SPATIAL ANALYSIS AND PERFORMANCE OF COMMUNITY HEALTH WORKERS IN DETECTING LEPROSY IN RISK AREAS IN PARÁ

ANÁLISE ESPACIAL E ATUAÇÃO DE AGENTES COMUNITÁRIOS DE SAÚDE NA DETECÇÃO DE HANSENÍASE EM ÁREAS DE RISCO NO PARÁ

ANÁLISIS ESPACIAL Y DESEMPEÑO DE LOS TRABAJADORES DE SALUD COMUNITARIOS EN LA DETECCIÓN DE LA LEPRA EN ZONAS DE RIESGO EN PARÁ

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ABSTRACT

Objective: To evaluate the effectiveness of Community Health Workers (CHWs) in identifying suspected cases of leprosy in risk areas, using spatial analysis as a support tool in the municipality of Santarém, Pará. Methods: A cross-sectional, descriptive, and quantitative study was conducted between June and October 2019. Twenty-four CHWs from Basic Health Units (BHUs) located in low-, medium-, and high-risk areas for leprosy

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were included, identified through spatial analysis of data from the Notifiable Diseases Information System (SINAN, 2006-2014). The CHWs received training on leprosy and administered suspicion questionnaires during home visits (HV). Data were statistically analyzed and georeferenced in QGIS. Results: 83% of CHWs recognized leprosy as an infectious disease, but only 50% demonstrated knowledge about transmission and contact surveillance. During the HD, 19 suspected cases were identified, 17 with skin lesions and 13 with neurological changes (pain, numbness, tingling). Spatial analysis revealed a heterogeneous distribution of leprosy, with detection rates varying between census sectors, and highlighted the non-strategic location of some CHUs, limiting access for the population. Conclusion: Despite gaps in knowledge about transmission and surveillance, CHWs were effective in detecting suspected cases, reinforcing their role in expanding the capillarity of the health system. Spatial analysis proved essential for identifying priority areas and optimizing resource allocation. Continuous training of CHWs and integration of geospatial techniques into health surveillance strategies for leprosy control in endemic regions are recommended.

Keywords: Leprosy. Community Health Workers. Spatial Analysis. Early Detection. Public Health.

RESUMO

Objetivo: Avaliar a eficácia dos Agentes Comunitários de Saúde (ACS) na identificação de casos suspeitos de hanseníase em áreas de risco, utilizando análise espacial como ferramenta de suporte no município de Santarém, Pará. Métodos: Estudo transversal, descritivo e quantitativo, realizado entre junho e outubro de 2019. Foram incluídos 24 ACS de Unidades Básicas de Saúde (UBS) localizadas em zonas de baixo, médio e alto risco para hanseníase, identificadas por meio de análise espacial de dados do Sistema de Informação de Agravos de Notificação (SINAN, 2006-2014). Os ACS receberam treinamento sobre hanseníase e aplicaram questionários de suspeição durante visitas domiciliares (VD). Dados foram analisados estatisticamente e georreferenciados no QGIS. Resultados: 83% dos ACS reconheceram a hanseníase como doença infectocontagiosa, mas apenas 50% demonstraram conhecimento sobre transmissão e vigilância de contatos. Durante as VD, foram identificados 19 casos suspeitos, sendo 17 com manchas cutâneas e 13 com alterações neurológicas (dor, dormência, formigamento). A análise espacial revelou distribuição heterogênea da hanseníase, com taxas de detecção variando entre setores censitários, e destacou a localização não estratégica de algumas UBS, limitando o acesso da população. Conclusão: Apesar das lacunas no conhecimento sobre transmissão e vigilância, os ACS foram eficazes na detecção de casos suspeitos, reforçando seu papel na ampliação da capilaridade do sistema de saúde. A análise espacial mostrou-se essencial para identificar áreas prioritárias e otimizar a alocação de recursos. Recomenda-se capacitação contínua dos ACS e integração de técnicas geoespaciais nas estratégias de vigilância em saúde para controle da hanseníase em regiões endêmicas.

Palavras-chave: Hanseníase. Agentes Comunitários de Saúde. Análise Espacial. Detecção Precoce. Saúde Pública.

