Temporal trend analysis of confirmed tuberculosis cases in Brazil from 2011 to 2020

Análise de tendência temporal dos casos confirmados de tuberculose no Brasil de 2011 a 2020

Análisis de tendencia temporal de casos confirmados de tuberculosis en Brasil de 2011 a 2020

RESUMO

Objetivo: Analisar a tendência temporal de casos confirmados e notificados de Tuberculose (TB) no Brasil de 2011 à 2020, segundo características demográficas, socioeconômicas e regionais. Método: Trata-se de um estudo de série temporal com dados oriundos do Sistema de Informação de Agravos de Notificação (SINAN). A análise de tendência foi obtida utilizando-se regressão linear simples, com nível de significância de 5%. Para o processamento dos dados e análises estatísticas, utilizou-se o Software for Statistics and Data Science (Stata). Resultado: Evidenciou-se uma tendência de estabilidade dos casos de TB no Brasil. Houve aumento significativo dos casos entre homens, pardos, pessoas acima de 55 anos, residentes na região norte do país, bem como o expressivo aumento entre pessoas alcoólicas e diabéticas. Conclusão: Apesar de sugerirem a melhora das estratégias de vigilância, prevenção e controle da doença, demandam ações intersetoriais de enfrentamento da TB.
DESCRITORES: Tuberculose; Epidemiologia; Saúde Pública; Controle de Doenças Transmissíveis.

ABSTRACT

Objective: To analyze the time trend of confirmed and reported cases of Tuberculosis (TB) in Brazil from 2011 to 2020, according to demographic, socioeconomic and regional characteristics. Method: This is a time series study with data from the Sistema de Informação de Agravos de Notificação (SINAN). Trend analysis was obtained using simple linear regression, with a 5% significance level. The Software for Statistics and Data Science (Stata) was used for data processing and statistical analysis. Results: A tendency toward stability of TB cases in Brazil was evident. There was a significant increase in cases among males, mixed race, persons over 55 years of age, residents of the northern region of the country, as well as a significant increase among alcoholics and diabetics. Conclusion: Despite suggesting the improvement of strategies for surveillance, prevention and control of the disease, they demand intersectoral actions to confront TB.
DESCRIPTORS: Tuberculosis; Epidemiology; Public Health; Communicable Disease Control.

RESUMEN

Objetivo: Analizar la tendencia temporal de los casos confirmados y notificados de Tuberculosis (TB) en Brasil de 2011 a 2020, según las características demográficas, socioeconómicas y regionales. Metodo: Se trata de un estudio de series temporales con datos del Sistema de Informação de Agravos de Notificação (SINAN). El análisis de la tendencia se obtuvo mediante una regresión lineal simple con un nivel de significación del 5%. Para el tratamiento de los datos y el análisis estadístico se utilizó el programa informático de estadística y ciencia de los datos (Stata). Resultados: Se evidenció una tendencia a la estabilidad de los casos de TB en Brasil. Hubo un aumento significativo de casos entre los hombres, la raza mixta, las personas mayores de 55 años, los residentes de la región norte del país, así como un aumento significativo entre los alcohólicos y los diabéticos. Conclusión: Además de sugerir la mejora de las estrategias de vigilancia, prevención y control de la enfermedad, se requieren acciones interdisciplinarias para hacer frente a la TB.
Descriptores: Tuberculosis; Epidemiología; Salud Pública; Control de Enfermedades Transmisibles.

Fernanda Lara Pereira de Souza
Nurse graduated from the State University of Minas Gerais – Passos Unit.
ORCID: 0002-3553-7401

Lauren Matozinhos Clark
Student in Nursing at the State University of Minas Gerais – Passos Unit.
ORCID: 0000-0001-6354-9699

Elton Junio Sady Prates
Undergraduate in Nursing at the Federal University of Minas Gerais. ORCID:
ORCID: 0000-0002-5049-186X

artigo

Souza, F. L. P., Clark, L. M., Prates, E. J. S., Prates, M. L. S., Moura, J. P.
Temporal trend analysis of confirmed tuberculosis cases in Brazil from 2011 to 2020

Maria Luiza Sady Prates
Student in Nursing at the Federal University of Minas Gerais.
ORCID: 0000-0001-6199-7092

