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FATORES ASSOCIADOS COM INCAPACIDADE FÍSICA EM HANSENÍASE EM UM CENTRO DE REFERÊNCIA NO NORTE DO BRASIL

CLINICAL AND SOCIODEMOGRAPHIC FACTORS ASSOCIATED WITH PHYSICAL DISABILITY IN LEPROSY IN A REFERENCE CENTER IN THE NORTH OF BRAZIL

FACTORES ASOCIADOS A LA DISCAPACIDAD FÍSICA EN LA ENFERMEDAD DE HANSEN EN UN CENTRO DE REFERENCIA EN EL NORTE DE BRASIL

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RESUMO:

Hanseníase é a principal causa infecciosa de incapacidade física no mundo. A alta endemicidade no norte brasileiro, torna importante a identificação dos fatores de risco para a ocorrência de incapacidade em indivíduos com essa enfermidade. O objetivo foi descrever o perfil dos pacientes com incapacidades em hanseníase e verificar a associação com os aspectos clínicos e epidemiológicos. **Métodos:** Estudo transversal, analítico e descritivo com variáveis sociodemográficas e clínicas de 174 novos pacientes diagnosticados em um hospital do estado do Tocantins. Utilizou-se o teste do Qui-quadrado, Exato de Fisher e a Razão de Chances (OR) com Intervalo de Confiança (IC) de 95% ($p \leq 0,05$), para identificar fatores de risco para incapacidade. **Resultados:** Indivíduos nas faixas etárias de 30-59 anos e ≥60 anos, ocupações de aposentado e lavrador tiveram mais chances de apresentar incapacidades. A classificação multibacilar, formas lepromatosa e neural primária, apresentar múltiplas lesões cutâneas, ausência de reação e neuropatia acima de dois nervos foram associados a incapacidades. **Conclusões:** Houve alto risco de incapacidades em idosos e nos indivíduos com a forma neural primária. O diagnóstico precoce da hanseníase, treinamento constante dos profissionais de saúde sobre a doença e monitoramento neurológico contínuo pode prevenir e/ou mitigar as deficiências físicas.

PALAVRAS-CHAVE: *Mycobacterium leprae*. Hanseníase. Incapacidade.

ABSTRACT:

Leprosy is the main infectious cause of physical disability in the world. Due to its increasing prevalence in northern Brazil, it is crucial to identify the risk factors for the occurrence of disability in persons with this disease. This study aimed to describe the profile of patients leprosy-related disabilities and analyze their association with clinical and epidemiological factors. Cross-sectional, analytical, and descriptive study with sociodemographic and clinical data of 174 new patients diagnosed in a hospital in the state of Tocantins were collected. The chi-square and Fisher's exact tests were used, and the odds ratio (OR) with a 95% confidence interval (CI) ($p \leq 0.05$) were used to identify risk factors for disability. Patients within the 30–59-year age group, aged ≥60 years, those who were retired, and whose who were rural workers were more likely to present disabilities. Multibacillary, lepromatous, and primary neural forms; those presenting with multiple skin lesions, had no reaction, and exhibited neuropathy over two nerves, were associated with disabilities. The study found a high risk of disabilities in older patients and in individuals with the primary neural form of leprosy. An early diagnosis of leprosy, the constant training of health professionals about the disease, and the continuous monitoring of neurological symptoms can prevent and/or mitigate disabilities caused by leprosy.

