LEX LOCALIS-JOURNAL OF LOCAL SELF-GOVERNMENT
ISSN:1581-5374 E-ISSN:1855-363X
VOL. 23, NO. S6(2025)

STATISTICAL ANALYSIS OF DENGUE DISEASE CAUSED BY THE MOSQUITO (*AEDES AEGYPTI)* IN PERU AND OTHER SOUTH AMERICAN COUNTRIES

Olegario Marín-Machuca[1]; Walter Eduardo Blas-Ramos[2]; José Eduardo Candela-Díaz[3]; Carlos Enrique Chinchay-Barragán[4]; José Manuel Santamaría -Ballena[5]; María del Pilar, Rojas-Rueda[6], Rodríguez Landauro Ana-Juliet[7]; Zambrano-Cabanillas, Abel Walter[8] and Obert Marín-Sanchez[9]

[1]Academic Department of Food Sciences, Faculty of Oceanography, Fisheries, Food Sciences, and Aquaculture. Universidad Nacional Federico Villarreal. Lima 1500 Peru.
ORCID: 0000-0002-0515-5875
[2]Academic Department of Food Sciences, Faculty of Oceanography, Fisheries, Food Sciences, and Aquaculture. Universidad Nacional Federico Villarreal. Lima 1500 Peru.
ORCID: 0000-0001-7817-122X
[3]Faculty of Oceanography, Fisheries, Food Sciences, and Aquaculture. Universidad Nacional Federico Villarreal. Lima, Peru.
ORCID: 0000-0002-4198-5745
[4]Academic Department of Food Sciences, Faculty of Oceanography, Fisheries, Food Sciences, and Aquaculture. Universidad Nacional Federico Villarreal. Lima 1500 Peru.
CODE:0000-0003-0053-4865
[5]Faculty of Oceanography, Fisheries, Food Sciences, and Aquaculture. Universidad Nacional Federico Villarreal. Lima, Peru.
ORCID: 0000-0003-0197-1733
[6]School of Human Medicine, Universidad Norbert Wiener, Lima, Peru. ORCID: 0000-0003-3812-7579
[7]Huarochirí Health Network, Ministry of Health, Lima, Peru.ORCID: 0000-0001-7373-4468
[8]Department of Aquaculture, Faculty of Oceanography, Fisheries, Food Science, and Aquaculture; Member of the GISA and DISA research groups of the EUPG and of EPIAC, Universidad Nacional Federico Villarreal. Lima 1500, Peru.
Code ORCID: 0000-0001-6930-5601
[9]Environmental Assessment and Biological Diversity Laboratory, Bioprosgen Research Group, Universidad Nacional Tecnológica de Lima Sur, Lima, Peru.
ORCID: 0000-0003-2912-1191

omarín@unfv.edu.pe[1]
wblas@unfv.edu.pe[2]
jcandela@unfv.edu.pe[3]
cchinchay@unfv.edu.pe[4]
jcandela@unfv.edu.pe[5]
maria.rojasr@uwiener.edu.pe[6]
juliet.rodland@gmail.com[7]
azambrano@unfv.edu.pe[8]
omarins@untels.edu.pe[9]

***Corresponding author**: omarin@unfv.edu.pe

ABSTRACT

The increase in incidents and the territorial expansion of dengue-transmitted diseases have become a crucial issue for public health in Peru and other South American countries. Throughout 2022, a total of 3,123,752 suspected and confirmed cases of arboviral diseases were reported in the Region of the Americas, of which 2,809,818 cases (90%) were diagnosed as dengue. The objective of this study was to perform a statistical analysis of dengue disease caused by the mosquito (*Aedes aegypti)* in the main South American countries and to draw relevant conclusions for the development of guidelines aimed at establishing prevention systems and protecting public health in the affected regions. The fatality rate of dengue disease is a matter of concern in our

country, with a total of 197,461 cases and 339 deaths reported. In Peru, during 2023, 55% of dengue cases occurred in women, while 38% of cases were recorded in the 30–59 age group and 22% in the 18–29 age group. The most affected regions are Ucayali, Loreto, Piura, San Martín, Huánuco, and Amazonas, accounting for 81% of dengue cases in Peru.

Keywords: statistical analysis, dengue, South American countries, Peru.

INTRODUCTION

The increase in the number of incidents and the territorial expansion of arthropod-borne diseases, such as chikungunya and dengue, have become a crucial issue for public health across the American continent. This situation poses significant challenges regarding their control and prevention in several countries of the region (Santos et al., 2023; Pan American Health Organization, 2022).