Josely Pinto de Moura
Professor of the Nursing and Biological Sciences Course (Bachelor's Degree) at the State University of Minas Gerais - Passos Unit. PhD from the Interunit Doctoral Program in Nursing - USP/SP/RP, Master in Fundamental Nursing from USP, Specialist in Hospital Infection Control (USP), specialist in Hospital Administration (UNAERP), Graduated in Nursing from the Faculty of Nursing and Obstetrics of Steps.
ORCID: 0000-0002-3856-4181

INTRODUCTION

Tuberculosis (TB) is the humanitie's most antique infectious disease and, even if treatable, it is considered a global public health problem and one of the diseases that leads to death most frequently.[1,2]

The vulnerability to TB is influenced by biological determinants that affects the immune response to the Mycobacterium tuberculosis, as occur in little children and patients with comorbidities, as living with HIV or diabetes. [3,4]

The fragility to the TB is also influenced by social determinants fully bounded to poorness situation what generates a individual's higher exposition of contact risk with M. tuberculosis and consequently illness due to precarious conditions of living, subnutrition, inadequate conditions of work and lack access of health services. Beyond that, the patients with TB face productivity loss at their jobs and high costs associated with TB diagnosis and treatment. [3,4]

The years of 2015 has became a milestone at TB's story, when the World's Health Organization (WHO) has proposed a Global Strategy for the And of Tuberculosis.[6] Moreover, other documents at the global ambit have stand out commitments related to a view of a world free from this disease, with emphasis at the Moscow Declaration (2017) and the High Level Reunion's Declaration (2018).[4]

The global perspectives concerning to the TB politics are centered at the sustainability of the actions for the disease control, through adequate financing, high level political commitment and multissetorial engage.[5] With the aim of contributing with the goal of 90% of reduction at incidence rate; reduction of 95% at the number of deaths related to the disease; and permit that no person with TB, as well as his family, face catastrophic costs due to the infec-

> The vulnerability to TB is influenced by biological determinants that affects the immune response to the Mycobacterium tuberculosis, as occur in little children and patients with comorbidities, as living with HIV or diabetes

tion.[3,4] Yet, stands out the importance of organization and health services dinamic at the actions of TB control, as well as in the form that the services organize themselves to detect and treat the cases.[2]

In 2020, WHO promoted a report about the progress monitoring related to the TB global goals and the implementation of the High Level Politics Declaration. The document calls attention to the actual status of the intermediary turning points of the goals of the Global Strategy for the end of Tuberculosis established from 2015 to 2020, that wasn't reached.[5]

From this perspective, it aimed to analyse the temporal tendency of confirmed and notified cases of TB in Brazil from 2011 to 2020.

METHOD

It is a study of temporal series. The data were obtained through the Notification Worsening Information System (SINAN) and were exported of the Brazilian Public Health System Informatics Department (DATASUS), via TABNET, an app developed by DATASUS who disponibilize informations about public health. In that way, the data was collected on 8 september 2021, being those extracted from 2011 to 2020.

The TB indicator from the temporal series tendency analysis was stratified by Sex (masculine; feminine); Age-group (years: 0-14; 15-24; 25-34; 35-44; 45-54; 55-64; 65 or more); Schooling level (illiterate; 1ª to 4ª grade incomplete; 4ª grade compete of EF; 5ª to 8ª grade incomplete; Basic schooling; High school incomplete; College education; College education complete); ethnicity/skin tone (white; black; yellow; brown; indigenous); Infection by Human Immunodeficiency Virus (HIV); acqui-

artigo

Souza, F. L. P., Clark, L. M., Prates, E. J. S., Prates, M. L. S., Moura, J. P.
Temporal trend analysis of confirmed tuberculosis cases in Brazil from 2011 to 2020

red Immunodeficiency syndrome (AIDS); mellitus diabetes; mental illness; tabagism; alchoolism; illicit drug use; notificated cases at Brazil and other regions.

To avoid temporal tendency it was applied a simple linear regression as the variable (Yi) was the local and the independent variable (Xi) given by time (year of survey). The negative sign of the gradient (β) of the line adjusted by the template indicated that the relation between the indicator and the time was decreasing, while the value of the positive angular coefficient represented the medium annual increase.

As a measure of adequation of the template it was used a residue analysis and the R-squared that indicates the percentage of explaining the dependent variable of the values. It was adopted a significance level of 5%. For the data and statistic analysis processing, the Software for Statistics and Data

Science (Stata) version 16 was used.

