Research and Innovation Article
Salud UIS ISSN: 2145-8464

The invisible epidemic: Cutaneous leishmaniasis in marginalized communities in a municipality in Santander, Colombia

La epidemia invisible: Leishmaniasis cutánea en comunidades marginadas de un municipio de Santander, Colombia

Diego Fernando Ordoñez Téllez[1]*, Luis Alberto López Romero[2], Carolina Becerra Arias[1]

[1] Universidad Industrial de Santander, Bucaramanga, Colombia
[2] Universidad Autónoma de Bucaramanga, Bucaramanga, Colombia

Received: 06/10/2025. Approved: 29/01/2026

Abstract

Introduction: Leishmaniasis is a chronic vector-borne disease caused by protozoa of the *Leishmania* genus and is considered one of the sixteen neglected infectious diseases by the Pan American Health Organization. In Colombia, nine species circulate, with a significant presence in Santander**. Objective:** To describe the epidemiological behavior of cutaneous leishmaniasis in Landázuri during the first half of 2025. **Methodology:** A descriptive cross-sectional study was conducted using data from the public health surveillance system of Landázuri from 2019 to 2025, for cutaneous leishmaniasis. For the descriptive analysis, absolute and relative frequencies were calculated. Incidence rates were also calculated based on annual case counts and expressed per 10,000 inhabitants. An endemic channel was developed to determine success, safety, alert, and epidemic zones for each epidemiological week. **Results:** During the first 21 epidemiological weeks of 2025, 114 cases were reported, a figure higher than the total number of cases recorded in previous years, with relative increases of +338% compared with 2024 and up to +776% compared with 2019. A total of 63.9% of cases occurred in men, with a median age of 20 years. The incidence rate for 2025 was 105.7 per 10,000 inhabitants, far exceeding previous years. The endemic channel confirmed that most of the analyzed weeks remained within the epidemic zone. **Conclusions:** The analysis reveals an increase in the number of cutaneous leishmaniasis cases in the municipality of Landazuri in 2025, exceeding the expected level based on the endemic channel. This pattern could be related to social, economic, and environmental factors, which are proposed as a hypothesis to be examined in future studies using appropriate study designs.

Keywords: Leishmaniasis; Disease Outbreaks; Social Determinants of Health; Vector Borne Diseases; Infectious Skin Diseases; Vector Control of Diseases

* **Correspondence**: Diego Fernando Ordoñez Téllez, diegofernandordonez@gmail.com. Industrial University of Santander. Cra. 32 #29-31, Bucaramanga, Santander

Suggested citation: Ordoñez Téllez DF, López-Romero LA, Becerra Arias C. The invisible epidemic: Cutaneous leishmaniasis in marginalized communities in a municipality in Santander, Colombia. Salud UIS. 2026; 58: e26v58a14. doi: https://doi.org/10.18273/saluduis.58.e:26v58a14

https://doi.org/10.18273/saluduis.58.e26v58a14

Resumen

Introducción: La leishmaniasis es una enfermedad vectorial crónica causada por protozoos del género *Leishmania*, considerada una de las dieciséis enfermedades infecciosas desatendidas y olvidadas por la Organización Panamericana de Salud. En Colombia circulan nueve especies, con presencia considerable en Santander. **Objetivo:** Describir el comportamiento epidemiológico de la leishmaniasis cutánea en Landázuri durante la primera mitad del año 2025. **Metodología:** Se realizó un estudio de corte transversal descriptivo con datos del sistema de vigilancia de salud pública del municipio de Landázuri para los años 2019 a 2025, para leishmaniasis cutánea. Para el análisis descriptivo se calcularon las frecuencias absolutas y relativas. Además se calcularon las tasas de incidencia con base en los casos por año y amplificando la tasa por 10.000 habitantes. Se elaboró el canal endémico para el evento para determinar zonas de éxito, seguridad, alarma y brote, para cada semana epidemiológica. **Resultados:** En las primeras 21 semanas epidemiológicas del 2025 se registraron 114 casos, cifra superior a la totalidad de los años anteriores, con incrementos relativos de +338% respecto a 2024 y hasta +776% frente a 2019. El 63,9% correspondió a hombres, con mediana de edad de 20 años. La tasa de incidencia para 2025 fue de 105,7 por 10.000 habitantes, superando ampliamente la de años previos. El canal endémico confirmó que la mayoría de semanas analizadas permanecieron en zona de brote**. Conclusiones:** El análisis evidencia un incremento en el número de casos de leishmaniasis cutánea en el municipio de Landázuri, durante 2025, superior al esperado, a partir del canal endémico. Este comportamiento podría estar relacionado con factores sociales, económicos y ambientales, lo cual se plantea como una hipótesis para ser evaluada en futuros estudios con diseños que así lo permitan.