In 2022, a total of 3,123,752 suspected and confirmed cases of arboviral diseases were reported in the Region of the Americas. Of this total, 2,809,818 cases (90%) were diagnosed as dengue, while 273,685 cases (9%) corresponded to chikungunya. It is important to note that both dengue and chikungunya cases reached their highest incidence rate during epidemiological week 18, which began on May 1, 2022. World Health Organization reports that 119% of disease can increase from previous year, wereas effective treatment and strategies is needed. Along with the control effects dengue remains as the most common diseases in brazil and other tropical regions, which spreads from every three to five years and raised at the end of 2022. With 1,269,004 cases and 437 deaths in 2021. Nicaragua, Brazil, and Belize recorded highest dengue incidences with 14,554, 11,045, and 7,889 cases with 100,000 population, which highlights acute conditions in Brazil, Argentina, and Colombia were control efforts remain insufficient (Ramírez et al., 2024). Additionally, chikungunya also showed highest incidence in the region on the same year. Paraguay reports high meningoencephalitis incidence which possibly linked to the same disease and its neurological complications (Bisset et al., 2021). The increasing cases of chikungunya continues to distress public health authorities, and evenmore become more difficult for disease control efforts (Gräf et al., 2021). This study shows that dengue and other diseases within a comprehensive public health prevention and protection system.

LITERATURE REVIEW

In 2023, dengue transmission continued without showing any signs of slowing down. During the first months of the year, Peru reported a total of 20,017 dengue cases between January 1 and March 4, with 25 deaths, among which 80 cases were classified as severe. Dengue cases were recorded in 19 of 25 regions in Peru, wereas, DENV-1, DENV-2 and DENV-3 were detected in 2017 as the highest incidence of (68,290 cases). Statistical analysis is helpful for detecting the recent rise in disease (Munanyco, 2023). Similarly, From January 1 to March 11, 2023, Peru shown a drastic increase in chikungunya cases, which records 593 incidents, in the year of 2022. 69% of cases were recorded in Piura and 29% was reported in San Martin. The rapid increase of chikungunya in new regions poses a major difficulty in public health authorities for controlling and preventing its transmission (Higuera & Ramírez, 2019). In 2023, favorable climatic conditions, temperature and humidity have increased mosquito proliferaion and spread of dengue and other arboviral diseases. Brazil, Colombia, and Venezuela aggravated the epidemiological situation across the Americas(Arrasco et al., 2024). Dengue and chikungunya pose serious public health issue, these viruses spread over many years because of mosquitoes such as genus *Aedes* (Stegomyia), particularly *Aedes aegypti*. These arboviruses can be transported by infected travelers (imported cases), which may

lead to the emergence of new areas of local transmission, provided that vectors and a susceptible population are present. As arboviruses, all individuals living in areas where these mosquitoes proliferate are at risk, although the impact is greater on vulnerable populations, who face a lack of sufficient resources in control programs to effectively respond to outbreaks (World Health Organization [WHO], 2023a).

The impact of the increased transmission in the region will be determined by various factors, including each nation's capacity to implement a coordinated public health response and to ensure adequate medical care. Other influencing factors include the progression of the arbovirus season in the Southern Cone, the high mosquito density resulting from the suspension of vector control activities during the COVID-19 pandemic, and the large number of people vulnerable to arboviral infections, particularly in areas where these viruses have begun to spread (Lévano, 2024).

Likewise, conflicting priorities and the potential for confusion with other diseases can negatively affect both disease control and the appropriate treatment of patients. This is due to several factors, including the possibility of misdiagnosis, since the symptoms of chikungunya and dengue are often nonspecific and similar to those of other infections, such as Zika or measles, which can result in inadequate treatment. Rodriguez et al., 2022 discussed that the high number of disease cases, collective outbreaks, and less resources after the COVID-19 pandemic have triggered the healthcare overcrowding and obstructed arboviral disease control.

Dengue is a febrile illness that tends to intensify during the rainy season, which serves as a trigger for mosquito reproduction. This situation is further aggravated by poor hygiene and sanitation practices among the population, including lack of control over water reservoirs, waste accumulation, household vegetation, and stagnant water in tanks or solar ponds, among others (Valladares & Linarez, 2020). Dengue is a viral disease of endemic–epidemic nature, transmitted by the mosquito commonly known as *Aedes aegypti*, which is currently considered one of the most significant diseases worldwide in terms of morbidity, mortality, and economic impact (Burgos et al., 2019). It is also considered an emerging disease, given the increasing number of cases in different regions, becoming a major threat to many countries (Burgos et al., 2019).

