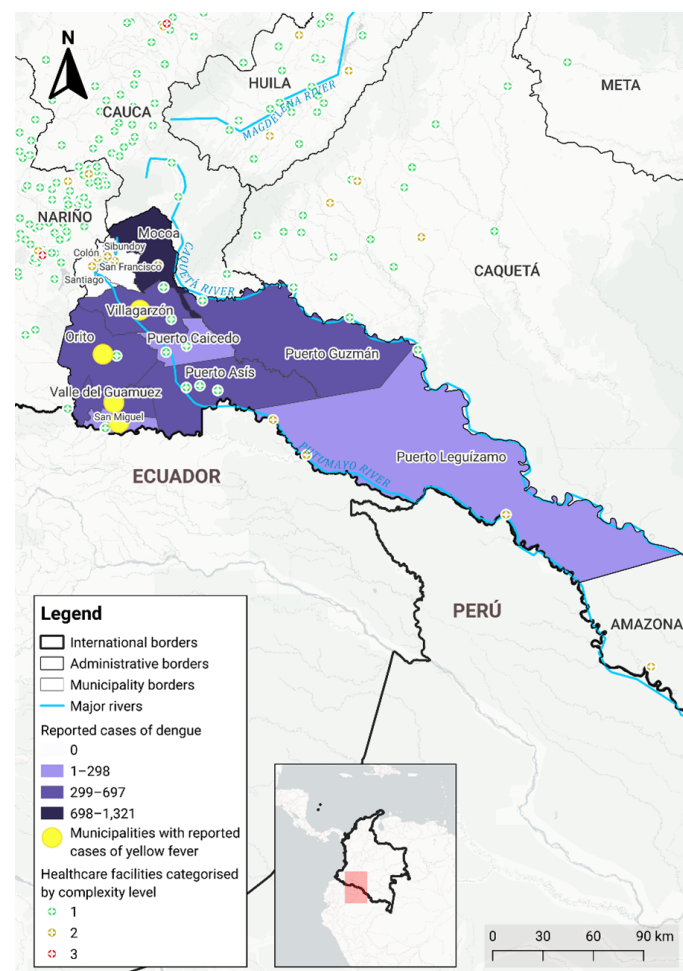


Dengue and yellow fever in Putumayo: key drivers and anticipated impacts for 2025

KEY FINDINGS

- Putumayo faces a disproportionate risk of severe health impacts and humanitarian consequences in comparison to other departments in Colombia because of a combination of environmental, structural, and conflict-related factors.
- The middle and lower regions of Putumayo feature favourable environmental conditions for mosquito proliferation, including high temperatures, prolonged rainy seasons, and widespread water stagnation (Gobernación Putumayo 11/2023; KII 20/01/2025). These pre-existing conditions can further intensify with climate change and La Niña (FAO 2022; 3iS et al. 25/04/2024; DANE 24/04/2024).
- Widespread water contamination and inadequate sanitation infrastructure, particularly in informal settlements and rural areas, create ideal breeding grounds for *Aedes aegypti* mosquitoes (REACH 09/08/2024 a and 09/08/2024 b).
- Insufficient vaccination coverage against yellow fever in adults leaves a significant portion of the population highly vulnerable to severe outbreaks (Salud Putumayo unpublished).
- Weak disease surveillance and response systems delay early detection and containment efforts (Salud Putumayo unpublished).
- The health system is fragile and overstretched, with limited hospital capacity, a shortage of medical personnel, and frequent service disruptions, particularly in middle and lower Putumayo (Gobernación Putumayo 11/2023).
- High levels of human mobility, including seasonal labour movement and cross-border migration, hinder disease-tracking and facilitate the spread of VBDs by increasing the risk of exposure (Mongabay 24/07/2024; SINCHI 2022).
- The presence of non-state armed groups (NSAGs) leads to mobility restrictions, confinements, security threats, and barriers to accessing healthcare, particularly in rural and Indigenous communities (OCHA 03/02/2025).

Map 1. Reported number of dengue and yellow fever cases in Putumayo in 2024



Sources: ACAPS using data from OPS (03/02/2025); Salud Putumayo (accessed 07/02/2025); INS (2024 a); OCHA (04/04/2023 and 14/12/2022); WB (21/07/2018)

ABOUT THIS REPORT

Aim

This report analyses the anticipated humanitarian impacts of a potential increase in dengue and yellow fever cases in Putumayo during 2025. It analyses how key drivers, structural vulnerabilities, and aggravating factors could shape the spread of these vector-borne diseases (VBDs) and their humanitarian impacts in this scenario while offering probable developments and potential risks with significant consequences for affected populations. This analysis is intended to inform decision-making, operational planning, and strategic interventions by highlighting critical contextual dynamic

Methodology

This analysis is based on a review of secondary data, including reports and documents from international organisations, local authorities, and community based organisations. 12 key informant interviews were conducted with experts, humanitarian organisations, communities, and authorities to gather first-hand insights on the structural challenges and conflict dynamics in Putumayo. The temporal scope of the analysis covers the period from January–December 2024, with an anticipatory outlook for the first half of 2025, assessing potential public health and humanitarian impacts. The geographical focus is the department of Putumayo, considering both urban and rural areas, as well as the specific needs of Indigenous populations and other at-risk groups.

This report was coordinated with the Health Cluster to examine the intersection between the health crisis and the armed conflict in Putumayo. The objective is to provide a comprehensive understanding of how conflict dynamics aggravate public health challenges, shaping the overall humanitarian situation.

By applying an anticipatory and crisis complexity framework, this analysis recognises that VBD outbreaks in Putumayo are not isolated health events but part of a broader multifaceted crisis. It integrates key variables as both drivers and aggravating factors to assess the compounded impact of health system constraints, socio-environmental dynamics, and conflict-related disruptions.

Limitations and information gaps

This analysis is subject to several data limitations and methodological constraints, primarily owing to gaps in epidemiological surveillance, challenges in data collection, and limited access to disaggregated health information.

One of the key limitations is a lack of precise epidemiological data specific to Putumayo, particularly in rural, Indigenous, and conflict-affected areas. Significant underreporting of dengue and yellow fever cases occurs because of restricted access to healthcare facilities, low testing capacity, and logistical barriers in remote regions. The extent of secondary dengue infections remains unclear given the absence of robust disease monitoring mechanisms. While reinfections are known to increase the likelihood of severe illness, current surveillance limitations hinder a comprehensive understanding of their prevalence in the department (WHO 23/04/2024).

Putumayo's complex mobility patterns, as a department bordering Ecuador and Peru – including constant intermunicipal and transnational movements – hinder the registration, systematisation, and monitoring of cases, making it difficult to track infection trends and vaccination coverage. This challenge is particularly relevant for migrants, refugees, seasonal workers, and cross-border populations, whose health status often remains unrecorded in national surveillance systems.

