Factors related with adherence to treatment of tuberculosis in the Department of Boyacá

Sandra Helena Suescún-Carrero [a], Clara Milena Niño [b],
Andrey Ucros-Álvarez [c], Julián Robles-Ríos [d]

a. Ph.D. in Research Methodology and Public Health. Research Group of the Public Health Laboratory of Boyacá. Secretary of Health of Boyacá - Tunja, Colombia. ORCID: https://orcid.org/0000-0001-5821-4421
b. Bacteriologist specialized in Epidemiology. Secretary of Health of Boyacá -Tunja, Colombia. ORCID: https://orcid.org/0009-0009-1507-9640
c. Medical Student. University of Boyacá -Tunja, Colombia. ORCID: https://orcid.org/0000-0001-5702-9435
d. Master in Social Protection Management. Tuberculosis and Hansen's Disease Program. Secretary of Health of Boyacá -Tunja. ORCID: https://orcid.org/0009-0008-1477-9728

DOI: 10.22517/25395203.25460

Abstract

Introduction: Tuberculosis is a chronic infectious disease caused by *Mycobacterium tuberculosis*, capable of affecting any organ or tissue with the most common form being pulmonary disease.

Objective: To identify the factors affecting adherence to anti-tuberculosis treatment in patients in the Department of Boyacá during the years 2017-2019.

Methodology: Retrospective descriptive study that used as sources of information data recorded in the base of the departmental Tuberculosis program and SIVIGILA. Univariate analysis was performed, determining the distribution of variables and bivariate analysis in which the association between adherence to tuberculosis treatment and independent variables was explored, the Chi-square test was used.

Results: 402 patients were included, adherence to anti-tuberculosis treatment was 96.5% and non-adherence was 3.5%. The 66.7% were female; 55.7% lived in urban areas; 66.5% belonged to the subsidized regime; 89.7% were mestizos; 91.2% corresponded to other population groups, followed by 7.5% of the population deprived of liberty and 1.3% street dwellers. Among the comorbidities, co-infection with HIV (4.2%) was the

most common. Among the causes of non-adherence to treatment were lack of interest, frequent change of address, contract terminated with the EPS and suspension of treatment due to hepatic toxicity. The patient with the highest probability of abandoning treatment belonged to the male sex, to the migrant or street-dwelling population group and was affiliated to the subsidized regime; a statistically significant relationship was found between these variables and the result with adherence to treatment.

Conclusions: Although the result obtained in this study is not high, it is important to monitor adherence to tuberculosis treatment in order to reduce the risk of complications derived from its abandonment, such as higher mortality, development of bacterial resistance, and a longer period of contagiousness.

Key words: Tuberculosis; treatment; adherence; risk factor.

Resumen

Introducción: la tuberculosis es una enfermedad infecciosa crónica causada por ***Mycobacterium tuberculosis***, capaz de afectar cualquier órgano o tejido siendo la forma más común la enfermedad pulmonar.

Objetivo: identificar los factores que afectan la adherencia al tratamiento antituberculoso en pacientes del Departamento de Boyacá durante los años 2017-2019.

Metodología: estudio descriptivo retrospectivo que utilizó como fuentes de información datos registrados en la base del programa departamental de Tuberculosis y SIVIGILA. Se realizó análisis univariado, determinando la distribución de las variables y análisis bivariado en el que se exploró la asociación entre la adherencia al tratamiento de tuberculosis y las variables independientes, se utilizó la prueba de Chi cuadrado.

Resultados: se incluyeron 402 pacientes, la adherencia al tratamiento antituberculoso fue 96,5% y la no adherencia de 3,5%. El 66,7% eran de sexo femenino; 55,7% vivián en zona urbana; 66,5% pertenecían al régimen subsidiado; 89,7% mestizos; 91,2% correspondían a otros grupos poblacionales, seguido del 7,5% de población privada de la libertad y 1,3% habitantes de calle. Dentro de las comorbilidades la coinfección con VIH con 4,2% fue la de mayor presencia. Entre las causas de no adherencia al tratamiento fueron desinterés, cambio frecuente de domicilio, contrato finalizado con la EPS y suspensión del tratamiento por toxicidad hepática. El paciente con mayor probabilidad de abandonar el tratamiento pertenece al sexo masculino, al grupo poblacional de migrantes o habitantes de calle y se encuentra

afiliado al régimen subsidiado, se encontró una relación estadísticamente significativa entre estas variables y el resultado con la adherencia al tratamiento.

