DOI: https://doi.org/10.36489/nursing.2021v24i273p5243-5254

Spatial analysis of deaths from pulmonary tuberculosis in the state of Amazonas

ABSTRACT | Objective: to analyze the distribution of deaths from pulmonary tuberculosis in the state of Amazonas. Method: it is an ecological study with secondary data from the Mortality Information System, during the period from 2007 to 2017. The QGIs software was used to create a digital map and the RStudio software for statistical analysis. In the data analysis, multiple linear regression, the Moran Global index and the Lagrange multiplier test were applied. Results: 1,267 cases of deaths from pulmonary tuberculosis were identified in the state of Amazonas. Most deaths occurred in males (64.64%); singles (47.43%); aged ≥ 60 years (51.14%); race / brown color (71.11%). It was found that there is no spatial autocorrelation using the Moran Global index (0.0094). Conclusion: The spatial distribution of deaths occurred heterogeneously in different regions of the state of Amazonas, with high mortality rates during the period from 2007 to 2017.
Keywords: Pulmonary Tuberculosis; Death; Spatial Distribution.

RESUMEN | Objetivo: analizar la distribución de muertes por tuberculosis pulmonar en el estado de Amazonas. Método: se trata de un estudio ecológico con datos secundarios del Sistema de Información de Mortalidad, durante el período de 2007 a 2017. Se utilizó el software QGIs para crear un mapa digital y el software RStudio para análisis estadístico. En el análisis de datos se aplicó regresión lineal múltiple, el índice Moran Global y la prueba del multiplicador de Lagrange. Resultados: se identificaron 1.267 casos de defunciones por tuberculosis pulmonar en el estado de Amazonas. La mayoría de las muertes ocurrieron en hombres (64,64%); solteros (47,43%); edad ≥ 60 años (51,14%); raza / color marrón (71,11%). Se encontró que no existe autocorrelación espacial usando el índice Moran Global (0.0094). Conclusión: La distribución espacial de las defunciones ocurrió de manera heterogénea en diferentes regiones del estado de Amazonas, con altas tasas de mortalidad durante el período 2007 a 2017.
Palabras claves: Tuberculosis Pulmonar; Muerte; Distribución Espacial.

RESUMO | Objetivo: analisar a distribuição dos óbitos por tuberculose pulmonar no estado do Amazonas. Método: trata-se de um estudo ecológico com dados secundários do Sistema de Informação de Mortalidade, durante o período de 2007 a 2017. O software QGIs foi utilizado para elaborar um mapa digital e o software RStudio para as análises estatísticas. Na análise dos dados foi aplicado a regressão linear múltipla, o índice de Moran Global e o teste multiplicador de Lagrange. Resultados: identificou-se 1.267 casos de óbitos por tuberculose pulmonar no estado do Amazonas. A maioria dos óbitos ocorreram no sexo masculino (64,64%); solteiros (47,43%); com faixa etária ≥ 60 anos (51,14%); raça/cor parda (71,11%). Verificou-se que não existe autocorrelação espacial através do índice de Moran Global (0.0094). Conclusão: A distribuição espacial dos óbitos ocorreu de forma heterogênea nas diferentes regiões do estado Amazonas, apresentando elevadas taxas de mortalidade durante o período de 2007 a 2017.
Palavras-chaves: Tuberculose Pulmonar; Óbito; Distribuição Espacial.

Mirely Ferreira dos Santos

Nurse - PhD student in Public Health at the University of São Paulo - USP. Master in Health Sciences from UFRR. Specialist in Urgency and Emergency (FIP / PB). EBTT professor at the Federal Institute of Amazonas-IFAM / Currently in a Provisional Exercise at the Rectorate of the Federal Institute of São Paulo / IFSP - Server Health Care Coordination - CSS.
ORCID: 0000-0002-8842-3678

Jacinta Ferreira dos Santos Rodrigues

Portuguese Language Teacher. Master of Arts from the Federal University of Roraima - UFRR. Specialist in Language, Linguistics and Literature (FIP / PB). EBTT professor at the Federal Institute of Paraíba - IFPB
ORCID: 0000-0003-2452-9956

Recebido em: 05/11/2020
Aprovado em: 23/11/2020

Mikaely Ferreira dos Santos

Administrator from the State University of Paraíba - UEPB. MBA in Coaching from UNINASSAU - PE.
ORCID: 0000-0001-7319-1440

