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ORIGINAL ARTICLE

SOCIODEMOGRAPHIC, CLINICAL AND GEOSPATIAL PROFILE OF NEW LEPROSY CASES DIAGNOSED AT LAURO DE SOUZA LIMA INSTITUTE, BAURU, SÃO PAULO, BETWEEN 2015 AND 2019

PERFIL SOCIODEMOGRÁFICO, CLÍNICO E GEOESPACIAL DE CASOS NOVOS DE HANSENÍASE DIAGNOSTICADOS NO INSTITUTO LAURO DE SOUZA LIMA, BAURU, SÃO PAULO, ENTRE 2015 E 2019

PERFIL SOCIODEMOGRÁFICO, CLÍNICO Y GEOSPACIAL DE LOS NUEVOS CASOS DE LA LEPRA DIAGNÓSTICOS EN INSTITUTO LAURO DE SOUZA LIMA, BAURU, SÃO PAULO, ENTRE 2015 Y 2019

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ABSTRACT

Although Brazil has shown a considerable reduction in the number of new cases of leprosy, some studies have shown active transmission even in non-endemic areas, such as São Paulo state. Considering this, we investigated the sociodemographic, clinical, and geospatial profile of new cases of leprosy diagnosed between 2015 and 2019 at the Lauro de Souza Lima Institute (ILSL) a reference center localized in Bauru, a municipality in the interior of São Paulo state. A total of 177 new cases of leprosy were

diagnosed in this period, with 61.6% of the patients born in the state. Most of the individuals were male (59.9%), the most prevalent age group was 60 to 69 years old, 79.1% declared themselves white color/race and 65.6% had little or no schooling. The borderline form of leprosy was the most frequent (42.4%), slit skin smear was positive in 38.4% of patients (49.0% among men and 22.5% among women) and 49.0% had disabilities at diagnosis. Georeferencing, performed for cases from the municipality of Bauru (n = 31), revealed that most patients lived in regions with a high level of social vulnerability. The profile of leprosy new cases found at ILSL pointed to a predominance of adult or elderly men with low education, multibacillary, presenting physical disabilities and a long time of symptoms. Altogether, our data suggests a delay in diagnosis that may contribute to the maintenance of leprosy transmission even in a non-endemic region.

Keywords: *Leprosy. Descriptive epidemiology. Geographic mapping.*

RESUMO

Embora o Brasil venha apresentando uma redução considerável no número de casos novos de hanseníase, alguns estudos têm demonstrado transmissão ativa mesmo em áreas não endêmicas, como o estado de São Paulo. Diante disso, investigamos o perfil sociodemográfico, clínico e geoespacial dos casos novos de hanseníase diagnosticados entre 2015 e 2019 no Instituto Lauro de Souza Lima (ILSL), um centro de referência localizado no município de Bauru, interior do estado de São Paulo. Foram diagnosticados 177 novos casos de hanseníase nesse período, sendo 61,6% dos pacientes naturais do estado. A maioria dos indivíduos era do sexo masculino (59,9%) e a faixa etária mais prevalente foi de 60 a 69 anos; 79,1% se autodeclaravam brancos e 65,6% possuíam pouca ou nenhuma escolaridade. A forma clínica dimorfa foi a mais frequente (42,4%), a baciloscopia foi positiva em 38,4% dos pacientes (49,0% entre o sexo masculino e 22,5% entre o sexo feminino) e 49,0% dos pacientes possuíam incapacidades no diagnóstico. O georreferenciamento, realizado para os casos oriundos do município de Bauru (n = 31), revelou que a maioria dos pacientes residia em regiões com elevado nível de vulnerabilidade social. O perfil dos pacientes atendidos no ILSL apontou para predominância de homens adultos ou idosos com baixa escolaridade, multibacilares, apresentando incapacidades físicas e longo tempo de sintomas. Em conjunto, nossos dados sugerem atraso no diagnóstico que pode contribuir para a manutenção da transmissão

da hanseníase mesmo numa região não endêmica.

