PAHO

Pan American Health Organization | World Health Organization Regional Office for the Americas

Public health risk assessment related to Western Equine Encephalitis (WEE) virus in the Region of the Americas

23 February 2024

Risk assessment elaborated with the data available as of 14 February 2024

Overall Risk
Regional
Moderate

Confidence in available information
Regional
Moderate

General Risk Statement

The present rapid risk assessment (RRA) aims to assess the current regional public health risk related to Western Equine Encephalitis virus (WEE) present in the Americas, considering the following criteria: (i) the potential risk to human health (including exposure risk, clinical-epidemiological behavior of the disease, indicators of magnitude and severity, as well as more detailed risk factors and determinants in countries where outbreaks have been identified), (ii) the risk of dissemination (vector activity, hosts, reservoirs, and cross-border geographic spread), and (iii) the risk of insufficient capacity for prevention and control with available resources (encompassing response capacities, surveillance, diagnostic techniques, health service preparedness, and supplies).

On 19 December 2023, the Pan American Health Organization / World Health Organization (PAHO/WHO) issued an alert regarding the risk to human health associated with the circulation of the WEE virus in equines in Argentina and Uruguay *(1)*. As of 19 December 2023, 921 cases had been confirmed in equines (920 in Argentina and one case in Uruguay) *(1)*. Subsequently, on 20 December 2023, a human case of the disease was confirmed in Argentina *(2)*, and on 30 January 2024, a human case was confirmed in Uruguay *(3)*. Argentina had last reported human cases of WEE in 1982-1983 and in 1996 *(4)*, while Uruguay had last reported a human case of WEE in 2009 *(5)*.

Since November 2023, a sustained increase in WEE cases in equines and humans has been observed in both Argentina and Uruguay *(6)*. In addition, a case of WEE was detected in an equine in Brazil, in the state of Rio Grande do Sul, which shares its southern border with Uruguay and its western border with Argentina *(7)*. According to information available from official sources, as of 14 February 2024 the date of the elaboration of this risk assessment, 2,464 outbreaks[1] in animals (1,445 in 16 provinces of Argentina, 1,018 in 16 departments of Uruguay, and one case in a Brazilian state) and 73 confirmed cases in humans (69 in Argentina and four in Uruguay) have been reported *(8)*. The distribution of confirmed human cases in Argentina and Uruguay coincides with areas with a higher number of suspected and confirmed equine cases *(6)*. In Argentina, seven human deaths resulting from WEE have been confirmed *(9)*.

All fatal cases associated with the recent outbreak in Argentina (n=7) reported a history of having lived, worked, or visited a rural or semi-rural area and 86% (n=6) reported a history of previous illness or underlying condition (diabetes, oncological disease, arterial hypertension, among others). Most deaths occurred in patients between the ages 60 and 79 years (n=6), and one death occurred in a 34-year-old *(9)*.

WEE virus circulates naturally in birds and is transmitted to equines and people primarily by the mosquito vector *Culex tarsalis,* but there are multiple vectors, including the *Aedes melanimon*, *Aedes dorsalis,* and *Aedes campestris*, which maintain virus circulation in wild enzootic cycles *(10)*. Equines and humans infected with WEE are not contagious to other animals or people *(11)*.

[1] Outbreak: means the occurrence of one or more cases in an epidemiological unit *(8)*.

Passerine birds are the main reservoir hosts for Eastern Equine Encephalitis (EEE) and WEE viruses; however, in South America, other mammals, such as rodents and bats, may play a role as significant reservoirs of the virus, while equines and humans serve as terminal hosts *(5)* and are not involved in further transmission of the virus. Since birds act as a reservoir for the virus, they have the potential to become amplifying hosts, thus spreading the infection to other countries during migration *(12)*. No cases of bird transmission of the disease have been reported, making mosquitoes the primary vector and birds simply reservoirs.

Several factors could be associated with the increasing risk of exposure with the vectors of WEE. The summer season in southern hemisphere countries affect the vector's feeding habits. While *Culex tarsalis* is primarily an ornithophilic vector during the spring-summer, it exhibits dietary shifts by mid-summer, increasing its feeding on mammals *(12, 13, 14).* The recent WEE outbreaks in Argentina and Uruguay coincide with the summer season in these countries, which typically spans from December to March. There is no data available suggesting that there is an increased density of the vector.

Other factors such as climate change leading to increased rainfall and higher temperatures, deforestation due to the expansion of the agricultural frontier, increased urbanization, among other human activities that favor the spread of the vector and create an environment conducive to vector-host interaction, and the potential increased transmission of WEE.

