Frecuencia de *mycobacterium tuberculosis* en pacientes del centro de salud infa de la ciudad de macas 2019-2023

Frequency of Mycobacterium Tuberculosis in Patients of the INFA Health Center in the City of Macas 2019-2023

[1] Melany Pamela Valdez Montenegro   https://orcid.org/0009-0002-3860-9156
Biochemistry and Pharmacy Degree, Catholic University of Cuenca, Cuenca, Ecuador.
melany.valdez.75@est.ucacue.edu.ec

[2] Jonathan Gerardo Ortiz   https://orcid.org/0000-0001-6770-2144
Biochemistry and Pharmacy Degree, Catholic University of Cuenca, Cuenca, Ecuador.
jonnathan.ortiz@ucacue.edu.ec

DIGITAL ANATOMY is an electronic, quarterly journal that will be published in electronic format and has the mission of contributing to the training of competent professionals with a humanistic and critical vision who are capable of presenting their investigative and scientific results to the same extent that positive changes in society are promoted through their intervention.https://anatomiadigital.org
The journal is published by Editorial Ciencia Digital (a prestigious publisher registered with the Ecuadorian Book Chamber with membership number 663).www.celibro.org.ec

Palabras claves:

Mycobacterium tuberculosis

Epidemiología

Baciloscopia

Salud pública

Resumen

Introducción: La tuberculosis (TB) sigue siendo una preocupación de salud pública a nivel global, causada por la bacteria *Mycobacterium tuberculosis*. Afecta principalmente los pulmones y se transmite a través de gotículas respiratorias. Las personas con enfermedades inmunodeprimidas son más susceptibles. A nivel mundial, la TB es una de las principales causas de muerte, con altas tasas de mortalidad, especialmente en regiones como Asia y África. **Objetivo:** Describir la frecuencia de *Mycobacterium Tuberculosis* en muestras tanto pulmonares como extrapulmonares en pacientes que asisten al Centro de Salud INFA de la ciudad de Macas, periodo 2019-2023. **Metodología:** Se utilizó un diseño descriptivo de corte transversal, con un muestreo no probabilístico de cobertura total. Se analizaron n=28 muestras positivas, mediante pruebas de biología molecular y baciloscopia. **Resultados:** Se confirmaron 28 casos de TB, con predominio en hombres y en adultos de 21 a 64 años. La muestra mucosa fue la más prevalente. Se observó una marcada variación en la incidencia, destacando el año 2022 con la mayor cantidad de casos registrados. **Conclusión:** Este estudio destaca la importancia de comprender la epidemiología y la resistencia a medicamentos de la tuberculosis en el Centro de Salud INFA de Macas, subrayando la necesidad de estrategias efectivas de control y prevención para abordar esta enfermedad a nivel local y global. **Área de estudio:** Microbiología.

Keywords:

Mycobacterium tuberculosis,

Epidemiology,

Bacilluscopy, Public Health.

Abstract

Introduction: Tuberculosis (TB) remains a global public health concern caused by the bacteria Mycobacterium tuberculosis. It mainly affects the lungs and is transmitted through respiratory droplets. People with immunocompromised diseases are more susceptible. Globally, TB is a leading cause of death, with high mortality rates, especially in regions such as Asia and Africa. Objective: To describe the frequency of Mycobacterium tuberculosis in pulmonary and extrapulmonary samples in patients attending the INFA Health Center in Macas, period 2019-2023. Methodology: A descriptive cross-sectional design with non-probabilistic total coverage sampling was used. A group of

n=28 positive samples was analyzed using molecular biology and smear microscopy tests. Results: Twenty-eight cases of TB were confirmed, predominantly in males and adults aged 21 to 64 years. The mucosal sample was the most prevalent. A marked variation in incidence was observed, highlighting the year 2022 with the highest number of cases recorded. Conclusion: This study highlights the importance of knowing the epidemiology and drug resistance of tuberculosis in the INFA Health Center of Macas, underscoring the need for effective control and prevention strategies to address this disease locally and globally.**Field of Study:**Microbiology.