Palabras clave: Leishmaniasis; Brotes de Enfermedades; Determinantes Sociales de la Salud; Enfermedades Transmitidas por Vectores; Enfermedades Cutáneas Infecciosas; Control de Vectores de las Enfermedades

Introduction

Leishmaniasis is a chronic vector-borne disease caused by a flagellated protozoan of the genus *Leishmania* and is recognized as one of the sixteen neglected infectious diseases (NIDs) by the Pan American Health Organization (PAHO)[1]. Worldwide, 51 species of this parasite have been identified, 20 of which are capable of infecting humans. In Colombia, nine circulating species have been reported, seven of which are present in the department of Santander[2].

The primary vector in Colombia is the sandfly of the genus *Lutzomyia*, which is distributed from sea level up to 3,500 meters above sea level (m a.s.l.), affecting various reservoirs, including animals and humans. This results in highly complex transmission dynamics. The disease is closely associated with poverty and malnutrition, reflecting inadequate housing conditions and poor sanitation in the most affected areas[3,4]. Additionally, patterns of human mobility that favor intrusion into vector habitats, together with changes in the ecological configuration of these ecosystems induced by climate change, are key factors contributing to the spread and expansion of the disease[4-6]. According to the PAHO, an outbreak is defined as an unusual increase in the number of cases of a disease beyond what is expected, with variable duration and geographic extent, as is currently observed in the community under study[7].

According to the World Health Organization (WHO), in 2023, it was estimated that between 600,000 and 1 million new cases of cutaneous leishmaniasis occur worldwide each year; however, only around 200,000 cases are reported. Approximately 95% of cases occur in the Americas, the Mediterranean basin, the Middle East, and Central Asia[4]. For example, in an endemic area of southeastern Morocco in 2022, the incidence reached 63.2 cases per 100,000 inhabitants[8]. In Colombia, cutaneous leishmaniasis had an incidence of 61.1 cases per 100,000 inhabitants at risk in 2022 (excluding imported cases), a value that remains within the national target of 90 per 100,000. In Santander, that same year, 714 cases were reported with an incidence of 204.6 per 100,000 inhabitants at risk, more than three times the national rate. Furthermore, according to the epidemiological bulletin up to week 26 of 2025, the national incidence of cutaneous leishmaniasis was estimated at 23.7 cases per 100,000 inhabitants at risk[9]. This situation may reflect a clear increase in cases within the department[10].

Landázuri is a municipality in the department of Santander, located in the Vélez province, characterized by a large, dispersed rural population. The municipal capital is situated at an altitude of 1,100 m a.s.l. It has been

nationally recognized for the high prevalence of cases reported annually; however, the local hospital has recently issued a new alert due to a concerning increase in the number of reported cases. Colombia is a country prone to leishmaniasis outbreaks, and several regions are considered endemic (nearly all territory below 1,750 m a.s.l.)[11]; therefore, these events are recognized as events of public health interest by the National Institute of Health (INS). Consequently, it is essential to make these events visible in order to raise awareness of the disease and promote the development of both pharmacological and non-pharmacological strategies for its control and prevention. For this reason, the objective of this study was to describe the epidemiological pattern of cutaneous leishmaniasis in Landázuri during the first half of 2025.

Methodology

Study design and population

A descriptive cross-sectional study was conducted using data from the Public Health Surveillance System (SIVIGILA) of the municipality of Landázuri from 2019 to 2025, based on reported cases of cutaneous leishmaniasis.

Instrument and measurements

All records reported to the National Institute of Health (INS) for cutaneous leishmaniasis by the local public health institution (E.S.E.) and originating from the municipality of Landázuri, Santander, Colombia, were included. All records corresponded to laboratory-confirmed cases, in accordance with the event surveillance protocol[12].

Cases reported by the E.S.E. were confirmed through direct visualization of the parasite using Field stain, a method endorsed by the Clinical Practice Guideline for the Comprehensive Care of Patients with Leishmaniasis[13].

Data collection procedure

All information recorded in the mandatory case notification form for cutaneous leishmaniasis (code 420) submitted to SIVIGILA was included. The data were downloaded in XLS format from the surveillance system of the E.S.E. Hospital Integrado Landázuri for subsequent cleaning and analysis. Duplicate records were identified and excluded from the analysis based on patient identification number and year of reporting, following the criteria established in the leishmaniasis surveillance protocol[12].

Statistical analysis

For descriptive analysis, absolute and relative frequencies were calculated for categorical variables. Measures of central tendency were used for continuous variables; for those with a normal distribution, the mean and standard deviation (SD) were reported, and for non-normally distributed variables, the median and interquartile range (IQR) were reported.

Annual incidence rates were estimated using the number of reported cases and the official municipal population projections for 2020–2035 provided by DANE for Landázuri.

To construct the endemic channel, a database was created in Excel® containing the number of reported cases and incidence rates for Landázuri by year. For the years 2019 to 2024, all 52 epidemiological weeks were included, whereas for 2025, data were analyzed up to epidemiological week 21.