KEYWORDS: *Mycobacterium leprae. Leprosy. Disability.*

RESUMEN:

Enfermedad de Hansen es la principal causa infecciosa de discapacidad física en el mundo. A causa de la alta endemicidad en el norte brasileño, se hace importante la identificación de factores de riesgo para la ocurrencia de discapacidad en individuos com esa enfermedad. El objetivo fue describir el perfil de los pacientes con discapacidades en la enfermedad de Hansen y verificar la asociación con los aspectos clínicos y epidemiológicos. ***Métodos****: Estudio transversal, analítico y descriptivo con variables sociodemográficas y clínicas de 174 nuevos pacientes diagnosticados en un hospital del estado de Tocantins. Se utilizó el test de Ji-cuadrado, el Exacto de Fisher y el Odds ratio (OR) con Intervalo de Confianza (IC) de 95% ($p \leq 0,05$) para identificar factores de riesgo para la discapacidad.* ***Resultados****: Individuos del rango etario de 30-59 años y ≥60 años, ocupaciones de jubilado y de campesino tuvieron más probabilidades de presentar discapacidades. La clasificación multibacilar, formas lepromatosa y neural primaria, el hecho de presentar lesiones cutáneas, ausencia de reacción y neuropatía por encima de dos nervios fueron asociados a discapacidades.* ***Conclusiones****: Hubo un alto riesgo de discapacidades*

en los ancianos y en los individuos con la forma neural primaria. El diagnóstico precoz de la enfermedad de Hansen, el entrenamiento constante de los profesionales de salud sobre la enfermedad y el monitoreo neurológico continuo pueden prevenir y/o mitigar las discapacidades físicas.

Palabras clave: *Mycobacterium leprae. Lepra. Discapacidad.*

INTRODUÇÃO

Leprosy is a neglected tropical disease that affects socioeconomically compromised populations with unfavorable living conditions; hence, it persists as a public health problem in several countries, including Brazil (Monteiro *et al*., 2017). It is the main infectious cause of disability and peripheral neuropathy in the world, and it is of greater importance in the endemic regions of developing countries (Assis et *al*., 2019), as it is a chronic granulomatous infectious disease caused by the microorganism *Mycobacterium leprae* (Bandeira; Pires; Quaresma, 2019).

The World Health Organization (WHO) (2018) guidelines indicate that since individuals with up to five skin lesions or had no bacilli in a skin smear have a few bacilli, they are classified as paucibacillary (PB). Conversely, those with more than five skin lesions, with nerve involvement, or with bacilli in a slit-skin smear, regardless of the number of skin lesions, are classified as multibacillary (MB).

Changes in the host immune response determine the various clinical manifestations of leprosy, which range from mild to more severe forms (Mendonça *et al*., 2008). According to the Madrid Classification (1953), the clinical forms of the disease are known as indeterminate, tuberculoid, borderline or dimorphic, and lepromatous or Virchow's (BRASIL, 2017; BRASIL, 2019). In addition, primary neural leprosy, also known as pure neural leprosy, occurs in 5% to 10% of cases. Primary neural leprosy is characterized by the presence of peripheral neuropathy, the absence of skin patches, and a negative bacilloscopy result (Tiwari *et al*., 2017; Oliveira *et al*., 2019).

The WHO launched the Global Strategy for Leprosy 2021–2030, which is aimed at eliminating this disease in 120 endemic countries. The targets to be achieved are a 70% decrease in the annual number of new cases and a 90% reduction in new cases among children and those with a Physical Disability Grade (PDG) of 2 (present deformities) (OMS, 2021).

According to global data from 2019, 202,185 new cases of the disease were registered, 10,813 (5.34%) of which showed PDG 2 disabilities at the time of diagnosis. The presence of PDG 2 disabilities at diagnosis indicates the late detection of leprosy, highlighting that Brazil has showed an increasing number of new cases with deformities over the years. Currently, the country has the second highest number of new cases and PDG 2, following India (WHO, 2020).

Tocantins presents high endemicity (≥10/100,000 inhabitants) (BRASIL, 2020a) and had the highest rate of new cases diagnosed with PDG 2 at the time of diagnosis for 2 consecutive years (2018 and 2019) (BRASIL, 2021), with a 69.4% increase in new cases diagnosed with PDG 2 from 2009 to 2018 (BRASIL, 2020b).