Dengue is transmitted through the bite of infected female mosquitoes of the genus *Aedes*. It occurs in tropical and subtropical climates, mainly in urban and semi-urban areas. Among the social factors associated with its spread are population density, poor socioeconomic conditions, houses with drains obstructed by waste, uncovered water containers, and water stored for more than seven days, as observed in countries such as Brazil, Colombia, Argentina, and Peru (Murillo & Ponce, 2020). According to Aguilar and Barragán (2021), it is estimated that approximately 390 million dengue infections occur worldwide each year. In recent decades, dengue disease has shown a clear upward trend, reflecting a worrying increase that has led to the current high global case numbers.

The dengue disease is transmitted through the bite of the *Aedes aegypti* mosquito, affecting people of all ages. Its symptoms range from mild fever to debilitating high fever accompanied by severe headache; in some cases, it may progress to severe forms, including respiratory distress and significant organ damage, showing a seasonal pattern. The disease occurs more frequently during warmer and rainier months (Naranjo et al., 2019). Regarding the dengue serotypes, four have been reported: DENV-1, DENV-2, DENV-3, and DENV-4 (*dengue virus* serotypes 1, 2, 3, and 4). The vector *Aedes aegypti* breeds in water bodies located

in tropical and subtropical regions around the world (Juárez et al., 2022). Moreover, infection with one serotype produces permanent immunity against reinfection by that same serotype; however, sequential infection with two different serotypes is a major risk factor for developing severe forms of the disease (Juárez et al., 2022).

Velasco et al. (2020) point out that dengue and COVID-19 share a significant similarity in their signs and symptoms, which can lead to delays in the diagnosis of COVID-19 infection and greater viral spread. This occurs because, in most dengue cases, warning signs are absent, and management is carried out on an outpatient basis.

Perales et al. (2019) state that dengue continues to be a major ongoing public health problem in Peru, showing an upward trend over the past five years. The most frequent clinical manifestations include fever, headache, arthralgia, myalgia, eye pain, nausea, vomiting, and lower back pain. According to the Pan American Health Organization (PAHO, 2020), the highest proportions of dengue cases in various countries across the Americas were reported in Brazil with 1,040,481 cases (65%), Paraguay with 218,798 cases (14%), Bolivia with 82,460 cases (5%), Argentina with 79,775 cases (5%), and Colombia with 54,192 cases (3%). Furthermore, according to Estado de Salud (2023), Peru, Bolivia, and Argentina are experiencing a resurgence of dengue cases this year, with Brazil ranking first, reporting over 24 million cases since 1980, followed by Colombia with more than one million cases.

The purpose of this study is to conduct a statistical analysis of dengue fever caused by the mosquito *Aedes aegypti* in the main South American countries and to draw relevant conclusions aimed at developing guidelines and training documents that can serve as preventive systems and help protect public health in the aforementioned regions.

METHODS AND MATERIALS

The research employed an explanatory and descriptive statistical study aimed at thoroughly analyzing the causes and effects of the phenomena under investigation in relation to other factors. Regarding the population and sample, and in order to address public health needs, statistical data from the main South American countries were considered. The management model refers to the methodology used to organize and coordinate resources with the purpose of achieving established policies, meeting objectives, and adhering to regulations. Concerning surveillance and control of the spread of the mosquito (*Aedes aegypti*), these are systematic and decentralized processes carefully designed to capture and record information related to the distribution of *Aedes aegypti*, as well as to assess its population over time. These procedures are established to allow continuous and detailed analysis of the current situation, which is crucial for preventing and controlling the expansion of this vector and for the early detection of other potential vectors. The Aedic Index refers to the percentage of households that tested positive for the presence of *Aedes aegypti* in a specific locality, an essential indicator since it measures the vector's presence in the area, providing valuable information about its distribution. The Container Index refers to the percentage of water-holding containers that tested positive for *Aedes aegypti* in a given geographic area. This index is calculated by taking the proportion of containers that were found positive in relation to the total number of containers inspected. The Egg Density Index represents the average number of *Aedes aegypti* eggs per positive ovitrap. The data collection instruments consisted of the ovitrap

system, a device used to record information and specifically designed to capture mosquito eggs. Additionally, the household inspection form was used to document the findings from inspections conducted in homes that could contain water and become potential mosquito breeding sites.

