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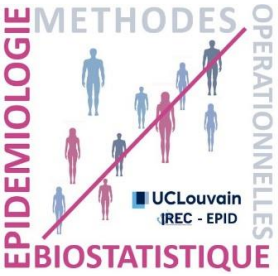

Spatial distribution of tuberculosis in Cochabamba, socioeconomic determinants and catastrophic costs for households

Marcelo Rojas Mattos

Promotor: Prof. Annie Robert

Thesis submitted in fulfilment of the requirements for the degree of Doctor in Public Health Sciences

Belgium, July 2022

Tuberculosis in Cochabamba: Spatial distribution and socioeconomic determinants

July 2022

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Summary

In developing countries, socioeconomic factors contribute to the burden of tuberculosis, a highly contagious disease, and patients incur catastrophic costs, directly or indirectly related to its Directly Observed Treatment (DOT) in a health center, during 3 to 6 months. The objective of our study was to establish the spatial distribution of tuberculosis in Cochabamba, its link with socioeconomic factors, and its treatment cost for patients. Results of our ecological study showed higher incidence in tropical areas than in Altiplano or valleys, but in all areas, not to be homeowner was associated with increased incidence. 44% of patients had catastrophic costs, either directly due to DOT because of transportation and food, or indirectly because of a loss of income. Our findings suggest that it urges to delocalize DOTs to communities and to setup a video-assisted treatment of patients in order to increase adherence to treatment and therefore reduce tuberculosis in Bolivia.

Résumé

Les conditions socioéconomiques contribuent au fardeau de la tuberculose, maladie très contagieuse. Son traitement dure 3 à 6 mois, avec des coûts directs et indirects pour les patients qui sont parfois catastrophiques, induisant alors une non-adhérence. L'objectif de notre étude était d'établir la distribution spatiale de la tuberculose, sa relation avec des facteurs socioéconomiques et d'évaluer les coûts pour les patients. Notre étude écologique montre une incidence plus élevée dans les Régions Tropicales que dans les Andes, mais dans chaque région, l'incidence était associée au fait de ne pas être propriétaire de son logement. 44% des patients avaient des coûts catastrophiques, directs par le transport et la nourriture lors des déplacements pour le DOT (Directly observed treatment) et indirects par une perte de revenus. Il est urgent de délocaliser les DOTS vers les communautés et mettre en place une surveillance vidéo-assistée du traitement pour réduire la tuberculose en Bolivie.

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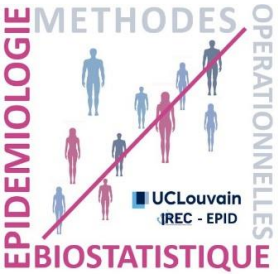

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Summary

Socioeconomic variables contribute to the burden and the spread of the tuberculosis, especially in developing countries. Likewise, patients with tuberculosis usually incur large costs directly related to their disease. Additional indirect costs also increase the economic burden of households creating barriers of access and adherence that can affect the healing of patients.

The objective of our thesis was to determine the distribution of tuberculosis, its relationship to socio-economic determinants and assess the socio-economic consequences for patients and their households affected by the disease in the department of Cochabamba, Bolivia.

Therefore, on the one hand we conducted an ecological study to evaluate the spatial distribution of tuberculosis and its relationship with socioeconomic determinants and the other hand we conducted a cross-sectional study with retrospective data collection to determine the socioeconomic impact of TB on patients and their households.

We found that each region of the Department showed different values and characteristics regarding not only the incidence of tuberculosis but also regarding geography and socioeconomic variables, reflecting different realities in the five regions. The distribution pattern of the incidence of tuberculosis highlighted a high incidence in the Tropicals Regions, a moderate incidence in the Metropolitans Regions and a low incidence in the Valleys, Southern Cone and Andean Regions.

The relationship between the incidence of tuberculosis and socioeconomic variables was also different between Regions. However, the variable "not homeowner" correlated positively with the incidence of tuberculosis in each Region. This variable has a very important link with the economic situation of households, because people who do not have their own home go to rental

contracts that are usually associated with precarious conditions and the overcrowding of people, increasing risk of tuberculosis contamination.

Likewise, we found that patients with TB treated in the health services network of Cochabamba, Bolivia, face a great financial burden as a result of the disease. Before the beginning of the diagnosis when seeking health care, more medical direct costs are observed, especially by radiography and medicines, these costs decrease during treatment, probably because the coverage of the health system allows avoiding these costs when the patient is already diagnosed. During the treatment, the most important costs were those related to transport and food due to the administration of the DOTS, due to the fact that many people have to travel long distances and even consume food outside the home to receive their treatment in the health center. In addition, there are costs for nutritional supplements and additional foods to the regular diet that patients must incur to improve their general condition.