A significant challenge in dengue control in Colombia is the need to strengthen molecular surveillance to monitor genotypic variations of the virus. Although the National Institute of Health conducts some level of molecular surveillance, the coverage is not fully comprehensive across all departments of the country, limiting the ability to predict epidemiological trends and adapt public health interventions to regional disease dynamics (Gutierrez-Barbosa et al. 03/10/2020; INS 15/07/2024).

This report seeks to provide a plausible and evidence-based anticipatory outlook, integrating available data with contextual expertise. That said, in anticipatory analysis, rapidly evolving disease transmission dynamics, climate variability, and security conditions complicate the forecasting of potential scenarios. Information gaps are particularly notable for specific populations, including Indigenous communities, migrants, refugees, and LGBTQ+ individuals, whose health risks and access to services are often underrepresented in official datasets.

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OVERVIEW

Table 1. Baseline information and dengue and yellow fever cases in rural and urban areas of Putumayo department

Projected total population of Putumayo in 2024: Urban – 202,466 | Rural – 186,250

	Indicator	Urban	Rural
1	% of total population	52	47
2	% of Indigenous population	9	19
3	% of population in poverty according to the Multidimensional Poverty Index (2023)	11	16
4	% households with pipeline (2023)	74	31
5	% households with sewerage (2023)	92	12
6	% households with rubbish collection (2023)	99	21
7	% of total reported dengue cases (2024)	67	32
8	% of total reported yellow fever cases (2024)	0	100

Created with Datawrapper

Sources: ACAPS using data from OPS (03/02/2025); Salud Putumayo (accessed 17/02/2025); DANE (22/03/2023 a, 22/03/2023 b, 28/08/2023, 24/04/2024 a, 24/04/2024 b, and 19/04/2024)

Putumayo is facing an increasing public health crisis because of VBDs. Located in the southern region of Colombia and part of the Amazon Basin, Putumayo shares borders to the north with the departments of Nariño and Cauca, Caquetá to the north and east, Amazonas to the west, and the countries of Ecuador (Sucumbíos province) and Peru (Loreto department) to the south. Putumayo had an estimated population of 387,716 in 2024, 18% of whom were Indigenous (DANE 28/08/2024). Over 47% of the population lives in rural areas, where access to public services is limited and poverty levels are significantly higher compared to urban centres (DANE 24/04/2024, 19/04/2024, and 22/03/2023 a).

The department is divided into 13 municipalities across three subregions: upper, middle, and lower Putumayo. While upper Putumayo has a cooler Andean climate, the middle and lower subregions are characterised by warm, tropical conditions that facilitate mosquito proliferation and disease transmission (OCHA 22/04/2024; KII 29/11/2024). Agriculture is the primary economic activity, with a large portion of the population relying on subsistence farming (Amundsen Otterlei 14/05/2023).

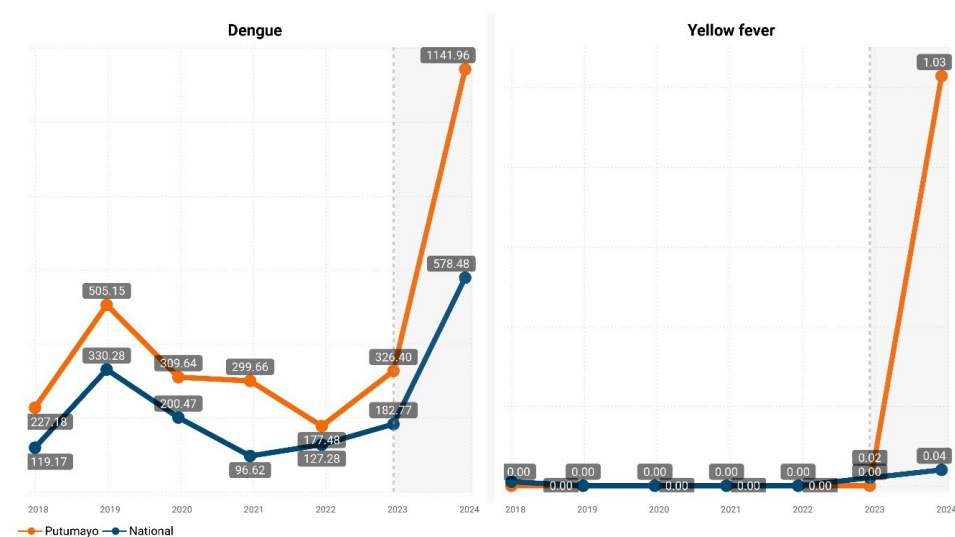
In 2024, Colombia recorded 23 cases of yellow fever, including 13 fatalities (OPS 03/02/2025). Putumayo is among the 11 departments where yellow fever is endemic in Colombia, and the presence of the virus and its transmission cycles pose a continuous risk (MinSalud accessed 18/02/2025). In 2024, the department registered four yellow fever cases, all of which were fatal and reported in rural areas (OPS 03/02/2025). In April 2024, the Putumayo government declared a health emergency following three fatal cases reported in Orito, Valle del Guamez, and Villagarzón (Gobernación Putumayo 05/04/2024). This development is particularly alarming, as the department had not reported a case since 2006, marking a significant shift in its epidemiological landscape (Salud Putumayo accessed 06/02/2025; Minsalud accessed 19/12/2024).

In 2024, the country reported 308,142 dengue cases, with over 2,800 classified as severe and 207 resulting in death. While Putumayo is not the department reporting the highest number of dengue cases in Colombia, its fatality rate is among the highest. From January–November 2024, the Colombia-wide dengue fatality rate was 0.06%. Putumayo had the third-highest fatality rate nationwide (0.24%), following Guainía (0.31%) and La Guajira (0.27%) (INS 2024 b). In 2024, Putumayo registered 4,763 confirmed dengue cases, including 38 classified as severe, and 67% of these cases were in urban areas (Salud Putumayo accessed 07/02/2025). Several municipalities, including Mocoa, Orito, Puerto Caicedo, Puerto Guzmán, San Miguel, Valle del Guamez, and Villagarzón, were under red or yellow epidemiological alerts for dengue throughout 2024, indicating sustained high transmission rates (INS accessed 19/12/2024).

In January 2025, Colombia reported eight cases of yellow fever, including two fatalities, all in the department of Tolima (OPS 03/02/2025). Between January and the second week of February 2025, 4,948 cases of dengue were reported nationwide (INS 14/02/2025). Until 20 February 2025, data on both diseases in Putumayo was unavailable, as the departmental health secretariat had not released the first epidemiological bulletin of the year.

Between 2010–2020, dengue in Colombia followed cyclical outbreaks every three years, with Putumayo experiencing similar peaks, especially during El Niño events. Yellow fever cases, though less frequent, are similarly driven by environmental factors, such as rising temperatures and stagnant water, which create ideal mosquito breeding conditions (Gutierrez-Barbosa et al. 03/10/2020).

