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REVIEW ARTICLE

Social determinants of health and catastrophic costs associated with the diagnosis and treatment of tuberculosis

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ABSTRACT

The epidemiological relevance of tuberculosis is directly related to the socioeconomic profile of a given country. Vulnerability to tuberculosis is influenced by biological factors (e.g., malnutrition, HIV infection, and age) and social factors (e.g., unhealthy housing, high population density, inappropriate working conditions, and lack of access to health services). In many cases, multiple vulnerabilities occur in conjunction. We propose here a reflection on tuberculosis from the point of view of the social determinants of health, as well as the costs associated with its diagnosis and treatment in Brazil, based not only on data in the international literature but also on evidence related to the national context. Given the magnitude of tuberculosis as a socially mediated disease, there is an evident need for greater involvement of health professionals and of the scientific community to implement relevant operational and research measures to understand the social conditions influencing the health-illness continuum for tuberculosis patients. Although the recent economic crisis in Brazil has contributed to increased mortality from all causes, including tuberculosis, health and social protection expenditures have mitigated detrimental health effects. The evidence presented here underscores the importance of public social protection policies for minimizing the effects of tuberculosis indicators, with the aim of eliminating tuberculosis in Brazil.

Keywords: Tuberculosis; Social determinants of health; Cost of illness; Costs and cost analysis.

INTRODUCTION

In recent decades, there have been advances in tuberculosis control worldwide. The incidence of tuberculosis decreased by 2% between 2017 and 2018, and 53 million deaths were averted between 2000 and 2016. Despite these results, tuberculosis remains a global health priority. In 2018, there were an estimated 10 million new cases of tuberculosis, approximately 1.5 million individuals having died from the disease.[1] In that same year, tuberculosis was one of the ten leading causes of death worldwide, ranking above HIV/AIDS as the leading cause of death from a single infectious agent. Tuberculosis morbidity and mortality are directly related to the socioeconomic profile of a given country, being higher in poorer countries, where 95% of tuberculosis-related deaths occur.[1]

Brazil remains on the list of countries with the highest burden of tuberculosis. In 2019, 73,864 cases of the disease were reported in the country, and 4,490 individuals (including men, women, and children) died from the disease in the country.[2] According to the World Health Organization (WHO), Brazil ranks 20th for disease burden and 19th for tuberculosis/HIV coinfection.[1-3]

The distribution of tuberculosis in Brazil is directly related to differences in socioeconomic conditions across municipalities. In municipalities in which socioeconomic conditions are better (in accordance with new Brazilian National Tuberculosis Control Program criteria), the tuberculosis incidence rate increased by 1.8%, from 31.8/100,000 population in 2015 to 32.3/100,000 population in 2018 ($p = 0.004$). In municipalities in which socioeconomic conditions are poor, the tuberculosis incidence rate increased by 2.7%, from 52.2/100,000 population in 2015 to 53.7/100,000 population in 2018 ($p < 0.001$).[2]

The End TB Strategy, approved by the World Health Assembly in 2014 and by Brazil in 2017, with the implementation of the Brazilian National Plan to End Tuberculosis as a Public Health Problem,[4] includes the following targets for achievement by 2035: a 90% reduction in the tuberculosis incidence rate; a 95% reduction in the number of tuberculosis-related deaths; and elimination of catastrophic costs caused by tuberculosis.

The strategy is based on three pillars; the second pillar focuses on "bold policies and supportive systems", emphasizing the importance of social support for successful tuberculosis control.[4,5]

Vulnerability to tuberculosis is influenced by biological factors affecting the immune response to *Mycobacterium tuberculosis*, as occurs in young children and patients with comorbidities such as HIV infection and diabetes mellitus. Vulnerability to tuberculosis is also influenced