Despite being a treatable disease, late diagnosis and treatment can increase the risk of developing leprosy-related disabilities (Aslam *et al*., 2019). In addition, reactionary episodes also favor the occurrence of permanent nerve damage that causes physical deformities (Bandeira; Pires; Quaresma, 2019).

The high leprosy endemicity in the northern region of Brazil, especially in the state of Tocantins, demonstrates the importance and necessity of research aimed at investigating the risk factors for physical disabilities from the disease in this region. Therefore, the objective of this study was to describe the profile of patients with physical disabilities diagnosed with leprosy and verify their association with the clinical and epidemiological characteristics in a reference center in Brazil.

METODOLOGIA

A cross-sectional, analytical, and descriptive study was conducted, which comprised a convenience sample of 174 new, untreated patients referred and diagnosed with leprosy from January 2017 to December 2020 in a hospital located in the city of Araguaína, Tocantins, Brazil. This hospital mainly treats this disease in the northern region of the state and neighboring states, such as Pará and Maranhão.

Data were obtained from the Notifiable Diseases Information System (*Sistema de Informação de Agravos de Notificação*, SINAN), the medical records of patients diagnosed in the hospital, and using the Leprosy Simplified Neurological Assessment Form. This form, recommended by the Ministry of Health, analyzes the nerve integrity of patients and allows for the assignment of a PDG score, which varies on a scale from 0 to 2, where 0 means no disability, 1 indicates sensory and/or muscle strength loss, and 2 refers to visible damage to the eyes, hands, and/or feet (BRASIL, 2017).

Patients with incomplete documented records, underwent retreatment of the disease, did not undergo a neurological examination at diagnosis, with cognitive deficits due to difficulty in understanding the neurological evaluation, and with other peripheral neuropathies were excluded.

The data collected from SINAN corresponding to sociodemographic variables were sex, age group, race/color, level of education, occupation, area of residence, operational classification, clinical form, number of skin lesions, and PDG at diagnosis. The information collected from the patient medical records were the presence or

absence of leprosy reaction and the number and specification of the affected nerve trunks.

The data were tabulated into an Excel spreadsheet, and the statistical analysis was performed using the Epi Info 7™ statistical software, developed by the Centers for Disease Control and Prevention, using descriptive techniques of absolute and relative frequencies of the variables. The Chi-square test was used to determine the variables with a statistically significant association to physical disability, Fisher's exact test was used in samples less than five, and the odds ratio (OR) with a 95% confidence interval (CI) was used to identify the variables with a risk factor for physical disability at diagnosis, considering a significance level of $p \leq 0.05$.

This project was approved by the Ethics and Research Committee of the Hospital of Tropical Diseases of the Federal University of Tocantins under No. 4,550,694 and CAAE No. 40658120.3.0000.8102 on February 22, 2021.

RESULTADOS E DISCUSSÃO

Of the 174 individuals, 110 were men, most were aged between 30 and 59 years (54.6%), the race/color declared most was Pardo/black (86.21%), most had up to 8 years of education (74.14%), and most were students (18.97%) (Table 1).

Table 1. Distribution of leprosy cases in a reference hospital according to sociodemographic characteristics – Araguaína/TO, 2017-2020.

	Total (N = 174)		CI
	N	%	
Sex			
Male	110	63.22	55.59-70.39
Female	64	36.78	29.61-44.41
Age group			
0 to 14 years	24	13.79	9.04-19.82
15 to 29 years	17	9.77	5.8-15.18
30 to 59 years	95	54.6	46.89-62.15
60 years and over	38	21.84	15.94-28.72
Race/color			
Pardo/black	150	86.21	80.18-90.96
White/Asian descendant	24	13.79	9.04-19.82
Education			
0 to 8 years	129	74.14	66.97-80.47
More than 8 years	45	25.86	19.53-33.03
Occupation			

Retired	31	17.82	12.44-24.32
Homemaker	24	13.79	9.04-19.82
Rural worker	20	11.49	7.16-17.19
Student	33	18.97	13.43-25.59
Other*	66	37.93	30.7-45.58
Area of residence			
Urban	155	89.08	83.47-93.30
Rural	19	10.92	6.7-16.53

*Sum of the occupations in which up to eight cases were recorded; CI = 95% confidence interval.