Conclusiones: si bien el resultado obtenido en el presente trabajo no es elevado, es importante realizar vigilancia de la adherencia al tratamiento antituberculoso para disminuir el riesgo de complicaciones derivadas de su abandono como mayor mortalidad, desarrollo de resistencia bacteriana y un período de contagiosidad más prolongado.

Palabras clave: tuberculosis; tratamiento; adherencia; factores de riesgo.

Introduction

Tuberculosis (TB) is a chronic infectious disease caused by Mycobacterium tuberculosis, which can affect any organ or tissue. However, the most common form of the disease is pulmonary, when the infection affects organs other than the lung, this is called extrapulmonary tuberculosis, the most frequent location of this form of the disease is the pleural, followed by the lymph node (1). The disease is transmitted by close person-to-person contact, through the inhalation of infectious microdroplets with the presence of one to three tubercle bacilli (2). When the disease occurs, symptoms such as cough, fever, night sweats and weight loss may be mild for many months, as a result, patients delay seeking medical attention and, in the interim, transmit the bacteria to others. Over the course of a year, a TB patient can infect as many as 10 to 15 people through close contact. Without proper treatment, up to two-thirds of TB patients die (3).

Currently, six countries account for 60% of the total number of TB cases in the world, 33% of which are in South Africa, 27% in India, followed by Indonesia, China, the Philippines and Pakistan. It is estimated that in the year 2020, 9.9 million people worldwide were ill with tuberculosis, with an estimated 5.5 million deaths due to this cause, among which 214,000 were in coinfection with HIV; for the same year, 291,000 cases were identified in the Americas (4).

In the last ten years in Colombia there has been a trend towards an increase in the number of cases due to the improvement in the search for respiratory symptoms and the implementation of molecular diagnostic techniques. In 2020, a decrease in the number of cases was reported due to the direct impact of COVID 19 reporting 12,582 cases, with an incidence of 26.7 cases per 100 thousand inhabitants, making it the fifth country in the Americas with the highest burden of the disease, the departments that re-

ported the highest number of cases were Antioquia, Valle del Cauca, Bogota and Santander (5). In the country, tuberculosis mainly affects 65.8% of men, compared to 34.2% of women, and is concentrated in the adult working population, between 29 and 59 years of age, in whom nearly 46% of the cases are diagnosed. Regarding tuberculosis mortality, the country reports an estimated 1,000 deaths per year, with a rate of 2.0 deaths per 100,000 inhabitants, making it a priority event of important public health relevance (6). In Boyacá for the year 2019, 149 cases were reported, being one of the territorial entities that concentrates a lower number of cases along with Amazonas, Putumayo, Vaupés, Guaviare, but with a high lethality (5). It is important to take into account that these departments have rural or dispersed rural areas with low access to molecular diagnostic technologies, as is the case for the department of Boyacá in the period of this study.

Adherence to treatment is defined as "the degree to which a person's behavior-taking medications, following a diet and making lifestyle changes-corresponds to the agreed-upon recommendations of a health care provider" (6). The causes of non-adherence to treatment have classically been associated with patient factors such as addiction to drugs or alcohol and not having a fixed address, factors related to the quantity and toxicity of the drugs, socioeconomic factors and those related to the health system such as limited opening hours, the affiliation regime, treatment by health personnel or lack of information (7,8).

Poor patient adherence to anti-tuberculosis treatment, estimated at 40% in developing countries, continues to be the main determinant of treatment failure worldwide (9). In Colombia, for the year 2019, a treatment success rate of 75% was reported, with evidence of a high proportion of mortality with 12.5%, also 9% loss to treatment follow-up, 2.6% of cases not evaluated and 1% of failures (5).

Ending the global TB epidemic is one of the targets of the Sustainable Development Goals (SDGs). The World Health Organization (WHO) End TB strategy, approved by the World Health Assembly in 2014, proposes to reduce deaths by 90% and the incidence (new annual cases) of the disease by 80% by 2030 (1). Colombia is committed to adapting the global strategy, through the development of the Colombia Toward the End of TB 2016-2025 Strategic Plan, which also incorporates the Regional Action Plan into the national context (10).

