Temporal trend of the incidence of TB/HIV coinfection and HIV testing of the old Brazilian population from 2008 to 2018

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Abstract

Objective: Analyze the temporal trend of the incidence of TB/HIV coinfection and the ratio of HIV testing in the Brazilian old population and its regions from 2008 to 2018. *Method:* Ecological, time-series study carried out with all new cases of old people with TB/HIV coinfection. The data were extracted from SINAN-TB and analyzed using the *Prais-Winsten*method. *Results*: In the temporal analysis of the incidence, Brazil showed a stable trend (VPA 2.1), and regarding the regions: Southeast, decreasing trend (VPA -2.15); Northeast and North, increasing trends (VPA 9.92; VPA 10.18, respectively); and South and Midwest, stable trends (VPA 0.17; VPA 4.81, respectively). In Brazil and its regions, the ratio of HIV testing showed growing trends: Brazil (VPA 12.82), North (VPA 20.46), Northeast (VPA 17.85), Southeast (VPA 10.29), South (VPA 7.11), and Midwest (VPA 6.10). Of the 3213 new cases of TB/HIV coinfection reported during the study period, most (68.66%) were male, 78.74% in the age group from 60 to 69. As for the clinical form, the majority (72.70%) was of the pulmonary type. *Conclusion*: Given the magnitude and implications of TB/HIV coinfection in the old population for health care services, these findings may support health professionals and managers in adopting effective measures to control these diseases.

Keywords: Coinfection. Tuberculosis. HIV. Time Series Studies. Heath of the Elderly.

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INTRODUCTION

Tuberculosis (TB)/HIV coinfection has been a major challenge for global health. In 2017, among the 10 million people with TB in the world, 9% had TB/HIV coinfection[1]. In Brazil, the percentage of new coinfection cases varied from 11.5% in 2009 to 12.4% in 2014, and in 2017 it was 11.4% being the 19th position in the ranking of the 30 countries with high TB / HIV coinfection load[2].

The TB/HIV association causes complications of the clinical condition and treatment such as mental confusion, hepatotoxicity, and nephrotoxicity, as well as drug resistance[3]. Also, it causes modification of both infections, which impacts the sexual, work, social, and behavioral lives of people living with HIV (PVHIV)[4].

Studies on TB/HIV coinfection show that the disease is more frequent in adults[5,6], and temporal trend studies conducted with the general population show an increase in prevalence, incidence, and mortality in the age group of 60 years and over[7,8]. In Brazil, there was an increase in the incidence of TB/HIV coinfection in this population from 0.32/100,000 inhabitants in 2002 to 0.99/100,000 inhabitants in 2012, with a total variation of 209.38%[7], as well as increased mortality[8].

TB/HIV coinfection in the old population is the result of increased HIV[3] and vulnerability to TB. Older people living with HIV are more susceptible not only because of the disease[9] but also due to the alterations inherent to aging[10].

In the old population, TB/HIV coinfection is worrying since TB increases the possibility of association with other chronic diseases and unfavorable events[11], and HIV promotes increased comorbidity and frailty in old people[12]. Besides, the economic burden of TB/HIV coinfection is high due to the increased demand for the health system[13].

The knowledge of TB/HIV coinfection by temporal distribution allows identifying the magnitude of the disease. In Brazil, the literature has so far investigated this outcome through secondary data considering the general population and focusing on the mortality and incidence of this coinfection[7,8]. In the international context, a study focusing only on incidence was carried out in the Xinjiang Province, China[14].

Considering the magnitude of TB/HIV coinfection, the increasing frequency of this disease in older people, population aging, and the ratio that TB/HIV coinfection can achieve in this population, the objective of the present study was to analyze the temporal trend of TB/HIV coinfection, and the ratio of HIV testing in the old population of Brazil and its regions from 2008 to 2018.

METHOD

This is a population-based, ecological, time-series study carried out in Brazil and its geographic regions from 2008 to 2018. All new cases of TB/HIV coinfection in the age group of 60 years or over were included.

TB/HIV coinfection was defined as new TB cases (comprising new, unknown, and post-mortem cases) covering all forms and types of diagnosis whose *status* of the HIV variable was "positive"[15]. A new case includes any patient who has never been treated for TB or has been for up to 30 days; unknown are those identified at the time of or after death, considering the individuals when the possibilities for investigating previous entries and post-death are exhausted[16].