To account for demographic changes in the number of cases over time, the geometric mean was calculated annually using logarithmic transformation of incidence rates, along with the standard deviation and 95% confidence interval (95% CI). These estimates were subsequently back-transformed to obtain the corresponding number of cases per epidemiological week. Additional methodological details for developing endemic channels are available in a previous publication[13].

After obtaining weekly case counts adjusted for annual population size, the endemic channel was generated. Preliminary data for 2025 were used to plot the epidemic curve over the endemic channel. The 2025 population was used as the reference for estimating the mean and 95% CI of the number of cases per epidemiological week, using back-transformation of log-transformed incidence rates to original units (number of reported cases).

Differences in the number of reported cases between years were assessed using analysis of variance (ANOVA). A p-value <0.05 was considered statistically significant.

Ethical considerations

The study followed national and international ethical guidelines for research involving human subjects. According to Article 11 of Resolution 8430 of 1993[14], this research was classified as no risk, as it involved only the collection of information from the epidemiological surveillance system of the E.S.E. and did not involve the manipulation of sensitive patient variables.

Confidentiality was ensured in accordance with Law 1581[15] on personal data protection. The study protocol was approved by the Scientific Ethics Committee of the E.S.E. Hospital Integrado Landázuri (May 28, 2025).

Results

From the analysis of cutaneous leishmaniasis cases originating from the municipality of Landázuri between 2019 and 2025 (up to epidemiological week 21), a total of 413 cases were identified. When disaggregated by year, 2025—despite being more than 25 weeks from the end of the year—showed the highest number of reported cases, followed by 2024 and 2021, with 114, 70, and 66 cases, respectively.

When applying a cutoff at epidemiological week 21 for all analyzed years, the relative increase observed in 2025 compared with previous years was +338% compared with 2024, +356% compared with 2023 and 2022, +192% compared with 2021, +612% compared with 2020, and +776% compared with 2019.

Regarding sex distribution, 63.9% (264) of cases occurred in males. Most cases (81.4%, 336) originated from rural population centers, 13.3% (55) from dispersed rural areas, and 5.3% (22) from the municipal capital. The median age was 20 years (IQR 12–34). The rural localities with the highest number of cases were Miralindo (14.5%, 60 cases), Chorolo (5.1%, 21), Plan de Armas (4.1%, 17), and La Soledad (3.9%, 16). In terms of health insurance coverage, 82.6% (341) of cases belonged to the subsidized regime, followed by the contributory regime (11.9%, 49), uninsured individuals (4.7%, 19), and the special regime (0.9%, 4).

Regarding lesion location, 15.5% (64) were located on the face, 16.9% (70) on the trunk, 56.2% (232) on the upper limbs, and 39.9% (165) on the lower limbs. Among patients reported in 2025, 5.8% (24) had received previous treatment. Additionally, 37 patients (8.9%) were receiving treatment at the time the cases were reported: 54.1% (20) were receiving cryotherapy, and 45.9% (17) were receiving thermotherapy. The majority of patients (89.6%, 370) were treated with meglumine antimoniate (Glucantime), followed by miltefosine (6.8%, 28).

When estimating incidence rates, 2025 showed the highest rate, even in its preliminary form up to epidemiological week 21, representing a 55.2% increase compared with the second-highest rate (2024 up to epidemiological week 52). Conversely, the lowest incidence rates were observed in 2023 and 2019, respectively (**Table 1**). These findings were reflected in the epidemic curves by epidemiological week (**Figure 1**).

Table 1. Incidence rates of cutaneous leishmaniasis per 10,000 inhabitants in Landázuri by year

Year	Population	# cases	Incidence rate (per 10,000)
2019	10,358	34	32.82
2020	10,481	42	40.07
2021	10,440	66	63.22
2022	10,555	51	48.32
2023	10,624	33	31.06
2024	10,717	70	65.32
2025	10,782	114	105.73