It was used exclusively secondary data, which do not allow the subjects identification, minimizing this way the potential risks to the participants. All of the data were analysed according to the ethical principles established at Resolutions nº 466/12, and 510/16 of the Health National Council.

RESULTS

A stabilization tendency of the TB cases in Brazil was evidenced, with 87.813 cases registered in 2011 and 86.166 in 2020. Between the registered cases, it was observed a signifficative increasing tendency (p < 0,05) between the masculine sex, ethnicity/skin tone brown, residents of the North region of the country, at the age-group between 15 to 24 years and above 55 years

old (table 1).

It was verified, yet, a signifficative tendency (p < 0,05) of decrease of the cases between the lower schooling levels and a significant increase of cases between persons with the second grade complete (table 2). Furthermore, it was observed a significant tendency (p<0,05) of expressive increase of TB cases between alcoholic and diabetes carrier persons (table 3).

DISCUSSION

The resent study has evidenciate a higger incidence of TB cases between the masculine sex, ethnicity/skin tone brown, along, between persons of the age-group above 55 and above 65 years, what corroborates with the literatture.[7,8,9,10]

The high prevalence including TB mortality for the masculine sex is commonly related to a bigger contact with tubercule

Tabela 1 – Tendência temporal dos casos confirmados e notificados de tuberculose segundo variáveis sexo, faixa etária, raça/cor da pele, Brasil, 2010-2020.

Variável	Ano										p – valor	B*
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
Sexo												
Masculino	59.136	58.269	58.267	58.077	59.004	59.680	63.707	66.250	67.687	60.722	0.0201	834.4
Feminino	28.676	27.902	27.933	27.131	26.443	26.524	27.064	28.462	28.958	25.438	0.3780	-116.5
Faixa Etária												
0 a 14 anos	2.756	2.547	2.658	2.385	2.275	2.336	2.430	2.722	2.886	2.134	0.5661	-16.41
15 a 24 anos	14.334	14.388	14.173	13.928	14.624	15.076	16.452	17.421	17.507	14.725	0.0327	300.7
25 a 34 anos	21.215	20.723	20.539	20.482	20.160	20.072	21.174	21.917	22.395	20.090	0.5008	63.37
35 a 44 anos	17.262	16.872	17.062	16.778	16.623	16.975	17.509	18.493	18.723	16.647	0.2248	103.7
45 a 54 anos	15.039	14.792	14.490	14.264	13.941	13.740	14.054	14.622	14.678	12.957	0.0715	-119.4
55 a 64 anos	9.392	9.446	9.582	9.817	10.068	10.021	10.610	10.830	11.202	9.794	0.0159	148.3
65 ou +	7.736	7.314	7.591	7.476	7.745	7.977	8.532	8.704	9.187	8.033	0.0110	149.9
Raça/Cor da Pele												
Branca	29.142	29.597	28.650	27.937	27.086	26.716	26.332	27.182	27.963	27.628	0.0407	-227.8
Preta	11.524	11.966	11.787	11.206	11.154	10.871	11.027	11.444	12.244	12.632	0.3934	56.86
Amarela	743	709	705	663	610	582	422	537	552	720	0.1237	-17.55
Parda	35.293	37.644	37.882	38.682	38.535	39.427	40.428	43.665	46.289	47.358	0.0000	1.237
Indigena	884	994	883	945	870	993	931	912	936	929	0.7912	1.363

Fonte: Ministério da Saúde/SVS - Sistema de Informação de Agravos de Notificação - Sinan Net
Notas: Os dados foram coletados no dia 8 de setembro de 2021.
O cálculo do p-valor foi feito pela regressão linear.
Foram considerados, como estatisticamente significativos, os casos em que p-valor < 0.05.
* Indica o coeficiente de variação angular.

artigo

Souza, F. L. P., Clark, L. M., Prates, E. J. S., Prates, M. L. S., Moura, J. P.
Temporal trend analysis of confirmed tuberculosis cases in Brazil from 2011 to 2020

Tabela 2 – Tendência temporal dos casos confirmados e notificados de tuberculose segundo variáveis escolaridade e distribuição dos casos pelas regiões do país, Brasil, 2011-2020.