Introduction

Tuberculosis is a disease caused by the bacteria called Mycobacterium tuberculosis (MTB), this bacteria is known to affect the lungs; it is transmitted through respiratory droplets from person to person, expelling tuberculous bacilli, the process of this disease is reversible, since it is preventable and curable. People with immunosuppressed diseases such as HIV, diabetes or malnutrition tend to be more likely to be infected (1).

Tuberculosis (TB) is present around the world. In 2020, 1.5 million people died from tuberculosis, of which 214,000 were HIV-infected. This infectious disease is very deadly after COVID-19 and is the thirteenth cause of death (2). In 2020, the highest number of cases occurred in the South-East Asia Region, where 43% of new cases were recorded, followed by the Africa Region, which had 25% of cases, and finally the Western Pacific Region with 18% of cases (3).

In 2015, there were an estimated 268,000 new TB cases in the Region of the Americas, with 230,519 notifications, of which 217,081 were new and recurrent cases, and 13,438 were previously treated (4). Of those affected (189,025) 82% were tested for HIV and knew their status, of which 21,885 were seropositive. The estimated mortality rate is equivalent to 19,000 cases. MDR/RR TB (rifampicin resistance) was estimated at 7,700 cases, 4,611 cases (59.88%) were laboratory confirmed, and 3,477 cases (75.41%) started treatment (3).

In 2015, the World Health Organization estimated that there were 8,400 new cases of TB (51,600 inhabitants) in Ecuador, including people with TB/HIV coinfection. However, the National Health System (NHS), including the Integrated Public Health Network (RPIS) and the Network for Prevention, Diagnosis, Treatment and Control of TB/Complementary Clinical Practice Guideline 18 (RC), diagnosed and reported 5,215

cases (32,030 inhabitants). 62.08% of the estimate was met. Of the reported cases, 5,097 were new and recurrent cases and 118 were previously treated cases (4).

In 2016, TB claimed 1.7 million lives. Of the attributable deaths, 22% occurred among people living with HIV, and 5% of the 10.4 million cases had developed resistance to at least two first-line drugs. TB eradication is currently impossible because it cannot be controlled, especially in countries where poverty exists due to inefficient health systems (5).

Resistance to first-line drugs has been a serious problem, since in 2014 in China, 58.2% of the population had multi-resistance to rifampicin and isoniazid. Similarly, in Ecuador in 2017, resistance to first-line drugs was observed in 4.16%. Stopping treatment or evading treatment adherence has created resistance to anti-TB drugs, so different governments have opted to use various strategies such as text messages, emails and even phone calls so that patients can be seen and finish their treatment (6).

In Ecuador in 2018, 6094 cases of tuberculosis were recorded with an incidence of 34.53 per 100,000 inhabitants. The most affected group is 25 to 34 years old with 1523 cases, followed by 15 to 24 years old with 1252 cases, and finally 35 to 44 years old with 1027 cases (7). In Morona Santiago in 2016, there were 7 patients, who received professional treatment; this is why this study is relevant, because it will allow us to know new cases at the cantonal level, taking into account the bacterial infection of Mycobacterium Tuberculosis in pulmonary and extrapulmonary samples from the INFA Health Center 2019-2023 (8).

On the other hand, the WHO's planning is to end this infection by 2035, as well as the deaths caused by it; specifically protecting those people with a weak immune system or more vulnerable, because HIV is the leading cause of death globally. However, today this strategy can be reestablished due to the various cases of drug resistance to Rifampicin, which, being a first-line drug to treat this disease, has generated resistance due to non-compliance with its respective treatment (9).