INTRODUCTION

Tuberculosis (TB) is an infectious disease caused by Mycobacterium tuberculosis. [1,2] It is an alcohol-acid resistant bacillus (AARB) that has a preference for lung tissue, but can also affect other regions of the body, such as bones, nerves, among others. It is considered one of the oldest infectious diseases of mankind and, although it can be prevented and treated, it remains today as a serious public health problem. According to the World Health Organization (WHO), in 2016 there were 10,4 million new cases of tuberculosis in the world and 1,3 million deaths. [1]

There are several factors that have been associated with tuberculosis, including endogenous factors (age, sex, race, the presence of HIV and diabetes) and lifestyle (alcohol consumption). [3,4] This approach, even though it identifies risk factors at the individual level, does not consider the socioeconomic context of the population, which is one of the main determinants of the incidence of TB. [5]

The prevalence and mortality from TB have undergone several changes over the years worldwide, the prospects were that most countries would reach the goal of reducing these coefficients by 50% in relation to the indicators from 1990 to 2015. In 2015, a challenge was launched by the World Health Organization: the elimination of tuberculosis by 2050.

6 The disease represents the second leading cause of death among infectious diseases and, in 2012, caused around 1,3 million deaths worldwide, demonstrating its severity, especially in the 22 countries that concentrate 80% of the disease burden. [1]

Brazil is among the 30 countries that concentrate 80% of TB cases in the world. 1 Annually, there are about 73 thousand new cases and 4.500 deaths from tuberculosis in the country 7, being Amazonas, the state with the highest TB incidence rate, estimated at 71,4 cases per 100 thousand inhabitants, in 2017, double the country's average incidence, which was 33,5 cases per 100 thousand inhabitants. [8]

In the period from 2001 to 2011, the average annual mortality rate in Amazonas was 3,5 deaths per 100 thousand inhabitants, higher than the country's average rate, which was 2.5 deaths per 100 thousand inhabitants. During this period, both the incidence rate and the mortality rate showed a slow reduction. [9] In recent years, the disease has worsened, with an average annual increase of 3% in the incidence rate. [10]

Spatial and temporal analysis has been used as an important tool to assist in the process of understanding the complexity of tuberculosis. [11] Given the above, this study aimed to analyze the trend and distribution of deaths from pulmonary TB in the state of Amazonas, from 2007 to 2017, and to identify the areas with the highest frequency of deaths per municipality.

METHOD

This is an ecological study with secondary data from the Mortality Information System (MIS), with the unit of analysis being the municipalities of the state of Amazonas. The study population consisted of individuals residing in that state, who were diagnosed with pulmonary TB and died between 2007 and 2017.

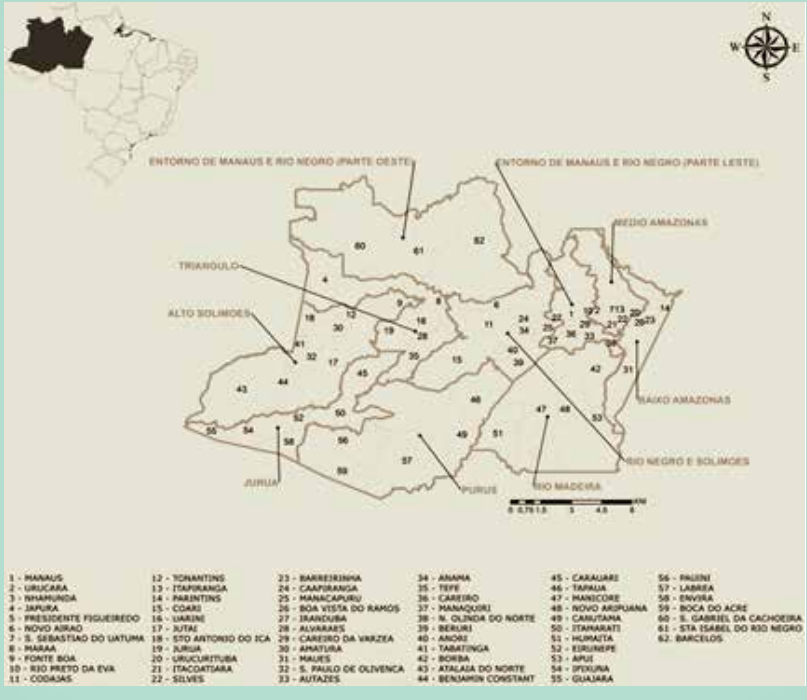
Information on the number of deaths, according to the years 2007 to 2017, was collected from secondary data available in the DATASUS [12] MIS. Data on the sociodemographic characteristics of the population of municipalities in the state of Amazonas, on the other hand, were collected through censuses carried out by the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística - IBGE) in the years 2000 and 2010, using the IBGE Automatic Recovery System - SIDRA (Sistema IBGE de Recuperação Automática). [13]

