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Social and environmental determinants of leptospirosis exposure in primary care: a cross-sectional study at the 24 de Mayo Health Center, Ecuador

Determinantes sociales y ambientales de la exposición a leptospirosis en el primer nivel de atención: estudio transversal en el Centro de Salud 24 de Mayo, Ecuador

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ABSTRACT

This study aimed to analyze these determinants associated with exposure among users of the 24 de Mayo Health Center, located in the rural parish of Portoviejo, Ecuador. A descriptive cross-sectional study was conducted with 50 participants (>18 years), selected through non-probabilistic sampling. Data were collected using a structured survey that assessed sociodemographic variables, occupation, knowledge about the disease, and exposure risks (contact with animals, contaminated water, and rodents), and were analyzed using descriptive statistics. Of the participants, 60% were aged 20–50 years, and 56% were male. The most common occupation was agriculture (36%), followed by homemaking (22%) and livestock farming (18%). Overall, 58% of respondents were unaware of the disease; among the 42% who had some knowledge, 43% identified contaminated water as the main transmission route, while only 29% mentioned animal urine. Additionally, 24% reported previous community cases, and 8% reported cases within their own family. Exposure associated with agricultural activities and a knowledge deficit were evident, highlighting the need for health education, active surveillance, and improvements in sanitation from the first level of care.

Keywords: leptospirosis, social determinants of health, occupational exposure, health attitudes and practices, primary health care, cross-sectional studies.

RESUMEN

El objetivo fue analizar estos determinantes asociados a la exposición en usuarios del Centro de Salud 24 de Mayo, parroquia rural de Portoviejo, Ecuador. Se realizó un estudio descriptivo transversal con 50 participantes (>18 años) mediante muestreo no probabilístico. Se aplicó una encuesta estructurada para evaluar variables sociodemográficas, ocupación, conocimiento y factores de exposición (contacto con animales, agua y roedores), con análisis descriptivo. El 60% tenía 20-50 años y el 56% era masculino. La agricultura (36%) fue la ocupación principal, seguida de labores domésticas (22%) y ganadería (18%). El 58% desconocía la enfermedad; del 42% que la conocía, el 43% señaló agua contaminada como vía principal y solo el 29% mencionó orina de animales. El 24% reportó casos comunitarios previos y el 8% familiares. Se evidenció exposición asociada a actividades agropecuarias y déficit en el conocimiento, resaltando la necesidad de educación sanitaria, vigilancia activa y mejoras en saneamiento desde el primer nivel de atención.

Palabras clave: leptospirosis, determinantes sociales de la salud, exposición profesional, actitudes y práctica en salud, atención primaria de salud, estudios transversales.

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INTRODUCTION

Social and environmental health determinants—including housing conditions, access to basic services, educational attainment, occupation, and public policy frameworks—exert a direct influence on the occurrence of infectious diseases (Hernández et al., 2017; De La Guardia & Ruvalcaba, 2020). Compounding these conditions are processes such as environmental degradation, climate change, and deficiencies in sanitation systems, all of which heighten the vulnerability of specific populations and facilitate the spread of zoonoses, among them leptospirosis (Guillén et al., 2023; Igreja et al., 2025).

Leptospirosis is a zoonotic disease caused by spirochetes of the genus *Leptospira*, and is considered endemic in tropical and subtropical regions. Its primary transmission mechanism involves direct or indirect contact with water and soil contaminated by the urine of reservoir animals, particularly rodents, pigs, and dogs (Azócar-Aedo, 2023). In the Ecuadorian context, the geographic distribution of the disease is closely linked to climatic factors, such as heavy rainfall and persistently humid soils, with a greater burden in provinces of the coastal region, including Manabí (Lazo et al., 2017).

Research conducted nationwide has documented the circulation of *Leptospira* in domestic and livestock animals, confirming the persistence of zoonotic risk across various territories of the country (Muyulema et al., 2024). Specifically, in the 24 de Mayo parish of Portoviejo, previous studies have identified the endemic presence of the disease, associated with scenarios of social and environmental vulnerability that favor its transmission (Haro, 2009).

Given this context, it is essential to gain a deeper understanding of the interplay between social determinants, environmental conditions, and community practices that influence leptospirosis transmission. Accordingly, the objective of the present study was to analyze the health determinants associated with the incidence of leptospirosis among users of the 24 de Mayo Health Center, located in Manabí, Ecuador.

METHODOLOGY

A descriptive cross-sectional study was conducted among users of the 24 de Mayo Health Center (Manabí, Ecuador). The study population comprised individuals who attended this primary care facility, from which a non-probabilistic sample of 50 participants was selected.