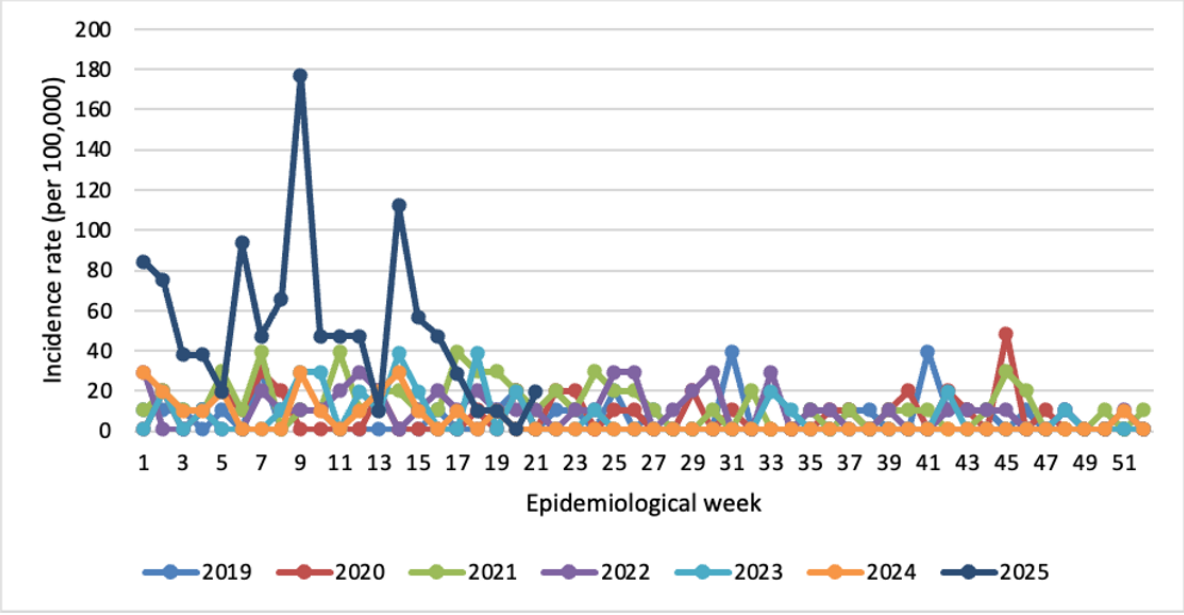

Figure 1. Epidemic curves for cutaneous leishmaniasis, Landázuri, 2019–2025 (preliminary)

Incidence rates increased in some years, such as 2021 and 2024, with the greatest increase observed in 2025. This is particularly notable considering that only the first 21 epidemiological weeks were included in the analysis, suggesting that both the absolute number of cases and the incidence rate may be higher than those estimated in the present report. For 2025, a relative increase of 35.6% was identified, despite covering less than half of the reporting period for that year, compared with the full 52 weeks of 2024.

Furthermore, the endemic channel showed that most epidemiological weeks in 2025 fell within the epidemic zone. Specifically, weeks 5, 7, 14, and 18 were classified in the alert zone, week 13 remained in the safety zone, and week 20 fell within the success zone (**Figure 2**).

Regarding data quality, three duplicate records were identified for 2024, corresponding to epidemiological weeks 36 and 37. In terms of completeness and consistency, it is important to highlight that the implementation of a web-based reporting system in recent years has enabled standardized data capture, validation, and timely integration of information from different reporting units. This registry control mechanism facilitates more comprehensive reporting across mandatory fields, thereby improving the overall quality of reported cases for subsequent

analysis. Consequently, for the variables included in the present characterization, complete information was available, allowing for the results reported in this study.

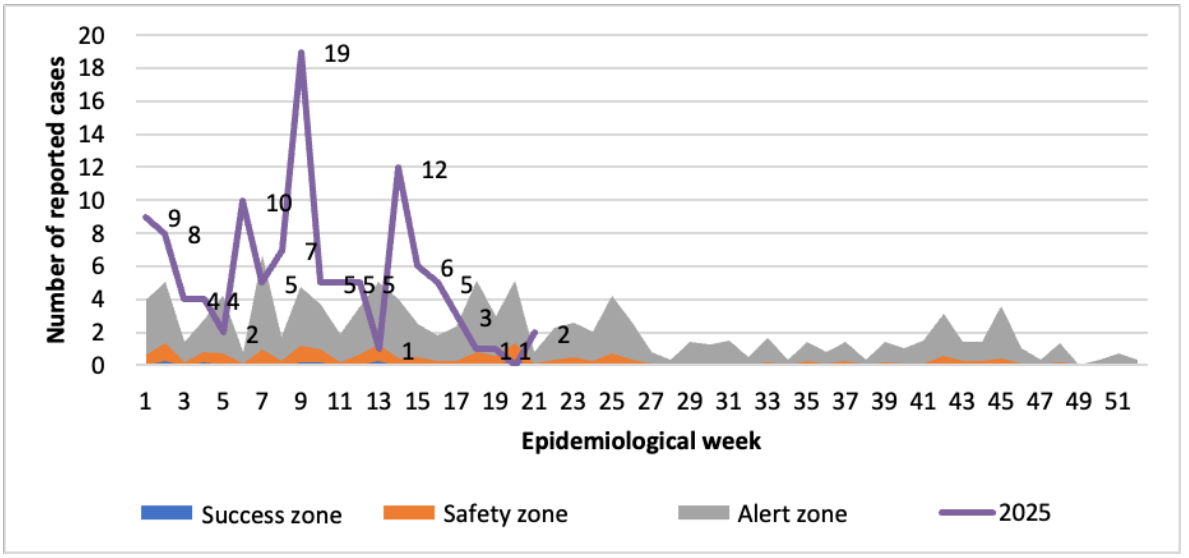

Figure 2. Endemic channel for cutaneous leishmaniasis (2019–2024) and epidemic curve up to epidemiological week 21 of 2025 in Landázuri, Santander

Discussion

The behavior of leishmaniasis cases in Landázuri in 2025 shows a clear increase compared with previous years at the same epidemiological week, reaching a total of 114 cases by week 21. Figures 1 and 2 show that the cumulative number of cases up to epidemiological week 21 of 2025 was higher than the number reported during the full 52 weeks of each of the previous five years. The median time from symptom onset to the date of reporting was 35 days, suggesting that patients may seek healthcare several days after identifying initial symptoms, such as skin lesions in the case of cutaneous leishmaniasis.

