PAN AMERICAN JOURNAL OF PUBLIC HEALTH

Original research

Sociodemographic characteristics, clinical manifestations, and concurrent outcomes of Oropouche fever and dengue in Espírito Santo, Brazil

João Paulo Cola[1], Thiago Nascimento do Prado[2], Otavio T. Ranzani[3], Ana Paula Brioschi dos Santos[1], Brenda Silva Freire[2], Raphael Lubiana Zanotti[1], Adriana Endlich da Silva Dela Costa[1], Karina Bertazo Del Carro[1], Lesliane de Amorim Lacerda Coelho[1], Cintia Lepaus Thomas[2], Dijoce Prates Bezerra[1], Orlei Amaral Cardoso[1], Angelica Espinosa Miranda[2], Ethel Leonor Noia Maciel[2], Creuza Rachel Vicente[2]

Suggested citation Cola JP, do Prado TN, Ranzani OT, Brioschi dos Santos AP, Freire BS, Zanotti RL, et al. Sociodemographic characteristics, clinical manifestations, and concurrent outcomes of Oropouche fever and dengue in Espírito Santo, Brazil. Rev Panam Salud Publica. 2025;49:e127. https://doi.org/10.26633/RPSP.2025.127

ABSTRACT

Objective. To compare sociodemographic and clinical characteristics and the outcome severity between confirmed cases of Oropouche fever and dengue in the state of Espírito Santo, Brazil.

Methods. A cross-sectional study used secondary data from the state health surveillance system of Espírito Santo, 2024–2025. The study includes laboratory-confirmed cases of Oropouche fever and dengue. The authors calculated absolute and relative frequencies of variables. Pearson's chi-square and Fisher's exact tests assessed differences. Firth's penalized logistic regression estimated odds ratios (OR) for severe manifestations and death, with 95% confidence intervals (95% CI).

Results. A total of 12 135 OF cases and 18 018 dengue cases were confirmed. Compared with dengue cases, Oropouche fever was more prevalent among males (53.5%), white individuals (56.3%), and residents of rural and peri-urban areas (52.1%). Fever (84.5% vs. 78.7%), headache (83.9% vs. 72.1%), and myalgia (76.5% vs. 67.5%) were the most common symptoms in both groups, with significantly higher proportions among Oropouche fever cases. Dengue cases showed higher odds of progressing to severe disease (OR 15.35; 95% CI 10.60–22.23) and death (OR 2.09; 95% CI 1.10–3.98).

Conclusion. Oropouche fever and dengue presented overlapping clinical profiles; however, Oropouche fever was more frequent in rural and peri-urban areas. Dengue was associated with greater severity and lethality. These findings underscore the importance of surveillance to support strategies for monitoring, clinical management, and control, while accounting for the distinct epidemiological and clinical profiles of Oropouche fever and dengue.

Keywords Bunyaviridae infections; dengue; arbovirus infections; signs and symptoms; epidemics.

INTRODUCTION

Since its discovery in Trinidad and Tobago in the 1950s, the Oropouche virus (OROV) has remained localized and caused outbreaks in the Amazon region of Latin America (1, 2). OROV produces an acute febrile illness that resembles other arboviral infections, such as Zika, dengue, and chikungunya (1, 2). However, it is transmitted by a different vector; *Culicoides paraensis* is

[1] Secretaria de Estado da Saúde do Espírito Santo, Espírito Santo, Brazil. ✉ João Paulo Cola, joaopaulocola@gmail.com

[2] Universidade Federal do Espírito Santo, Espírito Santo, Brazil.

[3] DataHealth Lab, Institut de Recerca Sant Pau (IR SANT PAU), Barcelona, Spain.

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs 3.0 IGO License, which permits use, distribution, and reproduction in any medium, provided the original work is properly cited. No modifications or commercial use of this article are permitted. In any reproduction of this article there should not be any suggestion that PAHO or this article endorse any specific organization or products. The use of the PAHO logo is not permitted. This notice should be preserved along with the article's original URL. Open access logo and text by PLoS, under the Creative Commons Attribution-Share Alike 3.0 Unported license.

the main vector of the urban/epidemic cycle (1). The most frequently reported symptoms following OROV infection include fever, headache, myalgia, orbital pain, nausea, and vomiting (3). Reports have also documented vertical transmission (4, 5), congenital malformations (4, 5), and neurological (6) and hemorrhagic (7) manifestations.

In Brazil, OROV initially spread within the Amazon region. However, in 2024, outbreaks were recorded outside this area (8). The expansion may be related to viral genetic recombination of the M1L2S2 lineage (9). However, the available evidence does not establish a causal link demonstrating that this lineage was solely responsible for the virus's expansion (9). In Espírito Santo (ES) state in southeastern Brazil, the virus spread rapidly, particularly in rural and peri-urban areas, as well as in regions with banana, coffee, and cacao plantations, which reported the highest number of Oropouche fever (OF) cases in the country (10).

Between 2024 and 2025, ES state experienced an unprecedented and concerning epidemiological scenario, characterized by the largest OF epidemic ever documented outside the Amazon in Brazil, which occurred concomitantly with the state's largest dengue epidemic on record (11). Cases of arboviral coinfection were also documented in ES, most notably dengue and chikungunya and dengue and OROV coinfections (12). This context led to a substantial number of cases and directly strained the health care system. Notably, this period registered a high number of dengue-related deaths (11), as well as the first reported deaths from OF in both Brazil (7) and ES (13).

In several recent outbreaks outside the Amazon region, including ES, OF and dengue have occurred concurrently, creating major challenges for epidemiological surveillance, timely diagnosis, and appropriate clinical management (8). The co-circulation of these arboviruses may compromise control efforts, as they are transmitted by different vectors and require distinct strategies. At the clinical level, overlapping symptoms complicate differential diagnosis, often delaying appropriate treatment and increasing the risk of severe disease (3). This scenario not only increases the risk of disease progression but also strains health services, which must follow parallel protocols and care pathways. Comparing dengue and OF is therefore particularly relevant, given their shared geography, overlapping clinical features, and combined burden on surveillance, patient care, and health system capacity.