Ecuador, like all other countries, has presented resistance to first-line drugs, especially Rifampicin (RP), with 2018 being the year with the highest resistance to this drug with 252 cases (10). In Morona Santiago, TB cases also presented this anomaly, which is why this article is important since it will provide more up-to-date information on new cases with their respective resistance, maintaining as its main objective the description of the frequency of Mycobacterium tuberculosis in both pulmonary and extrapulmonary samples in patients attending the INFA Health Center in the city of Macas, period 2019-2023.

Tuberculosis is preventable and treatable, but it is still one of the most deadly contagious diseases in the world, because it cannot be controlled; this is seen more in countries where their health system is very inefficient in controls, prevention and follow-ups, regenerating new cases in other patients or even in the same ones (11).

Treatments such as rifampicin and isoniazid are drugs to which Mycobacterium tuberculosis has generated resistance, due to poor administration or incorrect use, this generates drug resistance which can be detected with special laboratory tests where the sensitivity of the bacteria to the drugs is analyzed (12).

Diagnostic tests can be molecular in nature, such as GeneXpert MTB/RIF, this test has been used successfully and its results are given in a matter of hours, on the other hand, bacteriological culture is also used; with the help of these tests, the different resistance patterns are detected (13).

At the local level in the Morona canton there are no updated studies on the Mycobacterium tuberculosis bacteria, since the last study was carried out in 2016; it is for this reason that the present study is novel because in some way it will contribute to the INFA Health Center in the city of Macas to have an adequate, effective procedure that helps prevent tuberculosis resistance in patients, and determine the reasons why this bacteria becomes resistant, starting a treatment capable of eliminating this bacteria (14). The direct beneficiaries of this study will be the patients, and likewise the doctors who are within this epidemiological area of the INFA Health Center.

Methodology

Type of research (Research design and classification)

This research is descriptive, cross-sectional, secondary documentary.

Study universe, sample treatment and sample

This study is made up of records of patients with Mycobacterium tuberculosis, either pulmonary or extrapulmonary, who attended the INFA Health Center in the city of Macas during the period 2019-2023. A non-probabilistic sampling was used for total coverage. The universe was made up of 11,242 data records and a sample of n=28. These data will be obtained through the database of the Microbiology Department, Tuberculosis area.

Methods and techniques used

Identification of Mycobacterium tuberculosis

Molecular Biology (PCR)

This is a real-time PCR test, performed by a platform called GeneXpert - MTB/RIF, which simultaneously amplifies specific fragments of M. tuberculosis DNA and also detects mutations associated with rifampicin resistance in the rpoB gene. This result determines the importance of the disease and studies the risk of infection. The data is obtained in two hours through fluorescent readings of the samples. When the result is positive, the results are represented as high, medium and low levels, determining the absence or presence of the bacteria.(15).

Bacilloscopy

Identification of mycobacteria from any organic fluid. According to the WHO, two sputum samples should be analyzed, such as Ziehl-Neelsen staining, using the Fuchsin reagent for five minutes on the fixed and prepared sample on the slide, the heat fixes the mycobacterial pigments and then it is washed with alcohol. It is then decolorized with acid alcohol and with methylene blue, the mycobacteria can be observed under the microscope. It is negative if there are no bacilli in one hundred fields and if one is found it is reported by means of a cross number.(16).

Methods, techniques and instruments of research or data collection

The method used in this research is observation and data collection through the database of the Microbiology Department, Tuberculosis area, of the INFA Health Center in the city of Macas. This information will be used under the policies of the INFA Health Center, applying ethical standards based on the confidentiality and integrity of patients; where their data will be used anonymously with security codes.

Processing, analysis, summary and presentation of information (Tables, Graphs, Statistical analysis techniques).

For statistical analysis, a database will be generated in the SPSS 21.0 program, and will be carried out using descriptive statistics, central tendency measures, and frequency analysis.

