LEPROSY RELAPSE BETWEEN THE YEARS 2005-2015

RECIDIVA DA HANSENÍASE ENTRE OS ANOS 2005-2015

RECIDIVA DE LA LEPROSA ENTRE LOS AÑOS 2005-2015

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ABSTRACT

Objective: to describe the cases of leprosy relapse between the years 2005-2015. **Method:** quantitative, descriptive, cross-sectional study of confirmed cases of leprosy relapse, in the period from 2005 to 2015, in SINAN. Data were tabulated on Bioestat 5.0 generating tables, and descriptive analysis and Pearson chi-square test were performed at a significance level of 5% ($p < 0.05$). **Results:** there were 1,351 (7.87%) cases of leprosy relapse in the state of Bahia, with prevalence in males (61.1%), pardos (57.7%) and with age greater than or equal to 15 years (99.6%). The dimorphic clinical form, the zero degree of incapacity and the operational classification for MB were the most frequent, using PCT/MB/12 in 82.1% of cases. **Conclusion:** there is low effectiveness in the control of leprosy in the state of Bahia, since there was a relatively high prevalence of cases of relapse in the period under study. **Descriptors:** Leprosy; Relapse; Epidemiology; Neglected Diseases; *Mycobacterium leprae*; Multibacillary leprosy.

RESUMO

Objetivo: descrever os casos de recidiva da hanseníase entre os anos de 2005-2015. **Método:** estudo quantitativo, descritivo, transversal dos casos confirmados de recidiva em hanseníase, no período de 2005 a 2015, no SINAN. Os dados foram tabulados no Bioestat 5.0 gerando-se as tabelas e se realizou a análise descritiva e o teste do Qui-quadrado de Pearson ao nível de significância de 5% ($p < 0,05$). **Resultados:** foram notificados 1.351 (7,87%,) casos de recidiva da hanseníase no Estado da Bahia, com prevalência no sexo masculino (61,1%), em pardos (57,7%) e com idade maior ou igual a 15 anos (99,6%). A forma clínica dimorfa, o grau zero de incapacidade e a classificação operacional para MB foram os mais frequentes, tendo a PQT/MB/12 utilizada em 82,1% dos casos. **Conclusão:** há baixa efetividade no controle da hanseníase no Estado da Bahia, uma vez que se observa uma prevalência relativamente alta de casos de recidiva no período em estudo. **Descritores:** hanseníase; Recidiva; Epidemiologia; Doenças Negligenciadas; *Mycobacterium leprae*; hanseníase Multibacilar.

RESUMEN

Objetivo: describir los casos de recidiva de lepra entre los años 2005-2015. **Método:** estudio cuantitativo, descriptivo, transversal de casos confirmados de recidiva de lepra, en el período de 2005 a 2015, SINAN. Los datos fueron tabulados en el Bioestat 5.0 generar tablas y se realizó el análisis descriptivo y la prueba de chi-cuadrado de Pearson para un nivel de significancia del 5% ($p < 0,05$). **Resultados:** se notificaron 1.351 (7,87%) casos de recidivas de lepra en el estado de Bahia, con predominio en el sexo masculino (61,1%), pardos (57,7%) y con edad igual o superior a 15 años (99,6%). La forma clínica dimorfa, el grado cero de la incapacidad y la clasificación operacional para MB fueron las más frecuentes, utilizándose PQT/MB/12 en 82,1% de los casos. **Conclusión:** existe poca efectividad en el control de la lepra en el estado de Bahia, ya que se observó una prevalencia relativamente alta de casos de recidiva en el periodo bajo estudio. **Descritores:** Lepra; Recidiva; Epidemiologia; Enfermedades Olvidadas; *Mycobacterium leprae*; Hanseniasis Multibacilar.

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INTRODUCTION

Leprosy is an infectious disease caused by *Mycobacterium leprae*, with tropism for skin cells and peripheral nerves. The evolution of the disease is slow and presents itself with specific dermatoneurological manifestations.¹

The recommended specific treatment for leprosy is polychemotherapy, a measure that aims at eliminating the bacilli and preventing drug resistance. In some cases, the flaws in the therapeutic regimen, caused mainly by inadequate dosage and treatment period, as well as irregularity in the ingestion of medications, can compromise the healing and favor the disease relapse.²

Leprosy relapse is the process of relapse in which new signs and symptoms develop during or after the epidemiological surveillance of a patient who ended polychemotherapy correctly. Data from the WHO show that Brazil holds 49.8% of all cases of leprosy relapse in the world.²

OBJECTIVE

- To describe the cases of leprosy relapse in the state of Bahia, in the period from 2005 to 2015.

