**Short article/ Letter to Editor (European Journal of Public Health)**

**The worst year for dengue cases and deaths: global landmark of 6 million and 7,000 deaths in 2023**

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**To-the-Editor, (840 words)**

In 2023, the world experienced the worst outbreak of the dengue virus (DENV) on record. We collected data on the number of DENV cases and deaths reported by various countries to identify regions with the highest burdens. In 2023, over 6.5 million cases and >6600 deaths attributed to DENV were recorded, marking a historic milestone. South America reported the highest number of cases with 3,924,992 cases and 1,946 deaths, resulting in a case fatality ratio (CFR) of 0.05. Asia reported 1,622,405 cases and 3,637 deaths, with a CFR of 0.22, indicating a higher CFR. North America reported the highest number of cases (258,252.27) and deaths (90.30) per million population.

A comprehensive global response is urgently needed to control DENV infection, including vaccine development, vector control, public health initiatives, and improved clinical management.

In the first half of 2024, laboratory-confirmed dengue cases surged to nearly 4.7 million, with over 5,366 deaths reported globally [1]. As summer and the rainy season approach, countries in the Northern Hemisphere are bracing themselves for another potentially record-breaking year, eliciting both anticipation and surprise among observers.

Dengue fever, a mosquito-borne illness, is caused by four distinct serotypes of the dengue virus within the Flaviviridae family. Transmission to humans occurs through the bites of *Aedes aegypti (L.)* and *Aedes albopictus* (Skuse) mosquitoes. Currently, Dengue Virus (DENV) is endemic in over 125 countries, with reported cases to the World Health Organization (WHO) escalating annually. While the majority of infections (>80%) exhibit no or mild symptoms, leading to lifelong immunity against the specific serotype, reinfection with different serotypes, termed secondary dengue infection, poses a significant risk of severe dengue, potentially culminating in fatal outcomes[2].

We collected data on dengue cases and deaths from multiple sources: including WHO’s global dengue surveillance dashboard[2], WHO Eastern Mediterranean Region [3], WHO European Region [4], WHO Region of Africa [5], and WHO Region of the Americas [6], WHO South-East Asia Region [7], and WHO Western Pacific Region [8]. We used the national data to accumulate cases by country, continent, and the world.

Globally, a total of 6.43 million cases and 6,892 deaths were recorded in 2023. Continent-wise wise highest number of cases were reported from South America (3,924992 cases) and the highest deaths were reported in Asia (3,637 deaths). Globally, there were 396,705.79 cases and 199.14 deaths per 1000,000 population.

Two distinct hotspots of dengue virus circulation emerged: the South American and the South and Southeast Asian regions **(Table 1)**. Among the top five countries with DENV infections in 2023 were Brazil (3,088,723 cases), Vietnam (369,000 cases), Bangladesh (321,179 cases), Mexico (277,963 cases), and Peru (274,227 cases). Brazil (3,088,723) reported the highest number of cases and Bangladesh (1,705) reported the highest number of deaths.

Additionally, three European countries reported locally transmitted dengue cases in 2023: Italy (82 cases), France (43 cases), and Spain (3 cases) while the United States documented a record 156 locally transmitted cases of DENV [9].

WHO described several drivers for the largest-ever DENV outbreak in 2023 [2]. The impacts of the 2023 El Niño phenomenon and climate change, resulting in rising temperatures, heavy rainfall, and high humidity; fragile health systems strained by the COVID-19 pandemic; and political and financial instabilities in countries experiencing complex humanitarian crises and significant population movements [2]. The changes in rainfall seasonality and the introduction of heterogeneous serotypes contributed to the largest-ever outbreak in Bangladesh [10]. Brazil reported the highest-ever number of DENV cases in 2023 reported by any country in the world which was probably linked to climate change and co-circulation of all four serotypes in the country[2].