Figure 1. Incidence rate of reported dengue and yellow fever cases per 100,000 inhabitants at the national level and in Putumayo from 2018 to November 2024



Source: ACAPS using data from DANE (accessed 08/01/2025 a); DANE (accessed 08/01/2025 b); INS (2024 b); INS (2024 a); INS (accessed 17/12/2024)

The *Aedes aegypti* mosquito transmits dengue and yellow fever. A virus of the Orthoflavivirus genus causes dengue, the treatment of which is mainly supportive and aimed at alleviating symptoms and preventing complications. There are effective dengue vaccines, but these are not currently included in Colombia's national immunisation programme, making early detection only possible by laboratory testing, nor supportive care critical to reducing fatality rates (WHO 23/04/2024). Severe dengue can lead to organ failure, haemorrhagic symptoms, and death if left untreated. In contrast, yellow fever, also from an Orthoflavivirus, has an available vaccine that provides long-term immunity; however, vaccination coverage remains inadequate in Putumayo (PAHO 06/11/2024).

DRIVERS

Mosquito proliferation

In Colombia, the primary drivers of the proliferation of mosquito vectors are environmental degradation and systemic infrastructural failures, which create suitable breeding grounds and directly contribute to increased VBD transmission and outbreaks. In May 2023, a national contingency plan was introduced to control dengue outbreaks, focusing on mosquito eradication campaigns through environmental clean-up, the elimination of breeding sites, community engagement, and the selective use of chemical controls (MinSalud 19/06/2023). In 2024, yellow fever public health surveillance protocols were disseminated, incorporating surveillance strategies and the publication of community-based surveillance manuals to facilitate the adoption or adaptation of risk identification processes (INS 19/06/2024). That said, there is limited concrete information available on the outcomes of these initiatives.

In Putumayo, the combination of climatic conditions, deforestation, agricultural changes, and inadequate water and sanitation infrastructure intensifies the risk of VBDs, such as dengue and yellow fever, by creating more natural and artificial mosquito habitats (Ortiz et al. 23/12/2021).

Climatic conditions: temperature and humidity are the most critical climatic factors influencing the transmission of *Aedes* mosquitoes, which thrive at temperatures between 26–28° C, although their survival declines in extreme heat or cold conditions (Gobernación Putumayo 11/2023; Trinidad Sanchez Vega et al. 05/11/2023; Márquez-Benitez et al. 25/02/2019). Given Putumayo's distinct climatic subregions, VBDs such as dengue and yellow fever pose a greater risk in lower (27–30° C) and middle Putumayo (around 25° C), where temperatures align with the optimal range for *Aedes* mosquito development. In contrast, upper Putumayo (13–17° C), thanks to its higher altitude, presents less favourable conditions, limiting the presence of *Aedes aegypti* (Ortiz-Canamejoy and Villota 19/11/2018).

The municipalities most at risk include Mocoa, Orito, Puerto Asís, Villagarzón, Puerto Caicedo, Puerto Guzmán, Puerto Leguizamo, San Miguel, Valle del Guamuez, and Villagarzón, where sustained high temperatures, humidity, and rainfall create ideal conditions for mosquito survival (World Bank accessed 21/01/2025; Gobernación Putumayo/IICA 09/2020). In contrast, upper Putumayo municipalities – Colón, San Francisco, Santiago, and Sibundoy – are largely unaffected thanks to their lower temperatures (Ortiz-Canamejoy and Villota 19/11/2018). Confirmed cases of dengue and yellow fever in 2024 were concentrated in the middle and lower subregions, with no reported cases in upper Putumayo (Salud Putumayo accessed 06/02/2025; INS 2024 b and 2024 a).

Prolonged rainy seasons and extreme rainfall create extensive stagnant water pools, ideal for mosquito larvae development, while dry seasons increase reliance on artificial water storage systems, which also serve as breeding sites (Ortiz et al. 23/12/2021). In Puerto Asís, in August 2024, 90% of surveyed households reported perceiving changes in seasonal and climatic phenomena. Notably, 76% cited increased rainfall intensity from April–May, while 99% observed rising temperatures, particularly between December–March (REACH 09/08/2024 b).

Changes in agricultural production and land use: the expansion of agricultural lands, combined with a shift from other crops to illicit coca cultivation, has created conditions more favourable to mosquito proliferation. Coca cultivation, which dominates agricultural activity, has significantly altered hydrological systems and local landscapes (Mongabay 17/09/2023; Pares 14/09/2023). Putumayo had over 30,000 cultivated hectares by 2023, making it one of the three departments with the largest amounts of coca crops in Colombia (Mongabay 17/10/2023; UNODC 18/10/2024).

The concentration of illicit crops, particularly along the San Miguel and Putumayo riverbanks near the borders with Ecuador and Peru, leads to stagnant water pools from poorly managed irrigation and land systems. These pools become ideal breeding grounds for *Aedes* mosquitoes, increasing the transmission risk for dengue and yellow fever (Mongabay 17/10/2023). The shift in agricultural practices towards coca cultivation, explained by the failed policy of crop substitution and lack of state support to peasants, affects biodiversity and natural water systems, making it harder for the soil to absorb and drain water effectively (Mongabay 07/01/2021; InSight Crime 12/07/2019). These changes result in environmental degradation and deforestation, which in turn increases the risk of diseases transmitted by mosquitoes while also increasing the economic reliance of communities on illicit economies (OWP 13/04/2020; InSight Crime 01/03/2023).

Deforestation disrupts natural ecosystems, eliminating mosquito predators and creating new habitats for vectors (Ortiz et al. 23/12/2021; Huber et al. 10/05/2018). The conversion of forested areas for cattle ranching and illicit crop expansion disrupts and exposes natural water sources and drainage patterns, creating stagnant pools of water where mosquito proliferation accelerates (IUCN 23/12/2022). Putumayo recorded 10,852 hectares of deforestation in 2023, accounting for 0.4% of the department's territory and 14% of the total national deforested area. This highlights the significant scale of environmental loss in the region (IDEAM 07/2024; Gobernación Putumayo/IICA 09/2020). Up until March 2024, municipalities such as Valle del Guamez and Orito reported deforestation, coinciding with cases of yellow fever recorded in these areas during the same period (IDEAM 06/04/2024).



Poor WASH infrastructure: many riverine communities in Putumayo lack access to piped water systems, relying instead on open water storage in wells, tanks, and containers, which serve as breeding sites for mosquitoes and increase the risk of VBD transmission. Inadequate drainage and sewage systems further contribute to water stagnation in both urban and rural areas, supporting mosquito proliferation (REACH 09/08/2024 a and 09/08/2024 b).