Palavras-chave: *Hanseníase. Epidemiologia descritiva. Mapeamento geográfico.*

RESUMEN

Aunque Brasil ha mostrado una reducción considerable en el número de casos nuevos de la lepra, algunos estudios han demostrado transmisión activa incluso en áreas no endémicas, como el estado de São Paulo. Así, investigamos el perfil sociodemográfico, clínico y geoespacial de los nuevos casos de la lepra diagnosticados entre 2015 y 2019 en el Instituto Lauro de Souza Lima (ILSL), centro de referencia ubicado en el municipio de Bauru, en el interior del estado de São Paulo. Durante este período se diagnosticaron 177 nuevos casos de lepra, siendo el 61,6% de los pacientes nacidos en el estado. La mayoría de los individuos eran del sexo masculino (59,9%) y el grupo de edad más prevalente fue de 60 a 69 años; El 79,1% se declaró blanco y el 65,6% tenía poca o ninguna educación. La forma clínica dimorfa fue la más frecuente (42,4%), la baciloscopía fue positiva en el 38,4% de los pacientes (49,0% en el sexo masculino y 22,5% en en el femenino) y el 49,0% de los pacientes tenían discapacidad en el diagnóstico. La georreferenciación, realizada para los casos del municipio de Bauru (n = 31), reveló que la mayoría de los pacientes residió en regiones con un alto nivel de vulnerabilidad social. El perfil de los pacientes atendidos en el ILSL apuntó a un predominio de hombres adultos o ancianos con baja escolaridad, multibacilares, con discapacidades físicas y con largo tiempo de síntomas. En conjunto, nuestros datos sugieren un retraso en el diagnóstico que puede contribuir al mantenimiento de la transmisión de la lepra incluso en una región no endémica.

Palabras clave: *Lepra. Epidemiología descriptiva. Cartografía geográfica.*

INTRODUCTION

Leprosy is a neglected tropical disease (NTD), found in more than 120 countries, and affects over 200,000 people every year in the world[1]. Clinical manifestations present a broad spectrum depending on the immune response against *Mycobacterium leprae*[2]. Patients with a high bacillary load called Multibacillary (MB), present clinical forms borderline and lepromatous, while individuals who carry few or undetectable bacilli are called Paucibacillary (PB) and manifest the indeterminate or tuberculoid forms[2,3].

M. leprae affects mainly the peripheral nerves but can also colonize the skin and mucous membranes. The main symptoms are skin lesions with loss of thermal, painful, and tactile sensitivity[4]. Since it affects the peripheral nerves, this disease leads to deformities and physical disabilities when the diagnosis is late[5]. Thus, due to its disabling potential, leprosy is an important public health problem, especially in developing countries, as it directly affects the patients' quality of life, enhancing socioeconomic problems, which already occur in these countries[6].

Brazil ranks in second as the country with the highest number of new reported cases of leprosy[7]. In the year of 2019, the country registered 27,864 new leprosy cases, with a prevalence rate of 1.50/10,000 inhabitants, higher than the rate predicted by World Health Organization (WHO) as the elimination goal (1/10,000 inhabitants)[8]. Brazil also presents a great spatial diversity of the disease due to differences in socioeconomic, sociocultural, and environmental realities, giving the disease particular characteristics depending on the location where it is found, mainly due to political differences and access to health services[9,10]. In São Paulo state, for example, leprosy is less frequent, with 1,185 new cases in 2019, with a prevalence rate of 0.36/10,000 inhabitants[8]. On the other hand, states such as Mato Grosso, Maranhão, Pará and Pernambuco are considered endemic regions with a high number of new cases[8].

Epidemiological differences are also aggravated by vulnerabilities of Basic Health Units, which are responsible for combating and controlling the disease, therefore, constant surveillance of leprosy in Brazil is extremely important, even in non-endemic regions[11,12]. In this scenario, reference centers play an important role, providing specialized assistance to patients, helping to identify and monitor leprosy, and training professionals for the effective detection of leprosy and its complications. In addition,

they carry out basic and applied research that leads to advances in leprosy understanding and consequent improvement in its management[13,14]. Data obtained in reference centers allow knowing the clinical and epidemiological profile of patients, providing evidence for the establishment of public policies and direction of actions to control and eliminate leprosy[15-18].

Establishing this, the present study aimed to investigate the sociodemographic, clinical and geospatial profile of new leprosy cases diagnosed between the years 2015 to 2019 in Lauro de Souza Lima Institute (ILSL), a reference center in leprosy located in Bauru, interior of the state of São Paulo.

METHODOLOGY

This is a retrospective cross-sectional epidemiological study based on secondary data from new leprosy cases diagnosed in ILSL, from January 1st, 2015 to December 31st, 2019. ILSL is a research institute located in the city of Bauru, São Paulo, and it's linked to the State Department of Health of São Paulo, providing tertiary care for highly complex cases in sanitary dermatology and leprosy. Patients are referred by the public services of Primary Health Care (PHC) and, regarding leprosy, they have specialized services for laboratory diagnosis, physiotherapy, rehabilitation, and disability prevention[19].

Data collection and statistical analysis

Inclusion criteria: all new leprosy cases diagnosed in ILSL during the period from January 2015 to December 2019 were included in the study. Exclusion criteria: patients who arrived with a confirmed diagnosis of the disease to treat complications and/or sequelae were excluded from the analysis.

Clinical, epidemiological, demographic and laboratory data were collected using a specific form prepared by the research group, which included variables such as age, sex, race/skin color, marital status, full address, date of diagnosis, operational classification (MB and PB), clinical form and results of following laboratory tests: blood count, biopsy, bacilloscopy, anti-PGL-I and Mitsuda reaction. All data were collected through analysis of medical records in the Medical Archives and Statistics Sector (SAME) of ILSL. Results were recorded in Microsoft Excel spreadsheets and analyzed using Epi Info™ statistical software.