The strains on healthcare systems in countries experiencing complex humanitarian crises, as well as political and financial instabilities, along with large population flows and mass gatherings (e.g., carnivals, fairs, or agricultural expositions) in areas with reported cases, also play an important role in increasing the risk of spread of WEE.

Based on the criteria defined for this assessment, the overall risk in the Americas Region level has been classified as "**moderate**" with a "**moderate**" level of confidence in the available information.

Criteria	Assessment		Risk	Rationale
	Likelihood	Consequences		
Potantial risk to human health	Likely	Minor	Moderate	– Lack of systematic surveillance, may cause low case detection, resulting in underestimating the true burden of disease. – People who work or carry out outdoor activities in rural or semi-rural areas are exposed to a greater risk due to exposure to mosquito bites that act as a vector. – With regard to the severity of the clinical presentation of the disease, outbreaks of WEE in humans usually manifest as isolated cases with symptoms that are generally mild, moderate or even asymptomatic. Rarely, severe forms of aseptic meningitis and encephalitis occur. The mortality rate in humans ranges from 3% to 4% case fatality rate. – The majority of the fatal human cases documented in Argentina in the recent outbreak are persons between 60 and 79 years of age with comorbidities such as diabetes, oncological disease, arterial hypertension, among others. – There is no specific treatment or vaccine for WEE, medical care is focused on symptom management and control.
Risk of event spreading	Likely	Moderate	High	– WEE outbreaks identified in the last 20 years mainly occurred in rural and peri-urban areas, where the presence of vectors and/or hosts or reservoirs has been identified.

				– Direct human-to-human transmission of the virus has not been documented. – Proximity to urban and peri-urban centers in areas where the vector is present is also associated with increased risk, especially for those with good transportation connections. – Argentina and Uruguay are currently reporting sustained increases in WEE cases in equines and humans, affecting several provinces and departments. – In Brazil, in the state of Rio Grande do Sul, which shares its southern borders with Uruguay to the south and its western border with Argentina, one case of WEE was confirmed in an equine; however, no additional cases have been confirmed in equines or humans in that country. – The risk of spread may increase due to social, entomological, and environmental factors that favor vector proliferation in countries located in areas where WEE outbreaks have been confirmed. – Environmental factors generated by the "El Niño Phenomenon" and climate change (increased temperatures and changes in precipitation) could facilitate the geographical expansion of mosquitoes, which act as vectors, as well as alterations in the population dynamics and mobility of animals that act as hosts or reservoirs. – Since migratory birds (as passerine) act as a main reservoir for the virus, they have the potential to become amplifying hosts and spread the infection to more countries. However, no cases in birds have been reported as of the time of the elaboration of this risk assessment.
Risk of insufficient prevention and control capacity with available resources	Likely	Minor	Moderate	– There is no, or limited, systematic surveillance of WEE as most countries in the Region of the Americas do not have a national mandatory reporting requirement for this disease. – In most cases, the symptoms of WEE are mild or subclinical, which can lead to underreporting of the event and difficulties in diagnosis. – Laboratory diagnosis of WEE depends on the availability of tests in the countries and is subject to established laboratory algorithms for surveillance of this virus. Most countries in the Region do not have accessible diagnostic capacity. – In countries with diagnostic capacity, this capacity is generally centralized, which may lead to delays in diagnosis in the face of an increase in suspected cases at the subnational level. Restrictions and delays in laboratory diagnosis contribute to less sensitive and less timely surveillance. – There is much heterogeneity in surveillance and response capacity within the Region to outbreaks of WEE. – The documented outbreaks have not yet caused the saturation or collapse of health services; however, given the simultaneous large-scale circulation of other events, WEE outbreaks may be an additional burden on health systems in the countries of the Region.

				– Concomitant large-scale high-risk outbreaks and other public health emergencies (COVID-19 and dengue) further deplete resources and limit the response capacity of health teams. – Insufficient participation and mobilization of local communities in vector control activities. – WEE is a reemerging and under-identified disease, which means that it is under-funded and lacks high level institutional commitment to its surveillance, prevention, and vector control in affected countries.