Data on the annual incidence of TB/HIV coinfection were obtained from the Notifiable Diseases Information System (SINAN-TB) on Tuberculosis available on the website of the SUS Department of Informatics (DATASUS). Population data were obtained through intercensus estimates made available by the Brazilian Institute of Geography and Statistics (IBGE) available at DATASUS.

The sociodemographic variables investigated in the study were gender (male, age group - 60 to 69 years, 70 to 79 years, 80 years and over), period in years (2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017 and 2018), and regions (North, Northeast, Southeast, South, and Midwest). The clinical variables were clinical form (pulmonary, extrapulmonary, pulmonary + extrapulmonary), and use of antiretroviral (ignored/white, yes, no).

The data were organized in a database with the aid of the program *Excel* and analyzed with the statistical program *Stata* version 12.0. Absolute and relative frequencies were used for the descriptive analysis from 2008 to 2018.

Incidence rates of TB/HIV coinfection were calculated per 100,000 inhabitants. Subsequently, the incidence rates adjusted by age were directly standardized using as reference the Brazilian population from intercensus projections (2000 - 2030) available in DATASUS, to nullify the effect of the unequal demographic distribution of the population. The testing ratio was obtained by dividing the number of positive, negative, and ongoing cases of the HIV variable by the total number of new TB cases, by year of study and geographic region.

The regression of *Prais-Winsten* [17] was used to calculate the annual percentage change (APC). The increasing, decreasing, and stable trends were expressed as APC with the respective confidence intervals (95%). An increasing trend was considered when the APC was positive, negative decreasing, and stable when there was no significant difference between its value and the zero number ($p < 0.05$):

$$APC=[-1+10^{b1}]*100\%$$

$$CI_{95\%}=[-1+10^{b1min.}]*100\%; [-1+10^{b1max}]*100\%$$

RESULTS

In Brazil, 3,213 new cases of TB/HIV coinfection were reported in the elderly population from 2008 to 2018. Table 1 shows the number and percentage of new cases and the trend in the incidence rates of TB/HIV coinfection in Brazil and its regions. Although the Southeast region had a higher ratio of cases (TB/HIV) (41.70%), it was the region with one of the lowest rates (1.17/100,000 inhabitants), and a decreasing trend of TB/HIV coinfection (APC -2,15%). The northern region had the highest average rate of TB/HIV coinfection (2.50/100,000 inhabitants), and an increasing trend (APC 10.18%), as well as the Northeast region (APC 9.92%).

In some regions, long confidence intervals are observed due to the lower case records in these regions. The historical series of the incidence rates of TB/HIV coinfection in Brazil and its geographic regions is shown in Figure 1.

Table 2 shows the characterization by gender, age group, clinical form, and antiretroviral. Most of the cases were male aged between 60 and 69 years old and clinical form of pulmonary type. Less than 40% of antiretroviral information has been completed.

Table 3 shows the percentage and trend of cases tested for HIV. The trend in the testing ratio increased both in Brazil and in its regions, and a higher APC was observed in the North and Northeast regions, which showed lower testing ratios of 55.95% and 54.36%, respectively.

Figure 2 shows the representation of the historical series of HIV testing ratios in Brazil and its geographic regions.

Table 1. Number and percentage of new cases in the old population, average coefficient per 100,000 inhabitants, and the trend in the incidence rates of TB/HIV coinfection in Brazil and its geographic regions. 2008 – 2018.

Region	Cases N (%)	Average coefficient*	APC**	95% CI***	Interpretation
North	318 (9.90)	2.50	10.18	1.09 - 20.08	Increasing
Northeast	758 (23.59)	1.28	9.92	1.11 - 19.50	Increasing
Southeast	1.340 (41.70)	1.17	- 2.15	- 4.14 - -0.12	Decreasing
South	648 (20.17)	1.60	0.17	- 7.36 - 8.32	Stable
Central-West	149 (4.64)	0.96	4.81	- 4.39 - 14.91	Stable
Brazil	3.213 (100.00)	1.32	2.10	- 0.24 - 4.52	Stable

*Standardized taxes for the population of Brazil; **Annual percentage variation; ***Confidence Interval of APC.