Absolute and relative frequencies were used to describe the variables. Chi-square test was used to verify differences between genders. Values of $p < 0.05$ were considered statistically significant.

Spatial analysis

For georeferencing, Shapefiles (graphic base for cartography) were imported from the Brazilian Institute of Geography and Statistics (IBGE) with limits of all Brazilian states, Regional Health Departments (DRS) of São Paulo state and the municipality of Bauru, SP[20]. Addresses were transformed into geographic coordinates with Google Earth Pro software. The geographic coordinates were then incorporated into the Open Source version of QGIS Software 3.14 Pi, for geospatial analysis. Three methodologies were used in the analysis: (I) graduated layout representation, (II) flow analysis and (III) points distribution.

Schematic maps allow the visualization of different aspects of geospatial space by graduation, while flow representation allows identifying the volume of "traffic" or "circulation" of a population under study[21,22].

The distribution point analysis was performed only with patients residing in the city of Bauru, SP, where the neighborhoods were characterized according to the São Paulo Social Vulnerability Index (SoVI). SoVi subdivides neighborhoods with at least 50 permanent private residences into one of six groups that classify situations of lesser or greater vulnerability[23].

Ethical considerations

This study was previously submitted for approval by the Research Ethics Committee of ILSL (approval number 4,289,054), with the researchers commitment to maintain the anonymity of all participants, as well as the data confidentiality, respecting the norms of National Health Council for research involving human beings (Res. CNS 466/12).

RESULTS

From 2015 to 2019, 177 new leprosy cases were diagnosed in ILSL. Of these, 106 (59.9%) were male and 71 (40.1%) were female, and 38.4% of the patients were from other states. The year of 2017 had the highest number of diagnoses with notification of 41 new cases

(23.16%), although, in general, the total number of cases showed little variation over the years (Figure 1).

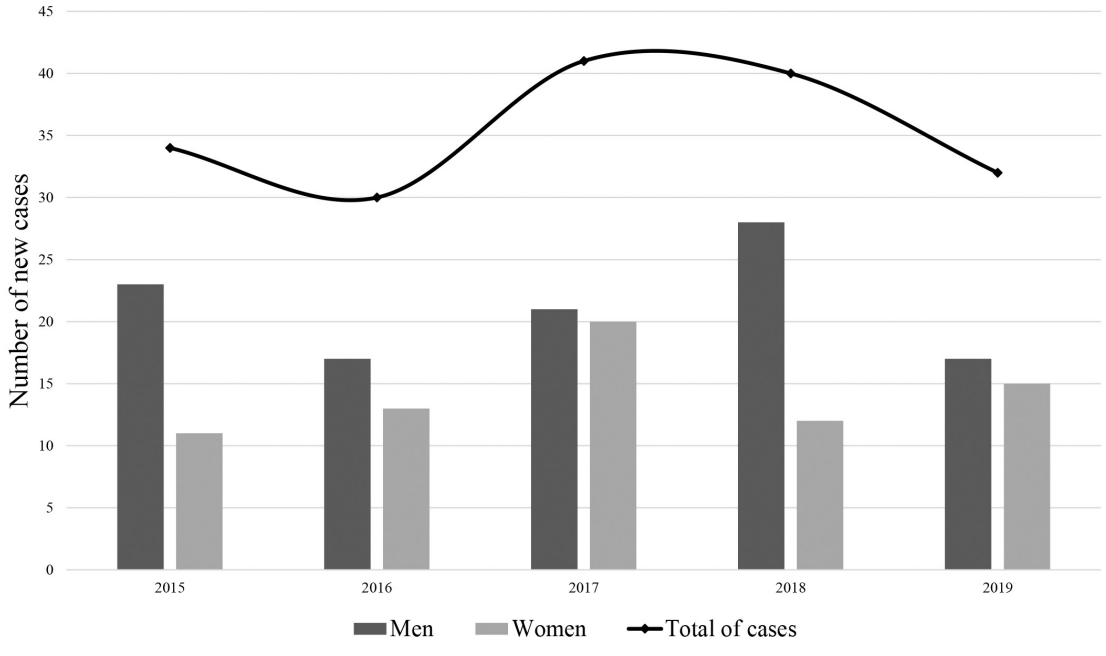
The most prevalent age group was between 60 and 69 years old, regardless of gender (Figure 2). Five cases were diagnosed in individuals under fifteen years old, 2 males (4 and 7 years old) and 3 females (5, 6 and 14 years old).

Sociodemographic and clinical profile of the patients is summarized in Table 1, in which 79.1% declared themselves to be white, 53.7% were married or in a stable relationship, 65.6% had low education (no formal education or primary education incomplete) and 94.9% lived in urban areas. Considering work activity, we found that the majority were employed (69.2%) and that there was great diversity in the occupations carried out. Hypertension was the most frequent comorbidity, affecting 23.7% of patients. In all these reported aspects, no significant differences were observed between genders.