Treatment for TB requires a significant investment of public health re-

sources due to prolonged treatment regimens with multiple drug regimens that are often complicated by drug toxicity; these challenges can strain adherence to treatment and lead to negative outcomes such as treatment failure and drug resistance (11). The aim of the present study was to identify the factors affecting adherence to anti-tuberculosis treatment in patients in the Department of Boyacá during the years 2017-2019.

Methodology

Design and study population

Retrospective descriptive observational retrospective study, with secondary information source conducted in patients with TB in the department of Boyacá, who initiated anti-TB treatment during the years 2017 to 2019.

Data collection

The sources of information used were the data recorded in the departmental TB program database and SIVIGILA records. The following variables were included: adherence to antituberculosis treatment, sex, age, affiliation regime, ethnicity, population group, habitat, type of TB, comorbidity, diagnostic criteria, and causes of non-adherence to treatment.

Statistical analysis

Univariate analysis was performed, determining the distribution of the variables. For the bivariate analysis, the association between the dependent variable (adherence to tuberculosis treatment) and the independent variables was explored using the Chi-square test; those with a p value <0.05 were considered statistically significant. The database was recorded in Excel and analyzed in the SPSS version 23 statistical package.

Ethical aspects

The study was approved by the ethics committee of the Secretariat of Health of Boyacá by memorandum SSBCEB 01-2021. It was classified as a non-risk research, based on the provisions of resolution 8430 of 1993 of the Ministry of Health (12). Ethical aspects related to the guarantee of confidentiality, benefits and minimum risk for the participants were considered.

Results

A total of 402 patients registered in the departmental TB program were included, 34.0% in 2017; 31.2% for 2018 and in 2019 34.8%. Of the total patients, 66.7% were female with a mean age of 54.9 with minimum value of 1 and maximum of 92 years, with a standard deviation 21.1. Of this population, 55.7% lived in urban areas; 66.5% belonged to the subsidized regime; 89.7% were mestizos; 91.2% corresponded to other population groups,

followed by 7.5% of the population deprived of liberty and 1.3% street dwellers (Table 1).

In relation to the type of tuberculosis, a greater number of patients were found to have pulmonary tuberculosis (80.2%) and as for the presence of comorbidities, these were present in 13.1% of the population, including HIV (4.2%), malnutrition (3.4%), diabetes mellitus (DM) (2.9%), renal disease (1.2%), and silicosis (0.5%). On the other hand, with respect to the positive diagnostic criteria to confirm the cases, 88.3% of the patients had positive pulmonary bacilloscopy with a bacillary load of (1+) 62.4%, (2+) 13.9% and (3+) 11.9%. Of the total number of patients, 234 (58.2%) were cultured and 64.1% had a positive result. A statistically significant relationship was found between sex, health system affiliation, population group and adherence to treatment (Table 1).

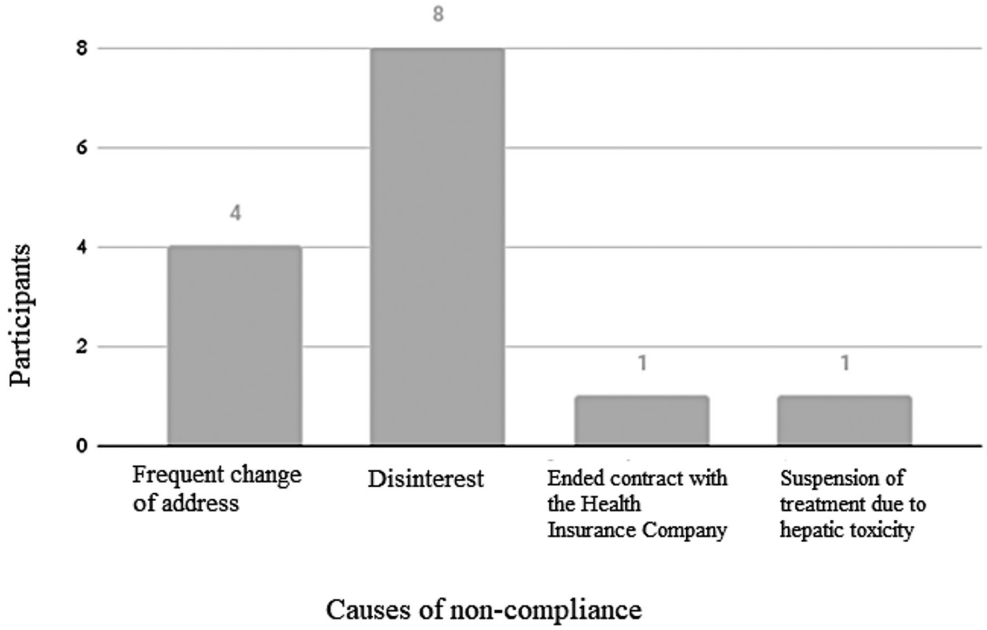
Table 1. Factors associated with adherence to treatment of patients with tuberculosis in the Department of Boyacá