Access to safe water remains unreliable across the department. In March 2023, the Ombudsman's Office reported that Mocoa, the departmental capital, still lacked a fully functional aqueduct system (DP 01/04/2023). Many communities in Puerto Caicedo, Puerto Guzmán, and Puerto Leguizamo depend on rainwater for daily use, while others, such as in Villagarzón, must dig deep wells near streams (EHP Colombia/OCHA 01/03/2024; KII 16/12/2024). Poor waste management further intensifies public health risks. Garbage accumulation near water bodies creates stagnant pools that become mosquito breeding grounds, while decomposing organic waste fosters larval development (EHP Colombia/OCHA 01/03/2024; KII 18/12/2024; KII 29/11/2024).

Puerto Asís exemplifies the compounding effects of poor WASH infrastructure on public health. Its limited sewage systems lead to wastewater accumulation near households, and wetlands around (KII 18/12/2024). Wetlands surrounding the municipality also frequently serve as informal waste disposal sites, increasing health risks from mosquito proliferation and water contamination (REACH 09/08/2024 b). Puerto Asís ranks among the five municipalities that reported the highest number of dengue cases in 2024, with 529 cases recorded. Yellow fever transmission has not been reported in the area, as it typically occurs in more sylvatic and isolated zones (Salud Putumayo accessed 07/02/2025; REACH 09/08/2024 b; KII 18/12/2024). In the same year, the municipality ranked among the five municipalities with the highest number of dengue cases (529 reported cases) (Salud Putumayo accessed 07/02/2025).

Human mobility and population growth

Human mobility, particularly in Putumayo, is a critical driver of VBD transmission, as it facilitates the movement of infected individuals, mosquitoes, and viral pathogens across regions. Research highlights that increased human movement amplifies the geographic spread of diseases such as dengue and yellow fever, particularly in areas with inadequate health systems, limited disease control measures, and environmental vulnerabilities (Massaro et al 15/11/2029; Lowe 05/2018). This relationship is especially evident in areas experiencing increased migration and travel, which alter ecological and social conditions, enhancing the risks associated with VBDs (Naser Lessani et al. 29/11/2023).

The department's population dynamics between 2020–2024 demonstrate how human mobility patterns can accelerate VBD transmission. While the total population grew by 7.53%, urban areas experienced a more pronounced increase of 10.09%, compared to a modest 4.88% growth in rural zones (DANE accessed 23/01/2025). This urbanisation trend has led to higher population densities in cities, creating conditions that facilitate disease transmission through increased human-vector contact. This is particularly relevant for dengue, with nearly 70% of cases reported in urban areas in 2024 (Salud Putumayo accessed 07/02/2025). The concentration of people in urban areas and limited vector control measures can amplify the spread of the VBD while straining local healthcare infrastructure and prevention resources.

Daily and economic movement: people regularly move between rural areas and municipal centres for economic activities, agricultural work, and access to essential services, including healthcare and education. This frequent movement increases exposure to *Aedes* mosquitoes, which bite primarily during daylight hours, heightening the risk of VBD transmission (WHO 23/04/2024; Reiner Jr et al. 26/05/2016). Rural inhabitants, particularly farmers, are at greater risk as they spend extended hours in the fields during the day, where mosquito presence is high (KII 16/12/2024).

Interdepartmental mobility driven by illicit economies, such as mining and coca cultivation, connects Putumayo with neighbouring regions. Given the lack of economic opportunities, many young people move to rural areas in search of work in illicit economies that have become an important source of income, mainly located in areas with a higher risk of exposure to VBDs (Mongabay 24/07/2024; SINCHI 2022). Adolescents, particularly those ages 12–14, have been reported to drop out of school during the coca cultivation season, further contributing to disease exposure cycles, with some returning afterwards while others abandon education entirely to work in illegal mines, in high-risk mosquito habitats of Puerto Guzmán and Caquetá department (KII 21/01/2025b; Mongabay 17/10/2023).

Cross-border mobility: Putumayo's strategic geographic location positions it as a key corridor for cross-border migration between Colombia, Ecuador, and Peru, as well as a centre for transnational economies (DP 25/01/2022). Migrants and refugees in transit often settle in densely populated, resource-limited areas with inadequate vector control and healthcare infrastructure. These conditions create ideal environments for vector proliferation and disease transmission, heightening public health challenges in host communities (KII 23/12/2024; Naser Lessani et al. 29/11/2023).

In 2023, cross-border mobility in Putumayo increased by 340.93% compared to the previous year, adding 33,283 migrants and refugees to its population (INEC accessed 23/01/2025). Ecuadorians and Peruvians often cross into Putumayo for economic opportunities or healthcare, while some Colombians move in the opposite direction owing to threats, armed conflict, and violence (KII 18/12/2024; INEC accessed 23/01/2025).

Cross-border mobility between Putumayo in Colombia and Sucumbíos in Ecuador is a risk factor for yellow fever transmission. In April 2024, a fatal case was reported in San Miguel, one of Putumayo's municipalities near the border (Conexión Putumayo 04/04/2024). Although the person died in Ecuador, the infection was acquired in Putumayo (INS 2024 a; KII 21/01/2025 a). This event is particularly concerning, as Ecuador had not registered any yellow fever cases since 2017, and it also poses a major challenge in terms of regional outbreaks, disease control, and cross-border surveillance for Colombian and Ecuadorian authorities (MinSalud accessed 11/20/2025).

Vaccination and prevention

Table 2. Accumulated yellow fever vaccination coverage in Putumayo by age group, from 1996 to September 2024

Age groups	Coverage (%)	Population susceptible to vaccination in 2024
1	97	1,220
2–14	98	1,632
15–18	54	12,711
19–40	100	-157,193
41–59	58	32,661

Note: a negative figure for the population susceptible to vaccination indicates that more vaccines were administered than initially projected. For the 19–40 age group, vaccination coverage is shown as 100%; however, actual coverage exceeds this given the surplus of vaccines administered beyond initial estimates.

Created with Datawrapper

Source: ACAPS using data from Salud Putumayo (unpublished)

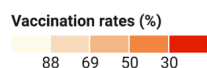
The limited and uneven vaccination coverage in Putumayo represents a critical driver contributing to the rise and prevalence of yellow fever cases. In Putumayo, 80% of the population lives in dispersed rural areas, increasing logistical challenges to vaccine distribution, which primarily depends on river transportation (UN 21/09/2024; DANE 30/04/2024). While vaccination rates for young children demonstrate the health system's capacity for

effective immunisation campaigns, significant gaps exist among other age groups, although there is not enough information regarding the causes. Particularly concerning are the low vaccination rates (below 60%) among adolescents ages 15–18 and adults ages 41–59, who, as part of the economically active population, are more exposed to vector-borne diseases (Salud Putumayo unpublished; La Silla Vacía 17/10/2023; Mongabay 17/10/2023). This insufficient yellow fever vaccine coverage leaves a significant portion of the population vulnerable to severe disease outbreaks, particularly among rural labourers, who face heightened exposure given a combination of low vaccination rates and frequent outdoor activities in high-risk environments.