As life habits, smoking habit and alcohol consumption were analyzed. Although most did not provide this information during anamnesis, we found 11.8% of alcohol consumption and 10.7% of smoking among patients, with alcohol consumption being more prevalent among males ($p < 0.05$).

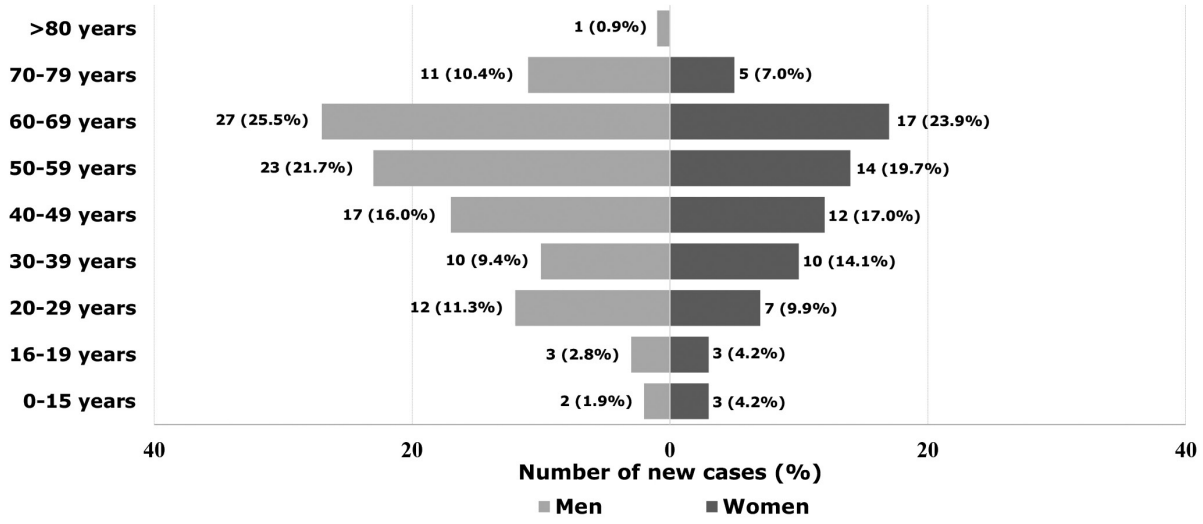
Women had more known leprosy cases in the family, with parents and partners being the main household contacts ($p < 0.05$). Time

Figure 1 – Absolute frequency of new leprosy cases diagnosed in Lauro de Souza Lima Institute from 2015 to 2019.



Souce: Elaborated by the authors.

Figure 2 – Age pyramid of new leprosy cases diagnosed in Lauro de Souza Lima Institute from 2015 to 2019.



Souce: Elaborated by the authors.

elapsed between the onset of symptoms and diagnosis was 6 to 24 months in 32.7% of cases and 0 to 6 months in 25.9% of patients. The most common clinical complaint was the presence of patches and/or lesions on the skin (62.1%), followed by paresthesia (42.9%) and loss of sensitivity (16.3%).

According to Madrid classification (1953)[3], the borderline form was predominant, corresponding to 42.4% of the total number of cases, followed by lepromatous (28.2%); although the latter was more frequent in males, the difference was not significant. In 80.8% of patients, the therapeutic scheme used was the multibacillary multidrug therapy (MDT-MB).

The occurrence of reverse reaction (RR) at the time of diagnosis was observed in 31.6% of the patients, while erythema nodosum leprosum (ENL) was observed in 4.5% of the individuals, and 47.4% of the patients did not present any type of reaction. The presence of grade 1 disability was verified in 32.7% of diagnoses and grade 2 was observed in 16.3%, while 24.2% had no physical disabilities.

The bacilloscopy of the slit-skin smear was positive in 38.4% of patients, and among males it was positive in 49.0%. In the same way, there was a predominance of positive bacilloscopic index in male biopsies. Anti-PGL-I antibodies were detected in 27.1% of the patients, while Mitsuda reaction was positive in 41.8% of the cases.

Table 1 – Epidemiological profile of patients diagnosed with leprosy from January 2015 to December 2019 in Lauro de Souza Lima Institute (n = 177).