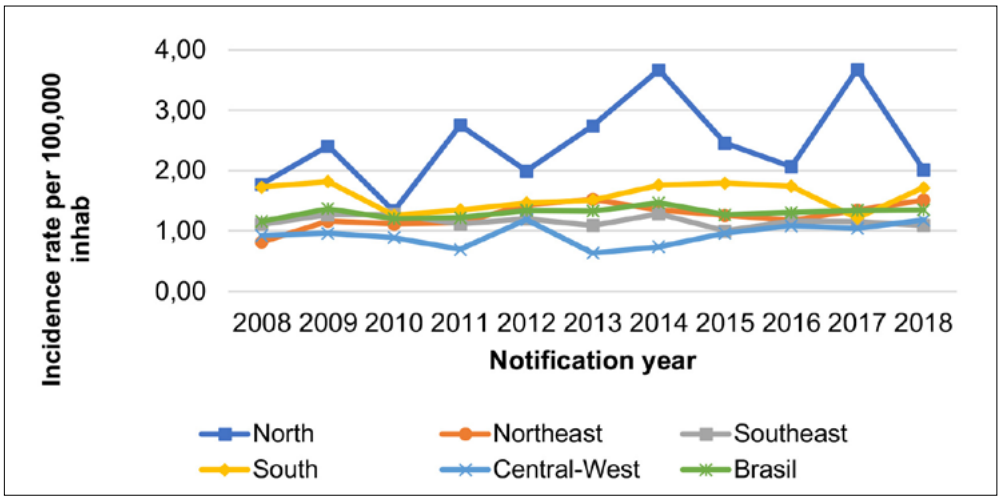

Figure 1. Historical series of standardized incidence rates of TB/HIV coinfection in old people in Brazil and its geographic regions. 2008 – 2018.

Table 2. Distribution of new cases of TB/HIV coinfection by sociodemographic and clinical variables in the old population in Brazil and its geographic regions. 2008 – 2018.

Variables	North		Northeast		Southeast		South		Central-West		Brazil	
Gender	n*	%**	n*	%**	n*	%**	n*	%**	n*	%**	n*	%**
Male	211	66.35	561	74.01	911	67.99	421	64.97	102	68.46	2206	68.66
Female	107	33.65	197	25.99	429	32.01	227	35.03	47	31.54	1007	31.34
Age group (years)												
60 – 69	231	72.64	563	74.27	1078	80.45	540	83.33	118	79.19	2530	78.74
70 – 79	69	21.70	148	19.53	231	17.24	93	14.35	26	17.45	567	17.65
80 and over	18	5.66	47	6.20	31	2.31	15	2.31	5	3.36	116	3.61
Clinical form												
Pulmonary	238	74.84	622	82.06	961	71.72	401	61.88	114	76.51	2336	72.70
Extrapulmonary	56	17.61	103	13.59	275	20.52	177	27.31	24	16.11	635	19.80
Pulmonary+ Extrapulmonary	24	7.55	33	4.35	103	7.69	70	10.80	11	7.38	241	7.50
Antiretroviral												
Ignored/Blank	234	73.58	561	74.01	1010	75.37	395	60.96	100	67.11	2300	71.59
Yes	60	18.87	132	17.41	216	16.12	168	25.93	41	27.52	617	19.20
No	24	7.55	65	8.58	114	8.51	85	13.12	8	5.37	296	9.21

*Absolute frequency; **Relative frequency; Source: SINAN.

Table 3. Number and percentage of tests carried out in the old population, average coefficient, and trend in the HIV testing ratio in Brazil and its geographic regions. 2008 – 2018.

Region	Cases N (%)	Average coefficient*	APC**	95% CI***	Interpretation
North	6.905 (9.55)	55.93	20.46	11.42; 30.23	Increasing
Northeast	19.105 (26.41)	54.36	17.85	12.59; 23.35	Increasing
Southeast	32.223 (44.55)	70.26	10.29	7.39; 13.27	Increasing
South	10.362 (14.32)	75.93	7.11	3.50; 10.85	Increasing
Central-West	3.736 (5.17)	61.57	6.10	2.25; 10.09	Increasing
Brazil	72.331 (100.00)	63.89	12.82	9.01; 16.75	Increasing

*Average testing rates; **Annual percentage variation; ***APC confidence interval.