A joint analysis of these diseases can support more effective prevention and control strategies, optimize laboratory and health care resources, and guide the development of appropriate clinical protocols, especially in regions experiencing simultaneous outbreaks, as occurred in ES. The objective of this study is to compare sociodemographic and clinical characteristics, as well as severity and mortality outcomes, between confirmed cases of OF and dengue in ES, Brazil.

METHODS

Study Design and Setting

We conducted a cross-sectional study using secondary data from the ES State Health Surveillance System (eSUS-VS). The State Department of Health (SESA-ES) provided the data. The e-SUS VS system was implemented in the state of ES in January 2020, replacing the Brazilian Ministry of Health's Information System for Notifiable Diseases (Sistema de Informação de Agravos de Notificação—SINAN). eSUS-VS is the only official system for the compulsory notification of diseases in the state and was developed in partnership with the Pan American Health Organization (PAHO). It is important to note that in March 2024, ES implemented reverse transcription polymerase chain reaction (RT-PCR) testing for the detection of OROV. Since then, all suspected arboviral cases in the state have been prospectively tested to OROV.

ES is a coastal state in southeastern Brazil, with approximately 4.1 million inhabitants distributed across 78 municipalities. The state covers an area of 46 000 km², encompassing both urban centers and rural areas dedicated to agriculture, particularly coffee, cacao, and banana production. ES has a tropical climate, with marked seasonal rainfall patterns.

Inclusion and Exclusion Criteria

This study included all symptomatic cases with suspected arboviral infection that were laboratory-confirmed for OF or dengue and reported to eSUS-VS between March 20, 2024, and May 30, 2025. Non-autochthonous cases of dengue and OF were excluded. This study classified cases as non-autochthonous when, after investigation, the probable place of infection was outside ES or the individual's official residence was outside ES.

In public health surveillance, a suspected arboviral case is defined as an individual with fever (typically lasting 2 to 7 days) and at least two of the following signs or symptoms: nausea or vomiting, rash, myalgia or arthralgia, headache or retro-orbital pain, petechiae, or a positive tourniquet test (14). However, in practice, clinical suspicion does not always fully meet these criteria and may include presentations without fever or with fewer accompanying symptoms.

Variables and Data Sources

The authors classified as laboratory-confirmed OF cases those with OROV RNA detected by RT-PCR in serum samples collected up to 5 days after symptom onset, or in urine or cerebrospinal fluid (CSF) samples collected up to 15 days after onset. For dengue cases, this study considered laboratory confirmation by viral RNA detection via RT-PCR, NS1 antigen positivity in serum samples collected within 5 days of symptom onset, or reactive IgM, enzyme-linked immunosorbent assay, antibodies after this period.

Data were extracted from eSUS-VS notification forms, which included the following:

Sociodemographic variables:

- Age group in years (0–10, 11–19, 20–39, 40–59, and ≥60);
- Sex (male/female);
- Race/skin color (white, nonwhite);
- Pregnancy status (yes/no);
- Area of residence (urban, rural, or peri-urban).

Clinical and laboratory characteristics:

- Epidemiological week of symptom onset;
- Reported symptoms at the onset of the disease (fever, headache, myalgia, nausea, retro-orbital pain, back pain, arthralgia, vomiting, arthritis, rash, and petechiae);

- Presence of comorbidities (hypertension, diabetes mellitus, autoimmune diseases, liver disease, chronic kidney disease, or ≥1 comorbidity);
- Laboratory confirmation method (RT-PCR, NS1, or IgM);
- Presence of severe manifestations (yes/no);
- Outcome (survival, death from the disease, or death from other causes).

This study classified severe manifestations of dengue cases as those with warning signs or severe dengue, according to Brazilian Ministry of Health guidelines (14). The authors classified severe manifestations of OF cases as those requiring hospitalization or presenting with signs or symptoms compatible with encephalitis, hemorrhagic manifestations, hepatic dysfunction, renal dysfunction, or decompensation of pre-existing comorbidities. The Special Epidemiological Surveillance Unit of Espírito Santo's State Health Department investigated all deaths from OF and dengue and classified them as disease-related or due to other causes.

The authors classify residential areas as urban areas, which are densely built with concentrated population and services. Rural areas are sparsely populated and dominated by agriculture or natural lands. Peri-urban areas are transition zones on the urban periphery, blending urban and rural characteristics.

Statistical Analysis

This study constructed an epidemic curve showing the temporal distribution of dengue and OF cases by epidemiological week of symptom onset. Absolute (*N*) and relative (%) frequencies were conducted for categorical variables. Pearson's chi-square test and Fisher's the mean and standard deviation were calculated.

The authors applied Firth's penalized logistic regression models to estimate odds ratios (ORs) and corresponding 95% confidence intervals (95% CIs) for severe manifestations and death, comparing dengue to OF cases. The models were adjusted for age and the presence of ≥1 comorbidity.

Incidence maps were constructed from georeferenced data at the municipal level on reported OF and dengue cases in ES. The maps highlight the Legal Amazon territory and ES with its metropolitan region. The study then represented the spatial distribution of absolute case counts and incidence rates (per 10 000 inhabitants) in municipal-level maps, using graded color scales to indicate intensity of case occurrence. The maps were generated using R software (version 4.5.1; R Foundation for Statistical Computing, Vienna, Austria).

All analyses were performed using Stata v.14.0 (Stata Corp, College Station, TX, USA), with p-values <0.05 considered as statistically significant.

Ethical Considerations

This study was approved by the Research Ethics Committee of the Centro de Ciências da Saúde da Universidade Federal do Espírito Santo (UFES) with Certificate of Presentation of Ethical Assessment (CAAE) number 70443223.5.0000.5060, and the requirement for informed consent was waived. All data were anonymized to ensure patient confidentiality.