Dengue is a major global health issue, impacting millions of individuals each year and presenting significant public health challenges. The incidence of dengue is increasingly being reported in rural areas, broadening its geographical and demographic reach. Dengue infection can vary from mild dengue fever to severe dengue, with fatality rates potentially exceeding 20%. However, with proper medical care, mortality rates can be reduced to less than 1%. The direct costs of dengue, including hospitalization, outpatient visits, and supportive care, are substantial, as are the indirect costs such as loss of productivity, long-term disability, and economic losses due to disease outbreaks are very high. The disease places a heavy burden on healthcare systems, resulting in significant economic and social strain.

There were discrepancies between our collected data (6.43 million cases and 6,892 deaths) and the WHO’s reported totals (6.5 million cases and over 7,300 dengue-related deaths) on their official webpage [2]. We searched the data on WHO’s Global Dengue Surveillance dashboard [1]and found no inconsistencies with our findings. However, the differences could be attributed to variations in case definitions used by different countries. Regardless, the number of cases and deaths is significant and concerning.

As a critical global health challenge, it demands coordinated efforts from multiple sectors. The adaptability of mosquitoes to various breeding sites, including urban environments, and their resistance to insecticides continue to hinder vector control efforts. While the development of dengue vaccines, such as Dengvaxia, marks significant progress, there are still concerns regarding the efficacy and safety of these vaccines across different age groups and serotypes. Therefore, vaccination strategies must be carefully tailored to specific epidemiological contexts. To address the burden of dengue, it is essential to enhance surveillance, improve clinical management, advance research on vaccines and treatments, and implement effective vector control strategies. International collaboration and sustained investment in public health infrastructure are crucial to mitigating the impact of dengue and protecting vulnerable populations worldwide.

Table 2: Number of dengue cases and deaths per million population by continents in 2023

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Continents | Cases | Deaths | Cases/Million | Deaths/Million |
| Africa | 194032 | 832 | 9088.38 | 33.63 |
| Antarctica | 0 | 0 | 0.00 | 0.00 |
| Asia | 1622405 | 3637 | 34416.06 | 36.03 |
| Europe | 128 | 0 | 2.12 | 0.00 |
| North America | 692109 | 477 | 258252.27 | 90.30 |
| Oceania | 1032 | 0 | 69.41 | 0.00 |
| South America | 3924992 | 1946 | 94877.55 | 39.18 |
| Total | **6434698** | **6892** | **396705.79** | **199.14** |