According to the 2010 Population Census, the state of Amazonas has a population of 3.483.985 inhabitants, this population being considered the second largest in the North Region and corresponding to approximately 1,8% of the current population in Brazil. 13 Amazonas has a total area of 1.559.161 km2, comprising 62 municipalities, the capital Manaus is the largest city in the North Region, with 2,1 million inhabitants. Figure 1 shows the distribution of the municipalities and the 9 health regions in the state of Amazonas.

In this study, the variables of interest were the number of deaths from pulmonary tuberculosis that occurred in each municipality in the state of Amazonas during the years 2007 to 2017, obtained by declaring deaths in the SIM of DATASUS, with the underlying cause being pulmonary TB - International Classification of Diseases, 10th revision (ICD - 10). The mortality rate per 100.000 inhabitants was calculated, according to the ratio between the number of deaths and the resident population. The variables were also selected: sex; marital status; race/color; age; education and place of death.

After data collection, a database was created in Excel with all information on the study variables. The QGIs software was used to create a digital map with the segments of the municipalities in the state

Figure 1 - Distribution of health municipalities and regions in the state of Amazonas.



Source: IBGE.

of Amazonas, thus providing the shapefile extension. The Excel spreadsheet was converted to CSV and exported to QGIs to be transformed into the attributes table. Subsequently, these data were transformed into a shape to be worked on and analyzed in the R software, using the language for statistical computing (version 3.6.1) [14] in RStudio (version 1.1.463).

For data analysis, multiple linear regression was used, the initial exploratory analysis comprised the estimate of the occurrence of deaths from pulmonary tuberculosis with sociodemographic variables. The Moran Global index was calculated and the Lagrange multiplier test was applied to verify the existence of spatial dependence. The research met and respected the guidelines of Resolution 466/2012 of the National Health Council of the Ministry of Health [15], and it did not need approval from the Research Ethics Committee, as the secondary data used in this study are in the public domain and there was no identification of the participants.

> “1.267 cases of deaths from pulmonary TB were identified in the state of Amazonas.”

RESULTS

1.267 cases of deaths from pulmonary TB were identified in the state of Amazonas. Figure 2 shows the mortality rate from pulmonary TB, according to the years 2007 to 2017. It can be seen that in the years 2007 (2,6 cases per 100,000 inhabitants) to 2009 (3,5 cases per 100.000 inhabitants) there was a trend of increasing mortality rate, in 2010 (2,8 cases per 100.000 inhabitants) there was a decline, followed by a further increase in 2011 (3,1 cases per 100,000 inhabitants) with an increasing trend until 2017 (4,2 cases for every 100.000 inhabitants).

Figure 2 - Characterization of the pulmonary tuberculosis mortality rate in the state of Amazonas, 2007 to 2017.

Source: SIM and IBGE.

The municipalities that presented a higher proportion of deaths from pulmonary TB in the period from 2007 to 2017, were: Manaus (59,52%); São Gabriel da Cachoeira (3%); Parintins (3%); Manacapuru (2,8%); Maués (2,4%); Tabatinga (2%); Itacoatiara (1,7%). All 62 municipalities in the state had cases of death, and some municipalities had a record of only one case, especially Anamã, Guajará, Japurá, Jaruá, Maraã and Tonantis. The lethality for pulmonary TB in the state of Amazonas was 3,88 for every 100 cases.

Regarding the sociodemographic variables of individuals who died in the state of Amazonas, during the period from 2007 to 2017, it was found that the majority of deaths occurred in males (64,64%); singles (47,43%); as for age, the largest proportion had an age group ≥ 60 years (51,14%); the most frequent race/color was brown (71,11%), followed by white (12,94%) and indigenous (9,94%). Regarding the education variable, (25,8%) did not present information, followed by low education (23,6%). There was also a preponderance of deaths occurring in the hospital environment (84,21%).