RESULTS

Epidemic Dynamics

Between March 20, 2024, and May 30, 2025, a total of 12 135 laboratory-confirmed cases of OF and 18 018 laboratory-confirmed cases of dengue were reported in ES. Five non-autochthonous OF cases and 230 non-autochthonous dengue cases were excluded. All OF cases were confirmed by RT-PCR. Among dengue cases, 4 125 (22.9%) were confirmed by RT-PCR, 6 944 (38.5%) by NS1 testing, and 6 949 (38.6%) by IgM testing.

The authors observed a sharp increase in confirmed OF cases starting in epidemiological week 43 of 2024, with continuous growth and evident acceleration between weeks 47 and 52. Transmission peaked in week 2 of 2025, with 938 confirmed cases. Between weeks 47 of 2024 and 5 of 2025, more than 6 000 OF cases were reported, representing the main epidemic period. From week 6 of 2025 onward, a sustained downward trend was observed, although viral circulation persisted until week 22 of 2025. In contrast, dengue cases were concentrated between epidemiological weeks 13 and 41 of 2024, peaking in week 13 with 2,134 cases, followed by a gradual decline and stabilization at low levels from week 31 onward (Figure 1).

The spatial distribution of OF and dengue cases in ES revealed distinct patterns. OF had the highest incidence in inland municipalities, particularly rural and peri-urban transition areas, forming localized high-rate clusters outside the metropolitan region. By contrast, dengue displayed a more diffuse pattern, with higher incidence concentrated in the metropolitan corridor and urban centers. Municipalities with the greatest OF incidence generally coincided with areas of lower dengue incidence, indicating distinct and geographic risk profiles (Figure 2).

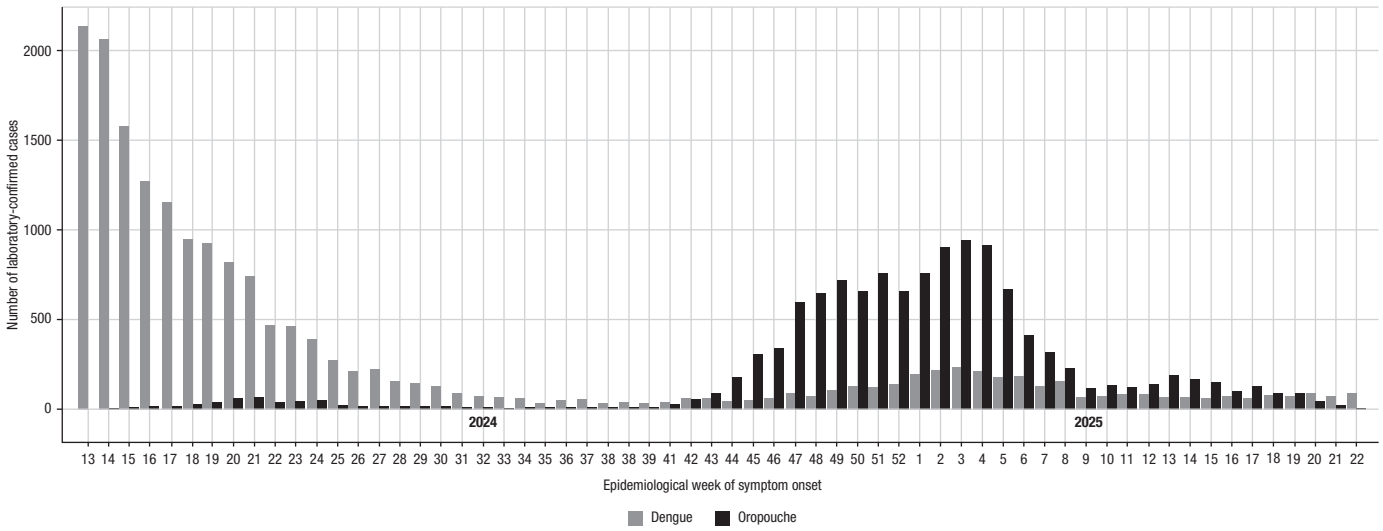
Sociodemographic and Clinical Characteristics

Table 1 presents the sociodemographic characteristics of confirmed OF and dengue cases. The mean age was similar between OF (42 years; SD ±18.1) and dengue (40 years; SD ±20.2). The age distribution differed significantly between the two arboviruses: OF cases were more frequent among adults aged 20–39 years (34.5%) and 40–59 years (34.8%), whereas dengue cases were more heterogeneous, with the highest proportion among individuals aged 20–39 years (31.1%).

With respect to sex, OF was more frequent among men (53.5%) and pregnant individuals (1.9%), while dengue predominated in women. Regarding race/skin color, most OF cases occurred in white individuals (56.3%), whereas dengue predominated among non-white individuals (59.6%). Residential areas also showed a marked difference: more than half the OF cases occurred in rural and peri-urban areas (52.1%), whereas dengue cases were predominantly urban (84.2%).

For clinical presentation, fever, headache, and myalgia were the most prevalent symptoms in both groups, but their proportions were significantly higher among OF cases: fever (84.5% vs. 78.7%), headache (83.9% vs. 72.1%), and myalgia (76.5% vs. 67.5%). Other symptoms were also more frequent in OF, such as nausea (37.1% vs. 34.8%), retro-orbital pain (35.7% vs. 31.2%), and back pain (31.5% vs. 27.2%). Conversely, some symptoms were more common in dengue patients, including skin rash (5.8% vs. 2.8%) and petechiae (6.4% vs. 2.5%) (Table 1).

FIGURE 1. Distribution of cases by epidemiological week



Source: Original figure for this article.

The presence of at least one comorbidity was similar between OF (11.6%) and dengue (10.2%). Hypertension was the most prevalent comorbidity in both groups, and it was more frequent in OF cases (10.2% vs. 8.8%) (Table 1).

Incidence of Severe Clinical Manifestations and Death

Dengue patients presented a higher frequency of severe manifestations (632/18 018; 3.5%) compared with OF (29/12 135; 0.2%). Although both diseases showed low case fatality rates, dengue-related deaths were more frequent (20/18 018; 0.1%) than OF-related deaths (2/12 135; 0.02%) (Table 1).