**Map 1:** Number of dengue cases and deaths per million population by country in 2023

**Appendix**

Table 1: Worldwide dengue cases and deaths in 2023. Sources: ECDC, WHO, WHO Afro

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Country | WHO Region | Continents | Cases | Deaths | Cases/Million | Deaths/Million |
| Afghanistan | WHO Eastern Mediterranean Region | Asia | 1700 | 1 | 40.25 | 0.02 |
| Oman | WHO Eastern Mediterranean Region | Asia | 2016 | 0 | 434.07 | 0.00 |
| Pakistan | WHO Eastern Mediterranean Region | Asia | 24352 | 0 | 101.26 | 0.00 |
| Saudi Arabia | WHO Eastern Mediterranean Region | Asia | 2259 | 0 | 61.14 | 0.00 |
| Somalia | WHO Eastern Mediterranean Region | Africa | 755 | 1 | 41.61 | 0.06 |
| Sudan | WHO Eastern Mediterranean Region | Africa | 10412 | 66 | 216.43 | 1.37 |
| Yemen | WHO Eastern Mediterranean Region | Asia | 951 | 1 | 27.61 | 0.03 |
| France | WHO European Region | Europe | 43 | 0 | 0.66 | 0.00 |
| Italy | WHO European Region | Europe | 82 | 0 | 1.39 | 0.00 |
| Spain | WHO European Region | Europe | 3 | 0 | 0.06 | 0.00 |
| Benin | WHO Region of Africa | Africa | 6 | 1 | 0.44 | 0.07 |
| Burkina Faso | WHO Region of Africa | Africa | 146878 | 688 | 6316.93 | 29.59 |
| Cape Verde | WHO Region of Africa | Africa | 410 | 0 | 684.84 | 0.00 |
| Chad | WHO Region of Africa | Africa | 1342 | 1 | 73.42 | 0.05 |
| Ethiopia | WHO Region of Africa | Africa | 21469 | 17 | 169.68 | 0.13 |
| Ghana | WHO Region of Africa | Africa | 18 | 0 | 0.53 | 0.00 |
| Guinea | WHO Region of Africa | Africa | 1 | 0 | 0.07 | 0.00 |
| Ivory Coast | WHO Region of Africa | Africa | 3922 | 27 | 135.84 | 0.94 |
| Mali | WHO Region of Africa | Africa | 4427 | 29 | 190.05 | 1.24 |
| Mauritania | WHO Region of Africa | Africa | 3582 | 0 | 736.58 | 0.00 |
| Mauritius | WHO Region of Africa | Africa | 265 | 0 | 203.76 | 0.00 |
| Niger | WHO Region of Africa | Africa | 148 | 0 | 5.44 | 0.00 |
| Nigeria | WHO Region of Africa | Africa | 72 | 0 | 0.32 | 0.00 |
| Sao Tome and Principe | WHO Region of Africa | Africa | 69 | 0 | 297.60 | 0.00 |
| Senegal | WHO Region of Africa | Africa | 248 | 1 | 13.96 | 0.06 |
| Togo | WHO Region of Africa | Africa | 8 | 1 | 0.88 | 0.11 |
| Anguilla | WHO Region of the Americas | North America | 1 | 0 | 62.90 | 0.00 |
| Antigua | WHO Region of the Americas | North America | 254 | 0 | 2693.59 | 0.00 |
| Argentina | WHO Region of the Americas | South America | 146876 | 75 | 3208.73 | 1.64 |
| Aruba | WHO Region of the Americas | South America | 22 | 0 | 207.01 | 0.00 |
| Bahamas | WHO Region of the Americas | North America | 243 | 1 | 588.92 | 2.42 |
| Barbados | WHO Region of the Americas | North America | 771 | 0 | 2734.09 | 0.00 |
| Belize | WHO Region of the Americas | North America | 1688 | 0 | 4108.81 | 0.00 |
| Bermuda | WHO Region of the Americas | North America | 1 | 0 | 15.61 | 0.00 |
| Bolivia | WHO Region of the Americas | South America | 156774 | 88 | 12654.73 | 7.10 |
| Brazil | WHO Region of the Americas | South America | 3088723 | 1184 | 14271.73 | 5.47 |
| Cayman Islands | WHO Region of the Americas | North America | 42 | 0 | 605.97 | 0.00 |
| Colombia | WHO Region of the Americas | South America | 131784 | 90 | 2530.16 | 1.73 |
| Costa Rica | WHO Region of the Americas | North America | 30649 | 0 | 5880.27 | 0.00 |
| Dominica | WHO Region of the Americas | North America | 419 | 0 | 5736.58 | 0.00 |
| Dominican Republic | WHO Region of the Americas | North America | 27972 | 62 | 2468.20 | 5.47 |
| Ecuador | WHO Region of the Americas | South America | 27838 | 33 | 1530.36 | 1.81 |
| El Salvador | WHO Region of the Americas | North America | 5788 | 0 | 909.36 | 0.00 |
| French Guiana | WHO Region of the Americas | South America | 2684 | 0 | 8598.29 | 0.00 |