Variables n		Adherence 388 (96,5)		Non-Adherence 14 (3,5)		Total 402		p
		%	n	%	n	%		
Gender	Female		66,7	4	28,6	263	65,4	0,001
	Male	129	33,3	10	71,4	139	34,6	
Age group	Under 15	7	1,7	0	0,0	7		0,11
	16-44	114	28,4	8	2,0	122		
	45-64	113	28,1	1	0,2	114		
	65 and over	154	38,3	5	1,2	159		
Affiliation Regime	Contributory	106	27.4	1	7.2	107	26,6	0,034
	Subsidized	258	66.5	10	71.4	268	66,7	
	Special Regime	24	6.1	3	21.4	27	6,7	
Ethnicity	Mixed race	348	89,7	12	85.7	360	89,6	0,633
	Others	40	10,3	2	14.3	42	10,4	
Population group	Population deprived of liberty	29	7,5	1	7.1	30	7,5	0.00
	Homeless people	5	1,3	2	14,3	7	1,7	
	Other population groups	354	91,2	11	78,6	365	90,8	
Residential area	Country	172	44.3	6	42.9	178	44,3	0.913
	Urban	216	55.7	8	57.1	224	55,7	
Year	2017	132	34.0	6	42.9	138	34,3	0.088
	2018	121	31.2	7	50.0	128	31,8	
	2019	135	34.8	1	7.1	136	33,8	
Type of TB	Pulmonary	311	80,2	13	92.9	324	80,6	0.238
	Extrapulmonary	77	19.8	1	7.1	78	16,4	
Comorbidity	Yes	51	13,1	6	42,8	54	13,4	0,372
	No	337	86,9	8	57,2	348	86,6	

Of the total population with tuberculosis during the study period, 3.5% abandoned anti-tuberculosis treatment, of which 3 patients were housewives, 2 were farmers, 2 reported various occupations, 1 was a miner, 1 was a retired person and 5 had no occupation, including homeless people, migrants and people deprived of liberty. Of the 14 patients, 4 reported drug dependence; 13 patients had pulmonary TB and 1 had pericardial extrapulmonary TB; 6 had comorbidities such as type 2 diabetes mellitus (DM), malnutrition, liver damage, motor disability, and none of them had HIV coinfection.

Among the causes of non-adherence to treatment, the main one was disinterest, in 8 of the 14 patients, followed by frequent change of address in 4 and contract finalized with the Health Insurance Company in 1 case and suspension of treatment due to hepatic toxicity in 1 patient (Figure 1). Regarding treatment attendance, the mean number of doses during the 1st phase of treatment was 35 doses with a minimum of 3 and a maximum of 66 doses; 4 of the 14 patients started the 2nd phase of treatment, which resulted in a mean of 31 doses with a minimum of 6 and a maximum of 63 doses.

Figure 1. Causes of non-adherence to treatment reported in the study population, Boyacá, Colombia (n=14).