The inclusion criteria were: age over 18 years, residence within the health center's catchment area, history of care at the facility during the study period, and provision of written informed consent. Exclusion criteria included minors, individuals who did not provide consent, respondents with incomplete or inconsistent surveys, and participants with a confirmed diagnosis of leptospirosis at the time of data collection—the latter to prevent potential bias in risk perception.

Data were collected using a structured questionnaire that covered sociodemographic variables, including age, sex, area of residence (rural/urban), educational level, employment status, marital status, and family income. In addition, the instrument included items assessing participants' level of knowledge, perceptions, and prior experiences regarding leptospirosis, as well as specific questions related to risk factors, such as contact with domestic animals, presence of rodents in the household environment, and access to drinking water.

The questionnaire was administered face-to-face, ensuring that all questions were clearly understood, participation was voluntary, and responses remained anonymous. Data were processed using descriptive statistics, with results expressed as frequencies and percentages. This approach was used to characterize the study population and to analyze the health determinants associated with leptospirosis exposure in the community.

The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki, respecting participants' autonomy, confidentiality, and well-being. All subjects received detailed information about the research objectives and provided their signed informed consent before enrollment.

RESULTS AND DISCUSSION

Of the 50 respondents shown in Figure 1, 28 were male (56%), and 22 were female (44%). This distribution shows a slight predominance of male participants in the rural sector studied, which may be related to men's greater participation in agricultural and livestock activities. These occupations involve more frequent contact with stagnant water, damp soil, and domestic or farm animals, all considered risk factors for leptospirosis transmission. The higher proportion of men observed in the surveyed population is consistent with findings from epidemiological studies conducted in rural and agricultural contexts, where men tend to have greater occupational exposure to *Leptospira* spp. due to agricultural, livestock, and animal handling activities (Wainaina et al.,

2024). In their systematic review, these authors indicate that occupational exposure is one of the main risk factors for human leptospirosis, especially in rural communities with traditional production systems and frequent contact with animal reservoirs.

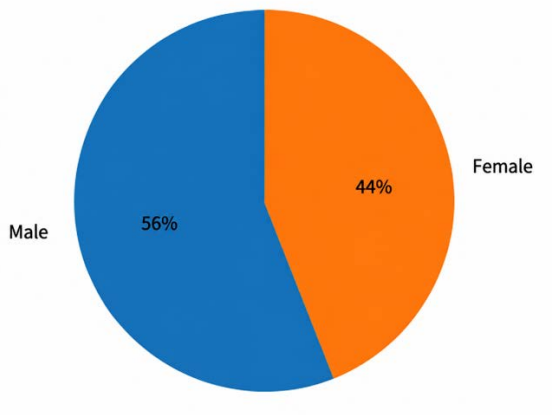

Figure 1. Gender distribution of respondents.

Likewise, although female participation was lower, the observed percentage remains significant, suggesting that women in rural areas are also exposed, primarily through domestic activities, handling small animals, and indirect contact with contaminated environments—a situation previously described in rural settings with limited sanitation (Wainaina et al., 2024). This gender distribution reinforces the need to consider both sexes in health education and prevention strategies, avoiding focusing on leptospirosis exclusively as a male-related risk and recognizing the diverse forms of exposure in rural communities.

Of the 50 respondents in Figure 2, 18 were engaged in agriculture, representing 36%, making them the predominant occupational group. The second largest group, 11 participants, were homemakers (22%), followed by 9 livestock farmers (18%). Other occupations included informal commerce (6 respondents, 12%), students (4 participants, 8%), and other activities such as day laborer or construction worker (2 respondents, 4%). This distribution reflects a clear predominance of agricultural activities, typical of the rural context of the studied area, which implies greater environmental and occupational exposure to factors associated with leptospirosis transmission.