As for the operational classification, 118 (67.82%) were classified as having multibacillary leprosy; the borderline clinical form was indicated for 66 individuals, 154 of whom had skin lesions and 57.79% had 1-5 lesions. Neural involvement was present in 159 patients, 78.62% of whom had more than two nerves affected, mainly the ulnar nerve (141 cases). The leprosy reaction occurred in 32 patients. A total of 95 (54.60%) patients presented with a physical disability at diagnosis, of which 13.22% and 41.38% had PDG 2 and PDG 1, respectively (Table 2).

Table 2. Distribution of leprosy cases in a reference hospital according to the clinical characteristics of the disease – Araguaína/TO, 2017-2020.

	Total (N = 174)		**CI**
	N	**%**	
Operational classification			
Multibacillary	118	67.82	60.33-74.69
Paucibacillary	56	32.18	25.31-39.67
Clinical Form			
Lepromatous	34	19.54	13.93-26.22
Boderline	66	37.93	30.7-45.58
Tuberculoid	39	22.41	16.45-29.34
Undetermined	12	6.9	3.61-11.74
Primary neural	20	11.49	7.16-17.19
Not classified	3	1.72	0.36-4.96
Skin lesions			
Yes	154	88.51	82.81-92.84
No	20	11.49	7.16-17.19
No. of injuries (n = 154)			
More than 5	65	42.21	34.3-50.42
1–5	89	57.79	49.58-65.70

Nerves affected			
Yes	159	91.38	86.18-95.09
No	9	8.62	4.91-13.82
No. of nerves (n = 159)	15		
More than 2	12	78.62	71.42-84.71
1-2	5	21.38	15.29-28.58
Main nerves affected	34		
Radial	91	52.3	44.61-59.91
Ulnar	14	81.03	74.41-86.57
Median	1	30.46	23.72-37.88
Common fibular	53	44.25	36.74-51.96
Posterior tibial	77	58.05	50.34-65.47
Reaction	10		
Yes	1	18.39	12.93-24.96
No	32	81.61	75.04-87.07
Bacilloscopy	14		
Positive	2	30.46	19.53-33.03
Negative	53	43.68	36.19-51.39
Not performed	76	25.86	19.53-33.03
Degree of PD	45		
0	79	45.4	37.85-53.11
1	72	41.38	33.98-49.08
2	23	13.22	8.57-19.17

N = number; CI = 95% confidence interval; PD = physical disability.

In the association analysis of the occurrence of physical disability and the sociodemographic aspects, statistical significance was found with age, presenting a three times higher chance of developing physical disability in the age group of 30 to 59 years (OR = 3.33; p≤0.05) and 16 times higher in the age group of 60 years or older (OR = 16; p≤0.05). Retired individuals (OR = 13.87; p≤0.05) and rural workers (OR = 4; p≤0.05) also showed statistical significance with physical disability, with 13 and 4-times higher risks, respectively (Table 3).

Table 3. Association between sociodemographic characteristics and the occurrence of physical disability in patients diagnosed with leprosy in a reference hospital – Araguaína/TO, 2017-2020.