Variável	Ano										p - valor	B*
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
Escolaridade												
Analfabeto	4.248	4.195	3.882	4.158	3.243	3.668	3.756	4.367	4.133	3.168	0.2899	-51.57
1ª a 4ª série incompleta do EF	11.677	13.306	12.420	11.771	11.107	10.921	10.430	10.351	10.150	8.407	0.0005	-400.4
4ª série completa do EF	5.542	5.370	4.896	4.523	4.399	4.104	3.970	4.161	4.021	4.069	0.0003	-171.6
5ª a 8ª série incompleta do EF	12.318	17.374	17.172	16.895	16.839	17.093	16.533	17.670	18.831	12.623	0.7293	88.49
Ensino fundamental completo	4.549	4.724	4.255	4.594	4.245	4.343	4.553	4.618	5.287	5.373	0.0569	79.67
Ensino médio incompleto	5.165	9.876	9.898	10.002	10.024	10.268	10.675	11.463	11.992	5.737	0.4962	182.1
Ensino médio completo	6.350	6.658	7.140	7.112	7.149	7.138	7.457	7.784	8.555	9.233	0.0002	263.4
Educação superior incompleta	1.904	1.985	2.055	2.183	2.164	2.192	2.368	2.550	2.668	1.255	0.7965	12.10
Educação superior completa	1.923	2.101	2.242	2.313	2.309	2.316	2.476	2.432	2.853	2.220	0.0239	56.86
Região do país												
Norte	8.742	8.566	8.877	8.776	9.013	9.365	10.157	10.389	11.690	10.529	0.0006	303.0
Nordeste	24.385	23.729	23.073	22.390	22.202	22.545	23.803	25.134	25.058	21.882	0.9436	10.07
Sudeste	39.490	38.412	38.463	38.578	39.193	39.543	41.428	42.773	42.848	38.799	0.0772	335.0
Sul	11.300	11.168	11.266	11.174	11.026	10.678	11.235	11.867	12.453	10.828	0.4488	45.98
Centro-Oeste	3.896	4.308	4.529	4.295	4.018	4.076	4.155	4.557	4.605	4.128	0.4054	2.390
Brasil	87.813	86.183	86.208	85.213	85.452	86.207	90.776	94.720	96.655	86.166	0.1162	718.0

Fonte: Ministério da Saúde/SVS - Sistema de Informação de Agravos de Notificação - Sinan Net
Notas: Os dados foram coletados no dia 8 de setembro de 2021.
Foram considerados, como estatisticamente significativos, os casos em que p-valor < 0.05.
* Indica o coeficiente de variação angular.

artigo

Souza, F. L. P., Clark, L. M., Prates, E. J. S., Prates, M. L. S., Moura, J. P.

Temporal trend analysis of confirmed tuberculosis cases in Brazil from 2011 to 2020

bacillis in laboral activities and higher frequency of nocive habits for health between men.11,8 Even existing evidences that women are more succeptibles to the disease progression, the imunological response may be diferent according to the sex. However, women present bigger rates of health care if compared to the masculine sex.11

TB is shown as a neglected disease, which profile is associate to social aspect vulnerability, likewise poorness situation, precarity in health and education. In a country like Brazil, it must consider the magnitude of social inequalities that turns the individuals vulnerable to the disease manifestation.12 The TB vulnerability may be included to comorbidities as diabetes mellitus, infection by HIV, mental illnesses, silicosis and chronic immunosuppressive conditions, as well as subnutrition, gathered at alcohol, tobacco and other drugs abuse. Which are predictive factors for the non-adhering to the disease' s treatment and increase of health costs.4

It must emphasize that patients coinfected with HIV/AIDS present increased death risk and one third of the obits related to HIV are due from TB.8 Beyond that, the presence of diabetes increases the severity and the risk of outcomes unfavorable at the treatment influencing its gravity and causing severe symptoms of the disease as death by TB. Persons with diabetes and TB struggle more in controlling the glucose levels at the blood if compared to a person with diabetes without TB.13,12

The population with mental illness and in a state of social vulnerability present higher risks to develop infectious diseases, such as TB. Between the implications at TB diagnosis and treatment, in this population, struggling into adeering the treatments, higher chances of contracting TB, multidrug-resistant and low life quality is found.14 At the same way, tobacco use, illicit drugs and alcohol are shown as the associated factors to re entering to the treatment, what beyond prejudicing the immunological system contributes expressively for the irregular abandon and adoption to the chimioterapy.15,8

Furthermore, a tendency to increase the cases between persons with schooling from second grade complete has succeeded. Low scholarly it's a predictor by TB mortality, considered a reflex of an entire gathering of precarious circumstances, which increase the vulnerability to TB and are responsible for the bigger occurence of the disease and low adoption to the treatment. On the other hand, the higher schooling level has been associated with the lowest prevalence of TB mortality.15,16