The research adheres to the ethical measures established in the Declaration of Helsinki, respect and privacy will be provided to patients and total confidentiality of the information collected from the database, safeguarding anonymity with security codes. This information will be used only for research purposes. The results of the study will help improve preventive, diagnostic and treatment interventions.(17)The research protocol will be evaluated and approved by the Teaching Commission of the INFA Health Center for the use of the records entered in the database of the Microbiology department in the Tuberculosis area of patients from the period between 2019-2023.

Results

In the study period between 2019 and 2023, a comprehensive analysis was carried out on the database of 11,242 samples admitted with suspected Mycobacterium tuberculosis, of which n=28 were confirmed, yielding revealing results on the incidence of Mycobacterium tuberculosis in the population. The data obtained reflect a clear disparity in terms of gender distribution, with the male sex being predominantly affected, representing 54% of the total cases analyzed (Chart 1).

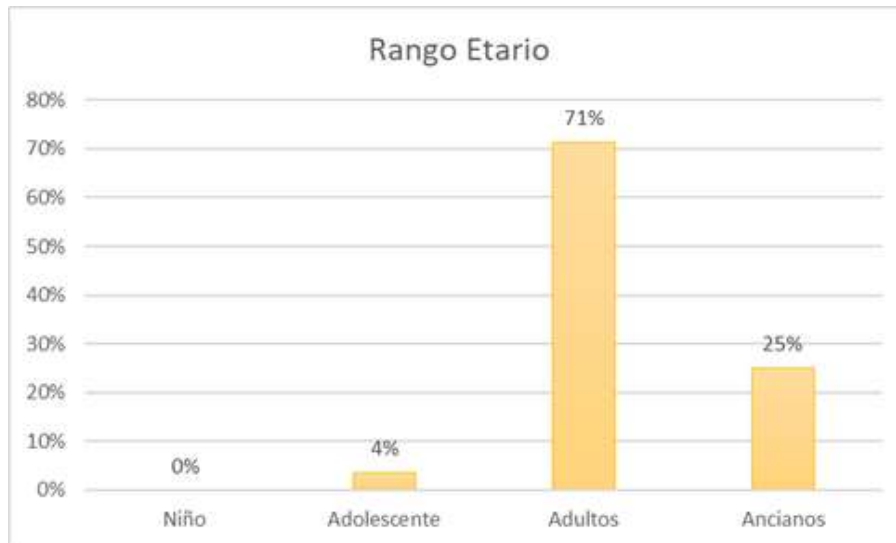**Chart 1.**Percentage of Mycobacterium tuberculosis according to its genus

Over the long period spanning 2019 to 2023, a clear variation in the incidence of Mycobacterium tuberculosis cases is observed. Within this time span, the year 2022 stands out as the one with the highest number of recorded cases (Chart 2). This finding points to a critical point in the evolution of the disease during that specific period. The identification of this key year provides a solid basis for further research, allowing for a deeper analysis of the factors that may have contributed to this notable increase in incidence.

Chart 2. Frequency of Mycobacterium tuberculosis, by years of study.

Within the age range evaluated, the marked prevalence in adults between 21 and 64 years of age is striking, as they constitute 71% of the identified cases (Chart 3). This specific demographic group emerges as a critical focus in the epidemiology of tuberculosis,

highlighting the need for preventive strategies and intervention programs aimed at this age group.