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by social factors, exposing individuals to a greater risk of contact with *M. tuberculosis* and subsequent illness due to conditions of precarious housing conditions, malnutrition, inappropriate working conditions, and lack of access to health services. In addition, patients with tuberculosis disease are faced with loss of work productivity and the high costs associated with the diagnosis and treatment of tuberculosis. In many cases, multiple vulnerabilities occur in conjunction, especially in shantytowns in poor countries and poor areas of large cities, where individual immune status is influenced by social determinants of health (SDOH) that increase the risk of active tuberculosis and latent tuberculosis infection.[6]

We propose here a reflection on tuberculosis from the point of view of SDOH and the costs associated with the diagnosis and treatment of tuberculosis in Brazil, based not only on data in the international literature but also on national evidence regarding the association between living conditions (i.e., access to education, health care, appropriate housing, and decent work) and the incidence of tuberculosis, as well as the impact that social support measures have on disease control.

METHODS

To provide a theoretical basis for the topics covered here, we conducted a narrative review of studies published between January of 2000 and November of 2019. The included studies were identified by database searching. The search strategy included title searches with the terms "social determinants of health" and "catastrophic costs" combined with the term "tuberculosis". We searched for studies published in any of the following languages: Portuguese, English, Spanish, French, and Italian. We searched the following databases: SciELO, MEDLINE (PubMed), and Google Scholar. We also searched the Brazilian National Ministry of Health website and the WHO website. A total of 230 studies were retrieved. Of those, 68% were published in the 2015-2019 period and 96% were in English. To identify additional studies, we carried out a hand search of the references cited in the studies retrieved by database searching. A total of 6 studies were thus identified as eligible for full review.

SOCIAL DETERMINANTS OF HEALTH AND THEIR ASSOCIATION WITH TUBERCULOSIS IN BRAZIL AND THE WORLD

According to the WHO, SDOH are the social, political, economic, environmental, and cultural conditions in which people are born, grow up, live, work, and age, including the local health care system, all of which influence their health status.[7,8] According to the Brazilian National Commission on the Social Determinants of Health,[9] SDOH are social, economic, cultural, ethnic/racial, psychological, and behavioral factors increasing the risk of disease, causing health problems to the population. SDOH have also been defined as inequities in the conditions in which people are born, live, and age, driven by inequities in power, money, and resources. By yet another definition, SDOH are factors and mechanisms by which societal conditions affect health and that can be altered by informed action.[10-12]

Societal conditions affect health by the following factors and mechanisms[9,13]:

- physical/material factors—income inequality and a lack of investment in social infrastructure influence the production of health and disease;
- psychosocial factors—individual perceptions and experiences in unequal societies are harmful to health;
- ecosocial perspectives—frameworks that seek to integrate social and biological reasoning and a dynamic, historical, and ecological perspective;
- social capital—wear and tear on relationships of support and security among people and among groups of people, through which economic (income-related) issues negatively influence health status.

Brazil has a population of 208.5 million inhabitants, of whom 13.5 million (6.5%) live in extreme poverty (i.e., on a monthly per capita income of less than 145 Brazilian reals [R$]) and 52.5 million (18.7%) live in poverty (i.e., on a monthly per capita income of less than R$ 420) as defined by the World Bank.[14] Recent data from the Brazilian Institute of Geography and Statistics show that 29.5 million people currently living in poverty have no access to sewerage; 13.5 million have no access to piped water; and 11.1 million have no access to garbage collection services. Poverty or low income plays a central role in school dropout rates and delayed academic achievement among individuals in the 15- to 17-year age bracket, with 11.8% dropping out of school during high school and 33.6% having delayed educational attainment. Extreme poverty affects a highly vulnerable group of individuals that are not generally well-equipped to enter the labor market.[15]