Geographic patterns of vaccination coverage highlight a clear divide: in lower and middle Putumayo, where vector-borne diseases are prevalent, vaccination rates are lower, particularly among children, while in high-altitude areas, including Colón, Santiago, and Sibundoy, lower vaccination rates are linked to a perceived lower risk thanks to less favourable conditions for mosquito proliferation (Salud Putumayo unpublished). Men engaged in agricultural work are at the highest risk of yellow fever transmission given their prolonged outdoor exposure. In 2024, four men in Putumayo were infected with yellow fever: three were between 20–26 years old, while one was 66 years old (MinSalud accessed 31/01/2025). While individuals ages 20–26 fall within the age group with the highest vaccination coverage, there is no available data confirming the vaccination status of these three cases, further highlighting potential gaps in vaccination coverage, challenges in vaccine accessibility, and individual factors affecting immunity.

Table 3. Accumulated yellow fever vaccination rates in Putumayo by municipality and age group, from 1996 to September 2024

Municipality ▲	1 year of age (December projection)	2–14 years of age	15–18 years of age	19–40 years of age	41–59 years of age
Colón	108	88	29	100	41
Mocoa	94	100	60	100	35
Orito	99	91	50	100	91
Puerto Asís	93	100	58	100	52
Puerto Caicedo	98	100	16	100	70
Puerto Guzmán	102	100	48	100	62
Puerto Leguizamo	98	100	19	100	40
San Francisco	94	84	23	100	35
San Miguel	95	93	100	100	89
Santiago	84	80	11	100	51
Sibundoy	102	87	30	100	39
Valle del Guamez	101	92	55	100	68
Villagarzón	95	100	100	100	78



Note: vaccination rates exceeding 100% indicate that more vaccines were administered than initially projected.

Created with Datawrapper

Source: ACAPS using data from (Salud Putumayo unpublished)

The distinct immunological profiles of these diseases further challenge vaccination. While yellow fever can be prevented through vaccination, dengue presents a more complex immunisation scenario because of the absence of a vaccine in Colombia (WHO 10/05/2024; OPS 10/2024). As a result, the risk of severe dengue outbreaks is higher than for yellow fever. In the absence of a vaccine for dengue, the response in Putumayo has involved vector control by health entities. These include home visits conducted by technicians and assistants in rural and urban areas to inspect for VBD larvae in mosquito breeding sites, such as stagnant water in storage tanks, following the 2023 Ministry of Health guidelines to address potable water challenges. While there are no exact figures on the impact of these preventive visits, one key informant noted that the effect appears limited. This is attributed to the difficulty of sustaining long-term behavioural changes, as well as technical challenges, such as the

design of water tanks, which are fully sealed and cannot be properly cleaned (MinSalud et al. 30/05/2023; KII 21/01/2025 a; KII 22/01/2025 b). Communities have also been adopting different informal prevention methods given gaps in more structured mosquito control programmes, such as the use of mosquito nets and the burning of wood or firewood to create smoke to deter mosquitoes (KII 22/01/2025 a; KII 22/01/2025 b).

AGGRAVATING FACTORS

Weaknesses of the health system

Putumayo's fragile and geographically fragmented health system is already struggling to meet routine medical needs, leaving it critically unprepared to handle a large-scale VBD outbreak. The department has only 22 healthcare centres: 13 are in urban areas, and nine are in rural areas. These centres are classified as level one and two facilities, providing first aid and emergency attention only (3iS 16/11/2024). There are no level three or four facilities within the department, requiring complex cases to be transferred to other regions, often leading to delays in critical care and increasing the risk of severe health outcomes.

Healthcare facilities in Putumayo are scattered, with a higher concentration in more accessible areas in the north and west of the department. In remote regions, particularly near forested areas in the east, such as around the La Paya National Natural Park in Puerto Leguizamo, the presence of healthcare centres is limited (3iS 16/22/2024). Adverse geographical and economic conditions create barriers to healthcare access, particularly in remote and sparsely populated rural areas, given poor road infrastructure and a lack of adequate transportation options (Gobernación Putumayo 27/02/2023).

In lower Putumayo, rural and remote areas around Orito, Puerto Leguizamo, and Valle del Guamez are particularly poorly served (3iS 16/11/2024). Limited healthcare access combined with proximity to jungle areas worsen the underreporting of yellow fever cases and delay outbreak responses. Orito and Valle del Guamez, where yellow fever cases have been recorded, face heightened exposure to the VBD without adequate medical facilities for timely response (Salud Putumayo accessed 07/02/2025). For instance, travelling from Puerto Leguizamo, located in the eastern part of the department, to a neighbouring municipality such as Puerto Asís takes approximately nine hours by river (KII 21/01/2025 a).

In contrast, middle Putumayo, located in the northeast of the department, has a higher concentration of healthcare centres and urban areas, where the majority of dengue cases have been reported. Municipalities such as Mocoa (1,321 cases), Villagarzón (697 cases), and Puerto Guzmán (649 cases) show the highest dengue incidence, partly thanks to better disease detection and reporting capacities. Orito and Valle del Guamez are key municipalities

reporting both yellow fever and dengue cases, reflecting a double VBD burden (Salud Putumayo accessed 07/02/2025). Despite improved surveillance, however, limited hospital capacity in these areas continues to strain the healthcare system, making it difficult to manage severe cases effectively.

Long distances, high transportation costs, and the lack of capacity to manage complex cases locally highlight systemic gaps in the healthcare system. Distances between municipalities are considerable, and transportation, often via river routes, is costly and dangerous owing to NSAG presence. In one documented case, extreme distances and the lack of capacity of healthcare centres to treat progressed diseases forced a rural family in Mocoa to have their over 20-year-old daughter with severe dengue airlifted to another department for treatment, incurring significant costs (KII 21/01/2025 b).

The availability of hospital services and equipment within the department, such as beds, medical staff, and emergency care clinics, is insufficient for the number of inhabitants (MinSalud accessed 20/12/2024 a; MinSalud accessed 20/12/2024 b; MinSalud accessed 20/12/2024 c). They heighten the vulnerability of the population and highlight the urgent need for improved health infrastructure and service delivery mechanisms.

Table 4. Healthcare service availability rate per 1,000 inhabitants in Putumayo in 2023

Service	Availability rate per 1,000 inhabitants
Number of inpatient beds	0.94
Number of hospitals and healthcare centres	0.07
Number of emergency department clinics	0.07
Number of medical staff	0.64

Created with Datawrapper

Source: ACAPS using data from MinSalud (accessed 20/12/2024 a); MinSalud (accessed 20/12/2024 b); MinSalud (accessed 20/12/2024 c).