RESULTS

The compilation, statistical analysis, and interpretation of the data are presented and discussed below:

Table 1. South American countries with the highest number of dengue cases from 1980 to 2024 (Health Status, 2024)

Country	Number of dengue cases
Brasil	23 696 682
Colombia	1 951 143
Venezuela	1 104 176
Bolivia	822 476
Paraguay	798 322
Ecuador	763 669
Peru	760 057
Argentina	320 525

Furthermore, the Pan American Health Organization (2022) confirmed the number of dengue cases and deaths reported in 2022, as shown in the following table:

Table 2. Dengue in South American countries in 2022 (Pan American Health Organization, 2023)

Country	Number of dengue cases	Number of deaths
Peru	72 851	84
Bolivia	16 544	10
Brasil	2 363 490	991
Argentina	750	0
Paraguay	7 428	0
Colombia	69 497	48
Venezuela	11 409	18
Ecuador	16 017	13
Uruguay	80	0

On the other hand, the Pan American Health Organization (2023) confirmed the number of dengue cases and deaths as shown in the following table:

Table 3. Dengue in South American countries in 2023 (Pan American Health Organization, 2024)

Country	Number of dengue cases	Number of deaths
Peru	197 461	339
Bolivia	133 779	77
Brasil	2 376 522	769
Argentina	118 089	65
Paraguay	6 534	8
Colombia	52 586	29
Venezuela	4 809	8
Ecuador	5 372	5
Uruguay	35	0

Zambrano (2016) states that the main risk factors for dengue fever are the rapid increase of poorly planned urban developments and the marked lack of control in tropical countries. In addition, national and community water supply and waste management systems have a severe impact on the growth of these mosquito-borne diseases; this situation is further aggravated by climatic conditions that favor mosquito proliferation.

In Peru, in 2023, it was reported that 55% of dengue cases occurred in women, while 38% of cases were found in the 30–59-year-old group and 22% in the 18–29-year-old group (Pan American Health Organization, 2020).

The fatality rate of dengue in Peru is alarming, with a total of 197,461 cases and 339 deaths reported. The increase in the number of cases is nearly double that recorded in 2022. The Ucayali, Loreto, Piura, Madre de Dios, San Martín, Huánuco, and Amazonas regions are among the most affected, accounting for approximately 81% of all dengue cases in the country (Quiceno, 2023).

In the Americas, dengue fever is considered a major and concerning public health issue. In 1950, a program was launched with the goal of eradicating the *Aedes aegypti* mosquito—the main vector of DENV—which achieved success in many countries, although complete eradication of the mosquito worldwide was not possible (Pan American Health Organization, 2020).

Data Analysis

Figure 1 shows the number of dengue cases reported from 1980 to 2024 in South American countries.