RESUMEN

Objetivo: Evaluar la eficacia de los agentes comunitarios de salud (ACS) en la identificación de casos sospechosos de lepra en zonas de riesgo, utilizando el análisis espacial como herramienta de apoyo en el municipio de Santarém, Pará. Métodos: Estudio transversal, descriptivo y cuantitativo, realizado entre junio y octubre de 2019. Se incluyeron 24 ACS de Unidades Básicas de Salud (UBS) ubicadas en zonas de bajo, medio y alto riesgo de lepra, identificadas mediante análisis espacial de datos del Sistema de Información de Agravos

de Notificación (SINAN, 2006-2014). Los ACS recibieron formación sobre la lepra y aplicaron cuestionarios de sospecha durante las visitas domiciliarias (VD). Los datos se analizaron estadísticamente y se georreferenciaron en QGIS. Resultados: El 83 % de los ACS reconocieron la lepra como una enfermedad infecciosa contagiosa, pero solo el 50 % demostraron conocimientos sobre la transmisión y la vigilancia de los contactos. Durante las VD, se identificaron 19 casos sospechosos, 17 de ellos con manchas cutáneas y 13 con alteraciones neurológicas (dolor, entumecimiento, hormigueo). El análisis espacial reveló una distribución heterogénea de la lepra, con tasas de detección que variaban entre los sectores censales, y destacó la ubicación no estratégica de algunas UBS, lo que limitaba el acceso de la población. Conclusión: A pesar de las lagunas en el conocimiento sobre la transmisión y la vigilancia, los ACS fueron eficaces en la detección de casos sospechosos, lo que reforzó su papel en la ampliación de la capilaridad del sistema de salud. El análisis espacial resultó esencial para identificar áreas prioritarias y optimizar la asignación de recursos. Se recomienda la formación continua de los ACS y la integración de técnicas geoespaciales en las estrategias de vigilancia sanitaria para el control de la lepra en regiones endémicas.

Palabras clave: Lepra. Agentes comunitarios de salud. Análisis espacial. Detección precoz. Salud pública.

INTRODUCTION

Leprosy is a chronic, infectious-contagious disease caused by *Mycobacterium leprae*, which mainly affects peripheral nerves and skin, and can lead to physical deformities and social stigma (REIBEL; CAMBAU; AUBRY, 2015). Despite advances in control, the disease persists as a public health problem, especially in countries such as India, Brazil, and Indonesia, which account for 80% of global cases (WORLD HEALTH ORGANIZATION, 2018).

In Brazil, leprosy has an uneven distribution, with higher detection coefficients in the North, Northeast and Midwest regions (FREITAS; DUARTE; GARCIA, 2017). This regional asymmetry is even more evident in the state of Pará, which stands out as one of the most endemic areas, with rates three times higher than the national average (BARRETO et al., 2014).

In view of this scenario, the Ministry of Health (BRASIL, 2018) emphasizes that early diagnosis and timely treatment are fundamental strategies to interrupt the chain of transmission and prevent disabilities. In this context, Community Health Agents (CHA) play a crucial role, as they act at the interface between the community and health services, facilitating the identification of suspected cases and adherence to treatment (SANTOS; PIERANTONI; SILVA, 2010). However, studies point to gaps in the knowledge of these professionals about clinical and epidemiological aspects of leprosy, which can compromise its effectiveness (ANDRADE et al., 2011).

Spatial analysis emerges as a promising tool to improve health surveillance, allowing the identification of risk areas and the strategic allocation of resources (SOUZA et al., 2018). In Santarém, Pará, the heterogeneous distribution of leprosy and the insufficient coverage of the Family Health Strategy (FHS) reinforce the need for innovative approaches to control the disease (MARCIANO et al., 2018).

This study aimed to evaluate the role of CHAs in the detection of suspected cases of leprosy, using spatial analysis to identify priority areas in Santarém. The central hypothesis is that the integration between the work of the CHAs and geospatial techniques can enhance active surveillance and contribute to the elimination of leprosy as a public health problem.

METHODOLOGY

TYPE OF STUDY

To achieve the proposed objectives, a cross-sectional, descriptive and quantitative study was carried out, developed from June to October 2019 in the municipality of Santarém, Pará.