The majority of Putumayo's population is enrolled in the subsidised healthcare system, with 86% of the urban population and 96% of the rural population covered under this public

health scheme, which significantly exceeds the national average of 55% (DANE 24/04/2024). Populations within the subsidised healthcare system often report limited access to diagnostics and treatment, increasing the likelihood of case underreporting and response delays, particularly during health emergencies or outbreaks (Gutierrez-Barbosa 03/10/2020).

Putumayo's healthcare system faces significant service delays, staff shortages, and a high rate of unmet medical needs, affecting nearly half of the department's population. Up until August 2024, Emssanar, the department's primary healthcare provider, had 168,991 affiliates and operated in all municipalities (Emssanar 08/2024). Since 2023, however, it has consistently exhibited medium to high levels of health rights violations, including delays in medical services and inadequate quality of care (DP 14/08/2023).

One of the main contributors to this crisis is the provider's financial instability, which has severely affected the availability and quality of healthcare services. In April 2023, the provider had an outstanding debt of COP 9 billion (USD 2.16 million) to Mocoa's municipal hospital (MinSalud 21/04/2023). By November 2024, its debt had escalated to COP 23 billion (USD 5.5 million), owed to the high-complexity hospital of Puerto Asís (Conexión Putumayo 06/11/2024). This is where the most important referral centre in the department for medium and high-complexity cases (Conexión Putumayo 04/12/2023). This financial strain has further weakened the hospital's ability to treat patients, widening the existing gaps in healthcare access across the region.

Food insecurity

In Putumayo, food insecurity aggravates the impact of dengue and yellow fever by increasing the vulnerability of affected individuals to severe disease complications and prolonged recovery times. Malnutrition weakens the immune system, reducing the body's ability to combat infections and recover effectively, while limited resources for healthcare further amplify disease severity and complications (Morales et al. 19/12/2023). A 2024 assessment revealed that 26% of households resort to consuming less preferred or cheaper foods for up to seven days, while 21% reported reducing portion sizes over the same period, further weakening their immune systems (REACH 09/08/2024 b). This nutritional crisis is especially concerning for children. According to departmental health data, children under 15 represent 45% of dengue cases in Putumayo. The group has a mortality rate of 2.3%, with 1,810 deaths among children under 19 years old between January–November 2024 (Salud Putumayo accessed 02/02/2025). By 2024, out of 104,646 people in need in the department, approximately 32,963 were children (OCHA 15/03/2024). The significance of these figures cannot be overstated, as they present a major risk factor for increased disease severity and prolonged outbreaks, particularly among vulnerable populations with low vaccine coverage.

Climate

Climate change is also aggravating barriers to healthcare access. In Putumayo, most municipalities exhibit high sensitivity to climate change, coupled with a high to medium predisposition to natural hazards such as floods, landslides, and extreme heat (Think Hazard accessed 07/01/2025; FAO 2022).

Unpredictable climatic cycles in the department disrupt agricultural calendars, heighten food insecurity, and limit healthcare access, particularly in remote and riverine areas (KII 23/12/2024; ET accessed 07/11/2024). Changing river dynamics, such as lower water levels during droughts and excessive flooding during rainy seasons, significantly disrupt transportation routes critical for healthcare delivery (KII 13/12/2024; REACH 09/08/2024 b). In areas such as Puerto Leguizamo, where river transport is essential to accessing health services, food, and medicine, communities face delays when river levels are too low or navigation becomes restricted, cutting them off from essential medical care (KII 23/12/2024; KII 18/12/2024; EE 30/10/2024).

Climate patterns: La Niña conditions are expected to persist, with a transition to an El Niño-Southern Oscillation neutral phase that has a 66% chance of developing from March–May 2025 (NOAA 17/03/2025; IDEAM 08/03/2025). As La Niña typically increases precipitation and river flow in Colombia, it is likely to result in floods that could further obstruct navigation and river transportation for daily activities and access to health assistance (3iS et al. 25/04/2024; DANE 24/04/2024). Between February–April, the municipalities of Mocoa, Orito, Puerto Asís, Puerto Guzmán, Puerto Leguizamo, San Miguel, and Valle del Guamez are expected to experience an increase in dengue cases linked to the expected climatic conditions. The municipality of Villagarzón is also expected to see an increase, though with a lower likelihood (IDEAM/INS 02/2025).

While seasonal forecasts indicate that the likelihood of El Niño developing in the second half of 2025 remains low, any potential shift towards the phenomenon could further affect water availability and transportation routes, heightening existing vulnerabilities (IDEAM/INS 02/2025; EHP Colombia/OCHA 01/03/2024; KII 18/12/2024). These conditions will worsen existing nutritional vulnerabilities as drought disrupts agricultural cycles, reduces crop yields, and intensifies food insecurity.

NSAGs and illegal economies

The presence of NSAGs in Putumayo significantly hinders public health efforts and heightens protection risks in the context of a VBD outbreak, as these groups impose mobility restrictions and limit access to medical services, food, and essential resources (KII 21/01/2025 a). Frente Carolina Ramírez, Comandos de la Frontera, and Estado Mayor Central (EMC) are among the main NSAGs operating in the department (PARES 16/07/2024; InSight Crime 14/06/2024). In border departments such as Putumayo, communities also face heightened risks from the presence of transnational organised crime groups alongside Colombian NSAGs, which exploit porous borders for illicit activities, such as smuggling and trafficking (OCHA 10/02/2025).

The fragmentation of EMC in January 2025 has raised alerts about escalating violence in southern Colombia (OCHA 10/02/2025; DP 21/01/2025). Territorial disputes between dissident factions and other armed groups have intensified, particularly in middle and lower Putumayo, leading to a rise in armed confrontations in Puerto Asís, Puerto Caicedo, Puerto Guzmán, Puerto Leguizamo, San Miguel, and Valle del Guamez, increasing forced displacement (DP 21/01/2025).

In 2024, Putumayo was the third department most affected by confinements, after Chocó and Cauca, with over 13,700 people unable to move freely because of armed group control. One of the largest single confinements occurred in Puerto Leguizamo in January 2024, affecting 6,231 individuals (OCHA 03/02/2025). Between January–June 2024, UNHCR recorded over 1,000 people displaced in Villagarzón and Puerto Caicedo as a result of armed clashes between NSAGs, further demonstrating the widespread humanitarian impact of violence among these groups (UNHCR 10/12/2024).

These conflicts have triggered multiple confinements affecting Indigenous and rural communities, including 23 villages in Gallinazo (November 2024), communities in Umancia and Guáquira (September 2024), and the rural communities of Santander and La Victoria. Armed groups' actions included recruitment (affecting two 13-year-old minors in September 2024), incursions (involving 150 Comandos de la Frontera members in Yurilla and La Florida in August 2024), and violent confrontations resulting in civilian casualties and displacement (affecting 14 families in José María and El Recreo) (DP 21/01/2025). On 29 January 2025, OCHA reported a risk of confinement in Puerto Guzmán, affecting over 7,000 people and restricting humanitarian access (OCHA unpublished; Infobae 30/01/2025).