The cases stability of the disease, notified at Brazil, during ten years analyzed, suggests that the monitoring of TB cases has shown some progresses. Although, its control is a challenge for Brazil, what shows the need of bigger investments at public politics development, once all of the social problems are reflexs of the inefficient politics.16

Factors as restraint to investigate contacts; make a precoce diagnose and start the antituberculosis therapy at basic care; as well as late diagnosis and low efficacy at the antituberculosis therapy, that may be decurrent of sociocultural factors associate to the patient and the health system organization, favour the TB dissemination.17 The spatial analysis of a health problem may contribute to the comprehension of its insertion at the society, its facing potentials and by consequence, the health situation of individuals and specific groups of the population.7

CONCLUSION

The present study results shows that there was a tendency of stability of confirmed and notified TB cases at Brazil. Those results, despite of suggesting the increase at vigilance, prevention and control of the disease strategies, demand intersetorial actions of TB facing, regarding the increasing tendency seen between man, brown, persons above 55 years, from the North region of the country, as well as the expressive increase of cases between diabetichal and alcoholic persons.

REFERENCES

1 Canto VB, Nedel FB. Completude dos registros de tuberculose no Sistema de Informação de Agravos de Notificação (Sinan) em Santa Catarina, Brasil, 2007-2016*. Epidemiologia e Serviços de Saúde, [S.L.], v. 29, n. 3, p. 1-10, jul. 2020. FapUNIFESP (SciELO). http://dx.doi.org/10.5123/s1679-49742020000300020.

2 Rabelo JVC, Navarro PD, Carvalho WS, Almeida IN, Oliveira CSF, Haddad JPA, Miranda SS. Avaliação do desempenho dos serviços de atenção primária à saúde no controle da tuberculose em metrópole do Sudeste do Brasil. Cadernos de Saúde Pública, [S.L.], v. 37, n. 3, p. 1-13, 2021. FapUNIFESP (SciELO). http://dx.doi.org/10.1590/0102-311x00112020.

3 Pedroso MRO, Guidoni LM, Zandonade E, Fregona G, Negri LSA, Oliveira SMVL. Custos catastróficos e sequelas sociais decorrentes do diagnóstico e tratamento da tuberculose no Brasil. Epidemiologia e Serviços de Saúde, [S.L.], v. 30, n. 3, p. 1-27, 2021. FapUNIFESP (SciELO). http://dx.doi.org/10.1590/s1679-49742021000300012.

4 Moreira ASR, Kritski AL, Carvalho ACC. Social determinants of health and catastrophic costs associated with the diagnosis and treatment of tuberculosis. Jornal Brasileiro de Pneumologia, [S.L.], v. 46, n. 5, p. 1-5, 2020. Sociedade Brasileira de Pneumologia e Tisiologia. http://dx.doi.org/10.36416/1806-3756/e20200015.

5 Brasil, Ministério da Saúde. Brasil Livre da Tuberculose. Plano Nacional pelo Fim da Tuberculose como Problema de Saúde Pública. Estratégias para 2021-2025. MS. Disponível em: https://www.gov.br/saude/pt-br/media/pdf/2021/abril/26/plano-nacional-pelo-fim-da-tb_para-consulta-publica.pdf

6 Souza CSB, Santos GM, Gouvêa AR, Costa MML, Mafra ALS, Pinto Neto JM, Santos EM. O significado da tuberculose pulmonar para a pessoa que adoece e seus comunicantes. SaudColetiv (Barueri) [Internet]. 11º de maio de 2020 [citado 22º de setembro de 2021];9(50):1760-8. Disponível em: http://www.revistas.mpmcomunicacao.com.br/index.php/

artigo

Souza, F. L. P., Clark, L. M., Prates, E. J. S., Prates, M. L. S., Moura, J. P.
Temporal trend analysis of confirmed tuberculosis cases in Brazil from 2011 to 2020

REFERENCES

saudecoletiva/article/view/153

7 Cavalin RF, Pellini ACG, Lemos RRG, Sato APS. Coinfecção TB-HIV. Revista de Saúde Pública, [S.L.], v. 54, p. 1-13, 14 dez. 2020. Universidade de Sao Paulo, Agencia USP de Gestao da Informacao Academica (AGUIA). http://dx.doi.org/10.11606/s1518-8787.2020054002108.