METHOD

This is a quantitative, descriptive, cross-sectional study of confirmed cases of leprosy relapse in the state of Bahia, in the period from 2005 to 2015, in SINAN. The estimated population of Bahia was 15,344,447 inhabitants in the year 2017, being composed

by 417 municipalities whose capital is Salvador and the climate, the caatinga.³

This study included confirmed cases of leprosy relapse from 2005 to 2015, in SINAN. Six cases were excluded since they did not have operational classification defined.

The following variables were applied to the data analysis: gender, age, race, education, area of residence, bacilloscopy, degree of incapacity at the time of diagnosis, clinical form, operational classification, initial therapeutic regimen and abandonment.

Data were tabulated on the Bioestat 5.0 generating tables, and descriptive analysis and Pearson chi-square test were performed at a significance level of 5% (p<0.05).

The whole study was conducted under the ethical precepts of Resolution 510/2016, which dispenses with the submission to the Research Ethics Committee (REC), since data are secondary and in the public domain.

RESULTS

In the study period, there were 1,351 (7.87%) cases of leprosy relapse in the state of Bahia, the majority in males (61.1%), in patients with age greater than or equal to 15 years (99.6%), *pardo* race (57.7%). The degree of schooling can be a risk factor for the occurrence of leprosy relapse. In this study, most cases of relapse had incomplete elementary education and lived in the urban area (66.4%), as shown in table 1.

Table 1. Sociodemographic characteristics of cases of leprosy relapse in the period from 2005 to 2015, in the state of Bahia.

Variables	N	%	GL	X ²	p*
GENDER					
Female	519	38.4	1	72.51	<0.0001
Male	832	61.6			
AGE GROUP					
< 15	5	0.4	1	1331.07	<0.0001
≥15 years	1.346	99.6			
RACE					
White	195	14.4	4	1580.2	<0.0001
Asiatic	10	0.7			
Pardo	779	57.7			
Black	281	20.8			
Indigenous	5	0.4			
Ignored**	81	6.0			
EDUCATION					
Incomplete elementary school	834	61.7	4	2355.43	>0.0001
Incomplete high school	76	5.6			
Complete high school	101	7.5			
Incomplete college	6	0.5			
Complete college	30	2.2			
Ignored**	304	22.5			
AREA					
Urban	897	66.4	2	986.96	<0.0001
Periurban	7	0.5			
Rural	330	24.4			
Ignored**	117	8.7			

Source: SINAN/SVS-MS. *Chi-Square **In the “ignored” variable, there was no statistical analysis.

The number of so-called ignored bacilloscopies (46.3%) was higher than the performed ones (35.9%) and, among the cases

of leprosy relapse, 48.9% had grade zero of disability, according to Table 2.

Table 2. Characteristics according to the bacilloscopy and degree of physical incapacity of the cases of leprosy relapse, from 2005 to 2015, in the state of Bahia, Brazil.

Variables	N	%	DF	X ²	p*
BACILLOSCOPY					
Positive	290	21.5	2	18.65	<0.0001
Negative	195	14.4			
Non-performed	241	17.8			
Ignored**	625	46.3			
Degree of incapacity at the diagnosis					
Degree zero	661	48.9	2	408.7	<0.0001
Degree I	263	19.5			
Degree II	146	10.8			
Ignored**	281	20.8			

Source: SINAN/SVS-MS. *Chi-square.
**The ignored variables were not part of the statistical analysis. DF= Degree of Freedom.

The dimorphic clinical form and the operational classification for MB were the most frequent in men and women. However, when compared with gender, the dimorphic

clinical form was more frequent among women. The PCT/MB/12 doses was used in 82.1% of the patients, according to Table 3.

Table 3. Relapse according to the clinical forms, the operational classification and the therapeutic scheme of leprosy, in the period from 2005 to 2015, in the state of Bahia, Brazil.