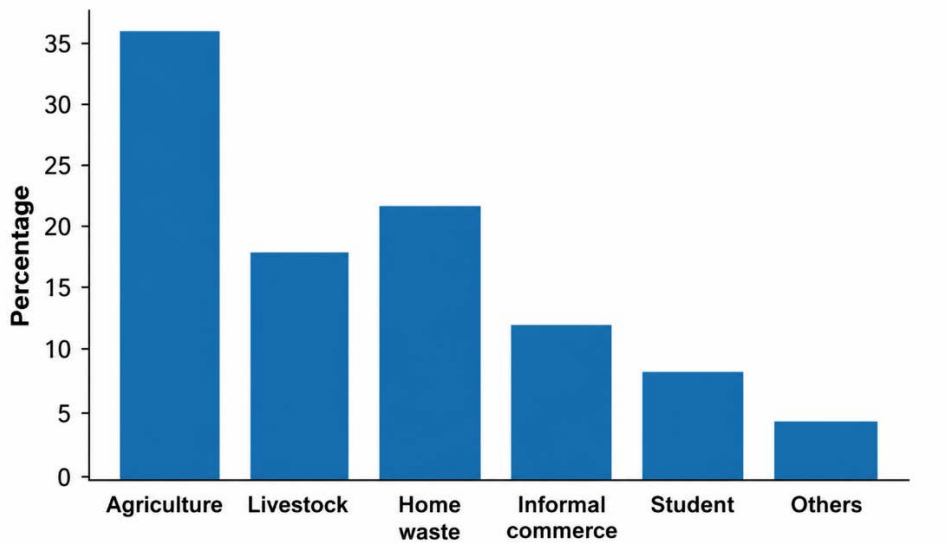

Figure 2. Occupational profile of the population.

The high proportion of participants engaged in agricultural and livestock activities observed in this study is consistent with what has been described in rural communities in Latin America, where agricultural work represents one of the main determinants of exposure to *Leptospira* spp. (Bradley & Lockaby, 2023). In their study conducted in a rural community in Argentina, the authors reported that activities related to agriculture, livestock management, and frequent contact with the humid rural environment increase the risk of infection due to constant interaction with soil, surface water, and potentially carrier animals.

Although housewives do not carry out direct agricultural activities, their significant proportion in the sample suggests indirect exposure, mainly associated with domestic animal handling, contact with yards or corrals, and the use of untreated water—conditions that have been identified as risk factors in rural settings (Bradley & Lockaby, 2023). This finding reinforces the idea that leptospirosis should not be considered exclusively a male occupational disease, but rather a zoonosis linked to the socio-environmental context of rural households (Atil et al., 2020).

The observed occupational distribution reveals an epidemiological scenario consistent with that reported in the literature, where the combination of rural productive activities, favorable environmental conditions, and human-animal contact significantly contributes to the maintenance

and transmission of leptospirosis in rural communities, highlighting the need for preventive interventions aimed at both the workplace and the home (Bradley & Lockaby, 2023).

Of the 50 respondents, 21 (42%) reported having heard of or knowing what leptospirosis is, while 29 (58%) indicated they had no prior knowledge. These results show that more than half of the studied population is unaware of the disease, reflecting a low level of health information in the evaluated rural sector, as can be seen in Figure 3. This lack of knowledge can negatively influence the early identification of symptoms, the adoption of preventive measures, and the timely search for medical attention, favoring underdiagnosis and the persistence of the disease in the community.

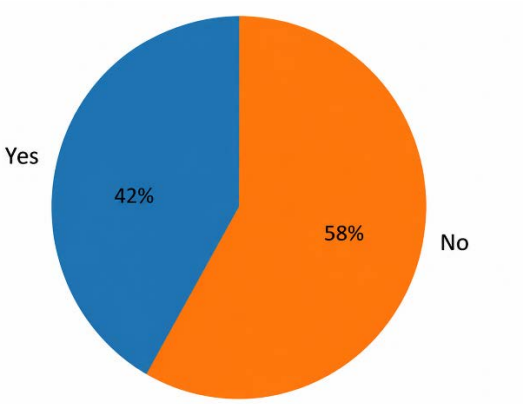

Figure 3. Prior knowledge of leptospirosis.

The widespread lack of knowledge about leptospirosis observed in this study aligns with the findings of Gonzales (2022), who notes that knowledge about this zoonosis is often insufficient even among populations with greater access to health information, such as university students, where low and medium levels of knowledge were identified in a considerable proportion of those evaluated. This situation is exacerbated in rural contexts, where access to health education programs is limited, and the perceived risk of zoonotic diseases is generally low (Gonzales, 2022).

The lack of knowledge about leptospirosis is related to the confusion of its clinical manifestations with other endemic febrile illnesses, which contributes to the underreporting of cases and the lack of recognition of the disease as a priority public health problem (Gonzales, 2022). In this regard, the high percentage of respondents who reported not knowing about the

disease in this study could explain the persistence of risky practices, such as contact with potentially contaminated water or close contact with animals without adequate protective measures.