8 Moraes AP, Soares JPCF, Vieira RFS, Santos DR, Guibilei DB, Carvalho MOP. Notification of 6442 Cases of bone tuberculosis in Brazil: epidemiological profile from 2009 to 2018. Coluna/Columna, [S.L.], v. 20, n. 2, p. 105-108, jun. 2021. FapUNIFESP (SciELO). http://dx.doi.org/10.1590/s1808-185120212002239569.

9 Silva DJ, Abreu FP, Xavier LEF, Duarte LP, Neves VJR, Souza AA et al. Estudo de série histórica de casos de tuberculose entre 1999 e 2015, em Ouro Preto, Minas Gerais, Brasil. Cadernos Saúde Coletiva, [S.L.], v. 29, n. 1, p. 36-45, mar. 2021. FapUNIFESP (SciELO). http://dx.doi.org/10.1590/1414-462x202129010120.

10 Rodrigues NCP, Andrade MK de N, O'dwyer G, Flynn M, Braga JU, Almeida AS de, Bastos LS, Lino VTS. Distribution of pulmonary tuberculosis in Rio de Janeiro (Brazil): a spatial analysis. Ciência & Saúde Coletiva, [S.L.], v. 22, n. 12, p. 4125-4134, dez. 2017. FapUNIFESP (SciELO). http://dx.doi.org/10.1590/1413-812320172212.0143016.

11 Cecilio HPM, Santos AL, Marcon SS, Latorre MRDO, Mathias TAF, Rossi RM. Tendência da mortalidade por tuberculose no estado do Paraná, Brasil – 1998 a 2012. Ciência & Saúde Coletiva, [S.L.], v. 23, n. 1, p. 241-248, jan. 2018. FapUNIFESP (SciELO). http://dx.doi.org/10.1590/1413-81232018231.25242015.

12 Sousa GGS, Pascoal LM, Costa ACPJ, Santos FS; Santos LH, Arcêncio RA et al. Trend and factors associated with Tuberculosis-Diabetes Mellitus comorbidity in a Northeastern Brazilian municipality. Revista Brasileira de Enfermagem, [S.L.], v. 74, n. 3, p. 1-8, 2021. FapUNIFESP (SciELO). http://dx.doi.org/10.1590/0034-7167-2020-1238.

13 Beraldo AA, Andrade RLP, Pinto ÉSG, Silva-Sobrinho RA, Saita NM, Monroe AA et al. Tuberculosis and diabetes mellitus: sociodemographic and clinical profile in brazilian municipalities. Revista Gaúcha de Enfermagem, [S.L.], v. 45, p. 1-10, 2021.

14 Arroyo LAH, Arcoverde MAM, Alves JD, Fuentealba-Torres M, Cartagena-Ramos D, Scholze AR et al. Spatial analysis of cases of Tuberculosis with Mental Disorders in São Paulo. Revista Brasileira de Enfermagem, [S.L.], v. 72, n. 3, p. 654-662, jun. 2019. FapUNIFESP (SciELO). http://dx.doi.org/10.1590/0034-7167-2017-0949.

15 Silva TC, Matsuoka P da FS, Aquino DMC de, Caldas A de JM. Fatores associados ao retratamento da tuberculose nos municípios prioritários do Maranhão, Brasil. Ciência & Saúde Coletiva, [S.L.], v. 22, n. 12, p. 4095-4104, dez. 2017. FapUNIFESP (SciELO). http://dx.doi.org/10.1590/1413-812320172212.20612015.

16 Alves JD, Arroyo LH, Arcoverde MAM, Cartagena-Ramos D, Berra TZ, Alves LS et al. Magnitud de los determinantes sociales en el riesgo de mortalidad por tuberculosis en el Centro-Oeste de Brasil. Gaceta Sanitaria, [S.L.], v. 34, n. 2, p. 171-178, mar. 2020. Elsevier BV. http://dx.doi.org/10.1016/j.gaceta.2019.01.004.

17 Mancuzo EV, Netto EM, Sulmonett N, Viana VS, Croda J, Kritski AL et al. Spirometry results after treatment for pulmonary tuberculosis: comparison between patients with and without previous lung disease. Jornal Brasileiro de Pneumologia, [S.L.], v. 46, n. 2, p. 1-9, 2020. Sociedade Brasileira de Pneumologia e Tisiologia. http://dx.doi.org/10.36416/1806-3756/e20180198.