The 2023 Health Situation Analysis (ASIS) for the municipality identified multiple factors potentially related to the increase in cases in the region. These include marked social inequalities, the impact of various anthropogenic activities, limited public health awareness, and deficiencies in basic infrastructure, particularly with respect to wastewater treatment due to the lack of treatment plants[6]. Such socioeconomic conditions have been described in the literature as predisposing factors for *Leishmania* infection and contribute to increased community vulnerability to disease transmission. The literature shows a broad consensus that poverty, inadequate housing, cohabitation with animals, and limited access to healthcare services are among the most relevant socioeconomic risk factors predisposing to Leishmania infection[16-18].

However, social factors may also be related to this increase in cases. Agriculture is the municipality's primary economic activity, with cocoa cultivation predominating[11,19-21]. This activity has been described in the literature as a risk factor for disease transmission in a territory[22-24]. According to Epidemiological Bulletin 26 of 2025, of the total number of cutaneous leishmaniasis cases, 5.0% were miners, 18.2% were farmers, and 20.2% were military personnel—the latter predominantly men aged 18 to 44 years (mean age 24.2 years)[8].

The increase in cocoa prices in 2024 significantly boosted its cultivation and distribution in the municipality, with prices rising by up to 350% compared with 2023[25]. This trend coincided with the initial increase in reported cases that same year, followed by a marked surge in 2025[23]. Recent agricultural reports indicate more than 7,000 hectares under cultivation and production exceeding 4,000 tons, positioning the municipality among the country's leading cocoa producers[26].

Transmission of leishmaniasis in agricultural settings is linked to the vector's preference for shaded, humid environments[22]. Waste generated during crop processing has also been described as a possible contributing factor, as an association has been reported with waste disposal through composting, recycling, and storage practices[24]. Another related factor is the use of insecticides, which may affect beneficial insects, such as cocoa pollinators or natural pest controllers[27]. Additionally, the proximity of plantations to homes and populated areas may further increase exposure risk.

Landázuri is also a coal-mining region, and mining constitutes an important source of income for many families in the area[24]. This sector has expanded considerably in recent years[23,28]. However, mining has been identified in the literature as a risk factor for leishmaniasis transmission due to conditions such as high humidity, organic waste accumulation, and the presence of cracks or crevices[29]. The higher burden observed in men is largely explained by occupational exposure, as they more frequently engage in mining and agricultural activities, increasing contact with the vector. This difference does not reflect sex-related biological susceptibility to the sand fly vector or the parasite, as previously described in the literature[30].

As previously mentioned, leishmaniasis is closely associated with poverty and malnutrition, reflecting inadequate housing and poor sanitation in the most affected areas[31,32]. Ecological factors also contribute to disease transmission, particularly through changes in abiotic conditions—such as relative humidity, temperature, and rainfall—that favor vector propagation, often linked to agricultural expansion and urbanization in forested areas[33]. In Landázuri, the temperate climate, with temperatures ranging from 18°C to 28°C in both urban and rural areas, and average annual rainfall between 2,000 and 3,000 mm (which has gradually increased since 1991), creates favorable conditions for vector survival and proliferation[26,34-37].

This study is the first to document the presence of an outbreak in the municipality. Its limitations include potential underreporting inherent to studies based on secondary data sources and the restricted availability of variables limited to those included in the official case notification form. Given the scope of the study, multivariate analysis was not conducted, although future research could explore factors associated with the increase in reported cases using more comprehensive data sources and analytical approaches. The study does not aim to establish causality; rather, it proposes hypotheses to be tested in future investigations designed to explore determinants of the observed increase in cases.

Furthermore, because the analyzed data were exported from the Landázuri E.S.E., the total number of cases may not fully reflect all cases originating in the municipality. Some patients may have been diagnosed elsewhere after the onset of symptoms. Therefore, it is recommended that future analyses also incorporate data from municipal and departmental health authorities, which consolidate case reports through the National Institute of Health.

Finally, the lack of detailed geoclimatic data, socioeconomic variables, and in-depth studies of specific parasite genotypes in this area limits the identification of predisposing factors that may have contributed to the onset of the current outbreak.