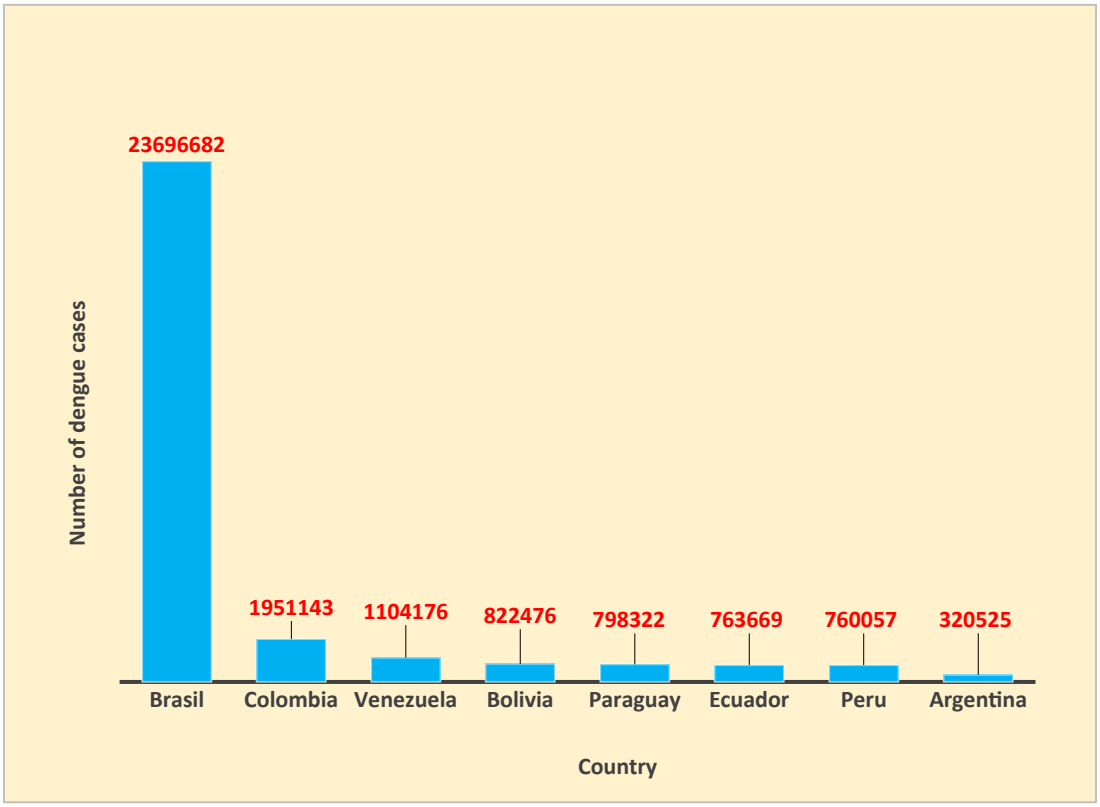

Figure 1. Dengue cases in South American countries from 1980 to 2024

Note. It can be observed that the highest number of cases occurred in countries with larger tropical areas, such as Brazil, Colombia, and Venezuela. Likewise, a higher number of cases is evident in countries with larger populations.

Impact of Dengue in South American Countries (2022–2023)

The analysis considers the fatality rate caused by dengue in South American countries between 2022 and 2023, showing that lethality increased in some countries while decreasing in others.

Fatality rate calculation:

$$Fatality\ rate\,(\%) = \frac{(Number\ of\ deaths) * 100}{(Number\ of\ dengue\ cases)}$$

Figure 2 presents the countries where dengue fatality rates increased from 2022 to 2023, along with the corresponding number of deaths.

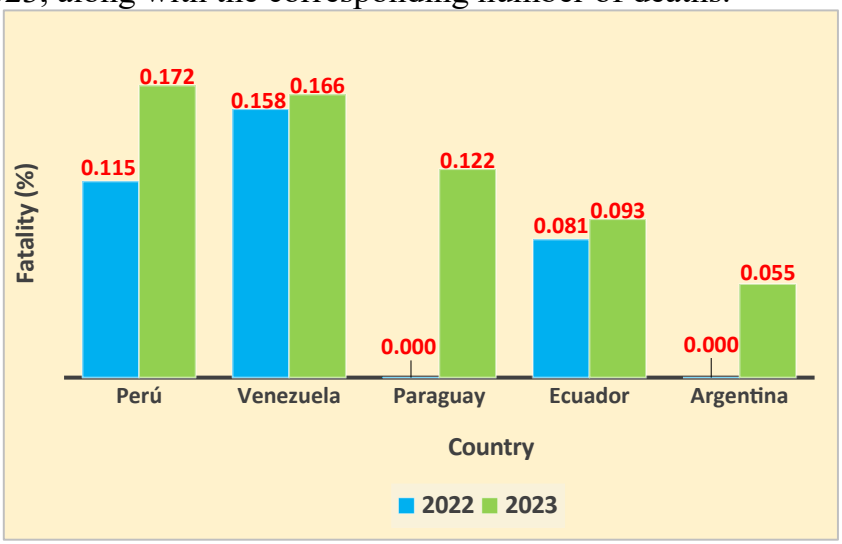

Figure 2. Countries with an Increase in Dengue Fatality Rates from 2022 to 2023
Note. When comparing the increase in dengue fatality per 10,000 infected individuals across Latin American countries, Venezuela shows the highest proportion, rising from 16 to 17 deaths. Peru follows, increasing from 12 to 17 deaths, then Paraguay, which rose from 0 to 12 deaths, Ecuador from 8 to 9 deaths, and Argentina from 0 to 6 deaths.

The factors contributing to the increase in dengue fatality rates are diverse and include geographical and environmental conditions, local customs, limited public awareness and training on tropical disease prevention, as well as the quality of healthcare services and hospital infrastructure within each country.

Figure 3 presents the countries where dengue fatality rates decreased from 2022 to 2023, along with the corresponding number of deaths.