Variables	Male		Female		Total		DF	X ²	P*
	N	%	N	%	N	%			
CLINICAL FORM									
Undetermined	70	12.4	63	17.5	133	14.4	3	30.77	<0.001
Tuberculoid	57	10.1	55	15.3	112	12.1			
Dimorphic	234	41.6	172	47.8	406	44.0			
Virchowian	202	35.9	70	19.4	272	29.5			
Total	563	100.0	360	100.0	923	100.0			
OPERATIONAL CLASSIFICATION									
Multibacillary	703	84.5	370	71.3	1073	79.4	1	34.10	<0.001
Paucibacillary	129	15.5	149	28.7	278	20.6			
Total	832	100.0	519	100.0	1351	100.0			
INITIAL THERAPEUTIC SCHEME									
PQT/MB/12 DOSES	678	82.1	364	71.0	1042	77.8	2	31.39	<0.001
PQT/PB/6 doses	125	15.1	141	27.5	266	19.9			
Other replacing schemes	23	2.8	8	1.6	31	2.3			
Total	826	100.0	513	100.0	1339	100.0			

Source: SINAN/SVS-MS. *Chi-square; DF: Degree of freedom.

This study showed that most (31.1%) relapse cases had no classification of the clinical form. For the remaining patients, the

dimorphic form prevailed (30.1%), according to Table 4.

Table 4. Prevalence of treatment abandonment of leprosy relapse according to clinical form, in the period from 2005 to 2015, in the state of Bahia, Brazil.

Clinical form	N	%	DF	X ²	P*
Undetermined	133	9.8	4	322.71	<0.0001
Tuberculoid	112	8.3			
Dimorphic	406	30.1			
Virchowian	272	20.1			
Unclassified	428	31.7			
Total	1351	100			

Source: SINAN/SVS-MS. *Chi-square test.

DISCUSSION

The number of cases of leprosy relapse in Bahia places the state in the sixth position in the Brazilian scenario, behind only Pernambuco, Mato Grosso, São Paulo, Maranhão and Pará.⁴

The predominant presence on males also occurred in other studies, such as in the city of Teresina-PI. The high prevalence may be associated with little concern of men with health, aesthetics and greater exposure to social contact and risk environments. Furthermore, they go few times to public health services. In addition, the man has a hormonal predisposition that favors the penetration and the dissemination of bacilli in the body.⁵⁻⁸

In this way, the male sex is exposed to the bacillus, which can be one of the main factors that explain the high prevalence in the gender. Nevertheless, some studies show, in certain populations, a greater number of infected women, justified by their greater routine demand to health services because they are more concerned with their appearance.⁹

Regarding age range with the highest prevalence, the result is similar to reports from other Brazilian states and in countries such as Colombia and India. Adults are five times more likely to have relapse of the disease when compared to children. Nonetheless, the results described in this study reveal that 0.4% of relapse cases occurred in those aged less than 15 years, which indicates the persistence of transmission of *M. leprae*, thus opening a series of discussions on the operational problems in the disease control by health services, highlighting the need for strictly following the protocol present in the Basic Operational Norm, focusing the actions on differential diagnosis of leprosy relapse compared to other dermatological diseases and disorders.¹⁰⁻¹²

The predominance of self-reports of *pardos* occurs due to the fact that this population is one of the largest ethnic groups of the Brazilian population, with records of 43.13%, according to the 2010 census.¹⁰⁻³

When assessing the degree of schooling, individuals with low education have difficulties to understand the disease, as well as prevention, being more likely to abandon PCT and to physical incapacity. This scenario contributes to a greater exposure of the most vulnerable individuals to the disease, since its understanding becomes limited.¹³⁻⁵

According to the World Health Organization, the reduced socioeconomic level ordinarily associates with leprosy in all classes of the population. However, the association between schooling and leprosy relapse is not defined yet.¹⁶

In the perspective related to the residence area and the largest number of relapse cases in Bahia, there is an analogy with a cross-sectional epidemiological study conducted in the municipality of Marituba - PA. According to the last demographic census of the IBGE, Bahia has 72.07% of residents in the urban area, which justifies the increase of cases aforementioned. Moreover, the aforementioned population has an easier access to health centers, which facilitates and ensures its notification.^{3,17}

The number of bacilloscopy in the study is not different from reports of other Brazilian states.⁶ Bacilloscopy, associated to other diagnostic forms, is essential for defining leprosy relapse. Bacilloscopy is recommended for all infected multibacillary patients, in order to allow evaluating the elevation of the bacilloscopic index or even the presence of bacilli visually intact. In the same way, the differential diagnosis between the leprosy reaction and relapse is important, cooperating as well, with the use of appropriate therapeutic regimen compared to the operational classification of the disease.¹⁸⁻⁹