The study was conducted in the urban area of Santarém, the third largest municipality in Pará, with 294,580 inhabitants (IBGE, 2010). For the selection of participants, 24 active Community Health Agents (CHA) from Basic Health Units (BHU) located in areas classified as low, medium and high risk for leprosy were included through spatial analysis. It is worth noting that the inclusion criteria included: CHAs working in the selected UBS and who signed the Informed Consent Form (ICF).

DATA COLLECTION

Initially, epidemiological data from leprosy cases reported in the Notifiable Diseases Information System (SINAN) between 2006 and 2014 were used. Subsequently, the georeferencing of these cases was carried out using the Quantum GIS (QGIS) software, which allowed the calculation of the detection rates by census tract. In addition, the CHAs received 40 hours of training on leprosy, and pre- and post-test questionnaires were applied to assess the knowledge acquired.

During the home visits (HV), the CHAs applied a standardized leprosy suspicion questionnaire, which contained 16 questions about signs and symptoms of the disease. It should be noted that the suspected cases identified were referred for medical evaluation. At the same time, the areas covered by the UBS were mapped in order to analyze their relationship with the spatial distribution of cases.

DATA ANALYSIS

The data were analyzed through descriptive statistics, with calculation of frequencies and percentages, using Microsoft Excel 2019®. Regarding the spatial data, these were processed in QGIS, where thematic maps were generated to visualize the risk areas. Finally, the performance of the CHAs in detecting cases was correlated with the detection rates by area, which made it possible to evaluate the effectiveness of the strategy.

ETHICAL ASPECTS

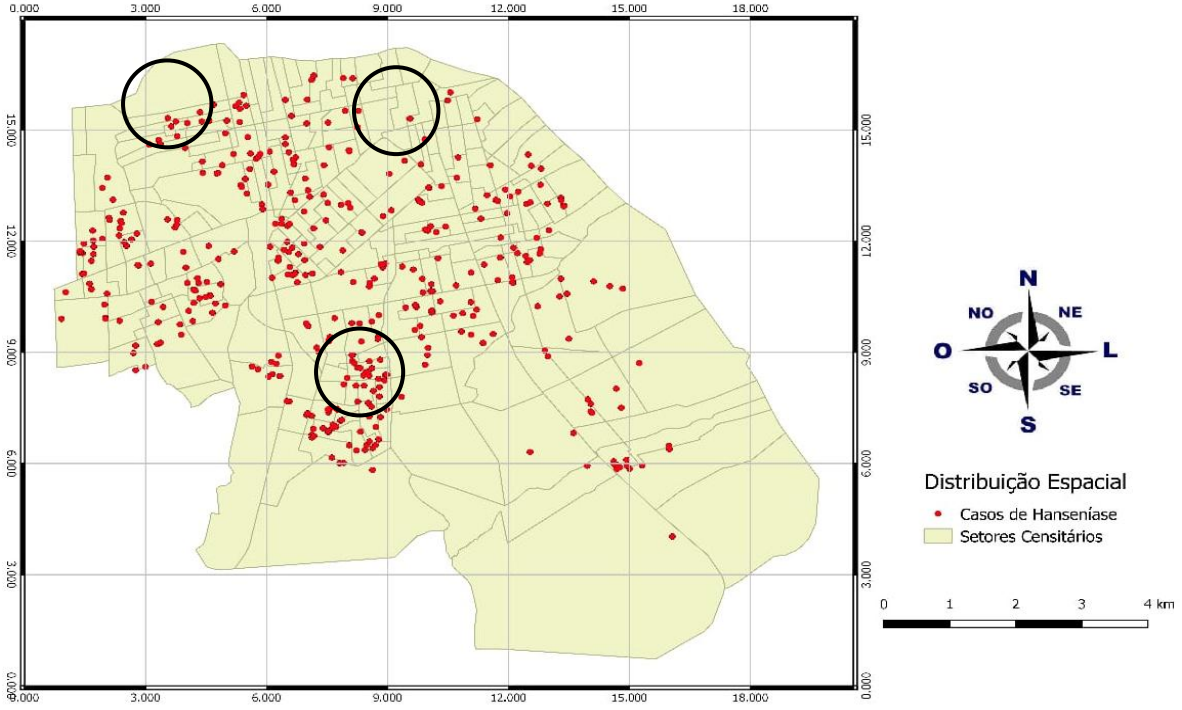
The study was approved by the Research Ethics Committee of the State University of Pará (Opinion No. 6.116.994, CAAE: 70318423.2.0000.5168), and was conducted in accordance with Resolution No. 466/2012 of the National Health Council (BRASIL, 2012).