Background Information

Hazard assessment

Western Equine Encephalitis
Western Equine Encephalitis (WEE) is a vector-borne disease caused by the virus of the same name, which belongs to the genus *Alphavirus* of the *Togaviridae* family. Like Eastern Equine Encephalitis (EEE) and Venezuelan Equine Encephalitis (VEE), WEE is part of the group of encephalitis caused by arboviruses *(11)*. While scientific evidence and surveillance data are limited, recent outbreaks and data gathered from the arboviral surveillance system have allowed for a partial characterization of the clinical-epidemiological behavior, socio-demographic variables associated with individual risk, and estimation of the general magnitude and severity of the event. Outbreaks of WEE in humans typically manifest as isolated cases with mild clinical signs, with most infections being asymptomatic. In more severe and rare forms, neurological manifestations include meningitis, encephalitis, or myelitis, with specific symptoms varying according to virus type and clinical syndrome. Meningitis is typically characterized by fever, headache, neck stiffness and other meningeal signs. Encephalitis may present with fever, altered consciousness, seizures, or focal neurological signs including motor disorders. The incubation period is 2 to 7 days and mortality in humans has been documented to range from 3-4% case fatality rate (CFR). There is no specific antiviral treatment or vaccine to prevent the disease in humans *(11)*. In arboviral encephalitis, the risk of infection is generally determined by exposure to infected vectors and depends on diverse factors, such as environmental conditions, the season, and human activities. People who live, work, or participate in outdoor activities in endemic areas or where active outbreaks of the disease in animals are reported are at increased risk due to exposure to mosquitoes *(11)*. The WEE virus circulates naturally in birds and is transmitted to equines and people mainly through the bite of an infected mosquito vector. The main vector is *Culex tarsalis*, but there are multiple vectors, including the *Aedes melanimon*, *Aedes dorsalis,* and *Aedes campestris*, which maintain virus circulation in wild enzootic cycles where passerine birds act as main virus reservoirs *(12)*. Humans and equines are terminal hosts of the virus and signifying they cannot further transmit the virus *(15)*. Most cases of human infection are associated with epidemics in equine populations. The virus can spread from one area to another by the migration of infected birds or by the movement of animals that act as reservoir hosts for the virus *(4)*.

Encephalitis caused by this virus occurs sporadically in equines and humans from mid-summer to late autumn in temperate regions, but can occur throughout the year in tropical regions, depending on climatic conditions that favor the presence of the mosquito vector *(12)*.

In relation to the main vector, *Culex tarsalis*, towards the end of the summer seasons, a change in feeding habit has been observed, leading many females to feed on mammals, such as rabbits, equines, cattle, and humans. This change in hosts may be crucial in the transmission of the virus to equines and humans. Dispersal occurs primarily during flights in search of hosts, traveling an average of about 100 meters per day from breeding sites in wetland and agricultural habitats *(12, 13, 14)*.

Exposure Assessment

Table 1. Summary of ongoing and/or reported WEE outbreaks as of 14 February 2024.

Region of the Americcas	
Per the World Animal Health Information System (WAHIS) of the World Organisation for Animal Health (WOAH), from 2006 to 2023, equine encephalitis has been reported in animals in 17 countries in the Region of the Americas. In that period, WEE was reported in equines in Brazil (2006, 2007, 2017, 2018, 2019, and 2022), Mexico (2019), and during 2023 the current outbreak was reported in Argentina and Uruguay *(16)*. Since 25 November 2023, when the first outbreak of WEE in equines was reported in Argentina, and until 12 February 2024, a total of 2,464 outbreaks in animals (1,445 in 16 provinces of Argentina, 1,018 in 16 departments of Uruguay and one case in a Brazilian state) and 73 confirmed cases in humans (69 in Argentina and four in Uruguay) have been reported. The distribution of confirmed human cases in Argentina and Uruguay coincides with areas with a higher number of suspected and confirmed equine cases *(6)*.	
Country/Territories	**Context**
Argentina	**<u>Equine outbreaks</u>** Between 25 November 2023 and 5 February 2024, the Argentina National Agrifood Health and Quality Service (SENASA per its acronym in Spanish) confirmed 1,445 outbreaks in equines (46 diagnosed by laboratory and 1,399 by clinical and epidemiology). Confirmed outbreaks have been reported in 16 provinces: Buenos Aires, Catamarca, Chaco, Corrientes, Córdoba, Entre Ríos, Formosa, La Pampa, La Rioja, Mendoza, Neuquén, Río Negro, Salta, San Luis, Santa Fe, and Santiago del Estero. The greatest concentration of outbreaks was reported in the province of Buenos Aires, representing 30% (n=14) of laboratory-confirmed equine outbreaks *(17)*. **<u>Outbreaks in humans</u>** Since the notification of the first human case of WEE in Argentina *(1)* on 20 December 2023 and as of epidemiological week (EW) 6 of 2024, 307 suspected human cases have been reported in 15 provinces, with 69 of the cases laboratory confirmed. The laboratory confirmed cases are distributed in the provinces of: Buenos Aires (n=41), Santa Fe (n=16), Entre Rios (n=5), Cordoba (n=4), Buenos Aires City (n=2), and Santiago del Estero (n=1). In addition, 21 human cases were classified as probable, in the provinces of Buenos Aires (n=15), Córdoba (n=1), and Santa Fe (n=5). The median age of the laboratory confirmed cases is 58 years, and ages ranged between 4 months to 81 years, with 61% (n=X) in the age group 50-69 years. Males accounted for 83% of the confirmed cases were male and 17% female. There were 7 deaths among the confirmed cases, reported in the provinces of: Buenos Aires (n=3), Cordoba (n=1), Entre Rios (n=1), and Santa Fe (n=2). The majority of the fatal cases, 86% (n=6), reported having lived, worked, or visited a rural or semi-rural area and 86% (n=6) reported a history of a previous disease or risk condition (diabetes, oncological disease, arterial hypertension, among others). The fatal cases were between 36 and 74 years of age; 71% (n=5) were male and 29% (n=2) were female *(9)*.