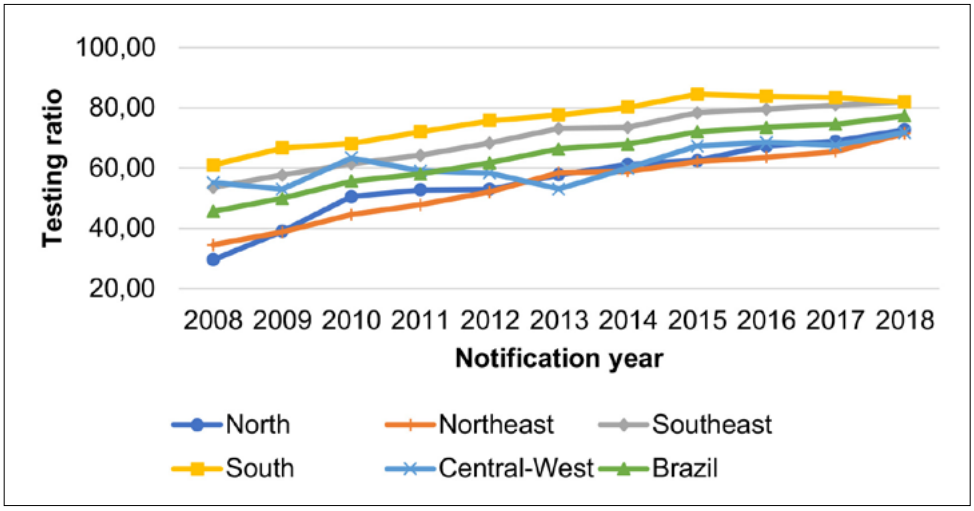

Figure 2. Historical series of the HIV testing ratio in the old people in Brazil and its geographic regions. 2008 – 2018.

DISCUSSION

The present study allowed to know the profile and the time trend of TB/HIV coinfection in the Brazilian old population, as well as the HIV testing. These findings enable the development of strategies to control these outcomes, reduce morbidity and mortality in this population, as well as contribute to the maintenance of sexuality and healthy aging.

The stable trend of TB/HIV coinfection in the old population found in Brazil in the period studied is a different finding from that found in the study by Gaspar et al.[7] evaluating the progression of TB and TB/HIV coinfection in Brazil in the period from 2002 to 2012 with the general population. During the period under analysis, the trend of this condition was increasing in all age groups, including those aged 60 and over.

The trend towards the stability of TB/HIV coinfection may be due to the combined treatment (therapy for TB and HIV) that was more effective in reducing TB/HIV coinfection by proposing a

deterministic model for the transmission of the coinfection including the use of both treatments as ideal control strategies[18].

The difference in time trend among the Brazilian regions analyzed in the present study was coincident with the findings of the study by Gaspar et al.[7] in which there was growth in the North, Northeast, and Central-West regions, whereas the South did not present significant differences, and differently from other regions in the Southeast region there was a reduction in rates.

In the present study, both the growing trend of TB/HIV coinfection observed in the North and Northeast regions and the decreasing trend of cases in the Southeast region may be related to health, education, and income indicators in these regions[19]. Brazil is a large country with distinct regional characteristics, in particular regarding social and economic characteristics.

The regional difference in terms of trends in the incidence of TB/HIV coinfection may be related to the quality of health care services resulting from socioeconomic inequalities that in turn influence the control of TB/HIV coinfection. A study analyzing the epidemiological aspects of co-infection in Northeastern Brazil showed that the region is an important endemic area for TB/HIV coinfection. Furthermore, the low percentage of cure, high percentage of non-adherence, occurrence of severe forms of extrapulmonary TB, and high lethality rate reflect the challenge to control TB/HIV coinfection in the Northeast region[20].

Another research aimed to verify the epidemiological aspects of TB/HIV coinfection in the state of Mato Grosso do Sul, and its association with the HDI showed that the cases of coinfection were associated with the HDI in areas with a higher population density, showing the need to adopt specific strategies[21].