Tuberculosis and poverty are correlated; poverty is associated with poor health, and poor health can lead to poverty, reducing job opportunities and resulting in a vicious cycle that tends to worsen.[6] Tuberculosis predominantly affects poorly educated adult males in their economically productive years. Tuberculosis is directly associated with living in "subnormal agglomerations" (i.e., slums), lack of access to primary health care, malnutrition, and poor diet quality, as well as with abuse of alcohol, tobacco, and other drugs.[16,17] Poor living conditions and lack of access to information (resulting from a low level of education) increase the risk of tuberculosis. A low level of education can limit patient understanding of the importance of appropriate treatment and the risks of noncompliance with tuberculosis treatment, creating further obstacles to the elimination of the disease and contributing to the emergence of drug-resistant strains (multidrug-resistant tuberculosis and extensively drug-resistant tuberculosis).[18-20]

Comorbidities such as diabetes mellitus, HIV infection, mental health disorders, silicosis, and chronic immunosuppressive conditions, as well as malnutrition, together with abuse of alcohol, tobacco, and other drugs, are predictive factors for noncompliance with tuberculosis treatment and increased health care costs.[7,21-23]

In a systematic review of the association between tuberculosis and socioeconomic indicators in Brazil, major risk factors for the development of tuberculosis included having no regular income, having a history of incarceration, being undernourished, being separated or widowed, and having few assets. In addition, alcoholism, unemployment, and a low level of education were associated with poor tuberculosis outcomes (death, treatment abandonment, and treatment failure).[24,25]

According to the WHO and the United Nations Human Settlements Programme, of 6.908 billion people in the world, approximately 1 billion (14.5%) lived in slums in 2010 and, by 2050, the number of slum dwellers will have doubled.[17] Slum dwellers live in extremely precarious conditions, including overcrowding, poor sanitation, poor housing conditions, poor transportation infrastructure, and increased violence.[26] In an ecological study conducted in 5,565 Brazilian municipalities, household crowding and the unemployment rate were the socioeconomic variables most commonly associated with the incidence of tuberculosis.[27] In contrast, the Accelerated Growth Program implemented in the Rocinha *favela* in the city of Rio de Janeiro, Brazil,[28] resulted in a reduction in the incidence of tuberculosis, achieved by urban interventions such as street widening and improved air circulation, showing that better living conditions can improve tuberculosis control.

CATASTROPHIC COSTS ASSOCIATED WITH THE DIAGNOSIS AND TREATMENT OF TUBERCULOSIS

Tuberculosis disease and treatment costs fall on the household budget, further aggravating poverty and resulting in lost work time, which in turn results in economic losses not only for families but also for the country, reducing the national workforce.[29-33]

Costs associated with tuberculosis diagnosis and treatment include direct costs, indirect costs, and coping costs. Direct medical costs are medical expenses such as medications, hospital/physician fees, laboratory tests, and imaging tests. Direct nonmedical costs are expenses such as transportation, food, and lodging, which can be assessed separately before and after the diagnosis of tuberculosis. Indirect costs are income reductions partially or fully attributable to disease-related work disability. Indirect costs include lost work productivity for patients and family caregivers.[34-37] Finally, coping costs are those incurred by patients and family caregivers when they cannot pay for care using their own income and therefore borrow money, use savings, sell assets, or cut down on spending for food/education.[37,38]

Difficulty gaining access to health care and the high costs involved can delay the diagnosis of tuberculosis and be economically catastrophic for households. Catastrophic costs are defined as the sum of direct, indirect, and coping costs to the patient ≥ 20% of total annual household income.[36-39]

The TB-specific indicator designated "catastrophic total costs due to TB" is different from the "catastrophic health care expenditures" indicator, which is used as an indicator of overall progress toward universal health coverage because catastrophic TB costs incorporate not only medical care expenditures for treatment but also indirect costs. The TB-specific indicator is restricted to patients diagnosed with and treated for tuberculosis, whereas catastrophic health care expenditures include health care costs for all household members and for all health conditions.[37]

IMPACT OF SOCIAL PROTECTION PROGRAMS ON TUBERCULOSIS OUTCOMES

Social protection sits at the intersection between health and social interventions and is an essential component of efforts to achieve ambitious health targets, including the end of tuberculosis. Social support provides tuberculosis patients with financial resources that can reduce financial hardship from direct and indirect health care costs, as well as reducing poverty and social vulnerability.[40-43]