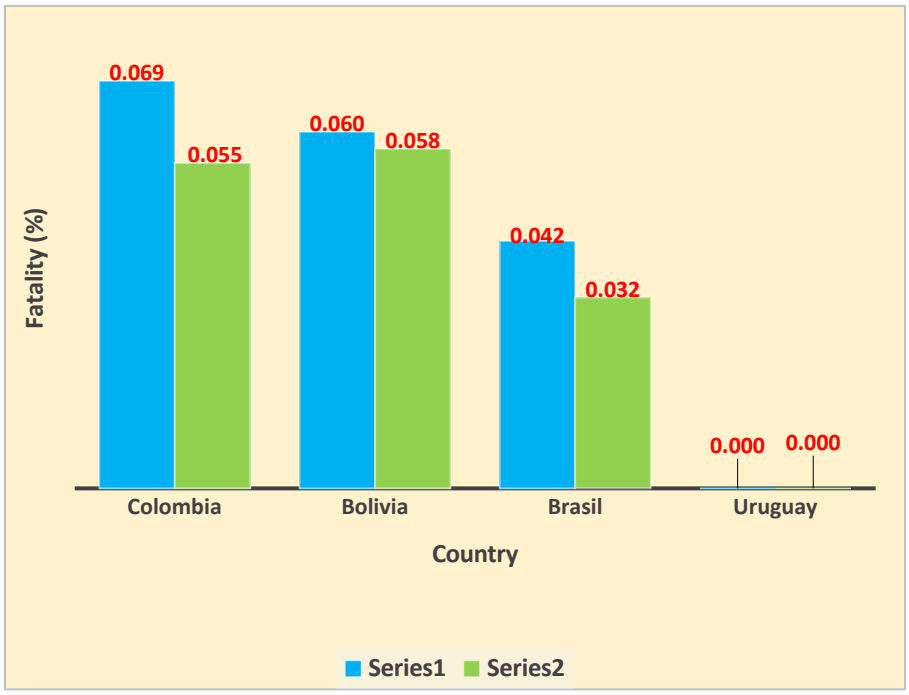

Figure 3. Countries with a Decrease in Dengue Fatality Rates from 2022 to 2023
Note. When comparing the decrease in dengue fatality per 10,000 infected individuals across Latin American countries, Colombia shows the greatest reduction, dropping from 7 to 6 deaths; followed by Bolivia, which decreased from 6 to 5.8 deaths; Brazil, which declined from 4 to 3 deaths; and Uruguay, which reported no dengue-related deaths.

Among the factors contributing to the decrease in dengue fatality rates, the most significant are the public health policies implemented in each country, particularly those related to medical care and hospital logistics—followed by training and education programs on disease prevention conducted by the responsible health authorities.

DISCUSSION

The data analysis of individuals affected by dengue fever caused by the mosquito *Aedes aegypti* highlights the severity of the situation in Brazil, Argentina, and Colombia—countries where disease control measures have proven insufficient, consistent with the findings reported by Ramírez et el., (2024). Favorable environmental conditions across South America during 2022 and 2023, such as increased temperature and humidity, enabled a higher mosquito population, thereby intensifying dengue transmission. Within this context, Brazil, Colombia, and Venezuela have significantly contributed to the worsening of this epidemiological situation in several South American regions, further complicating the efforts of health authorities to contain these dengue outbreaks. It is important to note that Peru experienced its highest accumulated incidence of dengue in 2017, with a record of 68,290 cases. Statistical data are crucial for understanding the recent increase in the incidence of this disease—a trend that has continued into 2024—consistent with the findings reported by Munayco (2023).

In tropical climates and areas with similar environmental conditions, including urban, semi-urban, and rural sectors, several social factors play a key role, such as high population density, poor socioeconomic conditions, housing with drainage

systems clogged by waste, the use of uncovered containers, and water stored for more than seven days. In countries such as Brazil, Colombia, Argentina, and Peru, the transmission of dengue fever caused by *Aedes aegypti* has persisted for extended periods, leading to increased mortality—consistent with the observations of Murillo and Ponce (2020). Statistical analysis confirms that Peru, Bolivia, and Argentina have experienced dengue resurgences from 2020 to 2023. Brazil remains the country with the highest number of reported cases since 1980, exceeding 24 million, followed by Colombia and Argentina with significant numbers—consistent with data reported by Health Status (2023).