An integrative review analyzed the relation between TB and social inequalities and showed that age, income, education, professional training, poverty, unemployment, access to health care services, and basic sanitation are factors that can interfere in the control of the disease[22]. Therefore, socioeconomic vulnerabilities can determine unfavorable results in the treatment of TB/HIV coinfection.

On the other hand, a study analyzing the quality and management of care for TB/HIV coinfection in the state of São Paulo showed that in the municipalities where quality was satisfactory there was a low ratio of TB/HIV coinfection, and a low AIDS incidence rate. In the municipalities where quality was unsatisfactory, there was a high ratio of TB/HIV coinfection, and a high AIDS incidence rate[23].

The higher frequency of TB/HIV coinfection in males is a similar finding to that found in another study carried out with a population aged 20 to 60 years or more in Brazil[24]. It seems likely that these results are because men are more likely to deny their vulnerability to diseases and exempt themselves from responsibility for self-care[25]. Regarding vulnerability to HIV, the old population cannot understand they are at risk of having the disease. Therefore, they usually do not use condoms during sexual intercourse[26].

Regarding age group, the incidence of TB/HIV coinfection in the younger age group is a result corroborated by studies analyzing the trend in the incidence and mortality of TB/HIV coinfection[7,8] in the general population. Both found higher rates in the younger old population. When compared to previous generations, people in this age group are more sexually free, and they are generally single or divorced, have more casual relationships[27], and do not use condoms[28] which makes them more vulnerable to HIV and consequently to TB.

The predominance of the clinical pulmonary form of TB is probably because this form is the most frequent one and the main infectious source for the disease spread[29]. Its incidence is similar to that found in the general population[5,6].

Comparing the percentage of those making use or not of antiretroviral therapy (ART), most of them are being treated. This is probably due to the early treatment of PLHIV with active TB to reduce mortality[3]. The importance of using ART

in co-infected people has been emphasized in some studies. A study in Ethiopia showed that ART had a protective effect against TB[30]. Similarly, a Chinese study found that not using ART was a risk factor for TB[31]. Other studies have shown that late-onset of ART[32] or not doing it[33] were risk factors for mortality in cases of coinfection.

The significant absence of national records regarding the use of antiretroviral drugs is a result that draws attention. This high percentage may be because the records regarding ART were included in SINAN only from the year 2014, and in the State of São Paulo only in the second half of 2016. Underreporting also contributes to the incompleteness of data, reflecting the result of organizational and structural problems on epidemiological surveillance systems, such as lack of notification by health professionals, late notification, manual or bureaucratic systems, extensive or inadequate forms requiring more time to complete, and notification of only a few diseases depending on the severity[34], which reinforces the need to improve data on coinfection.

The time trend of HIV testing in the old population with increasing TB in Brazil and all its regions is a relevant result. This increase in the testing ratio possibly results from the recommendation of testing all people with active TB for HIV, for which the use of the rapid HIV test is recommended since 2015[3]. WHO data show that of the 4.3 million TB cases reported in the general population in 2018, 64% were tested for HIV, representing a 27-fold increase in the number of people with TB tested for HIV when compared to 2004[9].

The early diagnosis of HIV in old people does not reduce the incidence of the disease, but promotes the timely onset of treatment with ART, and contributes to the improvement of health conditions and reduction of mortality[35].

The trends observed regionally must be analyzed with caution due to the inequalities of the data record in SINAN-TB, since the increased trends may reflect more an improvement in the quality of the information system than an increase in incidence.

Although the present study allows knowing the movement of measures of interest in health - in this case, TB/HIV coinfection -, it has some limitations. The population is old, therefore their results may be subject to survival bias. Other limitations were the use of secondary data from SINAN-TB and IBGE, the operational difficulties of this system such as underreporting, incorrect, incomplete, and duplicate filling of the variables, which can interfere in the interpretation of the data. Therefore, we recommend the linkage between databases and the HIV/AIDS Notifiable Diseases Information System (SINAN-Aids), Tuberculosis Mortality Information System (SIM-TB), and the HIV/AIDS Mortality Information System (SIM-AIDS) to improve data analysis in future studies.