Characteristics	Male (n = 106)	Female (n = 71)	*p value*	Total (n = 177)
Race/Ethnicity (self-declared)				
White	85 (80.2%)	55 (77.5%)	*p > 0.05*	140 (79.1%)
Black	9 (8.5%)	9 (12.7%)		18 (10.1%)
Mestizo	11 (10.4%)	5 (7.0%)		16 (9.0%)
NI	1 (0.9%)	2 (2.8%)		3 (1.7%)
Marital status				
Married/Common-law marriage	57 (53.7%)	38 (53.5%)	*p > 0.05*	95 (53.7%)
Divorced/Separated	26 (24.5%)	19 (26.7%)		45 (25.4%)
Single	15 (14.1%)	6 (8.4%)		21 (11.9%)
Widower	8 (7.5%)	7 (9.8%)		15 (8.5%)
NI	–	1 (1.4%)		1 (0.5%)
Education status				
Illiterate/Incomplete Elementary School	72 (67.8%)	44 (61.9%)	*p > 0.05*	116 (65.6%)
Complete Elementary School / Incomplete High School	16 (15.0%)	12 (16.8%)		28 (15.8%)
Complete High School /Incomplete Higher Education	13 (12.2%)	10 (14.0%)		23 (12.8%)
Complete Higher Education	4 (3.7%)	2 (2.8%)		6 (3.4%)
NI	1 (0.9%)	3 (4.2%)		4 (2.2%)
Residence Area				
Urban	101 (95.2%)	67 (94.3%)	*p > 0.05*	168 (94.9%)
Rural	5 (4.7%)	4 (5.6%)		9 (5.1%)
Occupation				
Retiree	26 (24.5%)	11 (15.4%)		37 (20.9%)
Domestic Skills	–	27 (38.0%)		27 (15.2%)
Unemployed	13 (12.2%)	4 (5.6%)		17 (9.6%)
Provision of Services	11 (10.3%)	2 (2.8%)		13 (7.3%)
Agricultural Worker	9 (8.4%)	3 (4.2%)		12 (6.7%)
Construction	10 (9.4%)	–		10 (5.6%)
Industrial Sector	7 (6.6%)	1 (1.4%)		8 (4.5%)
Student	2 (1.8%)	5 (7.0%)		7 (4.0%)
Driver	7 (6.6%)	–		7 (4.0%)
Civil Servant	3 (2.8%)	3 (4.2%)		6 (3.4%)

Characteristics	Male (n = 106)	Female (n = 71)	*p value*	Total (n = 177)
Occupation				
Commerce	4 (3.7%)	–		4 (2.2%)
Domestic Employee	–	4 (5.6%)		4 (2.2%)
Food Sector	14 (13.1%)	9 (12.6%)		23 (13.0%)
NI	–	2 (2.8%)		2 (1.1%)
Comorbidities				
Hypertension	26 (24.5%)	16 (22.5%)		42 (23.7%)
Diabetes Mellitus	9 (8.4%)	5 (7.0%)	*p > 0.05*	14 (7.9%)
Other Infectious Diseases	8 (7.5%)	2 (2.8%)		10 (5.6%)
Life habits				
Alcohol consumption				
Yes	19 (17.9%)	2 (2.8%)		21 (11.8%)
No	25 (23.5%)	23 (32.3%)	*p = 0.023*	48 (27.1%)
Former alcoholic	4 (3.7%)	–		4 (2.2%)
NI	58 (54.7%)	46 (64.7%)		104 (58.7%)
Smoking habit				
Yes	13 (12.2%)	6 (8.4%)		19 (10.7%)
No	29 (27.3%)	22 (30.9%)	*p > 0.05*	51 (28.8%)
Former smoker	8 (7.5%)	–		8 (4.5%)
NI	56 (52.8%)	43 (60.5%)		99 (55.9%)
Clinical complaint				
Patches and skin lesions	63 (59.4%)	47 (66.1%)		110 (62.1%)
Paresthesia	49 (46.2%)	27 (38.0%)		76 (42.9%)
Loss/decrease of sensitivy	12 (11.3%)	17 (23.9%)		29 (16.3%)
Pain	9 (8.4%)	4 (5.6%)		13 (7.3%)
Deformities	7 (6.6%)	3 (4.2%)	*p > 0.05*	10 (5.6%)
Loss of muscular strength	5 (4.7%)	2 (2.8%)		7 (3.9%)
Contact with leprosy patient	7 (6.6%)	11 (15.4%)		18 (10.1%)
Other Symptoms	19 (17.9%)	8 (11.2%)		27 (15.2%)
Symptom onset				
0 to 6 months	29 (27.3%)	17 (23.9%)		46 (25.9%)
6 to 24 months	39 (36.7%)	19 (26.7%)		58 (32.7%)
2 to 5 years	11 (10.3%)	10 (14.0%)	*p > 0.05*	21 (11.8%)
More than 5 years	12 (11.3%)	6 (8.4%)		18 (10.1%)
NI	15 (14.1%)	19 (26.7%)		34 (19.2%)