Conclusions

The analysis of reported cases of cutaneous leishmaniasis in Landázuri shows that, during 2025, there has been an increase in the incidence rate, supporting the presence of an active outbreak in the municipality, as evidenced by the endemic channel. This increase may be explained by the interaction of multiple social, economic, environmental, and occupational determinants (**Table 2**).

Table 2. Socioeconomic and ecological determinants in the endemic area that may influence the development of the outbreak

Type of factor	Description
Social	- Poverty and marginalization - Inadequate housing (mud walls, roofs without screening) - Migration and population displacement - Limited access to healthcare and education services
Ecological / Environmental	- Deforestation and ecosystem alteration - Agricultural expansion and urbanization in forested areas - Relative humidity - Average annual precipitation - Climate change expanding the distribution of the sand fly vector
Economic	
Agriculture	- Expansion of agricultural crops, particularly cocoa cultivation - Agricultural waste management practices - Use of insecticides - Location of plantations and their proximity to homes
Mining	- Atmospheric conditions within mines (e.g., humidity and low light) - Accumulation of organic waste - Presence of cracks and crevices within mines

The following are proposed as hypotheses regarding the socioeconomic and ecological determinants that may be influencing the development of the current outbreak:

- Social inequities—such as poverty, housing conditions, and the lack of basic infrastructure—create a context of vulnerability for this community.
- Similarly, coal mining activities (largely informal or illegal) and the expansion of cocoa cultivation may represent additional factors associated with the increase in reported cases, given that conditions such as high humidity, waste accumulation, and the presence of shelters in mines and crop areas create favorable environments for the vector.

Therefore, we call on health authorities to implement strategies that effectively regulate the various predisposing factors believed to be part of the public health problem affecting the municipality.

Finally, the current scenario suggests that leishmaniasis is not exclusively a clinical issue, but rather the result of an interplay of individual, socioeconomic, and environmental determinants. Therefore, disease control requires a comprehensive approach that integrates health system strengthening, community education, and the implementation of intersectoral policies. These strategies should incorporate strategies to mitigate the social and environmental conditions that facilitate transmission—particularly through vector control measures—with community participation as a key component. Likewise, attention should be given to animal reservoir management, timely diagnosis and treatment, and progress in vaccine development and novel immunological treatment strategies, including combinations of immunotherapy and chemotherapy.

Author Contributions

DFOT – Made substantial contributions to the conception and design of the study; participated in data collection and interpretation; drafted and critically revised the manuscript; approved the final version for publication; and assumes responsibility for the integrity and accuracy of the work. LALR – Made substantial contributions to the conception and design of the study; participated in data analysis and interpretation of the data; drafted and critically revised the manuscript; approved the final version for publication; and assumes responsibility for the integrity and accuracy of the work. CBA – Made substantial contributions to the conception and design of the study; participated in data analysis and interpretation; drafted and critically revised the manuscript; approved the final version for publication; and assumes responsibility for the integrity and accuracy of the work.

Acknowledgments

We sincerely thank the Hospital Integrado de Landázuri and the Municipal Health Secretariat for their valuable support and collaboration in the preparation of this scientific article. The willingness of both institutions to provide the required epidemiological data, as well as their commitment to research and strengthening scientific knowledge, were essential for the development of this work. Their contribution represents an important advancement for public health in our region.

Ethical considerations

Not reported by the authors

Conflicts of Interest

Not reported by the authors.

Funding

Funded with the authors' own resources.

AI Technological Support

The authors declare that no artificial intelligence (AI)–assisted technologies, language models, machine learning tools, or any similar technological resources were used in the drafting, analysis, data interpretation, or preparation of the conclusions of this manuscript. All content corresponds to the authors' original work, ensuring the originality and integrity of the article.

References

1. Panamerican Health Organization. Neglected, tropical and vector-borne diseases. Washington, D.C., United States; n.d. [Accessed August 31, 2025]. Available from: https://www.paho.org/es/temas/enfermedades-desatendidas-tropicales-transmitidas-por-vectores

2. Salgado-Almario J, Hernández CA, Ovalle CE. Geographical distribution of Leishmania species in Colombia, 1985–2017. Biomédica. 2019; 39(3): 278–290. doi: https://doi.org/10.7705/biomedica.v39i3.4312

3. Gómez-Ortega LC, Walteros-Acero DM, Gómez-Gómez JL, Agudelo-Chivatá NJ, Prieto-A FE, Walteros-A DM. Informe del evento leishmaniasis, Colombia, 2022. Bogotá D.C., Colombia; 2023. [Accessed August 31, 2025]. Available from: https://www.ins.gov.co/buscador-eventos/Informesdeevento/LEISHMANIASIS%20INFORME%202022.pdf

4. World Health Organization. Leishmaniasis fact sheet. Geneva, Switzerland; 2023. [Accessed May 5, 2025]. Available from: https://www.who.int/es/news-room/fact-sheets/detail/leishmaniasis

5. Pinzón-Redondo H, Orta-López C, Pérez-Yapes C, Juliao-Cardona L, Agamez-De Ávila I, Matorel-Bello E, et al. Visceral and cutaneous leishmaniasis in an urban area of Cartagena, Colombia: case report. Rev Cienc Biomed. 2012; 3(1): 83–88. https://revistas.unicartagena.edu.co/index.php/cbiomedicas/article/view/3179/2706

6. Secretaría Municipal de Salud y Gestión Social. Análisis de situación de salud participativo municipio de Landázuri 2023. Landázuri, Colombia; 2024.