Further studies on aging, sexuality, and prevention of TB/HIV coinfection in older people should be developed. Follow-up studies are recommended to analyze the impact of TB/HIV coinfection in the old population, as well as intervention research to control these diseases in this population.

CONCLUSION

The incidence of TB/HIV coinfection showed a stable trend in Brazil. However, it was decreasing in the Southeast, and increasing in the North and Northeast. The occurrence of an increasing trend in the HIV testing ratio in Brazil and its regions is emphasized.

Given the magnitude and implications of TB/HIV coinfection in the old population for health care services, these findings may support health professionals and managers in adopting effective measures to control these diseases.

As the population ages, new challenges in the health care sector appear. Therefore, the epidemiological knowledge and the behavior of these diseases over time allow to outline strategies aimed at the prevention and control of these diseases in this population, contributing to healthy aging.

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REFERENCES

1. Programa Conjunto das Nações Unidas sobre HIV/AIDS (UNAIDS) [Internet]. Genebra: UNAIDS; 2018 [cited 2019 July 02]. Estatísticas globais sobre HIV; [2 telas]. Available from: https://unaids.org.br/estatisticas/.
2. Brasil. Ministério da Saúde. Boletim Epidemiológico: Panorama epidemiológico da coinfecção TB-HIV no Brasil 2019 [Internet]. Brasília, DF: MS; 2019 [cited 2020 Feb. 02]. Available from: http://www.aids.gov.br/pt-br/pub/2019/boletim-epidemiologico-tb-hiv-2019.
3. Brasil. Ministério da Saúde. Manual Técnico para o Diagnóstico da infecção pelo HIV em adultos e crianças [Internet]. Brasília, DF: MS; 2018 [cited 2020 Feb. 02]. Available from: http://www.aids.gov.br/pt-br/node/57787.
4. Lemos LA, Feijão AR, Gir E, Galvão MTG. Aspectos da qualidade de vida de pacientes com coinfecção HIV/tuberculose. Acta Paul Enferm. 2012;25(1):41-47. Available from: http://dx.doi.org/10.1590/S0103-21002012000800007.
5. Oliveira LB, Costa CRB, Queiroz AAFLN, Araújo TME, Sousa kAA, Reis RK. Epidemiological analysis of tuberculosis/HIV coinfection. Cogitare Enferm. 2018;23(1):1-10. Available from: http://dx.doi.org/10.5380/ce.v23i1.51016.
6. Tshitenge S, Ogunbanjo GA, Citeya A. A mortality review of tuberculosis and HIV co-infected patients in Mahalapye, Botswana: does cotrimoxazole preventive therapy and/or antiretroviral therapy protect against death? Afr J Prim Health Care Fam Med. 2018;10(1):1-5. Available from: https://doi.org/10.4102/phcfm.v10i1.1765.
7. Gaspar RS, Nunes N, Nunes M, Rodrigues VP. Temporal analysis of reported cases of tuberculosis and of tuberculosis-HIV co-infection in Brazil between 2002 and 2012. J Bras Pneumol. 2016;42(6):416-22. Available from: http://dx.doi.org/10.1590/S1806-37562016000000054.
8. Lima MS, Martins-Melo FR, Heukelbach J, Alencar CH, Boigny RN, Ramos Jr AN. Mortality related to tuberculosis-HIV/AIDS co-infection in Brazil, 2000-2011: epidemiological patterns and time trends. Cad Saúde Pública. 2016;32(10):1-11. Available from: http://dx.doi.org/10.1590/0102-311X00026715.
9. Organização Mundial da Saúde. Global tuberculosis report [Internet]. Genebra: OMS; 2019 [cited 2019 July 02]. Available from: https://www.who.int/tb/publications/global_report/en/.
10. Vendramini SHF, Villa TCS, Gonzales RIC, Monroe AA. Tuberculose no idoso: análise do conceito. Rev Latinoam Enferm. 2003;11(1):96-103. Available from: http://dx.doi.org/10.1590/S0104-11692003000100014.
11. Rocha MS, Oliveira GP, Aguiar FP, Saraceni V, Pinheiro RS. Do que morrem os pacientes com tuberculose: causas múltiplas de morte de uma coorte de casos notificados e uma proposta de investigação de causas presumíveis. Cad Saúde Pública. 2015;31(4):709-21. Available from: http://dx.doi.org/10.1590/0102-311X00101214.
12. Calvo M, Martinez E. Update on metabolic issues in HIV patients. Curr Opin HIV AIDS. 2014;9(4):332-9. Available from: https://doi.org/10.1097/COH.0000000000000075.
13. Siqueira-Filha NT, Albuquerque MFM, Rodrigues LC, Legood R, Santos AC. Economic burden of HIV and TB/HIV coinfection in a middle-income country: a costing analysis alongside a pragmatic clinical trial in Brazil. Sex Transm Infect. 2018;94(6):1-10. Available from: https://doi.org/10.1136/sextrans-2017-053277.
14. Wang W, Wei-Sheng Z, Ahan A, Ci Y, Wei-Wen Z, Ming-Qin C. The characteristics of TB epidemic and TB/HIV co-infection epidemic: A 2007-2013 retrospective study in Urumqi, Xinjiang Province, China. Plos ONE. 2016;11(10):1-12. Available from: https://doi.org/10.1371/journal.pone.0164947.
15. Brasil. Ministério da Saúde. Boletim Epidemiológico, Coinfecção TB-HIV no Brasil: panorama epidemiológico e atividades colaborativas. Brasília, DF: MS; 2017 [cited 2019 July 02]. Available from: http://www.aids.gov.br/pt-br/pub/2017/coinfeccao-tb-hiv-no-brasil-panorama-epidemiologico-e-atividades-colaborativas-2017.
16. Brasil. Ministério da Saúde. Sistema de informação de agravos de notificação dicionário de dados – SINAN net – versão 5.0 [Internet]. Brasília, DF: MS; 2014 [cited 2020 Nov. 04]. Available from: http://siteantigo.suvisa.ba.gov.br/sites/default/files/sinan/arquivos/2016/09/26/dic_dados.html.
17. Antunes JLF, Cardoso MRA. Uso da análise de séries temporais em estudos epidemiológicos. Epidemiol Serv Saúde. 2015;24(3):565-76. Available from: http://dx.doi.org/10.5123/S1679-49742015000300024.
18. Fatmawati, Tasman H. An Optimal Treatment Control of TB-HIV Coinfection. Hindawi. 2016:1-11. Available from: http://dx.doi.org/10.1155/2016/8261208.