In the unadjusted Firth's penalized logistic regression analysis, dengue cases showed higher odds of evolving with severe manifestations (OR 2.70; 95% CI 2.33–3.07) and disease-related death (OR 1.64; 95% CI 1.03–2.29) compared with OF. After adjusting for age and the presence of ≥1 comorbidity, dengue cases maintained significantly higher odds of severe manifestations (OR 15.35; 95% CI 10.60–22.23) and disease-related death (OR 2.09; 95% CI 1.10–3.98) (Table 2).

DISCUSSION

The ES experienced, for the first time and concurrently, the largest epidemic of OF recorded outside the Amazon region in Brazil, and the most intense dengue epidemic ever documented in the state between 2024 and 2025. We observed broad dissemination of OF in ES. For both OF and dengue, fever, headache, and myalgia were the most common manifestations. However, dengue cases exhibited a higher likelihood of progressing to severe clinical manifestations and of death from the illness. OF cases predominated among young adults, males, and residents of rural and peri-urban areas, findings that align with studies from the Legal Amazon, an administrative region of the Brazilian Amazon encompassing nine states, and other parts of Latin America (15, 16).

The epidemic pattern documented suggests seasonal transmission, similar to other arboviruses, characterized by the rapid spread and concentration of cases in the early months of the year, i.e., corresponding to the rainy/warm season in tropical and subtropical regions. These findings underscore the need for active surveillance and targeted preventive measures during high-risk periods.

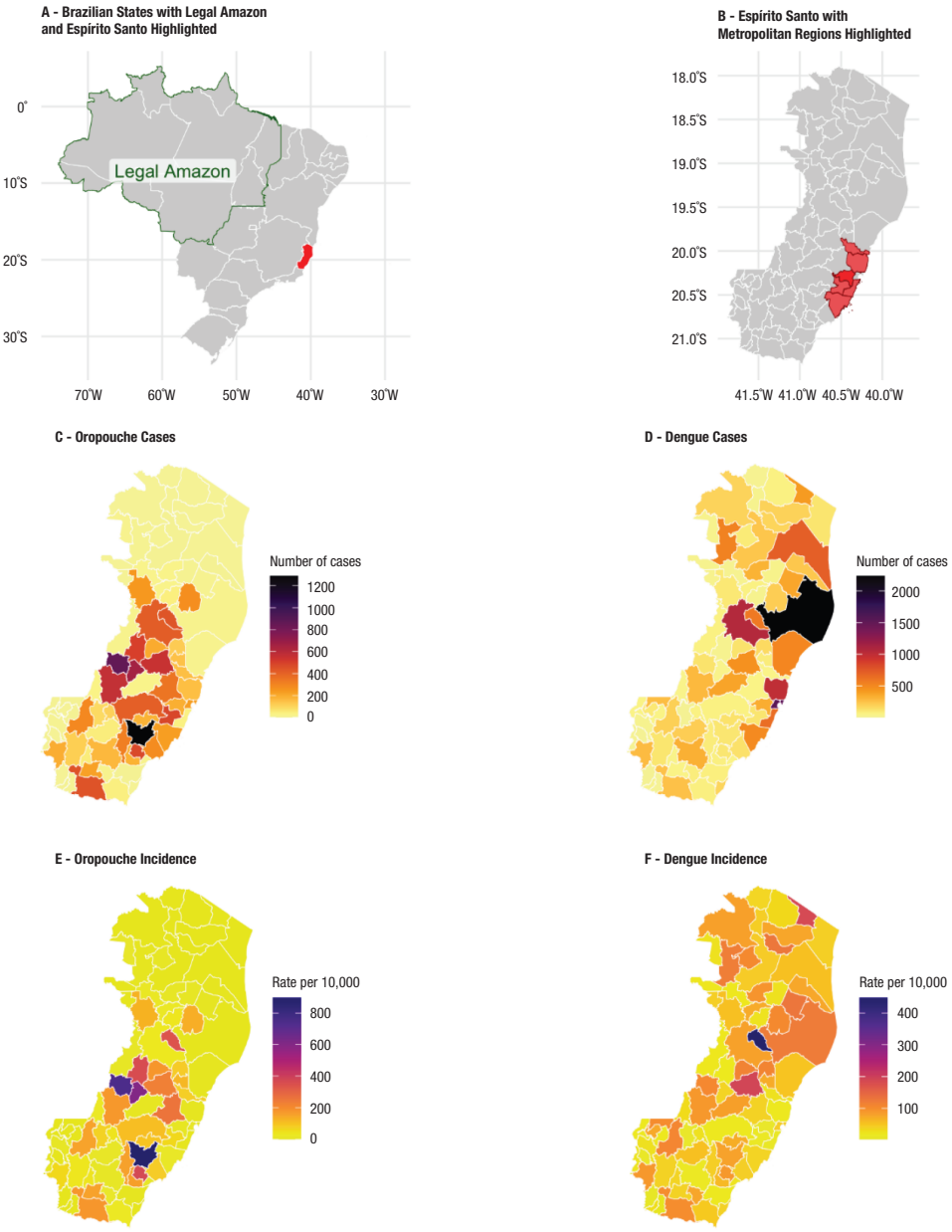
OF predominated in small municipalities, particularly those with extensive banana and coffee plantations, environments that favor vector proliferation (8). This pattern suggests that agricultural practices, together with climatic changes that may increase vector density outside the Amazon, have contributed to local establishment of the virus in ES (17). This hypothesis is consistent with our observation of higher OF frequency in rural and peri-urban zones, particularly in the municipalities of Alfredo Chaves, Laranja da Terra, Iconha, Itarana, and Itaguaçu, which recorded the highest OF incidence (18).