CONCLUSIONS

Likewise, it can be concluded that in Peru, in 2023, 55% of dengue cases corresponded to women, while 38% occurred in the 30–59 age group and 22% in the 18–29 age group. The case fatality rate of dengue is concerning, with a total of 197,461 cases and 339 deaths reported. The increase in the number of cases nearly doubled the value recorded in 2022. The most affected regions were Ucayali, Loreto, Piura, Madre de Dios, San Martín, Huánuco, and Amazonas, which together accounted for approximately 81% of all dengue cases in Peru. Across the Americas, dengue is considered a major and concerning public health problem. The analysis performed revealed that dengue fatality rates in South American countries between 2022 and 2023 have increased in some nations and decreased in others. The country with the highest proportional increase was Venezuela, rising from 16 to 17 deaths per 10,000 cases, followed by Peru, which rose from 12 to 17 deaths, Paraguay from 0 to 12 deaths, Ecuador from 8 to 9 deaths, and Argentina from 0 to 6 deaths. Among the factors contributing to the reduction in dengue fatality rates are the public health policies of each country, particularly those related to healthcare delivery and hospital logistics, as well as the training and prevention programs implemented by responsible institutions. It is essential to establish operational models in high-risk areas, reassessing their effectiveness and incorporating institutions and healthcare personnel in their implementation. Additionally, it is recommended to evaluate logistical and social barriers that hinder access to households scheduled for inspection and to implement community-based strategies that promote collaboration between residents and health authorities.

Acknowledgments

The authors express their gratitude for the collaborative effort that made the development of this manuscript possible.

Conflicts of interest

The authors declare no conflicts of interest or financial relationships related to this research that could have influenced the results, analysis, or interpretation of the findings presented in this manuscript.

Author contributions

All members of the research team contributed equally to the design, structure, and compilation of this article.

REFERENCES

Aguilar, A. y Barragán, G. (2021). Caracterización clínica, imagenológica y de laboratorio en pacientes pediátricos con dengue con signos de alarma,

estudio por realizarse en el Hospital Universitario de Guayaquil del año 2017 al 2020.

Bisset, L., Marqueti, F., Hernández, C., Leyva, S., Fuentes, G., Castex, R., Menéndez, D., García, G. y Castillo, P. (2021). Aportes científicos del Instituto de Medicina Tropical «"Pedro Kouri"» a la vigilancia de Aedes aegypti (Díptera: Culicidae) en Cuba, 1982-2020. *Revista Cubana de Medicina Tropical*, 73(3). https://revmedtropical.sld.cu/index.php/medtropical/article/view/687

Burgos, B., Loaiza, G., Gorozabel, M. y Moreno, L. (2019). Fisiopatología del dengue. *Revista Científica del Mundo de la Investigación y el Conocimiento,* 3(3), 622-642. http://recimundo.com/index.php/es/article/view/614

Estado de Salud (2023). *Ranking de los 20 países de América Latina con mayor número de casos de dengue reportados desde 1980 hasta julio de 2023*.

Gräf, T., Vazquez, C., Giovanetti, M., De Bruycker-Nogueira, F., Fonseca, V., Claro, I. M., De Jesus, J. G., Gómez, A., Xavier, J., De Mendonça, M. C. L., Villalba, S., Torales, J., Gamarra, M. L., Thézé, J., De Filippis, A. M. B., Azevedo, V., De Oliveira, T., Franco, L., De Albuquerque, C. F. C., … Alcantara, L. C. J. (2021). Epidemiologic History and Genetic Diversity Origins of Chikungunya and Dengue Viruses, Paraguay. *Emerging Infectious Diseases*, 27(5), 1393-1404. https://doi.org/10.3201/eid2705.204244

Higuera, A. y Ramírez, J. D. (2019). Molecular epidemiology of dengue, yellow fever, Zika and Chikungunya arboviruses: An update. *Acta Tropica*, 190, 99-111. https://doi.org/10.1016/j.actatropica.2018.11.010

Juárez, C., Duran, D., Ceja, O., Cortez, D., Baeza, J., Diaz, D., Benavides, Y., Reyes, K., Reyes, U., Uribe, G., Baeza, S., Vargas, M. y Mercado, U. (2022). Dengue neonatal: Serie de casos. *Revista Latinoamericana de Infectología Pediátrica,* 35(2), 81-85. https://dx.doi.org/10.35366/106659

Lévano, S. (2024). Control de vectores, diagnóstico temprano y educación: Los tres pilares de la prevención del dengue. *Revista Peruana de Ciencias de la Salud (ene-mar)*, 6(1). http://revistas.udh.edu.pe/index.php/RPCS/article/view/651 https://doi.org/10.37711/rpcs.2024.6.1.437

Munayco, C. V. (2023). Situación epidemiológica del dengue en el Perú. *Diagnóstico*, 62(2), e458. https://doi.org/10.33734/diagnostico.v62i2.458

Murillo, P. y Ponce, S. (2020). *Prevalencia de comorbilidades en pacientes con dengue con signos de alarma y dengue severo que ingresaron al Hospital de Infectología de Guayaquil*.