The inadequate filling of the notification form allows inferring that the prevalence of cases of leprosy relapse can be greater. These data are essential to evaluate the actions of combat and define new strategies to reduce the prevalence of leprosy in the state of Bahia, as well as in the Brazilian territory. The bacilloscopy is a cheap examination, with high specificity (100%), low sensitivity (50%) and is a criterion for confirming leprosy relapse, which allows making a differential diagnosis and classifying the disease.²⁰⁻²

The degree of incapacity expressed in this study resembles surveys conducted in the states of Mato Grosso and Espírito Santo.²³ According to the Ministry of Health, the clinical evaluation of the degree of physical incapacity of patients before and after treating leprosy is required for rehabilitation actions performed after discharge. In addition, studies suggest that the physical disability degree evaluation does not directly influence the measurement of the endemic level of the disease, relating only to operational factors linked to diagnosis, in which, in situations similar to the study discussed, in cases of degree zero, early diagnosis must result from the evolution of

the levels of disabilities that follow the disease evolution.¹⁹⁻²⁴

The relapse of the dimorphic clinical form was more frequent among women, disagreeing with results in the literature. The studies reported that the presence of relapse in women occurs due to situations such as pregnancy and breastfeeding.^{5,8,12,25}

The correct notification of cases of leprosy relapse is an important tool for the planning and the adoption of strategies for blocking the transmission of *M. leprae*. The dimorphic clinical form, which was prevalent in the study, has incapacitating potential and still contributes to the transmission of the disease, because individuals have high bacillary load and eliminate the bacillus to the external environment, contributing to the epidemiological chain, with a consequent increase of cases in the state.²⁶⁻⁹

In relation to the cellular response in a leprosy relapse picture, a study recently published indicated that the infection probably results from the reduced response of the effector T cells against *M. leprae* due to an inhibition in the expression of CD86, as well as to the predominance of T lymphocytes of memory associated with the TNF/IL-10 set and in the absence of the production of IFN- γ .³⁰

CONCLUSION

There is a low effectiveness in the control of leprosy in the state of Bahia, since there is a relatively high prevalence of relapse cases in the studied period, in addition to possible operational failures in the differential diagnosis of the disease, indicating a public health problem. Prospective studies are necessary to establish the actual rate of leprosy relapse in the state.

REFERENCES

1. Ministério da Saúde (BR), Secretaria de Políticas de Saúde, Departamento de Atenção Básica. Guia para o Controle da hanseníase [Internet]. Brasília: Ministério da Saúde; 2002 [cited 2018 Jan 15]. Available from: http://bvsms.saude.gov.br/bvs/publicacoes/guia_controle_hanseníase_cab10.pdf
2. World Health Organization. Relevé épidémiologique hebdomadaire. Weekly Epidemiol Rec [Internet]. 2017 July [cited 2018 Jan 15];92(28):393-404. Available from: <http://www.who.int/wer/2013/wer8831.pdf>
3. Ministério do Planejamento, Orçamento e Gestão (BR), Instituto Brasileiro de Geografia e Estatística. Brasil. Bahia. População [Internet]. Rio de Janeiro: IBGE; 2017 [cited