Chart 3. Percentage of Mycobacterium tuberculosis according to age range

Furthermore, different sample types were categorized to obtain a more detailed understanding of the presence of Mycobacterium tuberculosis. Among the varieties examined, salivary, mucopurulent, bloody, and mucous samples were found. The mucous sample emerged as the most prevalent, standing out for its significant presence in 43% of the set of cases analyzed (Chart 4). This finding suggests that the mucosa may play a crucial role in the early detection and burden of the disease in the population studied. In contrast, bloody samples did not present any positive samples, indicating a notable absence of Mycobacterium tuberculosis in this specific sample type during the analysis period. It should be noted that the preferred sample by the Health personnel at the INFA Health Center is the mucopurulent one, because they often contain a significant amount of cells, which can be beneficial for the detection of pathogens and also because the location of the pathogen can be specific within the body, and the direct sample in these affected areas increases the possibility of detection.
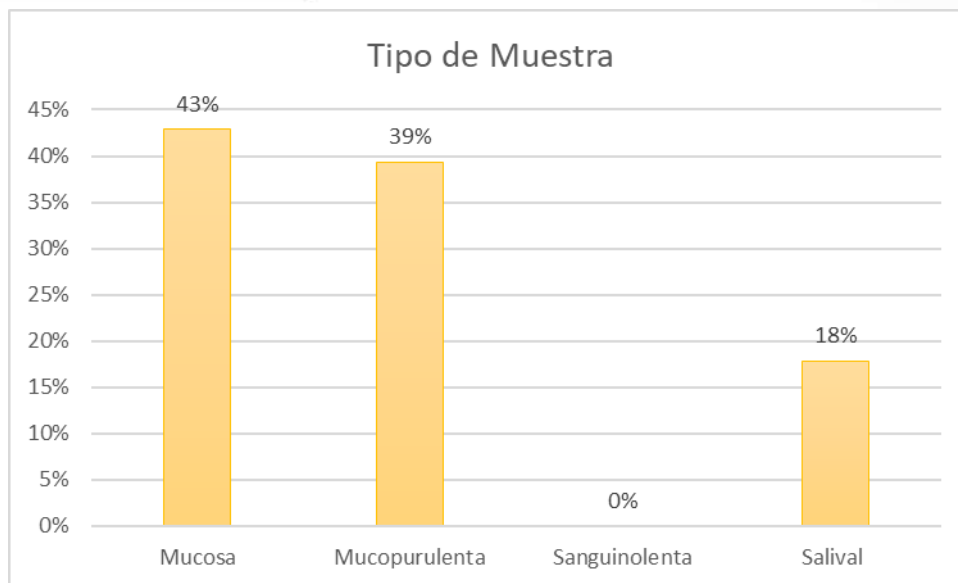
Chart 4. Mycobacterium tuberculosis Sample Type Classification

Discussion

Tuberculosis (TB) remains a global public health concern, as evidenced by data collected during the period 2019-2023. The incidence of Mycobacterium tuberculosis cases shows significant variability, with 2022 being the year with the highest number of recorded cases (18)This finding suggests the importance of further research to understand the factors that may have contributed to this one-time increase in incidence.

The gender distribution reveals a clear predominance in the male sex, constituting 54% of the total cases analyzed. This pattern of involvement could have implications for the transmission of the disease and highlights the need for specific preventive strategies for this demographic group (19).). This study presents a prevalence of tuberculosis cases in men. This observation coincides with several previous studies that have also found a higher incidence of this disease in men. For example, a study conducted by Maria Eugenia Piquero Valera found that tuberculosis in Ecuador was more common in men than in women, possibly due to differences in risk exposure and social behavior (20).

Analysis by age group highlights the prevalence in adults between 21 and 64 years, representing 71% of identified cases. This demographic becomes a critical focal point in the epidemiology of tuberculosis, underscoring the importance of targeting specific interventions and preventive strategies to this age group. This study identifies that adults between 21 and 64 years are the demographic group most affected by tuberculosis. This finding is consistent with previous research that has found a higher incidence of the disease in young and middle-aged adults. For example, a study conducted at the national level found that tuberculosis was more common in young adults, possibly due to socioeconomic factors and risk behavior (21).

Regarding the types of samples analyzed, the highest prevalence is observed in mucous samples, representing 43% of the total cases. The mucous sample emerges as the most relevant in the early detection and burden of the disease. In contrast, blood samples did not present any positive cases (22). The preference of health personnel for mucopurulent samples is justified by their significant cellular content and the possibility of detecting the presence of Mycobacterium tuberculosis in specific areas of the body. In addition, studies carried out by María Delfina Sequeira, Dr. Emilio Coni, Lucía Barrea and Susana Imaz have determined that a sample of purulent mucus taken from the lung represents the best opportunity to detect the presence of bacilli. While the main problem with mucous samples is the sensitivity and specificity of the detection method, since it does not always provide accurate results.(23).