Cash transfer programs are forms of social protection based on the provision of cash to vulnerable households with the objective of reducing risk, vulnerability, and chronic poverty, as well as improving human capital.[44,45]

Studies conducted in Brazil have shown that social protection has a positive impact on tuberculosis treatment outcomes. The *Programa Bolsa Família* (PBF) is a conditional cash transfer program for poor families (i.e., families living on a monthly per capita income of R$ 89-178) and extremely poor families (i.e., families living on a monthly per capita income of ≤ R$ 89).[46,47] The first study conducted in Brazil and examining the association between the PBF and tuberculosis treatment by correlating data from the Brazilian Tuberculosis Case Registry Database, the *Cadastro Único* database (which is used in order to identify and characterize low-income families), and the PBF payroll showed that the cure rate was 5% higher among tuberculosis patients who were PBF beneficiaries than among those who were not.[48]

Brazil's Family Health Strategy (FHS) facilitates access to health care and has led to higher rates of tuberculosis treatment success regardless of patient participation in a cash transfer program. A study conducted in the city of Rio de Janeiro examined the impact of the FHS and PBF on tuberculosis treatment outcomes.[49] Treatment was successful in 80% of the tuberculosis patients exposed to the FHS, being successful in 74% of those exposed to the PBF and in 64% of those exposed to neither program. Treatment

success rate was highest (82%) in those exposed to both programs.

A meta-analysis of nine randomized clinical trials (a total of 1,687 participants) showed a modest association between social protection strategies and tuberculosis treatment success (RR = 1.09; 95% CI: 1.03-1.14).[40] Social protection strategies had the greatest impact on the rate of treatment abandonment, showing that they improve access to health care and, consequently, adherence to tuberculosis treatment.[40,50]

In addition to having deleterious effects on the health of tuberculosis patients, SDOH and economic determinants of health have an impact on overall mortality in Brazil. A recent study showed that the economic recession in Brazil between 2014 and 2016 contributed to increases in mortality in the country, particularly among men, Black/Brown individuals, and individuals in the 30- to 59-year age bracket. However, health and social protection expenditures mitigated detrimental health effects, especially among vulnerable populations.[51]

FINAL CONSIDERATIONS

Given the magnitude of tuberculosis as a socially mediated disease, there is an evident need for greater involvement of health professionals, managers, and the scientific community to implement relevant operational and research measures to understand the social conditions influencing the health-illness continuum for tuberculosis patients. The evidence presented here underscores the importance of public social protection policies for minimizing the effects of tuberculosis indicators, with the aim of eliminating them in Brazil.

AUTHOR CONTRIBUTIONS

All authors conceived and designed the study; collected, analyzed, and interpreted the data; drafted and revised the manuscript for intellectual content; and gave final approval of the version to be published.