19. Programa das Nações Unidas para o Desenvolvimento -PNUD. Desenvolvimento humano nas macrorregiões brasileiras [Internet]. Brasília: IPEA; 2016 [cited 2020 Feb. 02]. Available from: http://www.ipea.gov.br/portal/images/stories/PDFs/livros/livros/20160331_livro-idhm.pdf.

20. Barbosa IR, Costa ICC. Estudo epidemiológico da coinfecção tuberculose-HIV no Nordeste do Brasil. Rev Patol Trop. 2014;43(1):27-38. Available from: https://doi.org/10.5216/rpt.v43i1.29369.

21. Baldan SS, Ferraudo AS, Andrade M. Características clínico-epidemiológicas da coinfecção por tuberculose e HIV e sua relação com o Índice de Desenvolvimento Humano no estado do Mato Grosso do Sul, Brasil. Rev Pan-Amaz Saúde. 2017 [cited 2020 Oct. 27];8(3):59-67. Available from: http://dx.doi.org/10.5123/s2176-62232017000300007.

22. Bertolozzi MR, Takahashi RF, França FOS, Hino P. A ocorrência da tuberculose e sua relação com as desigualdades sociais: estudo de revisão Integrativa na Base PubMed. Esc Anna Nery. 2020;24(1):1-9. Available from: http://dx.doi.org/10.1590/2177-9465-ean-2018-0367.

23. Campoy LT, Arakawa T, Andrade RLP, Ruffino-Netto A, Monroe AA, Arcêncio RA. Qualidade e gestão da atenção à coinfecção tuberculose e HIV no estado de São Paulo. Texto & Contexto Enferm. 2019;28: e20180166. Available from: https://doi.org/10.1590/1980-265x-tce-2018-0166.