7. Panamerican Health Organization. Glossary on outbreaks and epidemics. [Accessed August 31, 2025]. Available from: https://dsp.facmed.unam.mx/wp-content/uploads/2024/07/covid-19-glosario.pdf

8. Hakem A, El Khiat A, Ezzahidi A, Bouhout S, Ait Ali D, El Houate B, et al. Incidence and prediction of cutaneous leishmaniasis cases and its related factors in an endemic area of Southeast Morocco: time series analysis. Acta Trop. 2025; 264: 107579. doi: https://doi.org/10.1016/j.actatropica.2025.107579

9. Pava Garzón DM. Epidemiological week June 22–28, 2025. Instituto Nacional de Salud, Dirección de Vigilancia y Análisis del Riesgo en Salud Pública. Bogotá D.C., Colombia; 2025. https://www.ins.gov.co/buscador-eventos/Paginas/Vista-Boletin-Epidemilogico.aspx

10. Instituto Nacional de Salud. Informe de leishmaniasis, Colombia, 2022. Bogotá D.C., Colombia; 2023. https://www.ins.gov.co/buscador-eventos/Informesdeevento/LEISHMANIASIS%20INFORME%202022.pdf

11. Landázuri. Gente pujante y pionera de Santander. El Gran Santander. 2024;1:1. https://elgransantander.com/landazuri-gente-pujante-y-pionera-de-santander/

12. Instituto Nacional de Salud. Protocolo de vigilancia en salud pública de leishmaniasis. Version 6. Bogotá D.C., Colombia; 2024. doi: https://doi.org/10.33610/IMYH4569

13. Ministerio de la Protección Social, Instituto Nacional de Salud. Guía de atención clínica integral del paciente con leishmaniasis. Bogotá D.C., Colombia; 2010. https://www.minsalud.gov.co/Documents/Salud%20P%C3%BAblica/Ola%20invernal/Clinica%20Leishmaniasis.pdf

14. Colombia. Ministerio de Salud. Resolución 8430 de 1993, establishing scientific, technical, and administrative standards for health research. Bogotá D.C., Colombia; 1993. https://www.minsalud.gov.co/sites/rid/Lists/BibliotecaDigital/RIDE/DE/DIJ/RESOLUCION-8430-DE-1993.PDF

15. Colombia. Congreso de la República. Ley 1581 de 2012, general provisions for personal data protection. Bogotá D.C., Colombia; 2012. https://www.funcionpublica.gov.co/eva/gestornormativo/norma.php?i=49981

16. Valero N, Uriarte M. Environmental and socioeconomic risk factors associated with visceral and cutaneous leishmaniasis: a systematic review. Parasitol Res. 2020; 119(2): 365–384. doi: https://doi.org/10.1007/s00436-019-06575-5

17. Shaheen R, Abbas R, Virk R, Naseer M, Ahmad S, Abdullah M, et al. Socioeconomic, environmental, and behavioral risk factors associated with cutaneous leishmaniasis: a multi-region study. Insights J Life Soc Sci. 2025. https://insightsjlss.com/index.php/home/article/view/149

18. Hussain Z, Khan A, Shaheen R, Virk R, Zia Q, Ullah W, et al. Epidemiology and risk factors of vector-borne disease (cutaneous leishmaniasis). Insights J Health Rehabil. 2025. https://doi.org/10.71000/ijhr509

19. Alcaldía de Landázuri. El cacao. Facebook; 2024. [consulted 31 de agosto de 2025]. Disponible en: https://www.facebook.com/alcaldia.delandazuri/posts/el-cacaojuega-un-papel-crucial-en-la-econom%C3%ADa-deland%C3%A1zuri-a-continuaci%C3%B3n-detall/925617986342401/

20. Pulgar Baletta KT. Analysis of the territorial planning scheme of the municipality of Landázuri. Barrancabermeja, Colombia: Instituto Universitario de la Paz; 2019. https://es.scribd.com/document/421231074/MUNICIPIO-LANDAZURI

21. Cámara de Comercio de Bucaramanga. Cocoa in the provinces of Santander: National Agricultural Census. Bucaramanga, Colombia; 2018. https://www.camaradirecta.com/imagenes/vdo_conexion/cone_13c005d5999cb9a6a7983b8543ba2f816ca42378.pdf