RESULTS

The municipality of Santarém has 48 neighborhoods and 26 UBS with 43 ESF. Considering the urban population of the 2010 census, of 215,790 inhabitants, only 59.78% of the population is covered by the FHS.

The map in Figure 2 shows the spatial distribution of the cases notified by SINAN during the study period by urban census tracts of the municipality. A total of 311 cases of the disease were georeferenced, which corresponds to 83% of the leprosy cases residing in the urban area of Santarém, with a loss of 66 total cases due to inconsistency of addresses, which represents 17% of the cases in the urban area. To identify and classify hyperendemic census tracts, the mean detection rates (mean detection rate = number of cases in each census tract / Population of each census tract X 100,000) per tract were calculated. Based on this result, the UBS that are located in the zones of high, medium and low degree of leprosy detection were identified, and it was possible to select a UBS in each detection zone to apply the training, as can be seen in the map in Figure 3.

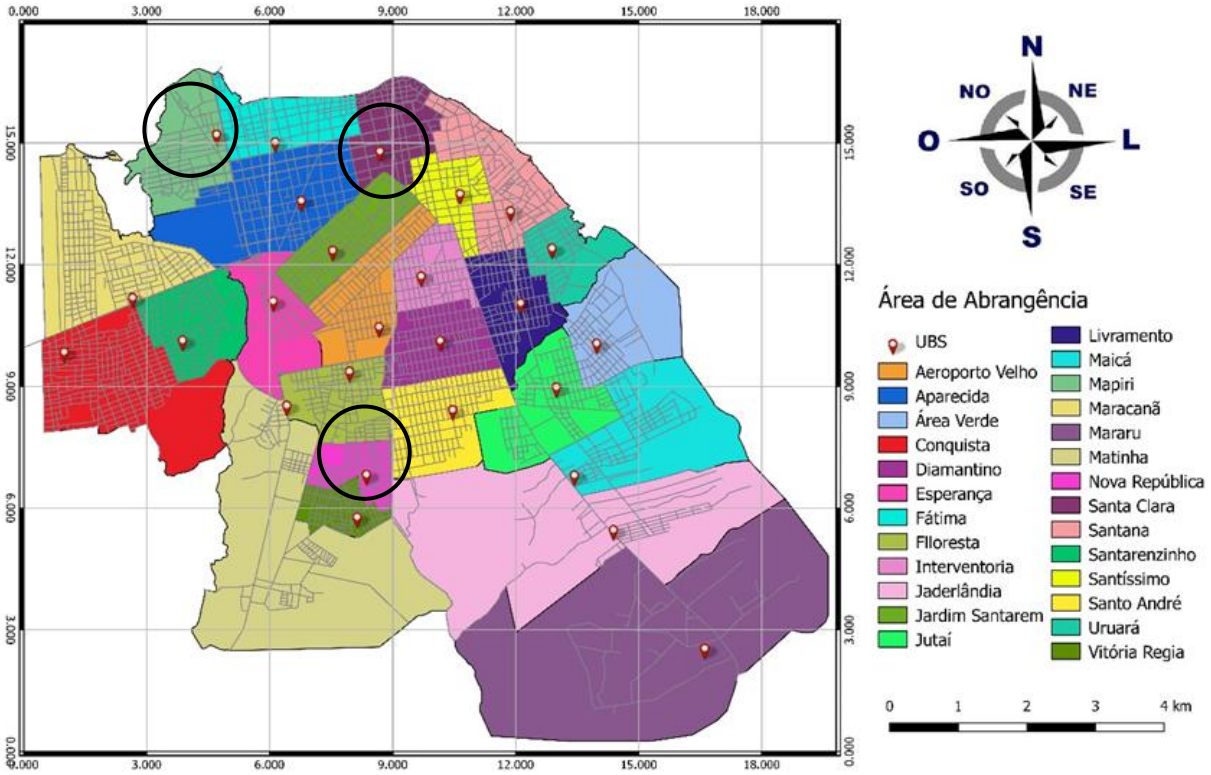
Figure 2. Spatial distribution of leprosy cases by census tracts and in the circle the location of the basic health units selected for the training of community health agents, in the Municipality of Santarém-Pará, Brazil, 2019.