The authors found distinct sociodemographic profiles for dengue and OF. Dengue occurred more frequently in females and was concentrated in urban areas, reflecting the urban ecology of *Aedes aegypti* (19). Nonetheless, an ongoing inward spread of dengue into peri-urban and rural settings was documented, indicating a possible expansion of transmission beyond traditional urban centers. This phenomenon may partly reflect the involvement of *Aedes albopictus* in peri-urban and rural transmission and highlights the need to expand surveillance and control measures into areas that have been historically underserved (20).

The sex distribution differences between the two arboviruses may relate to occupational exposures. Prior studies have linked OF occurrence to banana, coffee, and cacao plantations, rural environments in which men are more frequently engaged in harvesting and crop management and therefore more exposed to the *Culicoides paraensis* vector (8). Occupational exposure may thus explain the male predominance in OF (21). In contrast, dengue's predominantly urban transmission and greater impact on women may reflect differences in housing, mobility, and domestic exposure to *Aedes aegypti*.

Clinically, most cases presented symptoms common to other arboviral infections, fever, headache, and myalgia. Although

FIGURE 2. Map of cases and incidence in Espírito Santo, Brazil



Source: Original map for this article.

statistically significant differences in symptom frequencies were found between OF and dengue, their clinical similarity makes the differential diagnosis challenging in areas with co-circulation of other arboviruses such as chikungunya, dengue, and Zika. Systematic reviews (3, 22) comparing OF to chikungunya, dengue, and Zika report no clear distinguishing symptom profile, which may lead to underreporting of OF in regions endemic for other arboviruses, especially where specific laboratory testing is unavailable.

Laboratory diagnosis of arboviral infections still faces important access barriers, complicating differentiation between clinically similar diseases such as dengue and OF. Serological and immunochromatographic tests for dengue are widely available in Brazil and facilitate early detection; however, these methods have limitations in sensitivity and specificity depending on the timing of sample collection relative to symptom onset (23). Molecular assays (RT-PCR) are more effective for acute-phase differential diagnosis and viral detection but require specific conditions, timely sample transport, and specialized laboratory infrastructure, limitations that restrict access, particularly outside large urban centers. Despite these constraints, clinical guidelines advise that the absence of laboratory confirmation should not preclude consideration of alternate arboviral infections; clinical management should therefore rely on syndromic assessment and the presence of warning signs.

The systematic adoption of RT-PCR for OROV diagnosis in ES enabled laboratory confirmation of cases and helped delineate the OF outbreak. Nevertheless, reliance on early testing and

TABLE 1. Sociodemographic characteristics, initial signs and symptoms, comorbidities, severe manifestation and outcome of confirmed cases of Oropouche fever (*N* = 12 135) and dengue (*N* = 18 018) in Espírito Santo, Brazil, between March 20, 2024, and May 30, 2025

Variables	Oropouche fever *N* (%)	Dengue fever *N* (%)	*p*-value[a]
Mean age (SD±)	42 (18.1)	40 (20.2)	
Age range, years			<0.001
0–10	305 (2.5)	1 404 (7.7)	
11–19	1 122 (9.2)	2 341 (12.9)	
20–39	4 191 (34.5)	5 611 (31.1)	
40–59	4 227 (34.8)	5 436 (30.1)	
≥60	2 290 (18.8)	3 226 (17.9)	
Sex			<0.001
Female	5 634 (46.4)	9 718 (53.9)	
Male	6 501 (53.5)	8 300 (46.0)	
Pregnant women	242 (1.9)	120 (0.6)	<0.001
Race/skin color			<0.001
White	6 835 (56.3)	7 267 (40.3)	
Nonwhite	5 300 (43.6)	10 751 (59.6)	
Area of residence			<0.001
Urban	5 817 (47.9)	15 183 (84.2)	
Rural and peri-urban	6 318 (52.1)	2 835 (15.7)	
Initial signs and symptoms			
Fever	10 257 (84.5)	14 196 (78.7)	<0.001
Headache	10 187 (83.9)	12 993 (72.1)	<0.001
Myalgia	9 293 (76.5)	12 165 (67.5)	<0.001
Nausea	4 485 (37.1)	6 281 (34.8)	<0.001
Retro-orbital pain	4 341 (35.7)	5 626 (31.2)	<0.001
Back pain	3,830 (31.5)	4 376 (27.2)	<0.001
Arthralgia	1 979 (16.3)	3 179 (17.6)	<0.001
Vomiting	1 882 (15.5)	3 330 (18.4)	<0.001
Arthritis	1 052 (8.6)	1 356 (7.5)	<0.001
Rash	341 (2.8)	1 055 (5.8)	<0.001
Petechiae	298 (2.46)	1 160 (6.4)	<0.001
Comorbidities			
One or more comorbidities	1 415 (11.6)	1 844 (10.2)	<0.001
Hypertension	1 245 (10.2)	1 590 (8.8)	<0.001
Diabetes mellitus	440 (3.6)	570 (3.1)	0.059
Autoimmune disease	24 (0.2)	68 (0.3)	0.060
Liver disease	16 (0.1)	21 (0.1)	0.710
Chronic kidney disease	9 (0.1)	24 (0.1)	0.128
Severe manifestation	29 (0.2)	632 (3.5)	<0.001
Outcome			0.012[b]
Nonfatal	12 123 (99.9)	17 983 (99.8)	
Death due to the disease	2 (0.02)	20 (0.11)	
Death from other causes	10 (0.08)	15 (0.09)	

Source: Original table for this article.
Note: a. Pearson's chi-square test; b. Fisher's exact test.

the lack of widely available serological assays remain obstacles to large-scale OROV surveillance. These findings illustrate the importance of laboratory capacity and coordination between surveillance and clinical services when confronting emerging arboviruses.

TABLE 2. Odds ratio (OR) of severe manifestation and death of confirmed cases of Oropouche fever (*N* = 12 135) and dengue (*N* = 18 018) in Espírito Santo, Brazil, between March 20, 2024, and May 30, 2025

Variables	OR (CI 95%)	*p*-value	ORa (CI 95%)	*p*-value
Severe manifestation		<0.001		<0.001
Oropouche fever	1		1	
Dengue fever	2.70 (2.33; 3.07)		15.35 (10.60; 22.23)	
Death		0.048		0.025
Oropouche fever	1		1	
Dengue fever	1.64 (1.03; 2.29)		2.09 (1.10; 3.98)	

Source: Original table for this article.
Note: OR: odds ratio; ORa: odds ratio adjusted for age and one or more comorbidities.