Conclusions

- Tuberculosis (TB) remains a global health threat, with a significant burden of cases and drug resistance (24)The epidemiological reality presented in this study, focused on the INFA Health Center in Macas during the period 2019-2023, reflects not only the prevalence of the disease in the region but also the urgent need for control and prevention strategies.

- The findings reveal distinctive patterns in TB incidence, with 2022 standing out as a hotspot with the highest number of recorded cases. This data highlights the importance of further research to understand the factors underlying this one-time increase.(25)Furthermore, a marked prevalence is identified in adults aged 21 to 64 years, highlighting the need for specific interventions in this demographic group.

- The study also addresses the importance of early detection and the choice of sample types. The prevalence of cases detected in mucosal samples highlights its relevance in the timely identification of Mycobacterium tuberculosis (26).)Furthermore, a significant absence of cases is observed in bloody samples, supporting the preference for mucopurulent samples due to their significant cellular content.

Conflict of interest

The authors of this scientific research declare that there is no conflict of interest in relation to the presented article.

<div align="center">

Bibliographic references

</div>

1. Annual Report _TB_2018UV.pdf [Internet]. [cited January 4, 2023]. Available at: https://www.salud.gob.ec/wp-content/uploads/2019/03/informe_anual_TB_2018UV.pdf

2. Koch A, Mizrahi V. Mycobacterium tuberculosis. Trends Microbiol. 2018 Jun;26(6):555-6.

3. CDC. Tuberculosis (TB) in the United States [Internet]. Centers for Disease Control and Prevention. 2012 [cited 30 January 2023]. Available at:https://www.cdc.gov/tb/esp/publications/factsheets/drtb/mdrtbspanish.htm

4. Pulmonary Tuberculosis [Internet]. [cited 4 January 2023]. Available at: https://www.dynamed.com/condition/pulmonary-tuberculosis-27#GUID-D1AD7785-2439-42B5-8C87-482DDFA660A3

5. Tuberculosis: Symptoms, diagnosis and treatment. Clínica Universidad de Navarra [Internet]. [cited 30 January 2023]. Available at:https://www.cun.es/enfermedades-tratamientos/enfermedades/tuberculosis

6. OPSCDE18036_eng.pdf [Internet]. [cited 30 January 2023]. Available at:https://iris.paho.org/bitstream/handle/10665.2/49510/OPSCDE18036_eng ?sequence=2&isAllowed=y

7. Multidrug-resistant Tuberculosis (MDR TB) - DynaMed [Internet]. [cited 1 June 2023]. Available at: https://www.dynamed.com/condition/multidrug-resistant-tuberculosis-mdr-tb

8. Questions and Answers about Tuberculosis | TB | CDC [Internet]. 2021 [cited 4 January 2023]. Available at: https://www.cdc.gov/tb/esp/publications/faqs/tb-qa.htm

9. SciELO - Scientific Electronic Library Online [Internet]. [cited 30 January 2023]. Available at: http://scielo.sld.cu/scielo.php?script=sci_abstract&pid=S037507602020000 200010&lng=es&nrm=iso&tlng=es

10. 9. Tuberculosis (TB) [Internet]. [cited 11 March 2024]. Available at:https://www.health.ny.gov/es/diseases/communicable/tuberculosis/fact_sh eet.htm

11. 10. Cabrera PL, Victoria P, Andalia RR. Theoretical approach to social inequalities in tuberculosis as a health problem. Rev Cuba Salud Pública.