REFERENCES

1. World Health Organization [homepage on the Internet]. Geneva: World Health Organization [cited 2019 Dec 1]. Global tuberculosis report 2019. Available from: https://apps.who.int/iris/bitstream/handle/10665/329368/9789241565714-eng.pdf?ua=1
2. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde [homepage on the Internet]. Brasília: Ministério da Saúde; 2020 [cited 2020 Mar 29]. Boletim Epidemiológico. 2020. [Adobe Acrobat document, 40p.]. Available from: https://www.saude.gov.br/images/pdf/2020/marco/24/Boletim-tuberculose-2020-marcas–1-.pdf
3. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Vigilância das Doenças Transmissíveis . Brasília: Ministério da Saúde; c2019 [cited 2019 Nov 20]. Manual de Recomendações para o Controle da Tuberculose no Brasil. Brasília: Ministério da Saúde. [Adobe Acrobat document, 364p.]. Available from: http://bvsms.saude.gov.br/bvs/publicacoes/manual_recomendacoes_controle_tuberculose_brasil_2_ed.pdf
4. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Vigilância das Doenças Transmissíveis [homepage on the Internet]. Brasília: Ministério da Saúde; c2017 [cited 2019 Nov 20]. Brasil Livre da Tuberculose: Plano Nacional pelo Fim da Tuberculose como Problema de Saúde Pública 2017. [Adobe Acrobat document, 54p.]. Available from: http://bvsms.saude.gov.br/bvs/publicacoes/brasil_livre_tuberculose_plano_nacional.pdf
5. World Health Organization [homepage on the Internet]. Geneva: World Health Organization [cited 2019 Dec 1]. Guidelines on the management of latent tuberculosis infection 2015. Available from: http://apps.who.int/iris/bitstream/10665/136471/1/9789241548908_eng.pdf?ua=1&ua=1
6. Geraldes Santos Mde L, Figueiredo Vendramini SH, Gazetta CE, Cruz Oliveira SA, Scatena Villa TC. Poverty: socioeconomic characterization at tuberculosis. Rev Lat Am Enfermagem. 2007;15 Spec No:762-767. https://doi.org/10.1590/S0104-11692007000700008
7. Duarte R, Lönnroth K, Carvalho C, Lima F, Carvalho ACC, Muñoz-Torrico M, et al. Tuberculosis, social determinants and co-morbidities (including HIV). Pulmonology. 2018;24(2):115-119. https://doi.org/10.1016/j.rppnen.2017.11.003
8. World Health Organization [homepage on the Internet]. Geneva: World Health Organization [cited 2019 Dec 1]. Closing the gap: policy into practice on social determinants of health: discussion paper 2011. [Adobe Acrobat document, 56p.]. Available from: https://www.who.int/sdhconference/Discussion-Paper-EN.pdf
9. Brasil. Ministério da Saúde. Comissão Nacional sobre os Determinantes Sociais da Saúde (CNDSS) [homepage on the Internet]. Brasília: CNDSS; [cited 2019 Nov 30]. As causas sociais das iniquidades em saúde no brasil. Relatório Final da Comissão Nacional sobre Determinantes Sociais da Saúde, Abril 2008. [Adobe Acrobat document, 216p.]. Available from: http://bvsms.saude.gov.br/bvs/publicacoes/causas_sociais_iniquidades.pdf
10. Krieger N. A glossary for social epidemiology. J Epidemiol Community Health. 2001;55(10):693-700. https://doi.org/10.1136/jech.55.10.693
11. Donkin A, Goldblatt P, Allen J, Nathanson V, Marmot M. Global action on the social determinants of health [published correction appears in BMJ Glob Health. 2018 Jan 7;3(1):e000603corr1]. BMJ Glob Health. 2017;3(Suppl 1):e000603. https://doi.org/10.1136/bmjgh-2017-000603
12. Buss PM, Pellegrini Filho A. A Saúde e seus Determinantes Sociais. Physis. 2007;17(1):77-93. https://doi.org/10.1590/S0103-73312007000100006
13. Garbois JA, Sodré F, Dalbello-Araujo M. Da noção de determinação social à de determinantes sociais da saúde. Saude Debate. 2017;41(112). https://doi.org/10.1590/0103-1104201711206
14. International Bank for Reconstruction and Development/The World Bank [homepage on the Internet]. Washington, DC: World Bank Group; c2018 [cited 2020 Jan 1]. Poverty and Shared Prosperity: Piecing together the poverty puzzle. [Adobe Acrobat document, 201p.]. Available from: https://openknowledge.worldbank.org/bitstream/handle/10986/30418/9781464813306.pdf
15. Instituto Brasileiro de Geografia e Estatística (IBGE) [homepage on the Internet]. Rio de Janeiro: IBGE; c2019 [cited 2020 Jan 1]. Pesquisa de orçamentos familiares 2017-2018: primeiros resultados. Available from: https://www.ibge.gov.br/estatisticas/sociais/populacao/24786-pesquisa-de-orcamentos-familiares-2.html?edicao=25578&t=publicacoes
16. San Pedro A, Oliveira RM. Tuberculosis and socioeconomic indicators: systematic review of the literature [Article in Portuguese]. Rev Panam Salud Publica. 2013;33(4):294-301. https://doi.org/10.1590/S1020-49892013000400009
17. World Health Organization & United Nations. Human Settlements Program. Hidden Cities: unmasking and overcoming health inequities in urban settings [monograph on the Internet]. Kobe: World Health Organization Centre for Health Development; 2010. [cited 2019 Dec 1]. Available from: https://apps.who.int/iris/handle/10665/44439
18. Santos Jr GM, Santos DO, Gibaut MAM, Bispo TCF. Tuberculose: Adesão ao tratamento e os fatores que desencadeiam em abandono. Rev Enfermagem Contemp. 2016;5(2):284-292. https://doi.org/10.17267/2317-3378rec.v5i2.1041
19. Monteiro NLS, Luna Neto RTL, Tavares NBF, Campos RI, Alencar AFO, Lima MAS, et al. Abandono do tratamento da Tuberculose: Uma análise epidemiológica dos seus fatores de risco. Cad Cultura