Naranjo, J., Castillo, J., Hernández, P. y Castaño, D. (2019). Inmunopatología del dengue: Importancia y participación de los monocitos y sus subpoblaciones. *Revista Iatreia,* 32(3), 204-216. https://doi.org/10.17533/udea.iatreia.09

Organización Mundial de la Salud [OMS]. (2023a). *Expansión geográfica de los casos de dengue y chikungunya más allá de las áreas históricas de transmisión en la Región de las Américas*. https://www.who.int/fr/emergencies/disease-outbreak-news/item/2023-DON448

Organización Mundial de la Salud [OMS]. (2023b). *Expansión geográfica de los casos de dengue y chikungunya más allá de las áreas históricas de transmisión en la*

Región de las Américas. https://www.who.int/fr/emergencies/disease-outbreak-news/item/2023-DON448

Organización Panamericana de la Salud (2020). *Actualización Epidemiológica del dengue y otras arbovirosis*.

Organización Panamericana de la Salud. (2022). Síntesis de evidencia: Directrices para el diagnóstico y el tratamiento del dengue, la chikunguña y el zika en la Región de las Américas. *Revista Panamericana de Salud Pública*, 46, 1. https://doi.org/10.26633/RPSP.2022.82

Organización Panamericana de la Salud (2022-2023). *Casos Reportados de Dengue en las Américas*. https://www3.paho.org/data/index.php/es/temas/indicadores-dengue/dengue-nacional/9-dengue-pais-ano.html

Organización Panamericana de la Salud (2024). Dengue: Análisis por ciudades https://www.paho.org/en/arbo-portal/dengue-data-and-analysis/dengue-analysis-country

Perales, J., Popuche, P., Cabrejos, G. y Díaz, C. (2019). Perfil clínico, epidemiológico y geográfico de casos de dengue durante el fenómeno El Niño Costero 2017, Lambayeque – Perú. *Revista Habanera de Ciencias Médicas*, 18(1), 97-113. http://www.revhabanera.sld.cu/index.php/rhab/article/view/2302

Quiceno, M. (2023). *Dengue en América Latina: ¿Por qué sigue siendo una enfermedad tropical desatendida?*

Ramírez, I., Rumich, I., Carrera, M., Alcaraz, M., García, M. y Paranderi, N. (2024). Caracterización clínica de pacientes infectados con Chicungunya del centro ambulatorio de especialidades de J. Augusto Saldivar. *Revista científica UPAP*, 4(2). https://doi.org/10.54360/rcupap.v4i2.155

Rodríguez, A. J., León-Figueroa, D. A., Sah, R., y Villamil-Gomez, W. E. (2022). Arboviral diseases and monkeypox – An epidemiological overlapping differential diagnosis? *Revista del Cuerpo Médico Hospital Nacional Almanzor Aguinaga Asenjo*, 15(3), 323-324. https://doi.org/10.35434/rcmhnaaa.2022.153.1678

Santos, L. L. M., De Aquino, E. C., Fernandes, S. M., Ternes, Y. M. F. y Feres, V. C. D. R. (2023). Dengue, chikungunya, and Zika virus infections in Latin America and the Caribbean: A systematic review. *Revista Panamericana de Salud Pública*, 47, 1. https://doi.org/10.26633/RPSP.2023.34

Valladares, M. y Linares, N. (2020). Aprendamos la lección: También frenemos la curva del dengue en tiempos de COVID-19. INNOVARE Revista de Ciencia y Tecnología, 9(1), 58-59. https://doi.org/10.5377/innovare.v9i1.9664

Velasco, M., Chiara, C., Rodríguez, R., Urbina, A. y Inga, F. (2020). Coinfección entre dengue y COVID-19: Necesidad de abordaje en zonas endémicas. *Revista de la Facultad de Ciencias Médicas de Córdova,* 77(1), 52-54. http://dx.doi.org/10.31053/1853.0605.v77.n1.28031

Zambrano, I. (2016). *Protocolo de atención para dengue clásico y grave del Hospital Francisco Icaza Bustamante de Guayaquil*.