Source: Prepared by the authors.

Figure 3 shows the urban area of Santarém and the distribution of the 26 UBS with their respective areas of coverage. The circles show the identification of the UBS located in areas of high, medium and low degree of detection of leprosy. The UBS of Nova República is located in a high-risk area, the Mapiri/Liberdade unit in the medium area and the Santa Clara unit in a low-risk area for leprosy.

Figure 3. Distribution of basic health units (UBS) in the urban area according to their areas of coverage and location and in the circle of UBS selected for the training of community health agents, in the Municipality of Santarém-Pará, Brazil, 2019.



Source: Prepared by the authors.

After the identification and selection of the UBS (Figure 3), training on the disease studied was carried out for the CHAs of the UBS of Santa Clara (ESF I), Mapiri/Liberdade (ESF I/II) and Nova República (ESF I/II). The profile of the CHAs selected for the training identified that of the 24 (100%) participants in the study, 22 (92%) were female. The main age group of these CHAs was 31 to 60 years old, with 19 (79%) CHAs compared to the age group of 20 to 30 years old, with 3 (13%) CHAs and over 60 years old, 2 (8%) CHWs. Regarding education, 9 (38%) had completed high school, 2 (8%) had completed elementary school, 8 (33%) had incomplete university education, and 4 (17%) had already completed higher education. With regard to length of service, it was found that 6 (25%) had worked as CHAs for a period of up to five years and 18 (75%) had been in the FHS for more than five years. During the training of the 24 CHAs, it was found that 20 (83%) stated that they had received training on leprosy and 4 (17%) had not.

Table 1 refers to the application of the pre- and post-test during the training of the CHAs regarding the general aspects (the disease), diagnosis, transmission, treatment and surveillance of contacts. It can be seen that in the general aspects of leprosy, the CHAs recognized the disease as being infectious-contagious, with slow and chronic evolution and transmitted by *Mycobacterium Leprae,* 66% in the pre-test and 83% in the post-test. Regarding signs and symptoms, most of them recognized as whitish, reddish spots,

thickening of peripheral nerves with altered sensitivity and muscle strength, totaling 91% in the pre-test and 100% in the post-test. Regarding the clinical forms of leprosy, 56% in the pre-test and 100% in the post-test recognized the indeterminate, tuberculoid, dimorphic and virchowian forms of the disease and that the patients classified as multibacillary have the disseminating forms of the disease.

Regarding transmission, 54% of the CHAs in the pre-test and 91% in the post-test recognized that the main route of transmission of leprosy is the upper airways. In the case of the main diagnostic methods, 75% of the pre-test and 95% of the post-test recognized the clinical examination of the lesions and nerves, sputum smear microscopy, and biopsy as being diagnostic of the disease. Regarding treatment, almost all CHAs in the pre-test 95% and 100% in the post-test recognized the treatment being performed with the use of oral drugs (Multidrug Therapy – MDT) in a supervised manner. Regarding contact surveillance, 50% of the CHAs in the pre-test and 50% in the post-test recognized the home as the most likely place of infection and the components of contact surveillance as being: dermatoneurological examination, recommendation of BCG vaccine and health education actions.

Table 1- Knowledge about leprosy by Community Health Agents (CHA) in Santarém-Pará, Brazil, 2019.

Knowledge about leprosy	Pretest ***n*** (24)%	Test ***n*** (24) %
What is Leprosy	66	83
Signs and symptoms of leprosy	91	100
Clinical forms of leprosy	56	100
Route of transmission of leprosy	54	91
Diagnostic methods for leprosy	75	95
Treatment of leprosy	95	100
Contact Surveillance	50	50

Source: Prepared by the authors

Table 2 shows the result of the active search, carried out by the CHAs after training, for the discovery of suspected cases of leprosy with the application of the suspicion questionnaire in their coverage areas during the Home Visit (HV). Of the 19 suspected cases, distributed by FHS, there was a predominance of the presence of skin spots in 18 of the completed questionnaires, 13 also reported neurological alterations such as pain, numbness, tingling, etc., and two cases were discarded from suspicion because they informed that the spot was from birth, resulting in a total of 17 suspected cases.