Characteristics	Male (n = 106)	Female (n = 71)	*p value*	Total (n = 177)
Leprosy family history				
No	51 (48.1%)	23 (32.3%)	*p = 0.006*	74 (41.8%)
Yes	32 (30.1%)	37 (52.1%)		69 (38.9%)
Parents	9 (8.4%)	9 (12.7%)		18 (10.1%)
Siblings	11 (10.4%)	1 (1.4%)		12 (6.7%)
Spouses	3 (2.8%)	7 (9.8%)		10 (5.6%)
Children	2 (1.8%)	5 (7.0%)		7 (3.9%)
Grandparents	2 (1.8%)	4 (5.6%)	*p = 0.018*	6 (3.4%)
Parents and Siblings	–	2 (2.8%)		2 (1.1%)
Other	5 (4.7%)	5 (7.0%)		10 (5.6%)
NI	–	4 (5.6%)		4 (2.2%)
NI	23 (21.6%)	11 (15.4%)		34 (19.2%)
Madrid Classification				
Indeterminate	1 (0.9%)	3 (4.2%)		4 (2.2%)
Tuberculoid	12 (11.3%)	12 (16.9%)		24 (13.5%)
Borderline	44 (41.5%)	31 (43.6%)	*p > 0.05*	75 (42.4%)
Lepromatous	36 (33.9%)	14 (19.7%)		50 (28.2%)
NI	13 (12.3%)	11 (15.5%)		24 (13.5%)
Therapeutic scheme				
MDT-MB (PQT-MB)	87 (82.0%)	56 (78.9%)		143 (80.8%)
MDT-PB (PQT-PB)	11 (10.4%)	12 (16.9%)	*p > 0.05*	23 (13.0%)
Other	2 (1.9%)	1 (1.4%)		3 (1.7%)
NI	6 (5.7%)	2 (2.8%)		8 (4.5%)
Leprosy reactions				
Reversal Reaction – RR (Type 1 reaction)	31 (29.2%)	25 (35.2%)		56 (31.6%)
Erythema Nodosum Leprosum - ENL (Type 2 reaction)	3 (2.8%)	5 (7.0%)	*p > 0.05*	8 (4.5%)
Non-reactional	55 (51.9%)	29 (40.8%)		84 (47.5%)
NI	17 (16.0%)	12 (16.9%)		29 (16.4%)
Grade of Disability				
Grade 0	28 (26.4%)	15 (21.1%)		43 (24.2%)
Grade 1	34 (32.0%)	24 (33.8%)	*p > 0.05*	58 (32.7%)
Grade 2	18 (16.9%)	11 (15.4%)		29 (16.3%)
NI	26 (24.5%)	21 (29.5%)		47 (26.5%)

Characteristics	Male (n = 106)	Female (n = 71)	*p value*	Total (n = 177)
Slit-skin smear bacilloscopy				
Positive	52 (49.0%)	16 (22.5%)		68 (38.4%)
Negative	17 (16.0%)	18 (25.3%)	*p = 0.004*	35 (19.7%)
NI	37 (34.9%)	37 (52.1%)		74 (41.8%)
Bacilloscopic index (Biopsy)				
1-2+	13 (12.3%)	9 (12.7%)		22 (12.4%)
3-4+	12 (11.3%)	6 (8.4%)		18 (10.2%)
5-6+	36 (34.0%)	11 (15.5%)	*p = 0.010*	47 (26.6%)
Negative	26 (24.5%)	32 (45.1%)		58 (32.8%)
NI	19 (17.9%)	13 (18.3%)		32 (18.1%)
Anti-PGL-I				
Positive	32 (30.2%)	16 (22.5%)		48 (27.1%)
Negative	56 (52.8%)	46 (64.8%)	*p > 0.05*	102 (57.6%)
NI	18 (17.0%)	9 (12.7%)		27 (15.2%)
Mitsuda Reaction				
Positive	40 (37.7%)	34 (47.8%)		74 (41.8%)
Dubious	7 (6.6%)	4 (5.6%)	*p > 0.05*	11 (6.2%)
Negative	30 (28.3%)	19 (26.7%)		49 (27.6%)
NI	29 (27.3%)	14 (19.7%)		43 (24.2%)