	With PD		**No PD**		**OR**	**CI**	**p-value**
	N = 95		**N = 79**				
	N	**%**	**N**	**%**			
Sex							

	6		4				
Male	6	60	4	40			
	2		3		1.81	0.97-3.37	0.085
Female	9	45.31	5	54.69			
Age group							
	3						
60 years and over	2	84.21	6	15.79	16	4.49-56.99	≤0.05
	5		4				
30 to 59 years	0	52.63	5	47.37	3.33	1.21-9.13	≤0.05
			1				
15 to 29 years	7	41.18	0	58.82	2.1	0.55-7.99	0.449
			1				
0 to 14 years	6	25	8	75	1		
Race/color							
	8		6				
Pardo/black	1	54	9	46			
	1		1		0.83	0.35-2.00	0.860
White/Asian descendant	4	58.33	0	41.67			
Education							
	7		5				
0 to 8 years	4	57.36	5	42.64			
	2		2		1.53	0.77 - 3.04	0.285
More than 8 years	1	46.67	4	53.33			
Occupation							
	2						
Retired	6	83.87	5	16.13	13.87	4.07-47.25	≤0.05
			1				
Homemaker	9	37.5	5	62.5	1.6	0.51-4.93	0.595
	1						
Rural worker	2	60	8	40	4	1.23-12.99	≤0.05
	3		2				
Other	9	59.09	7	40.91	3.85	1.55-9.56	≤0.05
			2				
Student	9	27.27	4	72.73	1		
Area of residence							
			1				
Rural	9	47.37	0	52.63			
	8		6		0.72	0.27-1.87	0.669
Urban	6	55.48	9	44.52			

PD = physical disability; OR = odds ratio; CI = 95% confidence interval.

In the analysis of the clinical characteristics, a statistically significant association was found in the multibacillary cases (OR = 4.47; p≤0.05), which presented a four times increased chance of disability, and the lepromatous (OR = 8.33; p≤0.05) and primary neural forms (OR = 27; p≤0.05) reached an 8- and 27-times increased risk of suffering physical disability, respectively. The presence of nerve damage (OR = 9.15; p≤0.05) presented a nine-times increased risk, and having more than two nerves affected (OR = 2.87; p≤0.05) increased by the chance of disability by two (Table 4).

The presence of skin lesions (OR = 0.11; p≤0.05) proved to be a protective factor; however, among individuals who had lesions, the ones who had over five lesions (OR = 2.24; p≤0.05) had twice as much chance of developing physical disabilities (Table 4).

Given the fact that being compromised both the radial nerves (OR 3.23; p≤0.05) and median nerves (OR = 3.69; p≤0.05), it could be seen a three times greater risk for impairments; the ulnar nerves (OR = 2.94; p≤0.05) and common fibular nerves (OR = 1.94; p≤0.05) had the lowest risk factor. The non-occurrence of leprosy reaction (OR = 5.87; p≤0.05) increased the chance of presenting physical disability by five times (Table 4).

*Fisher's exact test; PD = physical disability; OR = odds ratio; CI = 95% confidence interval.

Table 4. Association between clinical characteristics and the occurrence of physical disability in patients diagnosed with leprosy in a reference hospital – Araguaína/TO, 2017-2020.

	With PD N = 95		No PD N = 79		OR	CI	p-value
	N	%	N	%			
Operational classification							
Multibacillary	78	66.1	40	33.9	4.47	2.25-8.87	≤0.05
Paucibacillary	17	30.36	39	69.64			
Clinical Form							
Lepromatous	25	73.53	9	26.47	8.33	1.83-37.82	≤0.05*
Boderline	38	57.58	28	42.42	4.07	1.00-16.42	0.075*
Tuberculoid	10	25.64	29	74.36	1.03	0.23-4.59	>0.999*
Primary neural	18	90	2	10	27	3.80-191.70	≤0.05*
Not classified	1	33.33	2	66.67	1.5	0.09-23.07	>0.999*
Undetermined	3	25	9	75	1		
Skin lesions							
Yes	77	50	77	50	0.11	0.02-0.49	≤0.05
No	18	90	2	10			
No. of injuries (n = 154)							
More than 5	40	61.54	25	38.46	2.24	1.16-4.32	≤0.05
1-5	37	41.57	52	58.43			