24. Bastos SH, Taminato M, Fernandes H, Figueiredo TMRM, Nichiata LYI, Hino P. Perfil sociodemográfico e de saúde da coinfecção TB / HIV no Brasil: uma revisão sistemática. Rev Bras Enferm. 2019;72(5):1458-65. Available from: http://dx.doi.org/10.1590/0034-7167-2018-0285.

25. Cortez MB, Trindade ZA, Menandro MCS. Racionalidade e sofrimento: homens e práticas de autocuidado em saúde. Psicol Saúde Doenças. 2017;18(2):556-66. Available from: http://dx.doi.org/10.15309/17psd180222.

26. Brito NMI, Andrade SSC, Silva FMC, Fernandes MRCC, Brito KKG, Oliveira SHS. Idosos, infecções sexualmente transmissíveis e aids: conhecimentos e percepção de risco. ABCS Health Sci. 2016;41(3):140-5. Available from: http://dx.doi.org/10.7322/abcshs.v41i3.902.

27. Brasil. Centro Internacional de Longevidade (CIL-BRASIL). Envelhecimento ativo: um marco político em resposta à revolução da longevidade [Internet]. Rio de Janeiro: CIL-BRASIL; 2015 [cited 2019 July. 02]. Available from: http://ilcbrazil.org/portugues/wp-content/uploads/sites/4/2015/12/Envelhecimento-Ativo-Um-Marco-Pol%C3%ADtico-ILC-Brasil_web.pdf .

28. Aguiar RB, Leal MCC, Marques APO, Torres KMS, Tavares MTDB. Idosos vivendo com HIV: comportamento e conhecimento sobre sexualidade: Revisão integrativa. Ciênc Saúde Colet. 2018. Available from: http://www.cienciaesaudecoletiva.com.br/artigos/idosos-vivendo-com-hiv-comportamento-e-conhecimento-sobre-sexualidade-revisao-integrativa/16889?id=16889.

29. Brasil. Ministério da Saúde. Guia de Vigilância em Saúde [Internet]. Brasília, DF: MS; 2019 [cited 2019 July 02]. Available from: http://bvsms.saude.gov.br/bvs/publicacoes/guia_vigilancia_saude_3ed.pdf.

30. Alemu YM, Awoke W, Wilder-Smith A. Determinants for tuberculosis in HIV-infected adults in Northwest Ethiopia: multicentre case-control Study. BMJ Open. 2016;4:1-7. Available from: http://dx.doi.org/10.1136/bmjopen-2015-009058.

31. Zhezhe C, Lin M, Nie S, Lan R. Risk factors associated with Tuberculosis (TB) among people living with HIV/AIDS: a pairmatched case-control study in Guangxi, China. Plos ONE. 2017;12(3):1-12. Available from: https://doi.org/10.1371/journal.pone.0173976.

32. Yong-Jia J, Liang PP, Shen JY, Sun JJ, Yang JY, Chen J, et al. Risk factors affecting the mortality of HIV-infected patients with pulmonary tuberculosis in the cART era: a retrospective cohort study in China. Infect Dis Poverty. 2018;7(1):1-10. Available from: https://doi.org/10.1186/s40249-018-0405-8.

33. Silva DI, Ceccato MGB, Silveira MR, Miranda SS, Gomes RM, Haddad JPA, et al. Predictors of mortality among individuals with tuberculosis and human immunodeficiency virus coinfection at a reference center in southeastern Brazil: A retrospective cohort study. J Young Pharm. 2018;10(4):476-80. Available from: https://doi.org/10.5530/jyp.2018.10.103.

34. Melo MAS, Coleta MFD, Coleta JAD, Bezerra JCB, Castro AM, Melo ALS, et al. Percepção dos profissionais de saúde sobre os fatores associados à subnotificação no Sistema Nacional de Agravos de Notificação. Rev Adm Saúde. 2018;18(71):1-17. Available from: http://dx.doi.org/10.23973/ras.71.104.

35. Alencar RA, Ciosak SI. O diagnóstico tardio e as vulnerabilidades dos idosos vivendo com HIV/aids. Rev Esc Enferm USP. 2014;49(2):229-35. Available from: http://dx.doi.org/10.1590/S0080-623420150000200007.