Table 2 - Number of suspected cases by Family Health Strategy (FHS) of the Basic Health Units (UBS) Mapiri/Liberdade, Nova República and Santa Clara, after application of the suspicion questionnaire by community health agents during the home visit (HV), from September to October 2019 in Santarém-Pará, Brazil, 2019.

Signs and Symptoms	**Family Health Strategy**

	Basic Health Unit		
	Mapiri/ Freedom	**New Republic**	**Santa Clara**
Do you feel numbness in your hands and/or feet?			
Tingling?		1	
Sensation of stings or needles?			
Cramps?		2	
Numb areas on the skin?			1
Skin blemishes?	3	10	
Loss of eyelashes or eyebrows?			
Is the change from birth?			2
Total Suspects	**3**	**13**	**1**

Source: Prepared by the authors

DISCUSSION

The results of this study demonstrated that the Community Health Agents (CHA) had a satisfactory knowledge about the clinical signs of leprosy, although important gaps persist regarding the mechanisms of transmission and surveillance of contacts. This finding corroborates the studies by Andrade et al. (2011) and Silva, Ribeiro and Oliveira (2016), who also identified deficiencies in the CHAs' knowledge of epidemiological aspects of the disease.

Regarding the effectiveness of the active search, the CHAs identified 17 suspected cases during home visits, which reinforces their strategic role in early detection, as recommended by the Ministry of Health (BRASIL, 2018). However, the difficulty in recognizing multibacillary cases can be compared to the results of Marciano et al. (2018), who evidenced the need for continuous training of these professionals.

Regarding the spatial analysis, the thematic maps not only confirmed the heterogeneity in the distribution of leprosy in Santarém, but also revealed the non-strategic location of some UBS. This result is in line with the observations of Souza et al. (2018), who highlighted the importance of geoprocessing for health planning. It is worth noting that the overlap between areas of high detection and regions with low FHS coverage, as pointed out by Barreto et al. (2014), suggests failures in the allocation of resources.

In the context of contact surveillance, only 50% of the CHAs demonstrated adequate knowledge, which contrasts with the recommendations of the National Leprosy Control Program (BRASIL, 2018). This data is alarming, because, according to Romanholo et al. (2018), contact surveillance is essential to interrupt the chain of transmission.

Finally, the refusal of some families to participate in the research highlights the persistent stigma associated with the disease, as described by Bernardes Filho et al. (2021). In view of this, it is suggested that educational actions not only focus on the CHAs, but also on the community, as proposed by Santos, Pierantoni and Silva (2010).

CONCLUSION

This study reveals a complex but promising scenario in the fight against leprosy in endemic areas. Community Health Agents emerge as key players in this process, demonstrating the ability to identify suspected cases during their home visit routines. However, it is observed that its potential could be even greater if it were not for the gaps in knowledge about crucial aspects of the disease, such as the mechanisms of transmission and the importance of contact surveillance.

Spatial analysis emerges as a fundamental ally in this battle, unveiling hidden patterns in the distribution of the disease and pointing out flaws in the organization of health services. The maps produced are not mere geographical representations, but true guides for action, showing where and how we should focus our efforts.

The suspected cases identified by CHWs during the study are more than numbers – they represent missed opportunities for early diagnosis that can now be corrected. Each skin spot discovered, each report of tingling or loss of sensation recorded, is a step towards interrupting the chain of transmission.

The path to follow becomes clear: it is necessary to invest in the continuous training of these health agents, to provide them with precise tools for spatial analysis and, above all, to work to overcome the stigma that still surrounds leprosy. Communities need to be partners in this process, understanding that early diagnosis is the key to avoiding sequelae and stopping the spread of the disease.

This research shows that when technical knowledge, innovative tools, and community work align, we create a powerful network to tackle leprosy. The results presented here are not an end point, but an invitation for managers, health professionals and the community to move forward together towards a future where this disease is no longer a public health problem.

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