Ciencia. 2015;13(2):90-99. https://doi.org/10.14295/cad.cult.cienc.v13i2.855

20. Rodrigues MW, Mello AGNC. Tuberculose e escolaridade: Uma revisão da literatura. RIAI. 2018;4(2):1-12. https://doi.org/10.17561/riai.v4.n2.1
21. Valenzuela-Jiménez H, Manrique-Hernández EF, Idrovo AJ. Association of tuberculosis with multimorbidity and social networks. J Bras Pneumol. 2017;43(1):51-53. https://doi.org/10.1590/s1806-37562016000000075
22. Silva DR, Muñoz-Torrico M, Duarte R, Galvão T, Bonini EH, Arbex FF, et al. Risk factors for tuberculosis: diabetes, smoking, alcohol use, and the use of other drugs. J Bras Pneumol. 2018;44(2):145-152. https://doi.org/10.1590/s1806-37562017000000443
23. Lönnroth K, Raviglione M. Global epidemiology of tuberculosis: prospects for control. Semin Respir Crit Care Med. 2008;29(5):481-491. https://doi.org/10.1055/s-0028-1085700
24. Pelaquin MH, Souza e Silva R, Ribeiro SA. Factors associated with death by tuberculosis in the eastern part of São Paulo city, 2001. J Bras Pneumol. 2007;33(3):311-317. https://doi.org/10.1590/S1806-37132007000300013
25. de Albuquerque Mde F, Ximenes RA, Lucena-Silva N, Sousa WV, Dantas AT, Dantas OM, et al. Factors associated with treatment failure, dropout, and death in a cohort of tuberculosis patients in Recife, Pernambuco State, Brazil. Cad Saude Publica. 2007;23(7):1573-1582. https://doi.org/10.1590/S0102-311X2007000700008
26. Prasad A, Ross A, Rosenberg P, Dye C. A world of cities and the end of TB. Trans R Soc Trop Med Hyg. 2016;110(3):151-152. https://doi.org/10.1093/trstmh/trw004
27. Pelissari DM, Rocha MS, Bartholomay P, Sanchez MN, Duarte EC, Arakaki-Sanchez D, et al. Identifying socioeconomic, epidemiological and operational scenarios for tuberculosis control in Brazil: an ecological study. BMJ Open. 2018;8(6):e018545. https://doi.org/10.1136/bmjopen-2017-018545
28. Brasil. Ministério do Planejamento. Secretaria de Desenvolvimento da Infraestrutura. Programa de Aceleração do Crescimento (PAC). Brasília: Ministério do Planejamento; c2018 [cited 2019 Nov 30]. 7º Balanço do PAC 2015-2018. Available from: http://http://pac.gov.br/sobre-o-pac/publicacoesnacionais
29. Barbosa IR, Pereira LMS, Medeiros PFM, Valentim RS, Brito JM, Costa ÍCC. Análise da distribuição espacial da tuberculose na região Nordeste do Brasil, 2005-2010. Epidemiol Serv Saude. 2013;22(4):687-95. https://doi.org/10.5123/S1679-49742013000400015
30. Costa JG, Santos AC, Rodrigues LC, Barreto ML, Roberts JA. Tuberculosis in Salvador, Brazil: costs to health system and families [Article in Portuguese]. Rev Saude Publica. 2005;39(1):122-128. https://doi.org/10.1590/S0034-89102005000100016
31. Grange, JM. The Global Burden of Tuberculosis. In: Grange JM, Porter JDH, editors. Tuberculosis: An interdisciplinary perspective. Singapore: Imperial College Press, 1999. p. 3-33. https://doi.org/10.1142/9781848160552_0001