22. Carrada-Figueroa C, Leal-Ascencio VJ, Jiménez-Sastré A, López-Álvarez J, López-Álvarez G. Transmission of cutaneous leishmaniasis associated with cocoa plantations *(Theobroma cacao)* in Tabasco. Gac Med Mex. 2014; 150(3): 218–224. https://www.anmm.org.mx/GMM/2014/n6/GMM_150_2014_6_499-508.pd

23. Muñoz G, Rojas CRD. *Leishmania panamensis* transmission in the domestic environment: results of a prospective epidemiological survey in Santander, Colombia. Biomédica. 2006; 26(2): 250–257. http://www.scielo.org.co/scielo.php?pid=S0120-41572006000500015&script=sci_abstract

24. Gutierrez JV. Environmental risk factors in the transmission of cutaneous leishmaniasis in an endemic area of Tabasco. Horiz Sanit. 2014; 13(2): 91–98. https://www.redalyc.org/pdf/4578/457845287004.pdf

25. Trading Economics. Cocoa. 2025. https://es.tradingeconomics.com/commodity/cocoa

26. Vargas Correa MF. Cocoa production and dynamics in Santander. Bucaramanga, Colombia: Universidad Santo Tomás; 2020. https://rsu.ustabuca.edu.co/images/DOCUMENTOS_OBSERVATORIO/Informes_Flash/2022/Produccion_Dinamicas_Cacao_Santander.pdf

27. Daza LCV. Geological cartography, characterization, and calculation of coal resources in mining title EK7-151, Landázuri, Santander. Sogamoso, Colombia: Universidad Pedagógica y Tecnológica de Colombia; 2018. https://repositorio.uptc.edu.co/challenge

28. Quiroga CJ. Socio-environmental impacts of illegal mining in Landázuri, Santander. Bucaramanga, Colombia: Unidades Tecnológicas de Santander; 2025. https://www.researchgate.net/publication/391880229_IMPACTOS_SOCIOAMBIENTALES_DE_LA_MINERIA_ILEGAL_EN_LANDAZURI_SANTANDER

29. Douine M, Bonifay T, Lambert Y, Mutricy L, Galindo MS, Godin A, et al. Zoonoses and gold mining: a cross-sectional study assessing yellow fever immunization, Q fever, leptospirosis, and leishmaniasis among populations working in illegal mining camps in French Guiana. PLoS Negl Trop Dis. 2022; 16(8): e0010326. doi: https://doi.org/10.1371/journal.pntd.0010326

30. Muñoz G, Rojas CRD. *Leishmania panamensis* transmission in the domestic environment: results of a prospective epidemiological survey in Santander, Colombia. Biomédica. 2006; 26(2): 250–257. https://pubmed.ncbi.nlm.nih.gov/17361849/

31. Okwor I, Uzonna J. Social and economic burden of human leishmaniasis. Am J Trop Med Hyg. 2016; 94(3): 489–493. doi: https://doi.org/10.4269/ajtmh.15-0408

32. Elizondo-Morales A, Fernández-Córdoba DA, Soto-Trejos L, Paniagua-Hidalgo D. Socio-environmental factors related to leishmaniasis at the cantonal level, Costa Rica, 2018–2021. Salud Publica Mex. 2024; 23(1): 167–180. doi: https://doi.org/10.19136/hs.a23n1.5686

33. Martínez DC, Ávila JL, Molano F. Sandflies (Diptera: Psychodidae: Phlebotominae) present in an endemic area of cutaneous leishmaniasis in West Boyacá, Colombia. Colomb Med (Cali). 2019; 50(3): 192–200. https://colombiamedica.univalle.edu.co/index.php/comedica/article/view/3051

34. Pinargote-Chancay R, Jaime-Hernández NK, Villegas-Chiriboga ME, Riofrio-Pinargote CA, Cañarte-Mero JK, Condo-Baque CA. Environmental conditions and leishmaniasis in Jipijapa canton. Polo Conoc. 2018; 3(7): 318–330. https://polodelconocimiento.com/ojs/index.php/es/article/view/555

35. Ma J, Guo Y, Gao J, Tang H, Xu K, Liu Q, et al. Climate change drives the transmission and spread of vector-borne diseases: an ecological perspective. Biology. 2022; 11(11): 1628. doi: https://doi.org/10.3390/biology11111628

36. Alcaldía Municipal de Landázuri. Municipal risk management plan, Landázuri, Santander. 2020. https://repositorio.gestiondelriesgo.gov.co:8443/bitstream/handle/20.500.11762/41553/Alcaldia_Landazuri_2016-2019_PMGR.pdf

37. Corporación Colombiana de Investigación Agropecuaria. Integrated agroclimatic management plan for the avocado production system *(Persea americana Mill.)* in the municipality of Landázuri, Santander. 2026. http://repository.agrosavia.co/server/api/core/bitstreams/3d281b4c-148f-4158-9f3e-91a919ea16d7/content