Nerves affected							
Yes	93	58.49	66	41.51	9.15	1.99-41.95	≤0.05
No	21	13.33	13	86.67			
No. of nerves (n = 159)							
More than 2	80	64	45	36	2.87	1.31-6.27	≤0.05
1-2	13	38.24	21	61.76			
Main nerves affected							
Radial							
Yes	62	68.13	29	31.87	3.23	1.73-6.03	≤0.05
No	33	39.76	50	60.24			
Ulnar							
Yes	84	59.57	57	40.43	2.94	1.32-6.54	≤0.05
No	11	33.33	22	66.67			
Median							
Yes	40	75.47	13	24.53	3.69	1.79-7.59	≤0.05
No	55	45.45	66	54.55			
Common Fibular							
Yes	49	63.64	28	36.36	1.94	1.05-3.57	≤0.05
No	64	47.42	51	52.58			
Posterior Tibial							
Yes	60	59.41	41	40.59	1.58	0.86-2.91	0.178
No	35	47.95	38	52.05			
Reaction							
Yes	27	84.38	5	15.63	5.87	2.14-16.12	≤0.05
No	68	47.89	74	52.11			

The present study found a higher frequency of physical disabilities in men; however, sex was not a factor associated with the presence of disability, demonstrating that the risk for disability is similar between the two sexes. The higher frequency observed in men is due to the fact that individuals may not seek medical care immediately, as they are unaware of the signs of the disease and/or for the fear of having their work-related activities interrupted, favoring the progression of

neurological damage and the onset of disabilities (Moschioni *et al*., 2010; Silva *et al*., 2018).

The number of patients with low education was prevalent in this study, but there was no relevant association of education level with disabilities, which may be due to the categorization of variables. Studies have shown that a low education is a risk factor for physical disabilities, and the authors justify that a higher the level of education leads to a greater understanding of the disease and relevant management, in addition to having earlier access to health services (Moschioni *et al*., 2010; Raposo *et al*., 2018).

Although no significant association was identified, disabilities were more prevalent in the Pardos/black individuals and urban residents. The urban residents have better health care coverage, and consequently have easier access to health services, unlike those from rural areas (Monteiro *et al*., 2013). The race/color that the population of this locality declares is consistent with the Tocantins characterization of cases with physical disability at diagnosis (BRASIL, 2020b), which can justify the observed predominance.

The greater chance of developing disability in the active age group (30 to 59 years) corroborates the findings in the literature (Shumet; Dermissie; Bekele, 2015; Guerrero; Muvid; León, 2013). This age group corresponds to the productive phase of life and social interaction, being more exposed and subject to infection (Silva *et al*., 2018), which coincides with the long incubation period of the disease, thereby leading to greater functional impairment (Araujo *et al*., 2014a). This disease impairment potential can affect professional activities and cause great economic loss to the society (Costa *et al*., 2017; Miranzi; Pereira; Nunes, 2010).

A greater chance of physical disability was also observed in the older population (60 years or older) than that in the younger population. This study classified 29 of the 38 older individuals as having MB leprosy. A study conducted with patients in the same age group also found an association of bacillus load with disabilities, demonstrating that the higher the bacillus load, the higher was the risk of nervous impairment and disabilities (Matos *et al*., 2019).

The risk of disabilities in this aging population is noteworthy, since they present more limitations. Although such age group requires tedious care, most of them live with family members or companions, thereby enhancing the transmission of the disease (Souza *et al*., 2020).

Retired people and rural workers also showed a statistically significant association with disabilities, presenting 13- and 4-fold higher risks, respectively, for disabilities. It is noteworthy that the older population represented the majority of the

public that matches the retired individuals (93.54%), and it is possible that this occupation has been influenced by the greater risk of disabilities in the elderly. The profession of rural workers can be justified by the fact that these individuals have a lower level of education (85%) and are more vulnerable to physical injuries due to the functions of this occupation.