| Grenada | WHO Region of the Americas | North America | 628 | 1 | 4976.90 | 7.92 |
| Guadeloupe | WHO Region of the Americas | North America | 11751 | 7 | 29686.31 | 17.68 |
| Guatemala | WHO Region of the Americas | North America | 72358 | 119 | 3999.44 | 6.58 |
| Guyana | WHO Region of the Americas | South America | 27709 | 0 | 34047.48 | 0.00 |
| Honduras | WHO Region of the Americas | North America | 34050 | 49 | 3214.14 | 4.63 |
| Jamaica | WHO Region of the Americas | North America | 8180 | 6 | 2895.02 | 2.12 |
| Martinique | WHO Region of the Americas | North America | 13239 | 6 | 36075.44 | 16.35 |
| Mexico | WHO Region of the Americas | North America | 277963 | 203 | 2163.88 | 1.58 |
| Montserrat | WHO Region of the Americas | North America | 6 | 0 | 1367.99 | 0.00 |
| Nicaragua | WHO Region of the Americas | North America | 181096 | 4 | 25700.83 | 0.57 |
| Panama | WHO Region of the Americas | North America | 20924 | 18 | 4682.99 | 4.03 |
| Paraguay | WHO Region of the Americas | South America | 63216 | 24 | 9213.11 | 3.50 |
| Peru | WHO Region of the Americas | South America | 274227 | 441 | 7982.69 | 12.84 |
| Puerto Rico | WHO Region of the Americas | North America | 1242 | 0 | 380.94 | 0.00 |
| Saint Barthelemy | WHO Region of the Americas | North America | 737 | 0 | 67036.57 | 0.00 |
| Saint Kitts | WHO Region of the Americas | North America | 286 | 1 | 5988.90 | 20.94 |
| Saint Lucia | WHO Region of the Americas | North America | 60 | 0 | 332.87 | 0.00 |
| Saint Martin | WHO Region of the Americas | North America | 1272 | 0 | 39654.58 | 0.00 |
| Saint Vincent | WHO Region of the Americas | North America | 17 | 0 | 163.94 | 0.00 |
| Sint Maarten | WHO Region of the Americas | North America | 1 | 0 | 22.61 | 0.00 |
| Suriname | WHO Region of the Americas | South America | 282 | 3 | 452.48 | 4.81 |
| Trinidad | WHO Region of the Americas | North America | 126 | 0 | 82.09 | 0.00 |
| Turks and Caicos Islands | WHO Region of the Americas | North America | 182 | 0 | 3951.20 | 0.00 |
| Uruguay | WHO Region of the Americas | South America | 48 | 0 | 14.02 | 0.00 |
| USA | WHO Region of the Americas | North America | 156 | 0 | 0.46 | 0.00 |
| Venezuela | WHO Region of the Americas | South America | 4809 | 8 | 166.76 | 0.28 |
| Virgin Islands | WHO Region of the Americas | North America | 7 | 0 | 70.89 | 0.00 |
| Bangladesh | WHO South-East Asia Region | Asia | 321179 | 1705 | 1857.02 | 9.86 |
| India | WHO South-East Asia Region | Asia | 94198 | 91 | 65.94 | 0.06 |
| Maldives | WHO South-East Asia Region | Asia | 3417 | 0 | 6558.28 | 0.00 |
| Nepal | WHO South-East Asia Region | Asia | 51243 | 20 | 1658.53 | 0.65 |
| Sri Lanka | WHO South-East Asia Region | Asia | 89799 | 61 | 4101.61 | 2.79 |
| Thailand | WHO South-East Asia Region | Asia | 159219 | 179 | 2217.50 | 2.49 |
| Australia | WHO Western Pacific Region | Oceania | 1023 | 0 | 38.69 | 0.00 |
| Cambodia | WHO Western Pacific Region | Asia | 35390 | 99 | 2088.54 | 5.84 |
| China | WHO Western Pacific Region | Asia | 19627 | 1 | 13.77 | 0.00 |
| Indonesia | WHO Western Pacific Region | Asia | 83302 | 633 | 300.15 | 2.28 |
| Laos | WHO Western Pacific Region | Asia | 32109 | 20 | 4206.17 | 2.62 |
| Malaysia | WHO Western Pacific Region | Asia | 120418 | 96 | 3509.86 | 2.80 |
| Myanmar | WHO Western Pacific Region | Asia | 6685 | 30 | 122.49 | 0.55 |
| New Caledonia | WHO Western Pacific Region | Oceania | 9 | 0 | 30.72 | 0.00 |
| Philippines | WHO Western Pacific Region | Asia | 195603 | 657 | 1667.01 | 5.60 |
| Singapore | WHO Western Pacific Region | Asia | 9938 | 0 | 1652.28 | 0.00 |
| Vietnam | WHO Western Pacific Region | Asia | 369000 | 43 | 3732.59 | 0.43 |