In the spatial analysis, 1.267 cases of death were geocoded, according to the period studied. Figure 3 shows a map showing the distribution of the municipalities with the highest mortality rates, according to the co-

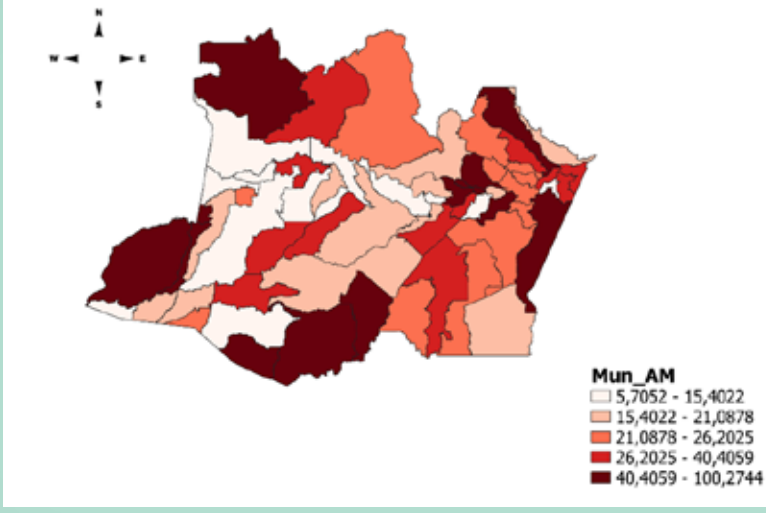
lor gradients with darker tones, thus demonstrating a disparity in the spatial distribution of deaths in the state of Amazonas. It is observed that the darkest areas of occurrence of deaths from pulmonary TB are concentrated in the municipalities of Manaus, São Gabriel da Cachoeira, Maués, Tabatinga, Iranduba, Manacapuru, Itacoatiara, Tefé and Parintins.

Through the application of multiple linear regression, it was identified that there is collinearity between the independent variables (sex; marital status; race/color; age; education). All assumptions were verified in the residues. The residues in function of the predicted values presented normal distribution and in function of the coovariables, it was observed that there is independence of the residues.

The Moran Global index was calculated and according to the result obtained (0.0094), it was found that there is no spatial autocorrelation, as its value was low. To be sure of the lack of spatial dependence, the Lagrange multiplier test (LMlag = 0.0387 and p <0.8439) was applied, which confirmed that there is no spatial dependence, as the values of the test statistic were very low.

> Studies report that TB is an infectious disease transmissible through the airways that annually affects thousands of people.

Figure 3 - Distribution of cases of deaths from pulmonary tuberculosis, by municipality of residence, Amazonas state, from 2007 to 2017.



Source: SIM-DATASUS.

DISCUSSION

The mortality rates for pulmonary TB identified in this study were significantly high in the state of Amazonas during the period from 2007 to 2017, with the finding that the city of Manaus had the highest proportion of deaths in the state. These data are worrying, knowing that pulmonary TB is a curable disease and that treatment is offered free of charge by the Unified Health System-SUS. These results are discrepant when compared to other regions and states in Brazil, where mortality rates are relatively lower. [16]

Studies report that TB is an infectious disease transmissible through the airways that annually affects thousands of people. Multi-drug resistance and HIV co-infection make treatment even more difficult. Although this is offered free of charge by the Ministry of Health, there are still high rates of incidence, and progression to deaths from TB, these consequences can be attributed to treatment abandonment or even inadequate adherence. [17]

Brazilian states are markedly heterogeneous, both in terms of indicators of TB morbidity and mortality, as well as performance indicators for control actions, with states in the North and Northeast regions having the worst rates in terms of disease burden and the performance of control measures. [7]

Regarding the sociodemographic variables analyzed, it was found that most cases of death were male, single, aged ≥ 60 years. These results are consistent with the study conducted in Rio Grande Norte, which reports a higher proportion of deaths from pulmonary TB in men. [18] As for age, they differ with the results of surveys conducted in the states of Minas Gerais [19], Mato Grosso do Sul [20] and Ceará [21], who state that deaths occurred in greater numbers among people aged ≤