NSAG control over territories and armed confrontations create severe barriers to healthcare access, particularly in rural and Indigenous communities. Confinements and mobility restrictions disrupt livelihoods, as communities depend on fishing and subsistence farming, increasing food insecurity and malnutrition, which in turn weakens immune responses to infectious diseases (EPH Colombia/OCHA 22/04/2024; KII 13/12/2024). In past instances, security

threats have led to the cancellation of medical brigades, leaving remote populations without essential health services. Mobility restrictions also prevent civilians from seeking medical care, attending routine check-ups, or receiving life-saving treatment, such as for severe dengue or yellow fever infection (OCHA 03/02/2025; EPH Colombia/OCHA 22/04/2024; KII 21/01/2025 a). In a scenario of widespread disease transmission, these conditions could further deteriorate health outcomes and hinder outbreak response efforts. Some communities indicate that NSAGs have restricted access to health workers in Putumayo and have reportedly confiscated vaccines (KII 21/01/2025 a).

During a VBD outbreak, affected populations face the dual burden of health risks and protection threats. Women, children, and displaced individuals may be forced to choose between risking their safety to access healthcare and remaining in unsafe conditions without treatment. A deterioration of physical and mental health from illness, combined with prolonged exposure to violence and displacement, may also reduce community resilience and recovery capacity. This has been observed during periods when NSAGs controlled the entry of health workers to certain areas, such as Puerto Guzmán and Puerto Asís in 2021 (INS 25/03/21; KII 21/01/2025 a).

ANTICIPATED IMPACTS

Based on an analysis of contextual factors in Putumayo, the presence and actions of NSAGs and their illegal economies, and current health system conditions, several significant impacts can be anticipated from a potential increase in dengue and yellow fever cases during the first semester of 2025, such as a severe public health crisis, increasing fatality rates, and impacts on education and food insecurity.

Health system overwhelm and increased fatality

The anticipated rise in dengue and yellow fever cases in Putumayo could overwhelm the already weakened health system of the department, resulting in delays in diagnosis, treatment gaps, and increased case fatality rates, particularly among children under five years old, pregnant women, older people, people with pre-existing conditions, and patients with severe haemorrhagic dengue or yellow fever complications (KII 21/01/2025 a).

The combination of a high case burden, limited healthcare infrastructure, and structural weaknesses in service delivery is expected to result in severe health outcomes. Hospitals could reach full capacity quickly in municipalities such as Mocoa and Puerto Asís, where most referrals are sent (KII 29/11/2024). Health workers would probably experience burnout and extreme exhaustion, further reducing the quality of care and leading to staff shortages in the middle of an outbreak. Triage systems could become overwhelmed, delaying care for

critical patients and forcing the prioritisation of the most severe cases, while others may receive delayed or inadequate treatment given resource constraints. The referral system to hospitals in Nariño and Valle del Cauca would also likely become overwhelmed, causing long waiting times for medical evacuations.

Displaced populations, Indigenous communities, migrants, and refugees could face significant obstacles in accessing life-saving healthcare owing to geographic isolation and transportation limitations, which could also increase the mortality risk for these populations. The NSAGs in rural areas also impose mobility restrictions, confinements, and targeted violence, limiting civilians' ability to seek healthcare. Disease control measures may face significant operational and logistical challenges, increasing the likelihood of prolonged transmission and severe health impacts.

Access constraints for vaccination coverage are highly probable, particularly for Indigenous and rural communities. The combination of physical access barriers and security risks could further impede efforts to expand immunisation coverage in these high-risk areas.

Impacts on livelihoods, food security, and educational disruption

In Putumayo, a surge in dengue and yellow fever cases would likely intensify existing food security challenges, making people more susceptible to severe diseases and symptoms. By 2024, approximately 90% of monitored populations already reported reduced food consumption and the loss of productive assets, a situation made worse by a failed crop substitution policy (ACH 05/2023). The National Plan of Crops Substitution (PNIS), launched in 2017, has faced implementation difficulties given delayed government assistance and a shift towards eradication policies (InSight Crime 01/03/2023).

The impact would be most severe in dispersed rural areas, where communities face multiple vulnerabilities, such as limited access to basic services, low income, and high NSAG control levels. Geographic isolation and security constraints already limit access to external food products and agricultural inputs, meaning illness-related disruptions to local production would further compromise food availability (ACH 05/2023). Young people engaged in illegal economic activities, such as gold mining, where they earn approximately COP 80,000 (USD 19) per day – nearly double the 2024 minimum daily wage of COP 43,300 (USD 10,37) – would face significant income losses because of illness-related work absences (Mongabay 24/07/2024). Indigenous communities such as the Inga and Kamëntsá, already experiencing the loss of traditional food systems, would face compounded challenges in maintaining food security and cultural practices (UUNAL 16/12/2024)

The impact on children is particularly concerning, with data showing 1,927 dengue cases among those under 19 years old in 2024 (Salud Putumayo accessed 02/02/2025). With over 32,900 children already identified as having acute needs by March 2024, increased disease prevalence may worsen existing malnutrition trends (OCHA 15/03/2024; KII 02/12/2024). Malnourished children are especially vulnerable to severe dengue, as nutritional deficiencies weaken immune response and can lead to higher viral replication and inflammatory complications, increasing recovery time and health risks (Almanza Martínez et al. 12/04/2024).

For households in areas under NSAG control, recovery is likely to be more challenging owing to pre-existing restrictions on food production and transportation, which limit access to adequate nutrition and healthcare services (REACH 09/08/2024 b). These constraints may force families to adopt coping strategies with potentially negative outcomes, such as reducing meal portions, withdrawing children from school to save on educational expenses, and selling productive assets.

Educational disruption varies between the diseases. Dengue typically requires one to two weeks for recovery, with prolonged fatigue affecting school attendance and daily activities (WHO 23/04/2024; Schaefer et al. 06/03/2024). Children in rural or conflict-affected areas, where access to basic healthcare and pain management medication is limited, may face longer recovery times. Secondary dengue infections pose additional risks, being more likely to result in severe illness (WHO 23/04/2024). Yellow fever generally has a shorter impact on education, with most symptomatic cases recovering within three to four days (WHO 31/05/2023).

High-risk populations

The anticipated outbreaks of dengue and yellow fever in Putumayo are expected to disproportionately affect populations already facing significant barriers to healthcare access and adequate living conditions.