The authors observed a higher frequency of severe manifestations and greater case fatality associated with dengue compared with OF. These associations remained elevated after adjustment for age and the presence of comorbidities, reinforcing dengue's higher clinical severity potential. At the same time, the results highlight that OF can also lead to severe disease, particularly among older adults and individuals with comorbidities. Another plausible explanation is that a substantial proportion of dengue cases may have been secondary infections, which are known to increase the risk of severe disease, given that ES is dengue-endemic and has experienced sustained increases in dengue cases since 2023. By contrast, OF cases likely reflected first-time exposures to OROV, and the occurrence and clinical impact of possible secondary OROV infections remain uncertain (24).

Although OF has traditionally been described as a self-limited disease, this study identified severe manifestations and deaths due to OROV infection; two documented deaths were attributed to OF. In 2024, ES faced its largest dengue epidemic (11), with elevated lethality, and the broader implementation of OROV testing in Brazil that year improved laboratory surveillance of suspected arboviral deaths, enabling the confirmation of OF-attributed fatalities. Case reports in the literature describe fatal OF courses marked by acute hepatic failure and hemorrhagic manifestations, suggesting a possible hepatic tropism of OROV or an exaggerated inflammatory response in susceptible individuals (7, 13).

This OF clinical trajectory resembles severe dengue, which can also present with hepatic dysfunction, coagulopathy, and hemorrhage (25). Given the clinical overlap between these conditions, clinicians should consider OROV in management algorithms for arboviral infections with potential severity, particularly in settings of viral co-circulation and in patients with risk factors for complications.

In endemic or co-circulating contexts, maintaining high clinical sensitivity for severe cases is essential to prevent deaths. Incorporating suspected or confirmed OF cases into dengue clinical management pathways may improve patient outcomes (26). Further investigations into the pathophysiological mechanisms underlying severity in OROV infection are necessary to inform more targeted clinical interventions.

This study makes a meaningful public health contribution by documenting the emergence of OF as a relevant threat outside the Amazon, with a rapid spread in rural and peri-urban areas. By comparing the clinical-epidemiological profiles and outcomes of OF and dengue, the findings emphasize the

importance of differential diagnosis in co-circulation settings and highlight the risks of underreporting and inappropriate clinical management. The identification of severe manifestations and deaths due to OF supports the need to revise clinical and surveillance protocols to include this arbovirus in clinical management flows.

This study has some limitations. The use of secondary surveillance data may have led to incomplete reporting, particularly of mild cases, and the confirmation strategy could have introduced selection bias by excluding cases without laboratory confirmation. In addition, the reliance on IgM serology may have caused misclassification, as IgM can persist for several months after acute infection and may exhibit cross-reactivity, especially among flaviviruses, potentially yielding false-positive results and biasing estimates.

The findings reflect the epidemiological context of ES and may not be generalizable to regions with different surveillance or diagnostic capacities. It is important to acknowledge that surveillance coverage and notification capacity likely differ across municipalities, particularly between more developed urban centers and less-resourced rural or peri-urban areas. In regions less equipped for diagnosis and reporting, OF cases may go undetected or misclassified.

In conclusion, OF disseminated widely in ES, primarily affecting young adult males living in rural and peri-urban areas. Most cases were mild and clinically similar to other arboviruses, although severe cases and deaths occurred. OF and dengue presented overlapping clinical profiles, but dengue was associated with greater severity and lethality.

These results reinforce the need for active surveillance to appropriately guide surveillance, clinical care, and control measures. In this context, active surveillance entails proactive case finding, strengthening syndromic surveillance for acute febrile illness in primary care, conducting field investigations in areas with suspected transmission, and expanding and expediting laboratory diagnosis for arboviral diseases.

Author contributions. JPC, TNP, OTR, and APBS conceived the original idea, analyzed the data, and contributed data or analysis tools. All authors interpreted the results, wrote the paper, and reviewed and approved the final version.

Conflicts of interests. None declared.

Disclaimer. Authors hold sole responsibility for the views expressed in the manuscript, which may not necessarily reflect the opinion or policy of the RPSP/PAJPH and/or PAHO.