52 years. The variable marital status, in turn, corroborates the results of the surveys above, demonstrating the prevalence of singles. [19,20,21]

With regard to race/color, the study showed that most cases (71,11%) were brown. This result is consistent with research data in Maranhão (68,91%) 22 and in Mato Grosso do Sul (50,5%) 20 who demonstrated that the majority of deaths occurred in individuals of mixed race/color. As for education, there was a predominance of low education, these results express similarity with studies that demonstrated the prevalence of illiteracy or low education as less privileged situations from the financial point of view, thus expressing risk factors for pulmonary TB. [19,20,23]

Another study also reports that low education, unemployment and income are individual factors associated with the increase in the incidence of TB and low adherence to treatment, which may be related to access to health services and the quality of diagnosis. People with less education and lower income are less likely to realize that they are at risk and to comply with treatment, as they have inequality in individual access to information, the benefits arising from knowledge, consumer goods and especially health services. [24]

Regarding the local variable of death occurrence, referring to the operational profile, it was identified that the highest proportion of deaths occurred in the hospital environment. These findings can be corroborated with national studies carried out in the states in Rio Grande do Norte [18], Maranhão [22], Mato Grosso do Sul [23] and in the city of São Paulo [25], which presented records above 80% of deaths from pulmonary TB that occurred in the hospital.

Spatial analysis allowed to identify the distribution of cases of deaths from pulmonary TB, being more frequent in certain municipalities in the state of Amazonas. Through the inspection of the spatial distribution map (Figure 3), spatial disparities were evidenced with a more intense distribution of deaths from pulmonary TB in the regions around Manaus; Rio Negro (west); Juruá River; in the regions of the Middle and Lower Amazonas and the Alto Solimões. These results are important to identify the pattern of distribution of this health problem to the population in the state of Amazonas.

Spatial analysis allowed to identify the distribution of cases of deaths from pulmonary TB, being more frequent in certain municipalities in the state of Amazonas.

It is noted that some of these regions, where mortality from pulmonary TB was higher, as in Rio Negro (western Amazonas state), the Middle and Lower Amazonas, coincide with the municipalities that present low social conditions with areas of high vulnerability such as the municipality of São Gabriel da Cachoeira. These data show that socioeconomic factors play an important role in the magnitude of TB.

The capital Manaus had an expressively high proportion of deaths when compared to the other municipalities in the state of Amazonas, as a large part of the Amazonian population resides in Manaus and, knowing that this city had a large population increase in the last decade, due to the migratory process, mainly of indigenous people in search of better living conditions, consequently, this resulted in a greater concentration in the number of subnormal clusters.

The behavior of TB, like that of other endemic diseases, is strongly influenced by the environment, making it possible to show that the association between TB and precarious socioeconomic conditions dates back to the beginning of the epidemiology of this disease, thus, there is a need to study it and about it intervene, taking into account its spatial distribution. [26] Spatial analysis is relevant for investigating and understanding the occurrence and distribution of mortality in a city, as it is the environment where the infectious agent circulates that, under specific conditions, causes the disease and even death as a result. [27]

Studies show that the strategies for reaching the agreed global goals, it is necessary to systematically integrate a set of surveillance actions, which identify the main points between the process of capturing and notifying new cases of the disease. [8] Health information should aim to reduce uncertainties and identify priority situations in order to support adequate planning for the execution of actions that condition reality to the necessary transformations. [28]

CONCLUSION

The spatial distribution of deaths from pulmonary tuberculosis occurred heterogeneously in different regions in the state of Amazonas, establishing consistency with the population's socioeconomic conditions. The present study provides information on high mortality rates during the period from 2007 to 2017, these findings demonstrate that pulmonary TB is still a public health problem in the state of Amazonas and that new strategies are needed to face this disease. The results of the research may also contribute to guiding managers and health professionals about the priority areas for the occurrence of pulmonary TB and in making decisions for the effectiveness of public policies and health promotion strategies.

