidemics.

In their assessment of the unprecedented development, the WHO highlighted various factors that include climate

change-induced shifts in weather patterns, the mosquitos' distribution and adaptation, unplanned urbanization and human activities, fragile health systems amid political and financial instability, co-circulation of multiple strains of the dengue viruses, lack of specific treatments, and "prolonged ongoing concurrent outbreaks, including COVID-19."

The disease is not contagious. Mosquitos harboring the viruses transmit the pathogen to humans. Symptoms typically begin from a few days to two weeks. These include high fevers, severe headaches, vomiting, muscle and joint pains, and a characteristic rash and itching. These usually last up to seven days and treatment is supportive. In rare cases, the disease can progress to a condition known as dengue hemorrhagic shock, with mortality rates of 10 to 25 percent, even with intensive medical support.

There are currently two vaccines available to protect against dengue infection. Dengavaxia, a live attenuated virus-based vaccine suitable against all four serotypes of dengue manufactured by Sanofi Pasteur, became available in 2015. The vaccine is given as three doses at six-month intervals. It is approved for use in individuals aged six through 45 with a previously laboratory-confirmed previous dengue infection and who live in endemic areas. Due to an antibody-dependent enhancement, the vaccine can make future dengue infections more severe in dengue-naïve recipients.

A second dengue vaccine, Qdenga, manufactured by Takeda Pharmaceuticals Vaccine which completed clinical trials in 2022, has been recommended by the WHO for the prevention of dengue in people four years of age or older without a previous dengue infection. It too is a live attenuated vaccine against all four serotypes of the dengue virus given as two doses three months apart.

However, limited supplies and costs of the vaccine have made it prohibitive. In Europe, the vaccine can be purchased at $115 per dose. It is $40 in Indonesia. In January, according to the *New York Times* report, Brazil purchased the entire global stock of Qdenga, paying $19 per dose for the bulk purchase. Still, that only leaves enough vaccine to treat 3.3 million of Brazil's 220 million people. Children aged six to 16 are being prioritized.

The rising prevalence of dengue and its spread towards the poles is exemplary and indicative of the massive redistribution of global biodiversity caused by climate change. 2023 was the warmest year since global records were started in 1850 and is 1.35 degree Celsius above the pre-industrial averages from 1850 to 1900. The continued global processes that are accelerating can only aggravate these processes for human populations.

According to a report published in February 2023 by the *Royal Society*, "One foundational meta-analysis estimated that, to date, terrestrial species have been moving uphill at a pace of 1.1 meter per year, and to higher latitudes at a pace of 1.7 kilometer per year. Among the millions of species on the move are some of the most consequential pathogens, disease vectors and wildlife reservoirs that affect human health and economic development."

They continued, "In recent years, mosquito-borne diseases like malaria, dengue and Zika virus have also expanded to new latitudes and elevations, and will continue to do so in the future, following the thermal limits on transmission set by their ectothermic vectors. Some of this expansion has been facilitated by parallel global invasions of Aedes aegypti and Aedes albopictus, which have spread an estimated 250 and 150 kilometers per year, respectively."

In another 2022 scientific report published in *Nature*, the authors attempted to quantify the full extent of climate change on human pathogenic diseases. In their exhaustive work, they wrote, "The compilation of pathogenic diseases aggravated by climactic hazards represent 58 percent of all infectious diseases reported to have impacted humanity worldwide, that is, out of an authoritative list of 375 infectious diseases documented to have impacted humanity, 218 were found to be aggravated by climactic hazards."

In their summary, they warn, "The human pathogenic disease and transmission pathways aggravated by climatic hazards are too numerous for comprehensive societal adaptations, highlighting the urgent need to work at the source of the problem: reducing greenhouse gas emissions."

However, greenhouse gas emissions and the ongoing climate change are a byproduct of the anarchy of capitalist production that places the immediate accumulation of profits above the broader issues that are making life inhospitable on the planet. It exacerbates the already criminal levels of inequality that have seen the accumulation of obscene wealth on one end and the impoverishments of billions of people on the other. Abject poverty, inadequate housing and nutrition, lack of access to quality health services, aggravate the dangers posed by these diseases that are growing in incidence and virulence.