32. Organização Pan-Americana da Saúde [homepage on the Internet]. Área de Tecnologia, Atenção a Saúde e Investigação. Projeto de Medicamentos Essenciais e Produtos Biológicos. Brasília: Organização Pan-Americana da Saúde; Ministério da Saúde; Ministério das Relações Exteriores; c2009 [cited 2019 Jan 1]. O acesso aos medicamentos de alto custo nas Américas: contexto, desafios e perspectivas. [Adobe Acrobat document, 82p.]. Available from: http://bvsms.saude.gov.br/bvs/publicacoes/acesso_medicamentos_alto_custo_americas.pdf
33. Fernandez AS, Pineda NS, Castro RB, Oliveira LL, Rita LMS, Xavier I, et al. Avaliação econômica nos serviços de atenção aos pacientes com tuberculose em Salvador-Bahia-Brasil, 2002-2003 [monograph on the Internet]. Associação Brasileira de Economia da Saúde; c2003 [cited 2019 Nov 30]. Available from: http://docplayer.com.br/17126079-Avaliacao-economica-nos-servicos-de-atencao-aos-pacientes-com-tuberculose-em-salvador-bahia-brasil-2002-2003.html
34. Oliveira A, Fonzar UJV, Santil FLP. Análise espacial da tuberculose nos anos de 2010 a 2015. Maringá/PR. Geoingá. [serial on the Internet]. 2017;9(2):52-70. [cited 2019 Dec 10]. Available from: http://periodicos.uem.br/ojs/index.php/Geoinga/article/view/49338
35. World Health Organization [homepage on the Internet]. Geneva: World Health Organization; c2002 [cited 2019 Dec 10]. World TB Day 2002 Highlights Report 24.03.2002. [Adobe Acrobat document, 28p.]. Available from: http://www.stoptb.org/assets/documents/events/world_tb_day/2002/Final_Highlights_Report_2002.pdf
36. Squire SB, Thomson R, Namakhoma I, El Sony A, Kritski A, Madan J. Catastrophic care-seeking costs as an indicator for lung health. BMC Proc. 2015;9(Suppl 10):S4. https://doi.org/10.1186/1753-6561-9-S10-S4
37. World Health Organization [homepage on the Internet]. Geneva: World Health Organization; c2017 [cited 2019 Dec 10]. Tuberculosis patient cost surveys: a handbook. Available from: https://apps.who.int/iris/bitstream/handle/10665/259701/9789241513524-eng.pdf;jsessionid=95D2C4FD5057605EBE7A42DEE487260E?sequence=1
38. Luiza VL, Tavares NU, Oliveira MA, Arrais PS, Ramos LR, Pizzol TS, et al. Catastrophic expenditure on medicines in Brazil. Rev Saude Publica. 2016;50(suppl 2):15s. https://doi.org/10.1590/s1518-8787.2016050006172
39. Boccia D, Bond V. The catastrophic cost of tuberculosis: advancing research and solutions. Int J Tuberc Lung Dis. 2019;23(11):1129-1130. https://doi.org/10.5588/ijtld.19.0521
40. Andrade KVF, Nery JS, Souza RA, Pereira SM. Effects of social protection on tuberculosis treatment outcomes in low or middle-income and in high-burden countries: systematic review and meta-analysis. Cad Saude Publica. 2018;34(1):e00153116. https://doi.org/10.1590/0102-311x00153116