References

1. Who. Global tuberculosis report 2017. World Health Organization. Geneva: 2017.
2. Brasil. Portal da Saúde. Ministério da Saúde. Tuberculose. Brasília: Ministério da Saúde, 2017. [Acesso em: 25 de ago. 2020]. Disponível em: https://portalarquivos2.saude.gov.br/images/pdf/2017/junho/29/plano_nacional_tb_web.pdf
3. Lacerda SNB, Temoteo RCA, Figueiredo TMRM, Luna FDT, Sousa MAN, Abreu LC, Fonseca FLA. Individual and social vulnerabilities upon acquiring tuberculosis: a literature systematic review. Int Arch Med. 2014; 7:1–8. [Acesso em: 28 de ago. 2020]. Disponível em: https://doi.org/10.1186/1755-7682-7-1
4. Ferrara G, Murray M, Winthrop K, Centis R, Sotgiu G, Migliori GB, Maeurer M, Zumla A. Risk factors associated with pulmonary tuberculosis: smoking, diabetes and anti-TNFα drugs. Curr Opin Pulm Med. 2012; 18:233–40. [Acesso em: 11 de out. 2020]. Disponível em: https://doi.org/10.1097/MCP.0b013e328351f9d6
5. Lonnroth K, Castro KG, Chakaya JM, Chauhan LS, Floyd K, Glaziou P, Raviglione MC. Tuberculosis control and elimination 2010–50: cure, care, and social development. Lancet. 2010; 375:1814–29. [Acesso em: 11 de out. 2020]. Disponível em: https://doi.org/ 10.1016/S0140-6736(10)60483-7
6. Who. The global plan to stop TB 2011-2015: transforming the fight towards elimination of tuberculosis - reprinted with changes, 2011. World Health Organization. Geneva: 2011.
7. Brasil. Boletim Epidemiológico. Ministério da Saúde. Brasília: 2015.
8. Brasil. Boletim epidemiológico - Implantação do Plano Nacional pelo Fim da Tuberculose como Problema de Saúde Pública no Brasil: primeiros passos rumo ao alcance das metas. Secretaria de Vigilância em Saúde/ Ministério da Saúde. Brasília. 2018.
9. GARRIDO MS, Sékula SB, Souza AB, et al. Temporal distribution of tuberculosis in the State of Amazonas, Brazil. Revista da Sociedade Brasileira de Medicina Tropical. 2015; v. 48, p. 63-69.
10. Castro DB. Tuberculose na população amazonense: distribuição espacial, determinantes sociais e a desigualdade da incidência nos anos recentes [tese]. Rio de Janeiro: Fundação Oswaldo Cruz, Escola Nacional de Saúde Pública Sergio Arouca; 2018. [Acesso em: 16 de out. 2020]. Disponível em: https://www.arca.fiocruz.br/bitstream/icict/30886/2/daniel_barros_de.pdf
11. Santos FGB, Paiva JPS, Araújo EMCF, Leal TC, Souza CDF, Duailibe FT. Tuberculose no estado de Alagoas: análise espacial e temporal entre 2010 e 2015. O Mundo da Saúde, São Paulo. 2019; 43 (1): 129-150. [Acesso em: 28 de ago. 2020]. Disponível em: 10.15343/0104-7809.20194301129150
12. Brasil, Ministério da Saúde. SIM/DATASUS. Sistema de Informação sobre Mortalidade. [Acesso em: 26 de mai. 2020]. Disponível em: http://tabnet.datasus.gov.br/cgi/deftohtm.exe?sim/cnv/obt10am.def
13. IBGE, Instituto Brasileiro de Geografia e Estatística. [Acesso em: 29 de ago. 2020]. Disponível em: https://sidra.ibge.gov.br/pesquisa/censo-demografico/demografico-2010/universo-caracteristicas-da-populacao-e-dos-domicilios
14. R Equipe Central, 2018. R: uma linguagem e ambiente para computação estatística. Viena, Áustria: R Foundation for Statistical Computing. Disponível em: https://www.R-project.org/
15. Brasil. Ministério da Saúde. Comissão Nacional de Ética em Pesquisa. Conselho Nacional de Saúde (BR). Diretrizes e Normas regulamentadoras de pesquisa envolvendo seres humanos. Resolução N° 466/12 de 12 de dezembro de 2012 – CNS. Brasília, DF, 2012.