Discussion

The adherence of the patients in the present study was 96.5%, a result similar to that described in other studies such as the one carried out in Ethiopia in which adherence was 90.6% (13) and in Pereira with 94.8% (14). The percentage of patients who did not adhere to treatment was 3.5%, the same as that found by Anduaga-Beramendi et al. (15) with 3.7% and by Usquiano et al. (16) with 2.1%; it differs from that described by other authors such as in Peru 11.9% (17); in Mexico 16.1% (18) and Santiago de Cali -Colombia with 81.8% (19). Although the result obtained in the present study is not high, it is important to take into account that the abandonment of tuberculosis treatment is one of the most important factors that decreases the efficiency of the therapy, being associated with failures, higher mortality,

development of bacterial resistance and a longer period of contagiousness.

According to the factors related to adherence to treatment in patients with tuberculosis, in the present study, among the socioeconomic factors, it was found that the male gender presented the lowest adherence, coinciding with other publications in which men have a greater tendency to non-adherence to anti-tuberculosis treatment than women, This may be related to the traditional role of men as the main source of income in many families, resulting in the lack of access to work permits, which is the cause of non-adherence to medical check-ups and treatment delivery.

Migrant population groups and homeless people present less adherence to treatment, due to the difficulties of access to health care, lack of social and family support and mobility, being these risk factors that prevent or hinder compliance with the follow-up treatment required by this pathology (4), coinciding with the results obtained in which one of the main causes of non-compliance of patients who did not adhere to treatment was the frequent change of address.

Regarding the factors related to the disease, among the comorbidities reported in the population studied, co-infection with HIV was the one with the highest presence, being found to be a risk factor for non-adherence or treatment failure as has been reported in several studies (22-24), not coinciding with the findings in the present study, in which all the patients with this comorbidity presented adherence to treatment, this can be explained because the population group with this pathology was very small.

In relation to the therapeutic regimen established for the management of tuberculosis, factors such as the time required for its administration; the appearance of adverse reactions (14) and intolerance to the drugs (25); the number of drugs and frequency of administration (26) are determinants that hinder adherence to treatment. In the present study, these factors can also be reflected in the lack of interest shown by the group that did not adhere to treatment, similar to that described by Meza-Condezo et al. (27) in which they found a connection between patient motivation for adherence to antituberculosis treatment, as well as abandonment due to hepatic toxicity.

The regime of affiliation to the health system in which the greatest number of cases of non-adherence to treatment occurred corresponds to the subsidized regime, finding in the present study a statistically significant relationship, similar to that described by Dueñes et al. (14) and by Shiotani, et al. (28), who found that the low stratum and the difficulty in accessing the

health system are associated with problems of adherence to treatment.

One of the limitations of the present study is related to the use of secondary sources; although all the available databases were used to guarantee the quality of the information, other variables could not be included because they were not contained in the patients' information.

Conclusions

It was found that patients' adherence to anti-TB treatment was 96.5% and non-adherence was 3.5%. It was determined that the patient with the highest probability of abandoning TB treatment belonged to the male population group, migrants and homeless people, and were affiliated to the subsidized system. No relationship was found with HIV coinfection as a risk factor for nonadherence to the disease; this may be explained by the fact that the population group with this pathology was very small. Among the causes of non-adherence to treatment, the main one was disinterest, followed by frequent change of address; contract terminated with the health care provider and suspension of treatment due to hepatic toxicity.

Abandonment of anti-tuberculosis treatment is a major barrier to TB control, with serious consequences such as the physical deterioration of the patient's health due to the disease, susceptibility to contracting other diseases, the possibility of stimulating bacterial resistance mechanisms to drugs, the continued spread of the infection and the perpetuation of the existence of tuberculosis in humanity.

Acknowledgments

To the Health Care Providers Institutions and the State Social Enterprises of the Department of Boyacá.

Funding: Departmental Tuberculosis Program and Public Health Laboratory of the Secretariat of Health of Boyacá.