2018 Jan 15]. Available from: <https://cidades.ibge.gov.br/brasil/ba/panorama>

4. Sistema de Informação de Agravos de Notificação (BR). O SINAN [Internet]. Brasília: SINAN; 2016 [cited 2018 Jan 21]. Available from: <http://portalsinan.saude.gov.br/o-sinan>
5. Bona SH, Silva LOBV, Costa UA, Holanda AON, Campelo V. Recurrence of leprosy in reference centers in Teresina, State of Piauí, Brazil, 2001-2008. Epidemiol Serv Saúde. 2015 Oct; 24(4):731-8. Doi: <http://dx.doi.org/10.5123/s1679-49742015000400015>.
6. Sarmento APA, Pereirão AM, Ribeiro F, Castro JL, Almeida MB, Ramos NM. Epidemiological profile of leprosy in the period 2009 to 2013 in the city Montes Claros (MG), Brazil. Rev Soc Bras Clin Med. 2015 Dec; 3(13):180-4.
7. Vieira MS, Nascimento MVF, Moreira WC, Vera SO, Sousa VXS, Viana MRP. Profile leprosy epidemiological in Union-PI municipality of the period 2010 to 2013. Rev Interd [Internet]. 2015 [cited 2018 Mar 21];8(4):120-6. Available from: https://revistainterdisciplinar.uninovafapi.edu.br/index.php/revinter/article/view/784/pdf_271
8. Kaimal S, Thappa DM. Relapse in leprosy. IJDVL [Internet]. 2009 [cited 2018 Jan 15]; 75(2):126-35. Available from: <http://www.ijdv.com/printarticle.asp?issn=0378-6323;year=2009;volume=75;issue=2;spage=126;epage=135;aulast=Kaimal>
9. Vieira GD, Aragoso I, Carvalho RMB, Sousa CM. Leprosy in Rondonia: incidence and characteristics of reported cases, 2001-2012. Epidemiol Serv Saúde. 2014 June; 23(2):269-75. Doi: <http://dx.doi.org/10.5123/S1679-49742014000200008>
10. Sena IVO, Machado RS, Brito BAM, Araújo TME, Silva GRF, Andrade EMLR. Relapsed Cases of Leprosy in a Hyperendemic City in Northeast Brazil. Int Arch Med. 2017; 10(141):1-8. Doi: <https://doi.org/10.3823/2411>
11. Silva FL. Recidiva da hanseníase no estado da Bahia [dissertation] [Internet]. Salvador: Universidade Federal da Bahia; 2014. Available from: http://www.repositorio.ufba.br:8080/ri/bitstream/ri/17393/1/Diss_MP_Fabiola_Leal_2014.pdf
12. Araújo FCB, Souza CNP, Ramos EMLS, Braga RM. Aspectos Associados à Recidiva da hanseníase. Rev Bras Biom [Internet]. 2015 Jan [cited 2018 Feb 15]; 33(1):42-50.

Available from:
http://jaguar.fcav.unesp.br/RME/fasciculos/v33/v33_n1/A4_Flavia_Cristiane.pdf

13. Silva MEGC, Souza CDF, Silva SPC, Costa FM, Carmo RF. Epidemiological aspects of leprosy in Juazeiro-BA, from 2002 to 2012. *An Bras Dermatol*. 2015 Nov/Dec; 90(6):799-805. Doi: <http://dx.doi.org/10.1590/abd1806-4841.201533963>

14. Abraçado MFS, Cunha MHCM, Xavier MB. Adherence to treatment of leprosy in patients with leprosy reactional episodes in a reference unit. *Rev Pan-Amaz Saúde*. 2015 June; 6(2):23-8. Doi: <http://dx.doi.org/10.5123/S2176-62232015000200003>

15. Brito KKG, Andrade SSC, Diniz IV, Matos SDO, Oliveira SHS, Oliveira MJGO. Characteristics of leprosy cases diagnosed through the exam contact. *J Nurs UFPE*. 2016 Feb; 10(2):435-41. Doi: 10.5205/reuol.8557-74661-1-SM1002201608

16. World Health Organization. WHO Expert Committee on Leprosy: eighth report [Internet]. Geneva: WHO; 2012 [cited 2018 June 15]. Available from: http://www.searo.who.int/entity/global_leprosy_programme/publications/8th_expert_committee_2012.pdf

17. Melo SL, Macedo GMM, Pires CAA, Cunha MHCM. Recurrence of leprosy cases in a highly endemic area in Pará State, Brazil. *Rev Pan-Amaz Saúde*. 2014 Sept; 5(3):19-24. Doi: <http://dx.doi.org/10.5123/s2176-62232014000300003>.

18. World Health Organization. Global strategy for further reducing the leprosy burden and sustaining leprosy control activities 2006-2010: operational guidelines [Internet]. New Delhi: WHO; 2006 [cited 2018 Jan 18]. Available from: <http://www.who.int/lep/resources/SEAGLP20062.pdf>

19. Ministério da Saúde (BR), Secretaria de Vigilância em Saúde. Portaria Conjunta Nº 125, de 26 de março de 2009. Define ações de controle da hanseníase [Internet]. Brasília: Ministério da Saúde; 2009 [cited 2018 Apr 15]. Available from: http://bvsms.saude.gov.br/bvs/saudelegis/sv/s/2009/poc0125_26_03_2009.html.