Moreover, this study found that having other occupations proved to be a risk for causing disabilities. However, in this category, the entire variety of remaining occupations were grouped and presented low frequency (less than eight cases), which did not yield a statistical significance when associated with physical disabilities in isolation. Therefore, their relevance was not considered in this research, since it was not convenient to regroup such occupations.

Regarding clinical aspects, the classification of MB was predominant. Patients with MB showed a four-times higher risk of generating disabilities than those with a paucibacillary form. Several other studies also demonstrated this as being a risk factor (Sarkar; Dasgupta; Dutt, 2012; Santana *et al*., 2018; Raposo *et al*., 2018; Santos *et al*., 2015; Sanchez *et al*., 2021). This is because MB patients have a weak cellular immune response, generating a high load of bacilli in the individual, thus leading to the development of peripheral nerve damage (Nobre *et al*., 2017; Paula *et al*., 2019).

Even though the borderline form was predominant, it did not present a significant association with risk for disabilities. However, the lepromatous and primary neural clinical forms showed significant risks of 8- and 27-times higher to cause disabilities, respectively. Studies also found the lepromatous form is a high-risk factor for causing physical disability (Araujo *et al*., 2014b; Santos *et al*., 2015; Monteiro *et al*., 2015). This MB form, which presents ineffective immune response, enhances disease chronicity, and causes more neural damage as the disease evolves, favors the development of physical disabilities (Paula *et al*., 2019; Araujo *et al*., 2014a).

Of the 20 individuals diagnosed with the pure neural form, 18 (90%) showed some disability. This diagnosis is mainly guided by complementary exams, such as serology, nerve biopsy, electroneuromyography, and molecular analysis (Santos *et al*., 2017; Khadilkar; Patil; Shetty, 2021). The large number of patients with physical disabilities diagnosed with this clinical form may be due to the low accessibility to advanced diagnostic methods in leprosy reference services, since the diagnosis is limited to its clinical manifestations in these places (Santos *et al*., 2017).

Since this form does not present with skin lesions, which is a typical aspect of the disease, it may be often overlooked, thus leading to a late diagnosis and resulting

in impairments (Sarkar; Dasgupta; Dutt, 2012). In the studies by Neves *et al*. (2021), the probability of misdiagnosis was high in those with affected nerves without skin lesions compared to that in individuals with the common disease characteristics.

Although the presence of skin lesions was negatively associated with physical disability when the number of lesions was evaluated, the risk of disabilities was twice as high in patients with more than five skin lesions. The presentation of over five spots was also observed as a risk factor for a PDG 2 disability in a study by Monteiro *et al*. (2015). A study on children showed that the risk of having nerve damage was five times higher in those with more than five skin lesions (Bandeira; Pires; Quaresma, 2017). These results demonstrate that the MB form of leprosy has an important association with physical disabilities.

The occurrence of nerve damage increased the risk of leading to disability by nine times, and having more than two compromised nerves increased the risk by two times. Moreover, having more than two affected nerves was relevant in the studies analyzed (Santos *et al*., 2015; Monteiro *et al*., 2015; Kumar; Girdhar; Girdhar, 2012). In summary, nerve lesion is a severe complication and is closely related to physical disabilities. Although there is subjectivity in the examination of the nerves evaluated, it is valid to identify the number of thickened nerves and their importance in the prognosis of the disease (Moschioni *et al*., 2010).

If the patient is diagnosed with affected nerves, it may be due to a delay in disease detection or an aggressive clinical form. These possibilities culminate in accelerated nerve damage, resulting in deformities (Santana *et al*., 2018).

The ulnar nerve was the most affected, corroborating the studies (Bandeira; Pires; Quaresma, 2017; Santana *et al*., 2018), but the chance of physical disability was also associated with the radial, median and common fibular nerves being compromised.