Conflict of interest: None

Electronic correspondence: sandrahsc@yahoo.com

References

1. Instituto Nacional de Salud-Colombia. Protocolo de Vigilancia en Salud Pública de Tuberculosis. versión 6. [Internet] 2022 [consultado 26 de marzo 2023]. Disponible en: https://www.ins.gov.co/buscador-eventos/Lineamientos/Pro_Tuberculosis%202022.pdf
2. Murray PR. Basic Medical Microbiology. 8th Edición. Filadelfia: Elsevier; 2017.
3. Organización Mundial de la Salud. Tuberculosis. [Internet] 2022 [consultado 26 de marzo 2023]. Disponible en: https://www.who.int/es/news-room/fact-sheets/detail/tuberculosis
4. López-Fuente C. Adherencia terapéutica en pacientes con Tuberculosis [Trabajo de grado]. [Madrid] Universidad Autónoma de Madrid;2018. 44p.
5. Ministerio de Salud y Protección Social- Colombia. Colombia destaca reducción de la tuberculosis [Internet] 2021 [citado el 20 de febrero de 2023]. Disponible en: https://www.minsalud.gov.co/Paginas/Colombia-destaca-reduccion-de-la-tuberculosis-.aspx
6. Pan American Health Organization. Adherencia a los tratamientos a largo plazo: pruebas para la acción. [Internet] 2004 [citado el 20 de febrero de 2023].Disponible en: https://iris.paho.org/handle/10665.2/41182
7. Tuberculosis, lo que hay que saber. Rev. chil. enferm. respir. [Internet]. 2008 Dic [citado 2023 Feb 20] ; 24(4): 317-322. Disponible en: http://dx.doi.org/10.4067/S0717-73482008000400008.
8. Culqui DR, Grijalva CG, Reategui SR, Cajo JM, Suárez LA. Factores pronósticos del abandono del tratamiento antituberculoso en una región endémica del Perú. Rev Panam Salud Publica. 2005; 18(1):14–20.
9. Gugssa Boru C, Shimels T, Bilal AI. Factors contributing to non-adherence with treatment among TB patients in Sodo Woreda, Gurage Zone, Southern Ethiopia: A qualitative study. J Infect Public Health. 2017 Sep-Oct;10(5):527-533. doi: 10.1016/j.jiph.2016.11.018.
10. Ministerio de Salud y Protección Social-Colombia. Plan Estratégico Hacia el Fin de la Tuberculosis en Colombia 2016-2025.[Internet] 2016 [citado el 25 de febrero de 2023]. Disponible en: https://www.minsalud.gov.co/sites/rid/Lists/BibliotecaDigital/RIDE/INEC/INTOR/Plan-estrategico-fin-tuberculosis-colombia-2016-2025.pdf
11. Lippincott CK, Perry A, Munk E, Maltas G, Shah M. Tuberculosis treatment adherence in the era of COVID-19. BMC Infect Dis. 2022 Oct 26;22(1):800. doi: 10.1186/s12879-022-07787-4.
12. Ministerio de Salud -Colombia. Resolución N° 008430 de 1993. [Internet] 1993 [citado el 20 de febrero de 2023]. Disponible en: https://www.minsalud.gov.co/Normatividad_Nuevo/RESOLUCION%208430%20DE%201993.pdf23.
13. Gebremariam, R.B., Wolde, M. & Beyene, A. Determinants of adherence to anti-TB treatment and associated factors among adult TB patients in Gondar city administration, Northwest, Ethiopia: based on health belief model perspective. J Health Popul Nutr 40, 49 (2021). https://doi.org/10.1186/s41043-021-00275-6
14. Dueñes M, Cardona D. Factores relacionados con el cumplimiento del tratamiento en pacientes con tuberculosis, Pereira, Colombia, 2012-2013. biomedica [Internet]. 1 de septiembre de 2016 [citado 26 de marzo de 2024];36(3):423-31. Disponible en: https://revistabiomedica.org/index.php/biomedica/article/view/2904
15. Anduaga-Beramendi A, Maticorena-Quevedo J, Beas R, Chanamé-Baca DM, Veramendi M, Wiegering-Rospigliosi A. Factores de riesgo para el abandono del tratamiento de tuberculosis pulmonar sensible en un establecimiento de salud de atención primaria, Lima, Perú. Acta méd. peruana [Internet]. 2016 Ene [citado 2024 Mar 26] ; 33(1): 21-28. Disponible en: http://www.scielo.org.pe/scielo.php?script=sci_arttext&pid=S1728-59172016000100005&lng=es

16. Usquiano MC. Factores asociados con la adherencia al tratamiento en personas afectadas con tuberculosis en los establecimientos de salud de La Microred El Porvenir Trujillo 2015 [Tesis] .[Trujillo]: Universidad César Vallejo; 2016. 55p.