Of the 21 respondents in Table 1 who reported knowing about leptospirosis, 9 identified contact with contaminated water as the main mode of transmission, representing 43%. Similarly, 6 participants indicated animal urine as a route of infection, corresponding to 29%, while 4 respondents mentioned the consumption of non-potable water, equivalent to 19%. Finally, 2 people indicated that they did not clearly know the modes of transmission, representing 9%.

Table 1. Knowledge of the forms of transmission

Identified form of transmission	Frequency (n)	Percentage
Contact with contaminated water	9	43
Animal urine (rats, cattle)	6	29
Consumption of non-potable water	4	19
Does not know clearly	2	9
Total	21	100

The predominance of contaminated water as the main transmission route aligns with the literature, which indicates that contact with stagnant water or damp soil contaminated with urine from infected animals is the primary mechanism of infection in humans, especially in rural and tropical areas (Ordóñez, 2023). In this review, the author highlights that *Leptospira* spp. penetrates through broken skin or mucous membranes after exposure to contaminated environments, which explains the frequent association of the disease with floods, heavy rains, and agricultural activities (de Azevedo, 2024).

However, the lesser recognition of animal urine as a direct source of infection observed in this study is significant, considering that the true reservoirs of leptospirosis are animals with prolonged *Leptospira* infection, primarily rodents, as well as dogs and livestock, which play a key role in maintaining the transmission cycle (Ordóñez, 2023). This lack of clear identification of the animal reservoir may contribute to the persistence of risky behaviors, such as close contact with animals without adequate biosecurity measures.

According to Table 2, of the 50 respondents, 12 (24%) reported knowing of cases of leptospirosis in the community, while 4 (8%) reported cases within their family. On the other hand,

the majority of participants, 34 (68%), indicated that they had not been aware of any cases of leptospirosis in their family or community in recent years.

Table 2. Cases of leptospirosis in the family or community

Answer	Frequency (n)	Percentage
Yes, in the community	12	24
Yes, in the family	4	8
No	34	68
Total	50	100

These results show that, although a considerable proportion of the population does not identify any recent history of the disease, there is a significant percentage of reported cases at the community level, suggesting persistent circulation of the agent in the environment, characteristic of rural areas with environmental conditions favorable for transmission. The presence of cases at the community level is consistent with what has been described for the province of Manabí and other areas of the Coastal region, where leptospirosis behaves as an endemic disease associated with environmental and occupational factors and close contact with domestic and production animals (Calvopiña et al., 2023). Likewise, the lower percentage of intrafamilial cases could be explained by the underdiagnosis of the disease and by its frequent nonspecific clinical presentation, which makes it difficult to recognize it promptly in the family setting (Calvopiña et al., 2023).

CONCLUSIONS

In the rural community of 24 de Mayo, exposure to leptospirosis does not respond to chance events, but to persistent structural conditions. The predominance of agricultural activities (agriculture 36% and livestock 18%), together with contact with potentially contaminated water and coexistence with reservoir animals, configures a continuous risk scenario. This vulnerability is aggravated by limited community knowledge: 58% are unaware of the disease and, among those who know it, only 29% identify animal urine as a means of transmission, which perpetuates risk practices and favors underdiagnosis, as reflected in the 24% of cases reported in the community. These findings show the need to strengthen contextualized health education and active epidemiological surveillance from the first level of care, as well as implement sanitation measures and promote preventive practices in the workplace and home settings, to interrupt the chain of transmission and improve community health.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

AUTHOR CONTRIBUTIONS

Conceptualization: Mariela S. Alcívar, José A. Cedeño, and Ricardo D. Romero. **Data curation:** Lesly S. Giler and Lindcy N. Mendoza. **Formal analysis:** Mariela S. Alcívar and Lesly S. Giler. **Investigation:** Mariela S. Alcívar, Lindcy N. Mendoza, Lesly S. Giler, Saúl R. Andrade, and José A. Cedeño. **Methodology:** José A. Cedeño, Saúl R. Andrade, and Ricardo D. Romero. **Project administration:** Saúl R. Andrade and Lesly S. Giler. **Resources:** Lindcy N. Mendoza and Mariela S. Alcívar. **Software:** Lesly S. Giler and José A. Cedeño. **Supervision:** Ricardo D. Romero. **Validation:** Ricardo D. Romero. **Visualization:** Lindcy N. Mendoza and Lesly S. Giler. **Writing – original draft:** Mariela S. Alcívar, Lindcy N. Mendoza, Lesly S. Giler, Saúl R. Andrade, and José A. Cedeño. **Writing – review & editing:** Mariela S. Alcívar, Ricardo D. Romero.