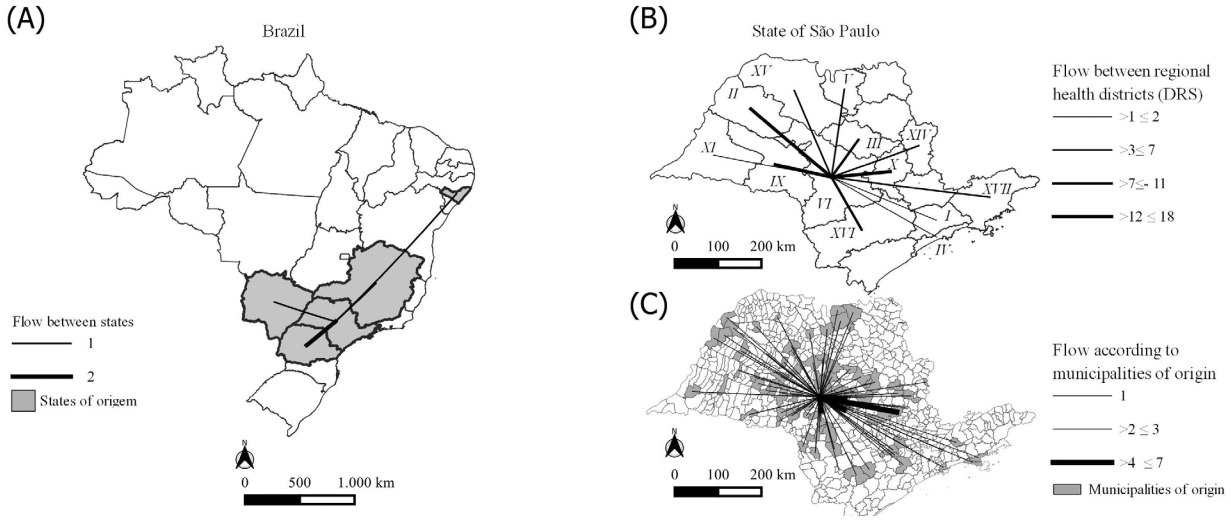
Subtitle: ENL – Erythema Nodosum Leprosum; NI – Not Informed; PQT-MB – Multibacillary Multidrug Therapy; PQT-PB – Paucibacillary Multidrug Therapy; RR – Reversal Reaction.

Source: Elaborated by the authors.

In geospatial analysis, it was observed that most cases diagnosed in ILSL resided in the state of São Paulo (172 cases – 97.18%) and 2 cases (1.13%) were from Paraná. The states of Minas Gerais, Mato Grosso do Sul and Alagoas had only 1 case each (0.56%) (Figure 3). Only the state of Alagoas is far from the state of São Paulo (about 2 thousand kilometers), the others border the state, with an average distance of around 500 kilometers between the place of residence and ILSL.

Eighty-one new cases (45.8%) were from Regional Health Department VI (DRS VI) in the state of São Paulo, which includes 68 municipalities, including Bauru, where ILSL is located (Figure 3). The average distance between the municipalities of origin and ILSL was around 120 kilometers. A considerable number of cases also came from Regional Health Department X (DRS X), Piracicaba region (16 new cases – 9.4%) and from Regional Health Department II (DRS II), Araçatuba region (12 new cases – 6.78%).

Figure 3 – Dynamics of patients flow in Lauro de Souza Lima Institute for leprosy diagnosis, considering the municipality of origin.



(A) Interstate Flow.
(B) Flow by Regional Health Department (DRS) and origin (I: Great São Paulo, II: Araçatuba, III: Araraquara, IV: Baixada Santista, V: Barretos, VI: Bauru, IX: Marília, X: Piracicaba, XI: Presidente Prudente, XIV: São José da Boa Vista, XV: São José do Rio Preto, XVI: Sorocaba and XVII: Taubaté).
(C) Flow according to the municipality of origin.

Source: Elaborated by the authors.

Among the new cases, 31 were residents of Bauru and were georeferenced (Figure 4). These patients were residents of the northwest region of the municipality, where the largest number of neighborhoods with high and very high social vulnerability are concentrated.

DISCUSSION

Since 2006, leprosy has been considered eliminated as public health problem in the state of São Paulo[24]. Although the detection rate has been falling in recent years[8], the number of new cases diagnosed in ILSL between 2015 and 2019 was higher than the cases observed between 2003 and 2007[25] (177 *versus* 167), suggesting the existence of operational weaknesses that make diagnosis difficult in the primary health care services. In this sense, our results showed that 70.6% of the patients had disseminated forms of the disease (borderline and lepromatous) and 49.0% had disabilities, data similar to those previously reported[25], and it also suggests late diagnosis. The delay of more than 24 months for diagnosis in 21.9% of individuals and the finding of leprosy in children under 15 years old (n = 5) corroborate

Figure 4 – Spatial distribution and flow of new leprosy cases in the municipality of Bauru, diagnosed in Lauro de Souza Lima Institute.

Source: Elaborated by the authors.

the existence of this worrying scenario that supports the maintenance of the transmission chain and raises concern about the possibility of the existence of a hidden endemic disease in the state of São Paulo. According to Opromolla *et al.*[26], this would happen by replacing active detection of cases by spontaneous demand, lack of knowledge of health professionals, or even by errors in diagnosis.

Regarding leprosy detection according to sex, data from the Ministry of Health, in the same time interval of our study, showed that 55.3% of diagnoses in Brazil were observed in male individuals, while in the state of São Paulo this percentage was 55.9%[8], similar to what was found in our study (59.9%) and also in other studies[25-27]. According to Nobre *et al.*[28], men may be more affected because they are more exposed to *M. leprae*, in fact, our data indicate a higher percentage of economic activity in males, as has been observed in the analysis of Brazilian workforce[29]. Furthermore, hormonal factors may favor the development of leprosy in males, since until adolescence the leprosy level is similar regardless of sex[28]. In this sense, our data demonstrate that lepromatous leprosy, the most disseminated form of the disease, was more frequent in males than in females (33.9%

versus 19.7%), also suggesting that hormonal factors may contribute to leprosy development in male population[28].