REFERENCES

1. Wesselmann KM, Postigo-Hidalgo I, Pezzi L, de Oliveira-Filho EF, Fischer C, de Lamballerie X, et al. Emergence of Oropouche fever in Latin America: a narrative review. Lancet Infect Dis. 2024;24:e439–52. https://doi.org/10.1016/S1473-3099(23)007405
2. Salvato RS. Re-emergence of Oropouche virus as a novel global threat. Curr Res Microbiol Sci. 2025;8:100406. https://doi.org/10.1016/j.crmicr.2025.100406
3. Tortosa F, Castillo GG, Izcovich A, Kleber L, dos Santos T, Gonzalez-Escobar G, et al. Revisión sistemática viva de las manifestaciones clínicas de la fiebre de Oropouche: claves para diferenciarla del dengue y otras arbovirosis. Rev Panam Salud Publica. 2024;e136. https://doi.org/10.26633/RPSP.2024.136
4. Cola JP, dos Santos APB, Zanotti RL, Dela Costa AEDS, Del Carro KB, Lacerda Coelho LDA, Espinosa Miranda A, et al. Maternal and fetal implications of Oropouche fever, Espírito Santo State, Brazil, 2024. Emerg Infect Dis. 2025;31(4):645–51. https://doi.org/10.3201/eid3104.241986
5. Martins FEN, Chiang JO, Nunes BTD, Ribeiro BDFR, Martins LC, Casseb LMN, et al. Newborns with microcephaly in Brazil and potential vertical transmission of Oropouche virus: a case series. Lancet Infect Dis. 2025;25:155–65. https://doi.org/10.1016/S1473-3099(24)00617-0
6. Gatti FD, Nodari JZ, Sousa TJ, Mendonça GCD, Tavaresa EA, Pinto IA, et al. Neuroinvasive Oropouche virus in a patient with HIV from extra-Amazonian Brazil. Lancet Infect Dis. 2025;25(8):e441–e442. https://doi.org/10.1016/S1473-3099(25)00352-4
7. Bandeira A, Pereira F, Leal A, Santos FPO, Barbosa AC, Souza MSPL, Souza DRD, et al. Fatal Oropouche virus infections in non-endemic region, Brazil, 2024. Emerg Infect Dis. 2024;30(11):2370–74. https://doi.org/10.3201/eid3011.241132
8. Graf T, Delatorre E, Ferreira CN, Rossi A, Santos HGG, Pizzato BR, et al. Expansion of Oropouche virus in non-endemic Brazilian regions: analysis of genomic characterisation and ecological drivers. Lancet Infect Dis. 2025;25(4):379–89. https://doi.org/10.1016/S1473-3099(24)00687-X
9. da Costa FB, Cavalcanti AC, Erbisti RS, Dias VZ, Moreira CGC, Grifo MM, et al. Introduction and spatial-temporal distribution of Oropouche virus in Rio de Janeiro State, Brazil. Pathogens. 2025;14(8):833. https://doi.org/10.3390/pathogens14080833
10. Delatorre E, de Mendonça G, Gatti F, Có ACG, Pereira JP, Tavares EA, et al. Emergence of Oropouche virus in Espírito Santo State, Brazil, 2024. Emerg Infect Dis. 2025;31(6):1178–88. https://doi.org/10.3201/eid3106.241946
11. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde e Ambiente. Coordenação Geral de Vigilância de Arboviroses. Monitoramento das arboviroses e balanço de encerramento do Comitê de Operações de Emergência (COE) Dengue e outras Arboviroses 2024. Available at: https://www.gov.br/saude/pt-br/centrais-de-conteudo/publicacoes/boletins/epidemiologicos/edicoes/2024/boletim-epidemiologico-volume-55-no-11.pdf/view
12. Nodari JZ, Gatti FD, Sousa TJ, Goulart JP, Delatorre E, Ribeiro-Rodrigues R, et al. Genomic and epidemiologic investigation of arboviral co-infections, Espírito Santo, Brazil. Am J Infect Control. 2025:S0196-6553(25)00520-6. https://doi.org/10.1016/j.ajic.2025.08.008
13. Có ACG, Mendonça GC, Gatti FD, Sousa TJ, Tavaresa EA, Nodari JZ, et al. Unravelling the pathogenesis of Oropouche virus. Lancet Infect Dis. 2025;25(7):e381–e382. https://doi.org/10.1016/S1473-3099(25)00341-X
14. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde e Ambiente. Departamento de Articulação Estratégica de Vigilância em Saúde e Ambiente. Guia de vigilância em saúde: volume 2. Ministério da Saúde, 6th ed. Brasília: Ministério da Saúde; 2023. Available at: https://www.gov.br/saude/pt-br/centrais-de-conteudo/publicacoes/svsa/vigilancia/guia-de-vigilancia-em-saude-volume-2-6a-edicao/view
15. Benitez A, Alvarez M, Perez L, Gravier R, Serrano S, Hernandez DM, et al. Oropouche fever, Cuba, May 2024. Emerg Infect Dis. 2024;30(10):2155–59. https://doi.org/10.3201/eid3010.240900
16. Scachetti GC, Forato J, Claro IM, Hua X, Salgado BB, Vieira A, et al. Re-emergence of Oropouche virus between 2023 and 2024 in Brazil: an observational epidemiological study. Lancet Infect Dis. 2025;25(2):166–75. https://doi.org/10.1016/S1473-3099(24)00619-4
17. Ceccarelli G, Branda F, Scarpa F, Ciccozzi M, Alcantara LCJ, Giovanetti M, et al. Oropouche virus infection: differential clinical outcomes and emerging global concerns of vertical transmission and fatal cases. Int J Infect Dis. 2025;150:107295. https://doi.org/10.1016/j.ijid.2024.107295
18. França CJ, Bergamaschi RB. Mapeamento das áreas periurbanas do Espírito Santo. Vitória: Instituto Jones dos Santos Neves; 2011. 32 p. Available at: https://ijsn.es.gov.br/Media/IJSN/PublicacoesAnexos/textosdiscussao/ijsn_td24_.pdf

19. Medeiros AS, Costa DMP, Branco MSD, Sousa DMC, Monteiro JD, Galvão SPM, et al. Dengue virus in *Aedes aegypti* and *Aedes albopictus* in urban areas in the state of Rio Grande do Norte, Brazil: importance of virological and entomological surveillance. PLoS ONE. 2018;13(3):e0194108. https://doi.org/10.1371/journal.pone.0194108
20. Ricas Rezende H, Malta Romano C, Morales Claro I, Santos Caleiro G, Cerdeira Sabino E, et al. First report of *Aedes albopictus* infected by dengue and Zika virus in a rural outbreak in Brazil. PLoS ONE. 2020;15(3):e0229847. https://doi.org/10.1371/journal.pone.0229847
21. Nogueira FA, Landmann CS, Damacena GN. Condições de vida, trabalho e acesso aos serviços de saúde em trabalhadores agrícolas e não agrícolas, Brasil, 2013. Ciênc Saúde Coletiva. 2021:26(s.3):5187–200. https://doi.org/10.1590/1413-812320212611.3.21312019
22. Wang Z, Huang L, Zhang X, Zhang X, Huang L, Zhu X, et al. Clinical presentation of Oropouche virus infection: a systematic review and meta-analysis. PLoS Negl Trop Dis. 2025;19(4):e0012962. https://doi.org/10.1371/journal.pntd.0012962
23. Macêdo JVL, Júniro AGS, Oliveira MDL, Andrade CAS. Systematic review and meta-analysis: assessing the accuracy of rapid immunochromatographic tests in dengue diagnosis. Diagn Microbiol Infect Dis. 2024;109(2):116227. https://doi.org/10.1016/j.diagmicrobio.2024.116227
24. Macchia A, Figar S, Biscayart C, González Bernaldo de Quirós F. Impact of prior dengue infection on severity and outcomes: meta-analysis of placebo-controlled trials. Rev Panam Salud Publica. 2024;48:129. https://doi.org/10.26633/RPSP.2024.129
25. Yang C-H, Lee I-K, Chen Y-C, Huang W-C, Hsu J-C, Tai C-H, et al. Prognostic factors in severe dengue patients: a multi-center retrospective cohort study. PLoS Negl Trop Dis. 2025:19(1):e0012846. https://doi.org/10.1371/journal.pntd.0012846
26. Yoosuf BT, Gaidhane AM, Vadia N, Menon SV, Chennakesavulu K, Panigrahi R, et al. Epidemiology, transmission dynamics, treatment strategies, and future perspectives on Oropouche virus. Diagn Microbiol Infect Dis. 2025;113(1):116882. https://doi.org/10.1016/j.diagmicrobio.2025.116882