REFERENCES

Atil, A., Jeffree, M. S., Syed Abdul Rahim, S. S., Hassan, M. R., Awang Lukman, K., & Ahmed, K. (2020). Occupational Determinants of Leptospirosis among Urban Service Workers. *International Journal of Environmental Research and Public Health*, *17*(2), 427. https://doi.org/10.3390/ijerph17020427

Azócar-Aedo, L. (2023). Basic Aspects and Epidemiological Studies on Leptospirosis Carried Out in Animals in Chile: A Bibliographic Review. *Tropical Medicine and Infectious Disease*, *8*(2), 97. https://doi.org/10.3390/tropicalmed8020097

Bradley, E. A., & Lockaby, G. (2023). Leptospirosis and the Environment: A Review and Future Directions. *Pathogens*, 12(9), 1167. https://doi.org/10.3390/pathogens12091167

Bradley, E. A., & Lockaby, G. (2023). Leptospirosis and the Environment: A Review and Future Directions. *Pathogens*, *12*(9), 1167. https://doi.org/10.3390/pathogens12091167

Calvopiña, M., Romero-Alvarez, D., Vasconez, E., Valverde-Muñoz, G., Trueba, G., Garcia-Bereguiain, M. A., & Orlando, S. A. (2023). Leptospirosis in Ecuador: Current Status and Future Prospects. *Tropical Medicine and Infectious Disease*, *8*(4), 202. https://doi.org/10.3390/tropicalmed8040202

Campos, N. (2014). Leptospirosis. *Medicina Legal de Costa Rica*, *31*(2), 112-118. https://www.scielo.sa.cr/scielo.php?script=sci_arttext&pid=S1409-00152014000200012

de Azevedo, S. S. (2024). Epidemiology of *Leptospira* sp. Infection: Current Status, Insights and Future Prospects. *Microorganisms*, *12*(1), 22. https://doi.org/10.3390/microorganisms12010022

Gonzales, L. C. (2022). *Nivel de conocimientos sobre leptospirosis y actitudes hacia la prevención en estudiantes de la Universidad de Huánuco–Tingo María, 2021* [Tesis de licenciatura, Universidad de Huánuco]. Universidad de Huánuco. https://repositorio.udh.edu.pe/handle/20.500.14257/3725

Guillén, M. M., Guillén, M. C., & Guillén, M. J. (2023). Leptospirosis: Epidemiología zoonótica en la Región Costa Central de Ecuador. *La Técnica*, *13*(2), 114-121. https://doi.org/10.33936/latecnica.v13i2.6225

Haro, J. I. (2009). *Seroprevalencia de leptospirosis en personas asintomáticas en localidades de riesgo de la parroquia Alhajuela del cantón Portoviejo y medidas preventivas. Julio a diciembre 2009* [Tesis de licenciatura, Universidad Laica Eloy Alfaro de Manabí]. https://repositorio.uleam.edu.ec/handle/123456789/1318

Hernández, M., Mauri Pérez, J. L., Vargas Yzquierdo, J., & Hernández Cabezas, M. (2017). Leptospirosis humana: Un abordaje epidemiológico desde los factores ambientales. *Revista Cubana de Medicina General Integral*, *33*(1), 129-138. https://pesquisa.bvsalud.org/portal/resource/pt/cum-74516

Igreja, R. P., de Macedo, P. M., & Schneider, M. C. (2025). One Health and Neglected Zoonotic Diseases. *Pathogens*, *14*(5), 482. https://doi.org/10.3390/pathogens14050482

Lazo, L., Zambrano, P., Barragán, V., Morales, M., Bulnes, C., Fimia, R., & Iannacone, J. (2017). Estado actual y estrategias futuras en la epidemiología de la leptospirosis en el cantón Portoviejo, provincia de Manabí, Ecuador. *Biotempo*, *14*(2), 197-209. https://doi.org/10.31381/biotempo.v14i2.1321

Muyulema, E., Moscoso, M., Barragán, G., Bustillos-Huilca, R., & Luna-Herrera, J. (2024). Prevalence and risk factors of bovine leptospirosis in the Ecuadorian Amazon. *Veterinary World*, *17*(11), 2612-2618. https://doi.org/10.14202/vetworld.2024.2612-2618

Wainaina, M., Wasonga, J., & Cook, E. A. J. (2024). Epidemiology of human and animal leptospirosis in Kenya: A systematic review and meta-analysis of disease occurrence,

serogroup diversity and risk factors. *PLOS Neglected Tropical Diseases*, *18*(9): e0012527. https://doi.org/10.1371/journal.pntd.0012527

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