17. Alvarado-Rosillo DF. Características Asociadas a la Adherencia del tratamiento Antituberculoso en establecimientos de Salud del I nivel de atención Piura 2018 [Tesis]. [Piura]: Universidad Privada Antenor Orrego; 2019. 32 p.

18. Heredia-Navarrete MR, Puc-Franco M, Caamal-Ley Á, Vargas-González A. Determinantes sociales relacionados con el tratamiento de tuberculosis en Yucatán, México. Rev Biomed. 2012; 23:113-120

19. Rodríguez Alviz E, Mondragón CH. Adherencia a la terapia farmacológica y sus factores determinantes en pacientes con tuberculosis de un centro de salud de Santiago de Cali. Rev Colomb Cienc Quím Farm [Internet]. 2014[citado 2024 Mar 26];43(1):104–19. Disponible en: http://dx.doi.org/10.15446/rcciquifa.v43n1.45467

20. Ramírez AMC, Ramírez JMC, Marín TÁ. Factores asociados al éxito del tratamiento de los pacientes con tuberculosis en Medellín, 2014. CES Salud Pública [Internet]. 2017 [citado el 15 de mayo de 2023];8(1):34–47. Disponible en: https://revistas.ces.eduo.co/index.php/ces_salud_publica/article/view/4420

21. Herrero MB, Arrossi S, Ramos S, Braga JU. Social determinants of nonadherence to tuberculosis treatment in Buenos Aires, Argentina. Cad Saude Pública.2015;31(9):1983–94.

22. Beltrán-León M, Pérez-Llanos F, Sánchez L, Parra-López C, Navarrete M, Sánchez R, et al. Prevalence and risk factors associated to tuberculosis and non-tuberculous mycobacterial infections in HIV-positive patients in Bogotá. Biomédica [Internet]. 2018 Mar 15 [citado 2023 Jul 16];38(1):120–7. Disponible en: https://revistabiomedica.org/index.php/biomedica/article/view/3410/3883#info

23. Torres GZ, Herrera MT. Perfil del paciente con tuberculosis que abandona el tratamiento en Chile: profile of patients in Chile. Rev. chil. enferm. respir. [Internet]. 2015 Mar [citado 2023 Jul 16] ; 31(1): 52-57. Disponible en: http://www.scielo.cl/scielo.php?script=sci_arttext&pid=S0717-73482015000100008&lng=es. http://dx.doi.org/10.4067/S0717-73482015000100008.

24. Okethwangu D, Birungi D, Biribawa C, Kwesiga B, Turyahabwe S, Ario AR, et al. Multidrug-resistant tuberculosis outbreak associated with poor treatment adherence and delayed treatment: Arua District, Uganda, 2013–2017. BMC Infect Dis [Internet]. 2019[citado 2023 Jul 16];19(1). Disponible en: http://dx.doi.org/10.1186/s12879-019-4014-3

25. Plata-Casas LI. Factores asociados a la no adherencia al tratamiento anti tuberculosis. Rev. cienc. ciudad. [Internet]. 2015 [citado 16 de julio de 2023];12(2):26-38. Disponible en: https://revistas.ufps.edu.co/index.php/cienciaycuidado/article/view/507

26. Adisa R, Ayandokun TT, Ige OM. Knowledge about tuberculosis, treatment adherence and outcome among ambulatory patients with drug-sensitive tuberculosis in two directly-observed treatment centres in Southwest Nigeria. BMC Public Health [Internet]. 2021;21(1). Disponible en: http://dx.doi.org/10.1186/s12889-021-10698-9

27. Meza-Condezo W, Peralta-Pumapillo A, Quispe-Gomez F, Cáceres-Belliro F. Adherencia terapéutica y factores condicionantes en su cumplimiento en pacientes con tuberculosis pulmonar atendidos en la Microred la Palma, Ica 2017. Revista Médica Panacea [Internet]. 2019[citado 2023 Jul 16];7(1). Disponible en: http://dx.doi.org/10.35563/rmp.v7i1.37

28. Shiotani R, Hennink M. Socio-cultural influences on adherence to tuberculosis treatment in rural India. Glob Public Health [Internet]. 2014 [citado 2023 Jul 16];9(10):1239–51. Disponible en: http://dx.doi.org/10.1080/17441692.2014.953562