Considering these data, it is mandatory for leprosy programs to develop strategies aimed to male public for early diagnosis of leprosy, in addition to subsidizing actions to promote self-suspicion, although many authors have been warning about the fragility of the program in this matter[11,30-32].

In the spatial analysis, we verified that the patients flow to ILSL occurs at national, state and municipal levels. This is a pattern already observed in other diseases or medical services in Brazil and it reflects the demand for complex facilities or more specialized human resources[33]. In leprosy, however, it is recommended that the diagnosis is made in the Primary Care network and only complications are referred to reference centers[34]. The referral of suspected leprosy cases to reference centers raises the necessity to train Primary Care professionals, in order to accelerate the diagnosis and treatment, reducing the chance of complications, and avoiding the overload of reference services, contributing to the interruption of the transmission chain. It is important to point out that a flow of patients from municipalities on the northeast and north borders of the state of São Paulo was identified, regions identified in the study of Opromolla *et al.*[26] as areas with a greater potential for maintenance of the endemic disease. Rodrigues-Júnior *et al.*[35] evaluated the epidemiological situation of leprosy between 2004 and 2016 and observed that the same regions were identified with high disease detection rates. These areas have historically had high concentrations of leprosy cases, since the first census of patients in 1820, and, even today, transmission remains active in this part of the state, requiring further investigation in these municipalities to understand the factors that contribute to the maintenance of the disease. It is worth noting the proximity of these areas to the states of Minas Gerais and Mato Grosso do Sul, which have leprosy detection rates higher than those observed in São Paulo[8].

Another important observation in our study is that 38.4% of the patients were born in other states of Brazil, especially in the Northeast region, which leads us to ask whether the migration of endemic regions could contribute to the leprosy cases found in the State of São Paulo. In a study carried out in the state of Maranhão, Murto *et al.*[36] stated that migration would be an important factor in determining leprosy control. The latent symptomatology of the disease would be a facilitating factor for its spread, as well as the possibility of exposure of migrant individuals to financial instabilities

that result in low quality of life[36-37]. Nobre *et al.*[28] observed that part of the leprosy patients in the state of São Paulo were from the North, Northeast and Midwest regions of Brazil, which demonstrate a higher incidence of leprosy cases[8], and suggest the link between the increase in cases and migration.

Considering the municipality of Bauru, it was possible to verify the concentration of new cases in a region where neighborhoods with high and very high social vulnerability are concentrated, which, in addition to the high proportion of individuals with low education verified in our study, reinforces the fact that leprosy affects people from less favored social classes. Social vulnerability is an important element for leprosy transmission, as socioeconomic factors are intrinsically related to malnutrition, inaccessibility to public services, high population density and precarious housing conditions, influencing the individual's exposure and response to the disease agent[38-39], especially in the family nucleus, which is the main transmission nucleus[40]. Menezes *et al.*[41] described a similar situation in their study in the northern region of Rio de Janeiro, showing that most cases occurred in peripheral neighborhoods with precarious socioeconomic conditions; a similar scenario was also observed by Dias *et al.*[42]. The most vulnerable populations also suffer from difficulties to access information and health services for diagnosing, treating and preventing disabilities[43-44]. Regarding race/skin color, a higher proportion of black and mestizo people was expected in this study, as they are more commonly included in poor and vulnerable populations[45-46]; however, the new cases were predominantly self-declared as white (79.1%)[47]. According to IBGE, most of the population in the state of São Paulo declare themselves as white (63.9%)[48], which may explain their predominance in this study. On the other hand, the percentage of mestizoes found in the study (9.0%) is below the percentage reported by IBGE in the state (29.1%)[48]. Considering that sociodemographic data are self-reported[49], the inconsistencies of color/race found in this study may be due to racial prejudice, which is still very strong in the country, affecting the reliability of these parameters, considering that this statement may not correspond to reality. Health services need to find strategies to obtain more reliable records to refine epidemiological studies.

CONCLUSION

The profile of new leprosy cases diagnosed in ILSL indicates predominance in adult or elderly men, self-reported white, with low education, presenting patches and/or skin lesions and paresthesia

that appeared more than 6 months ago. Male individuals were more positive in slit-skin smear bacilloscopy, biopsy and immunological tests, also presenting the most disseminated forms of the disease. People affected by leprosy travel long distances at national and state levels, which contributes to late diagnosis and to existing physical disabilities.

Given the above, the epidemiological scenario of new cases of leprosy diagnosed in ILSL indicates late diagnosis and weaknesses in leprosy care in Basic Health Units in the state of São Paulo. Further studies are necessary to assess the real epidemiological situation of leprosy in the state, as well as the reasons why these cases are not being diagnosed by primary health care services.

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