Uruguay	**<u>Equine outbreaks</u>** Betweeen 2 December 2023 and 6 February 2024, the Uruguay Ministry of Livestock, Agriculture and Fisheries (MGAP per its acronym in Spanish) confirmed 1,018 suspected cases in equines (80 laboratory-confirmed). Laboratory confirmed equine cases were reported in 16 departments: Artigas (n=3), Cerro Largo (n=1), Canelones (n=3), Durazno (n=1), Flores (n=3), Lavalleja (n=3), Montevideo (n=2), Paysandú (n=13), Rio Negro (n=11), Rivera (n=3), Rocha (n=3), Salto (n=1), San José (n=23), Soriano (n=2), Tacuarembó (n=4), and Treinta y Tres (n=4). The greatest concentration of cases was reported in San José, accounting for 29% (n=23) of the national laboratory-confirmed equine cases *(18)*. **<u>Outbreaks in humans</u>** As of 13 February 2024, four human cases of WEE were identified among three departments: Maldonado (n=1), Montevideo (n=1), and San José (n=2). In addition, 17 suspected cases were under investigation in the departments of Montevideo (n=5), San José (n=3), Canelones (n=2), Río Negro (n=2), Soriano (n=2), Artigas (n=1), Paysandú (n=1), and Rocha (n=1). Confirmed cases range in age from 42 to 73 years, all are male, and two had been discharged *(19)*.
Brazil	**<u>Equine outbreaks</u>** On 26 January 2024, the State of Rio Grande do Sul, Brazil, Secretariat of Agriculture, Livestock, Sustainable Production and Irrigation (SEAPI per its acronym in Portuguese) confirmed a case of WEE in an equine in the municipality of Barra do Quaraí, along the western border of the State. The sample was collected on 15 December 2023 and sent to the Minas Gerais Federal Laboratory of Agricultural Defense (LFDA/MG), where the diagnosis of WEE was confirmed *(7).* As of 14 February 2024, no human cases have been reported in Brazil.

Context assessment

WEE could be considered a reemerging disease due to its periodic impact and the occasional occurrence of outbreaks of varying magnitude. Virus activity can fluctuate from year to year, influenced by factors such as climatic conditions, mosquito vector distribution, and intermediate host and reservoir dynamics. Due to the lack of active and systematic surveillance in most countries in the Region, combined with symptoms of WEE usually being mild or subclinical in humans, there is low case detection and with challenges in diagnosis this results in underestimates of the true burden of the disease.

WEE outbreaks in recent years have primarily occurred in countries with warm, humid climates, where mosquito vectors can thrive and multiply more easily. WEE outbreaks tend to occur in areas where high outdoor activity occur, such as rural areas where equines are raised, as mosquitoes can infect both animals and humans.

The epidemiological behavior of WEE and other zoonoses of public health interest is linked to cycles involving wild vertebrates, mosquito vectors, ecological and demographic aspects, related to social conflicts, migrations, border policies, among others, so that their study, prevention, and control requires the participation of various disciplines and cooperation and coordination among several sectors.

Given the current situation related to climatic phenomena such as "El Niño", unusual increases in temperature and/or rainfall may generate an increase in vector density and viral transmission, which would facilitate possible epidemics of vector-borne diseases *(20)*.