The ulnar and common fibular nerves are located in cooler body areas. Such regions are preferred by the bacillus, which may cause a reduction in local nerve conduction speed (Santos *et al*., 2017). On the other hand, the radial and median nerves are located in protected anatomical regions which make it difficult to palpate them, justifying the discovery of late damage only when the deficiencies are already installed.

However, the impairment of any nerves, whether from the upper or lower limbs, increases the potential for deformities (Santana *et al*., 2018). It is worth emphasizing the importance of periodic neurological evaluation and adequate treatment to reduce nerve damage and consequently, prevent physical disabilities.

The leprosy reaction was present in 18% of the participants in this study, but the absence of reaction states an increased chance of causing physical disabilities by five times, which is a finding that is in disagreement with those of previous literature (Santos *et al*., 2015; Raposo *et al*., 2018; Paula *et al*., 2019). Since we included newly diagnoses patients, the occurrence of the reaction served as an alert and early diagnostic tool for medical care when compared to patients without reactive episodes because they did not present the common signs and symptoms to facilitate the need to seek early treatment.

These reactions can occur before, during, and after drug treatment (Khadilkar; Patil; Shetty, 2021), and even after the treatment is over, a large number of dead bacilli can remain in the nerves, which can generate immune responses and neuritis in affected patients (Scollard; Truman; Ebenezer, 2015).

More than half of the participants of this study showed a physical disability at the time of diagnosis. This finding can be explained by the fact that the present study was conducted in a reference center. This also demonstrates the difficulty of primary care and early detection and diagnosis of the disease, thus negatively affecting the onset of disabilities. This may be because, according to the Ministry of Health (2017), the referral to reference services is made when there are conflicts in the diagnosis and clinical management, presence of clinical complications related to the disease, relapses, leprosy reactions, treatment complications, or the need for surgical rehabilitation. In addition, cases of difficult diagnostic classification, such as those with suspected nerve involvement and the absence of skin lesions (BRASIL, 2016), should be referred to specialized services conditions.

As a limitation of this study, the greatest associations with disabilities may have been biased by the fact that it was conducted in a center specialized in the management of complications of the disease. In view of this, we suggest research focused on primary health care, where detection and diagnosis of cases should occur.

For those with some disability at the time of diagnosis, the occurrence of PDG 1 was frequent. Another study conducted in a Brazilian reference center found that patients diagnosed with PDG 1 had a 10.7% probability of progressing to PDG 2 at the time of discharge. The authors reinforce that the higher the degree of disability at diagnosis, the greater the possibility of disability at drug discontinuation; hence, this is an important indicator of a late diagnosis (Assis *et al*., 2019).

Nerve monitoring and continuous PDG assessment during multidrug therapy (MDT) and the onset of neuritis and reactions are fundamental to mitigate or avoid

deformities (BRASIL, 2019); thus, the early detection of PDG 1 becomes necessary and urgent to prevent possible physical disabilities (Sarkar; Dasgupta; Dutt, 2012).

The presentation of disabilities, adding to the stigma and discrimination of the disease, can limit the activities of individuals with leprosy, and thus compromise their social participation (Alencar, 2014).

CONSIDERAÇÕES FINAIS

The present study concluded that brown/black men with low levels of education and of economically active age in various occupations in the urban region presented physical disabilities. People over 30 years of age, those with the MB classification of disease, those without a reactional state, those with more than five skin lesions, and those with nerve involvement are more likely to present physical disabilities than those in the other categories. It is important to highlight the high risk of disabilities in the older population diagnosed with the MB clinical form and those with an absence of skin lesions and existing nerve damage.

Early detection and diagnosis, promotion of awareness and self-care campaigns about the disease, and the continuous training of health professionals are warranted to allow a deeper understanding of the neurological signs and symptoms of leprosy and its epidemiological clinical profile in endemic regions. The periodic neural monitoring of patients administered MDT is emphasized to provide appropriate and timely treatment in the occurrence of neuritis and reactions, and close monitoring of individuals with PDG 1, which can progress to permanent disabilities.

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