Young men

Yellow fever vaccination coverage remains critically low among youth (34% for ages 15–18), creating significant vulnerability. Even in Putumayo, where coverage is slightly higher at 53%, it remains well below the 95% recommended immunisation coverage for endemic areas (MinSalud 28/10/2024; OPS accessed 30/01/2025). Yellow fever poses a significant risk to young men involved in agricultural activities in Putumayo given frequent exposure to infected mosquitoes, particularly for those working in banana, sugar cane, corn, and coca (Ministerio de Comercio, Industria y Turismo 31/01/2024). This disease particularly spreads in sylvatic areas near rural environments where coca crops are located and young male workers are employed (KII 21/01/2025 a). The link between coca cultivation and yellow fever is well documented, as shown by the surge in cases during the 1990s in Colombia, coinciding with the expansion

of illicit crops in the departments of Caquetá and Meta (Castaño 20/08/2012). Like those departments in the past, Putumayo has witnessed an expansion of coca cultivation in recent years, particularly in the Orito-Vide settlement (middle Putumayo) and the zone bordering Ecuador (lower Putumayo) (UNODC 18/10/2024). Young people under 19 represent most of the population working in and around coca crops while having the lowest population rates in the department, placing them at increased risk of yellow fever infection (UNODC 2018; Mongabay 24/07/2024). Limited access to education and NSAG coercion often force young men into these activities, further increasing their risk of infection (KII 21/01/2025 a; KII 22/01/2025 b).

Pregnant women and female household heads

In Putumayo in 2024, an estimated 415 of the 4,655 reported dengue cases were among pregnant women, making them one of the most affected demographics (Salud Putumayo accessed 06/02/2025). Pregnant women face heightened risks from both dengue and yellow fever given their heightened vulnerability to severe illness, the potential for maternal and foetal complications, and the limited treatment options available during pregnancy. Severe dengue poses additional risks, including pre-eclampsia, gestational hypertension, anaemia, maternal haemorrhage, organ dysfunction, and, in extreme cases, maternal death (Ahuja and Motunde Gharde 11/11/2023). Dengue and yellow fever infection also increase the likelihood of the virus crossing the placental barrier, which can lead to complications for the infant, such as low birth weight or preterm birth. While yellow fever poses similar risks, its incidence is lower, and, of the overall cases among women, it primarily affects women in rural areas who have limited access to healthcare (CDC accessed 29/01/2025; Medicover 11/07/2024). Women responsible for household and childcare duties are also among the most affected by VBDs. In 2024, 18% of dengue cases were classified within this group, increasing the risk of disruptions to their daily responsibilities (Salud Putumayo accessed 06/02/2025). Limited access to healthcare and illness-related work absences may further challenge the 44.2% of households that already rely on women's income, making them and their families particularly vulnerable to the economic impacts of VBDs, for example, given work absences (KII 22/01/2025a; KII 22/01/2025 b).

Children and adolescents (0–15 years)

Despite being from households with proper water storage and sanitation, children in Mocoa have contracted dengue as a result of mosquito breeding sites in stagnant water near schools and abandoned fields (KII 20/01/2025). Adolescents ages 12–14 are at higher risk of VBD exposure as they may leave school because of recruitment or during coca harvesting seasons, later re-enrolling (KII 21/01/2025 a). This is especially critical since there is a gap in vaccination cover: although the group from 0–14 years of age have high rates of vaccination (over 95%), the 15–18 age group has a lower vaccination rate (Between 59% to 79%) (MinSalud 28/10/2024).

From January–September 2024, 229 cases of dengue were reported among children under 4 years old, a population with susceptibility to severe symptoms, such as haemorrhagic fever (OCHA 15/03/2024; KII 29/11/2024; Gobernación Putumayo 2024). Additional risk factors include lack of prior exposure to dengue as well as susceptibility to fluid loss and dehydration, which may cause prolonged recovery periods (Salazar Flórez et al. 19/03/2024; UNICEF 01/09/2023). Beyond biological vulnerabilities, children’s daily mobility between home and school increases their risk of dengue transmission and could imply extended school absences, further affecting overall wellbeing.

Older people

14% of the total cases of dengue reported during 2024 involved individuals over 50 years old, who are at high risk of acquiring dengue in urban areas and experiencing higher mortality and an increased likelihood of developing severe symptoms, such as haemorrhagic dengue (Rowe et al. 03/04/2014; Salud Putumayo accessed 11/02/2025). Their risk is heightened by pre-existing health conditions, such as diabetes and hypertension, which can heighten dengue symptoms, as well as by limited physical capacity to maintain household water storage and sanitation practices, potentially leading to increased exposure to dengue vectors (KII 21/01/2025 a). Public health teams report that older individuals often lack family or community support to implement preventive measures, such as regularly cleaning storage areas, disposing of waste, and installing mosquito nets. This increases their risk of infection, as they are less able to maintain mosquito-free environments on their own (KII 22/01/2025 a).

Indigenous communities

Indigenous communities in remote areas are particularly at risk of yellow fever infection (KII 13/12/2024; INS accessed 11/02/2025). These groups often face structural barriers to accessing health services, such as long travel distances, mobility restrictions imposed by NSAGs, and geographic constraints making yellow fever vaccine access difficult (UN 21/09/2024). Although there is no official vaccination data, vaccination coverage for yellow fever remains especially low in these areas, aggravating their risk of severe outbreaks. Indigenous communities also highlight the unpredictability of climatic cycles, which disrupt traditional agricultural calendars and increase vulnerability to health crises (SEI accessed 07/01/2025; ET accessed 07/01/2025; KII 16/12/2024).

Migrants and refugees

Putumayo serves as a key migration corridor, hosting 11,600 registered Venezuelan migrants and refugees by January 2024, primarily concentrated in Mocoa (KAS et al. 01/2024; KII 21/01/2025 a). These include both special permit holders with access to basic rights and migrants in transit to other countries (DP 25/01/2022). The Special Stay Permit does not always guarantee migrants and refugees access to health services, leaving them vulnerable to disease outbreaks. Venezuelan migrants and refugees are especially at risk of dengue and yellow fever owing to a combination of factors, including low-quality housing conditions and limited access to healthcare (DP 01/07/2021). According to a key informant, Venezuelan migrants and refugees in Mocoa often reside in informal settlements with limited access to sanitation and water infrastructure (KII 21/01/2025 a). These conditions increase the potential for stagnant water accumulation, creating favourable environments for mosquito breeding and elevating the risk of VBD transmission.

There are no official figures about how many migrants and refugees are immunised, which puts them at a higher risk of continued outbreaks. Access to treatment for severe cases of dengue and yellow fever remains a challenge, as migrants and refugees face barriers to accessing health treatment in Putumayo (OCHA 22/04/2024). When health access limitations are too great, or the severity of dengue or yellow fever is too high, many migrants are left to cover their own transportation costs for referral to other departments in Colombia or to the Peruvian territory. Some situations where this occurred were reported from Colombia to Soplín Vargas, in Peru (KII 21/01/2025 a). The area near the Ecuadorian border experiences high levels of human mobility, and pendular movement facilitates the spread of both dengue and yellow fever, especially among Ecuadorian migrants and refugees in San Miguel and Puerto Leguizamo (OCHA 22/04/2024; KII 21/01/2025 a).