12. Casal M. Drug resistance in Mycobacterium. Rev Esp Quimioter.

13. Lutge EE, Wiysonge CS, Knight SE, Sinclair D, Volmink J. Incentives and enablers to improve adherence in tuberculosis. Cochrane Database Syst Rev. 2015 Sep 3;2015(9):CD007952.

14. Ketata W, Rekik WK, Ayadi H, Kammoun S. [Extrapulmonary tuberculosis]. Rev Pneumol Clin. 2015;71(2-3):83-92.

15. CDC | TB | Testing and Diagnosis [Internet]. [cited 30 January 2023]. Available at: https://www.cdc.gov/tb/esp/topic/testing/default.htm

16. What-is-tuberculosis.pdf [Internet]. [cited 30 January 2023]. Available at:https://www.salud.gob.ec/wp-content/uploads/2016/12/3.-Qu%C3%A9-es-la-bio%C3%A9tica.pdf

17. 16.Xu B, Zhao Q, Hu Y, Shi Y, Wang W, Diwan VK. Experiences in anti-tuberculosis treatment in patients with multiple previous treatments and its impact on drug resistant tuberculosis epidemics. Glob Health Action. 2014 Aug 18;7:10.3402/gha.v7.24593.

18. Mashabela GT, by Wet TJ, Warner DF. Mycobacterium tuberculosis Metabolism. Microbiol Spectr. July 2019;7(4).

19. TB-Report-2019-2022-vd-signed-signed-signed-signed-signed.pdf [Internet]. [cited 4 February 2024]. Available at:https://www.salud.gob.ec/wp-content/uploads/2023/10/Reporte-de-TB-2019-2022-vd-signed-signed-signed-signed-signed.pdf

20. 19.Lado Lado FL, García Ramos R, Pérez del Molino ML, Ferreiro Regueiro MJ, Maceda Vilariño S, Túnez Bastida V. Drug-resistant tuberculosis. An Internal Med. April 2004;21(4):46-52

21. 20. Piquero Valera ME, Borrego Álvarez LA, Presno Labrador C, Centelles Cabrera M, Zangroniz Piquero A. Behavior of Tuberculosis in Health District 15D01 Ecuador during the period 2005-2014. Rev Cuba Med Gen Integral [Internet]. June 2016 [cited February 3, 2024];32(2):224-32. Available at: http://scielo.sld.cu/scielo.php?script=sci_abstract&pid=S0864-21252016000200009&lng=es&nrm=iso&tlng=e

22. 21.Tuberculosis - Infectious Diseases - MSD Manual Professional Version [Internet]. [cited 30 January 2023]. Available at: https://www.msdmanuals.com/en-us/professional/infectious-diseases/mycobacteria/tuberculosis

23. PDF-3-1.pdf [Internet]. [cited 10 March 2024]. Available at:https://www.ms.gba.gov.ar/sitios/tbc/files/2016/07/PDF-3-1.pdF

24. TB-Report-2019-2022-vd-signed-signed-signed-signed-signed.pdf [Internet]. [cited 4 February 2024]. Available at:https://www.salud.gob.ec/wp-

content/uploads/2023/10/Reporte-de-TB-2019-2022-vd-signed-signed-signed-signed-signed.pdf

25. 24.Tuberculosis: Symptoms, diagnosis and treatment. Clínica Universidad de Navarra [Internet]. [cited 30 January 2023]. Available at: https://www.cun.es/enfermedades-tratamientos/enfermedades/tuberculosis

26. 25.Tuberculosis - StatPearls - NCBI Bookshelf [Internet]. [cited 30 January 2023]. Available at: https://www.ncbi.nlm.nih.gov/books/NBK441916/26.Gómez Tangarife V, Gómez Restrepo AJ, Robledo Restrepo JA, Hernández Sarmiento JM. Drug resistance in Mycobacterium tuberculosis: contribution of constitutive and acquired mechanisms. Rev Public Health. 1 July 2018;20(4):491-7.

Indexaciones