20. Ministério da Saúde (BR), Gabinete do Ministro. Aprova as Diretrizes para Vigilância, Atenção e Controle da hanseníase. Portaria Nº 3.125, de 7 de outubro de 2010. Aprova as diretrizes para a Vigilância, Atenção e Controle da hanseníase [Internet]. Brasília: Ministério da Saúde; 2010 [cited 2018 Mar 21]. Available from:

http://bvsms.saude.gov.br/bvs/saudelegis/gm/2010/prt3125_07_10_2010.html

21. Ministério da Saúde (BR), Secretaria de Vigilância em Saúde, Departamento de Vigilância Epidemiológica. Guia de procedimentos técnicos: Baciloscopia em hanseníase [Internet]. Brasília: Ministério da Saúde; 2010 [cited 2018 Jan 18]. Available from:

http://bvsms.saude.gov.br/bvs/publicacoes/guia_procedimentos_tecnicos_corticosteroides_hanseníase.pdf

22. Teixeira MAG, Silveira VM, França ER. Characteristics of leprosy reactions in paucibacillary and multibacillary individuals attended at two reference centers in Recife, Pernambuco. *Rev Soc Bras Med Trop*. 2010 June; 43(3):287-92. Doi: <http://dx.doi.org/10.1590/S0037-86822010000300015>.

23. Diniz LM, Moreira MV, Puppim MA, Oliveira MLWDR. Retrospective study on leprosy relapse in the State of Espírito Santo. *Rev Soc Bras Med Trop*. 2009 Aug; 42(4):420-4. Doi: <http://dx.doi.org/10.1590/S0037-86822009000400012>.

24. Alves CJM, Barreto JA, Fogagnolo L, Contin LA, Nassif PW. Evaluation of the degree of incapacity of patients with a diagnosis of leprosy at a dermatology service in the state of São Paulo. *Rev Soc Bras Med Trop*. 2010 Aug; 43(4):1-2. Doi: <http://dx.doi.org/10.1590/S0037-86822010000400025>

25. Ferreira SMB, Ignotti E, Gamba MA. Clinical and laboratory characteristics in the retreatment of leprosy relapse. *Rev Bras Epidemiol*. 2012 Sept; 15(3):573-81. Doi: <http://dx.doi.org/10.1590/s1415-790x2012000300011>.

26. Araújo AERA, Aquino DMC, Goulart IMB, Pereira SRF, Figueiredo IA, Serra HO, et al. Neural complications and physical disabilities in leprosy in a capital of northeastern Brazil with high endemicity. *Rev Bras Epidemiol*. 2014 Oct/Dec; 17(4):899-910. Doi: 10.1590/1809-4503201400040009

27. Ribeiro GC, Fabri ACOC, Amaral EP, Machado IE, Lana FCF. Estimate of hidden prevalence of leprosy in the Diamantina micro-region - Minas Gerais *Rev eletrônica enferm*. 2014 Oct/Dec; 16(6):728-35. Doi: <http://dx.doi.org/10.5216/ree.v16i4.22371>.

28. Lopes DAC, Pereira LG. Analysis incidence of Leprosy in Juina municipality from 2004 to 2013. *Rev Saúde AJES* [Internet]. 2015 [cited 2018 Mar 21]; 1(2):201-26. Available from: http://www.revista.ajes.edu.br/index.php/S_AJES/article/view/20/pdf

29. Lima HMN. Epidemiological profile of leprosy patients treated at health Center in São Luís, MA. Rev Bras Clin Med [Internet]. 2010 [cited 2018 Feb 12]; 8(4):323-7. Available from:

https://www.researchgate.net/publication/263845285_Perfil_epidemiologico_dos_pacientes_com_hanseniose_atendidos_em_Centro_de_Saude_em_Sao_Luis_MA

30. Esquenazi D, Alvim I, Pinheiro RO, Moreira LO, Oliveira EB, Sarno EM, et al. Correlation between Central Memory T Cell Expression and Proinflammatory Cytokine Production with Clinical Presentation of Multibacillary Leprosy Relapse. Plos One. 2015 May; 10(5): e0127416. Doi:

[10.1371/journal.pone.0127416](https://doi.org/10.1371/journal.pone.0127416).

Submission: 2018/03/11

Accepted: 2018/08/12

Publishing: 2018/10/01

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