There is no specific treatment for WEE and, without a vaccine, prevention focuses on vector control and personal protective measures to prevent mosquito bites. Early intensive and supportive care for confirmed patients could reduce disease mortality and decrease case fatality rate (CFR). Prevention and control of WEE continue to pose significant challenges because the burden of this disease in countries of the Region has likely been underestimated. Outbreak response requires an integrated multidisciplinary and multisectoral approach to achieve its goal of reducing the public health impact of this disease.

Increased migration, effects of climate change (such as drought, rising temperatures, and flooding), political instability and insufficient development mean that an increasing number of people are at risk of contracting this and other zoonoses in countries where the vector has been identified. These factors, along with other factors such as financial crises, have left large populations in the Region of the Americas with insufficient access to adequate health care and at risk of complications following WEE virus infection.

Capacities	Vulnerabilities
Coordination • PAHO/WHO is in close contact with key partners and Member States to ensure a coordinated response for optimal support to countries with limited resources. • The recent outbreak of avian influenza in the Region has favored coordination between the human and animal health sectors in several countries.	**Coordination** • In some countries, insufficient coordination exists between the sectors that respond to equine encephalitis. • Low level of coordination between the health sector and other public and private actors in vector control. • Incipient development of the "One Health" approach, which limits coordination between the human, animal, and environmental health sectors.
Surveillance • Generation of regional epidemiological alerts and updates along with recommendations for Member States. • Provision of epidemiological surveillance materials, creation of a WEE case information dashboard and technical assistance to national authorities. • The information systems and data management capacity that was developed as part of the COVID-19 pandemic response is being leveraged for surveillance of re-emerging diseases. • Virtual cooperation spaces (VCS) have been created in the Region as a collaborative surveillance initiative between PAHO/WHO and Member States that allow the automated generation of different epidemiological analyses, situation rooms,	**Surveillance** • National public health emergency response teams are simultaneously facing other large-scale outbreaks and impacting timely and efficient response. • Limited use of case hotspot mapping for the implementation of targeted response activities. • Limited use of predictive tools and integration of vector and climate data. • Inadequate infrastructure for data reporting in many areas and insufficient connectivity in others.

and epidemiological bulletins, strengthening epidemiological surveillance.	
Laboratory • Publication of Laboratory Guidelines for the Detection and Diagnosis of Human Infection with WEE Virus (original and updated); provision of reagents for molecular and serological diagnosis in coordination with WHO and WHO collaborating centers. • Technical assistance and follow-up with laboratories in Argentina, Uruguay, and Paraguay. • Distribution of key (or critical) reagents for molecular diagnosis to countries with a history of circulation. • Existing laboratory network in Argentina and the United States with molecular and serological platforms including support from WHO and WHO Collaborating Centers.	**Laboratory** • Limited resources in many countries due to the simultaneous response to outbreaks of dengue and other viruses. • Serological diagnosis, the main tool, is complex and access to reagents is limited. • Limited number of reference laboratories capable of performing specific serological methods.
Case Management • Some countries have national networks of clinical experts. • The Region has an international technical group of experts on reemerging diseases that supports technical cooperation activities in the countries.	**Case Management** • Inadequate medical supplies for supportive treatment. • Given the few cases reported historically, there are several clinicians who do not have the expertise to detect and manage cases of WEE adequately.
Entomological surveillance and vector control • Strengthening the capacity of Member States to monitor insecticide resistance. • Strengthening vector control activities in affected countries. • Supporting the implementation of effective interactive vector monitoring and control by Member States through the issuance of guidelines. • Vector surveillance and control capacities that were developed as part of the response to arbovirosis are being leveraged for surveillance in countries where WEE outbreaks have occurred.	**Entomological surveillance and vector control** • Suboptimal waste control practices leading to more vector breeding sites. • Suboptimal vector control activities. • Countries have few formally trained entomologists working in ministries of health. • Vector control programs have been underfunded for decades, and their limited resources were often redirected to other response activities during the COVID-19 pandemic.

	• In some countries, there are insufficient personnel and resources with expertise in vector control of WEE.
Risk communication and community participation • Strengthened partner coordination achieved. • In countries where outbreaks have occurred, risk communication and community involvement have been improved to reinforce their commitment to vector control and knowledge of the signs/symptoms of WEE disease and recommended actions.	**Risk communication and community participation** • Limited resources. • Lack of targeted and effective risk communication, community participation and wastewater management in communities, with effective community feedback mechanisms. • Limited understanding of risk perception and health-seeking behaviors of affected populations.

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