41. Andrade KVF, Nery JS, Araújo GS, Barreto ML, Pereira SM. Association between treatment outcome, sociodemographic characteristics and social benefits received by individuals with tuberculosis in Salvador, Bahia, Brazil, 2014-2016. Epidemiol Serv Saude. 2019;28(2):e2018220. https://doi.org/10.5123/S1679-49742019000200004
42. Uplekar M, Weil D, Lonnroth K, Jaramillo E, Lienhardt C, Dias HM, et al. WHO's new end TB strategy. Lancet. 2015;385(9979):1799-1801. https://doi.org/10.1016/S0140-6736(15)60570-0
43. Boccia D, Rudgard W, Shrestha S, Lönnroth K, Eckhoff P, Golub J, et al. Modelling the impact of social protection on tuberculosis: the S-PROTECT project. BMC Public Health. 2018;18(1):786. https://doi.org/10.1186/s12889-018-5539-x
44. Boccia D, Pedrazzoli D, Wingfield T, Jaramillo E, Lönnroth K, Lewis J, et al. Towards cash transfer interventions for tuberculosis prevention, care and control: key operational challenges and research priorities. BMC Infect Dis. 2016;16:307. https://doi.org/10.1186/s12879-016-1529-8
45. Nery JS, Pereira SM, Rasella D, Penna ML, Aquino R, Rodrigues LC, et al. Effect of the Brazilian conditional cash transfer and primary health care programs on the new case detection rate of leprosy. PLoS Negl Trop Dis. 2014;8(11):e3357. https://doi.org/10.1371/journal.pntd.0003357
46. Brasil. Ministério da Saúde. Ministério do Desenvolvimento Social e Agrário [homepage on the Internet]. Brasília> Ministério da Saúde; c2015 . Bolsa Família: como funciona. Assistência Social. [cited 2019 Dec 1]. Available from: http://mds.gov.br/assuntos/bolsa-familia/o-que-e/como-funciona
47. Viana IAV, Kawauchi M, Barbosa TV, editors. Bolsa Família 15 Anos (2003-2018). Brasília: Enap; 2018. 530p.
48. Torrens AW, Rasella D, Boccia D, Maciel EL, Nery JS, Olson ZD, et al. Effectiveness of a conditional cash transfer programme on TB cure rate: a retrospective cohort study in Brazil. Trans R Soc Trop Med Hyg. 2016;110(3):199-206. https://doi.org/10.1093/trstmh/trw011
49. Durovni B, Saraceni V, Puppin MS, Tassinari W, Cruz OG, Cavalcante S, et al. The impact of the Brazilian Family Health Strategy and the conditional cash transfer on tuberculosis treatment outcomes in Rio de Janeiro: an individual-level analysis of secondary data. J Public Health (Oxf). 2018;40(3):e359-e366. https://doi.org/10.1093/pubmed/fdx132
50. Nadjane Batista Lacerda S, Cristina de Abreu Temoteo R, Maria Ribeiro Monteiro de Figueiredo T, et al. Individual and social vulnerabilities upon acquiring tuberculosis: a literature systematic review. Int Arch Med. 2014;7:35. https://doi.org/10.1186/1755-7682-7-35
51. Hone T, Mirelman AJ, Rasella D, Paes-Souza R, Barreto ML, Rocha R, et al. Effect of economic recession and impact of health and social protection expenditures on adult mortality: a longitudinal analysis of 5565 Brazilian municipalities. Lancet Glob Health. 2019;7(11):e1575-e1583. https://doi.org/10.1016/S2214-109X(19)30409-7