16. Brasil, Ministério da Saúde. Sala de Apoio à Gestão Estratégica. Brasília: SAGE/SUS [Acesso em: 10 de ago. 2020]. Disponível em: http://189.28.128.178/sage/
17. Sousa LO, Mitano F, Lima MCRAA, Sicsú AN, Silva LMC, Palha PF. Terapia de curta duração da tuberculose: uma análise discursiva. Rev Bras Enferm. 2016; 69 (6):1154 - 63. [Acesso em: 16 de out. 2020]. Disponível em: http://dx.doi.org/10.1590/0034-7167-2016-0330
18. Queiroz AAR, Berra TZ, Garcia MCC, Popolin MP, Belchior AS, Yamamura M et al. Padrão espacial e tendência temporal da mortalidade por tuberculose. Rev. Latino-Am. Enfermagem. 2018; 26 – 2992. [Acesso em: 16 de out. 2020]. Disponível em: http://10.1590/1518-8345.2049.2992
19. Augusto CJ, Carvalho WS, Gonçalves AD, Ceccato MG, Miranda SS. Characteristics of tuberculosis in the state of Minas Gerais, Brazil: 2002-2009. J Bras Pneumol. 2013; 39(3):357-64. [Acesso em: 16 de out. 2020]. Disponível em: http://dx.doi.org/10.1590/ S1806-37132013000300013
20. Espindola LCD. Estudo da mortalidade por tuberculose em Campo Grande - MS, 2001 a 2008 [Dissertação]. Rio de Janeiro: Escola Nacional de Saúde Pública; 2010. [Acesso em: 20 de out. 2020]. Disponível em: https://www.arca.fiocruz.br/bitstream/icict/23063/1/1159.pdf
21. Façanha MC. Evolução da mortalidade por tuberculose em Fortaleza (CE), entre 1980 e 2001. J Bras Pneumol. 2006; 32(6): 553-8. [Acesso em: 11 de out. 2020]. Disponível em: http://dx.doi.org/10.1590/ S1806-37132006000600013
22. Santos M, Yamamura M, Garcia MCC, Popolin MP, Silveira TRS, Arcêncio RA. Análise espacial dos óbitos por tuberculose pulmonar em São Luís, Maranhão. J Bras Pneumol. 2014; 40 (5): 543 – 551. [Acesso em: 10 de ago. 2020]. Disponível em: http://dx.doi.org/10.1590/S1806-37132014000500011
23. Larroque MM, Pontes ERJC, Marques APC, Fernandes SM. Mortalidade por tuberculose em municípios prioritários do estado de Mato Grosso do Sul, 1999-2008. Arq. Ciênc. Saúde UNIPAR, Umuarama. 2013; 17 (3): 163-169. [Acesso em: 10 de ago. 2020]. Disponível em: https://revistas.unipar.br/index.php/saude/article/viewFile/5066/2948
24. Yamamura M, Santos-Neto M, Santos RAN, Garcia MCC, Nogueira JÁ, Arcêncio RA. Epidemiological characteristics of cases of death from tuberculosis and vulnerable territories. Rev. Latino-Am. Enfermagem. 2015; 23 (5): 910-8. [Acesso em: 11 de out. 2020]. Disponível em: http://dx.doi.org/10.1590/0104-1169.0450.2631
25. Lindoso AA, Waldman EA, Komatsu NK, Figueiredo SM, Taniguchi M, Rodrigues LC. Profile of tuberculosis patients progressing to death, city of São Paulo, Brazil, 2002. Rev Saúde Pública. 2008; 42 (5): 805-12. [Acesso em: 16 de out. 2020]. Disponível em: http:// dx.doi.org/10.1590/S0034-89102008000500004
26. Hino P, da Costa-Junior ML, Sassaki CM, Oliveira MF, Villa TC, dos Santos CB. Time series of tuberculosis mortality in Brazil (1980-2001). Rev Lat Am Enfermagem. 2007;15 (5): 936-41. [Acesso em: 16 de out. 2020]. Disponível em: http://dx.doi.org/10.1590/ S0104-11692007000500009
27. Maciel ENL. Post-2015 agenda strategies for tuberculosis control in Brazil: challenges and opportunities. Epidemiol Serv Saúde. 2016. [Acesso em: 28 de ago. 2020]. Disponível em: http://dx.doi. org/10.5123/s1679-49742016000200021
28. Souza MSPL, Aquino R, Pereira SM, Costa MCN, Barreto ML, Natividade M et al. Fatores associados ao acesso geográfico aos serviços de saúde por pessoas com tuberculose em três capitais do Nordeste brasileiro. Cad. Saúde Pública. 2015; 31(1): 111-120.