Manuscript submitted 30 September 2025. Revised version accepted for publication on 30 October 2025.

Características sociodemográficas, manifestaciones clínicas y desenlaces de la fiebre del Oropuche y el dengue en el mismo periodo de tiempo en Espírito Santo, Brasil

RESUMEN

Objetivo. Comparar las características sociodemográficas y clínicas, así como la gravedad de los desenlaces, en los casos confirmados de fiebre del Oropuche y dengue en el estado de Espírito Santo, Brasil.

Método. Se llevó a cabo un estudio transversal en el que se utilizaron datos secundarios del sistema estatal de vigilancia de salud de Espírito Santo en el periodo 2024-2025. En el estudio se incluyen casos con confirmación de laboratorio de fiebre del Oropuche y dengue. Los autores calcularon la frecuencia absoluta y relativa de las variables. Las diferencias se evaluaron mediante la prueba de ji al cuadrado de Pearson y la prueba exacta de Fisher. Se utilizó una regresión logística penalizada de Firth para estimar los cocientes de posibilidades (OR, por su sigla en inglés) para las manifestaciones graves y la muerte, con intervalos de confianza del 95% (IC del 95%).

Resultados. Se confirmaron un total de 12 135 casos de fiebre del Oropuche y 18 018 casos de dengue. La fiebre del Oropuche fue más prevalente en los hombres (53,5%), las personas blancas (56,3%) y las residentes de zonas rurales y periurbanas (52,1%) en comparación con los casos de dengue. La fiebre (84,5% frente al 78,7%), el dolor de cabeza (83,9% frente al 72,1%) y la mialgia (76,5% frente al 67,5%) fueron los síntomas más frecuentes en ambos grupos, con proporciones significativamente más altas en los casos de fiebre del Oropuche. Los casos de dengue mostraron una mayor probabilidad de progresión a una enfermedad grave (OR 15,35; IC del 95%: 10,60-22,23) y de muerte (OR 2,09; IC del 95%: 1,10–3,98).

Conclusiones. La fiebre del Oropuche y el dengue presentaron perfiles clínicos solapados; Sin embargo, la fiebre de Oropuche fue más frecuente en las zonas rurales y periurbanas. El dengue se asoció a una mayor gravedad y letalidad. Estos resultados subrayan la importancia de la vigilancia para respaldar las estrategias de seguimiento, manejo clínico y control, teniendo en cuenta al mismo tiempo los perfiles epidemiológicos y clínicos diferentes de la fiebre del Oropuche y el dengue.

Palabras clave Infecciones por Bunyaviridae; dengue; infecciones por arbovirus; signos y síntomas; epidemias.

Características sociodemográficas, manifestações clínicas e desfechos concomitantes da febre do Oropouche e da dengue no Espírito Santo, Brasil

RESUMO

Objetivo. Comparar as características sociodemográficas e clínicas e a gravidade dos desfechos entre casos confirmados de febre do Oropouche e dengue no estado do Espírito Santo, Brasil.

Métodos. Trata-se de um estudo transversal que utilizou dados secundários do sistema estadual de vigilância em saúde do Espírito Santo, entre 2024 e 2025. O estudo incluiu casos confirmados em laboratório de febre do Oropouche e dengue. Os autores calcularam as frequências absolutas e relativas das variáveis. Avaliaram-se as diferenças utilizando os testes qui-quadrado de Pearson e exato de Fisher. Utilizou-se a regressão logística com penalização de Firth para estimar a razão de chances (RC) para manifestações graves e morte, com intervalos de confiança de 95% (IC 95%).

Resultados. No total, foram confirmados 12 135 casos de febre do Oropouche e 18 018 de dengue. A febre do Oropouche foi mais prevalente entre homens (53,5%), indivíduos brancos (56,3%) e residentes de áreas rurais e periurbanas (52,1%) em comparação com os casos de dengue. Em ambos os grupos, os sintomas mais comuns foram febre (84,5% contra 78,7%), cefaleia (83,9% contra 72,1%) e mialgia (76,5% contra 67,5%), com proporções significativamente maiores nos casos de febre do Oropouche. Os casos de dengue apresentaram maior chance de progredir para a forma grave da doença (RC 15,35; IC 95%: 10,60 a 22,23) e morte (RC 2,09; IC 95%: 1,10 a 3,98).

Conclusão. A febre do Oropouche e a dengue apresentaram perfis clínicos sobrepostos. No entanto, a febre do Oropouche foi mais frequente em áreas rurais e periurbanas. A dengue foi associada a maior gravidade e letalidade. Esses achados ressaltam a importância da vigilância para apoiar estratégias de monitoramento, manejo clínico e controle, levando em consideração os perfis epidemiológicos e clínicos distintos da febre do Oropouche e da dengue.

Palavras-chave Infecções por Bunyaviridae; dengue; infecções por arbovirus; sinais e sintomas; epidemias.