Indirect costs were the highest in the entire TB episode, mainly due to the loss of income due to TB especially in MDR-TB patients. Almost half of patients suffer a catastrophic cost, especially those who came from an urban province, those who were older than 55 years, and those having a low economic income.
Regarding the measures to be taken, due to the differences in the distribution of the disease in the different regions, adapted actions must be developed for each one of them. For the disease control, the epidemiological surveillance system must be adapted to each territorial base, using an active detection strategy in regions where the incidence is higher.

Our study reports a relationship between the disease and "not homeowner", this finding shows that tuberculosis is associated to the precariousness conditions and in specifically associated to the overcrowding of people. In this sense, many of bad conditions of people can be improved with an intersectoral approach focusing the

action on the socio-economic determinants to improve living conditions through primary prevention measures, like the implement social housing programs, improve the educational conditions of the population and improve the nutritional status of the vulnerable population.

Regarding costs related to tuberculosis when seeking health care, the public health system should take charge of patients in a timely manner, especially prioritizing the care of patients with suspected tuberculosis. In relation the costs during treatment, since these costs are indirect related to food and transportation, it is necessary to develop food and a transportation subsidy programs. Public policies must also be generated to achieve labor immobility until healing and implement protection programs to population from the economic and health effects of contracting TB, since indirect costs are the highest of the entire TB episode, mainly due to loss of income.

Resumé

Les variables socioéconomiques contribuent au fardeau et à la propagation de la tuberculose, en particulier dans les pays en développement. De même, les patients tuberculeux supportent généralement des coûts importants directement liés à leur maladie. Des coûts indirects supplémentaires augmentent également la charge financière des ménages en créant des obstacles à l'accès et à l'adhérence qui peuvent affecter la guérison des patients.

L'objectif de notre thèse était de déterminer la distribution de la tuberculose, sa relation avec les déterminants socio-économiques, et d'évaluer les conséquences socio-économiques pour les patients et leurs ménages touchés par la maladie, dans le département de Cochabamba, en Bolivie.

Par conséquent, d'une part, nous avons réalisé une étude écologique pour évaluer la distribution spatiale de la tuberculose et sa relation avec les déterminants socio-économiques, et d'autre part, nous avons réalisé une étude transversale avec collecte de données rétrospective pour déterminer l'impact socio-économique de la tuberculose chez les patients et à leur ménage.

Nous avons constaté que chaque région du département présentait des valeurs et des caractéristiques différentes non seulement en termes d'incidence de la tuberculose mais aussi en termes de géographie et de variables socio-économiques, reflétant des réalités différentes dans les cinq régions. Le patron de distribution de l'incidence de la tuberculose a mis en évidence une incidence élevée dans les Régions Tropicales, une incidence modérée dans les Régions Métropolitaines et une faible incidence dans les Régions des Vallées, le Cône sud et les Andes.

La relation entre l'incidence de la tuberculose et les variables socio-économiques était également différente entre les régions. Cependant, la variable "non

propriétaire" était positivement corrélée avec l'incidence de la tuberculose dans chaque Région. Cette variable a un lien très important avec la situation économique des ménages, du fait que les personnes qui n'ont pas leur propre maison ont des contrats de location qui sont généralement associés à des conditions précaires et surpeuplement des personnes, augmentant le risque de contamination par la tuberculose.

De même, nous avons constaté que les patients tuberculeux traités dans le réseau des services de santé de Cochabamba, en Bolivie, font face à un lourd fardeau économique en raison de la maladie. Avant le début du diagnostic, lors de la recherche de soins, on observe des coûts médicaux plus directs, notamment pour les radiographies et les médicaments. Ces coûts diminuent au cours du traitement, probablement parce que la couverture du système de santé permet d'éviter ces coûts lorsque le patient est déjà diagnostiqué. Pendant le traitement, les coûts les plus importants étaient ceux liés au transport et à la nourriture en raison de l'administration du DOTS, car de nombreuses personnes doivent parcourir de longues distances et même manger à l'extérieur de la maison pour recevoir leur traitement au centre de santé. De plus, il y a des coûts pour les suppléments nutritionnels et les aliments supplémentaires au régime alimentaire habituel que les patients doivent assumer pour améliorer leur état général.

Les coûts indirects étaient les plus élevés de tout l'épisode de tuberculose, principalement en raison de la perte de revenus due à la tuberculose, en particulier chez les patients atteints de tuberculose multirésistante TB-MDR. Près de la moitié des patients subissent un coût catastrophique, en particulier ceux qui venaient d'une province urbaine, ceux de plus de 55 ans et ceux à faible revenu économique.

Concernant les mesures à prendre, du fait des différences dans la distribution de la maladie dans les différentes régions, des actions adaptées doivent être

développées pour chacune d'entre elles. Pour contrôler la maladie, le système de surveillance épidémiologique doit être adapté à chaque base territoriale, en utilisant des stratégies de détection active dans les régions où l'incidence est élevée.

Notre étude rapporte une relation entre la maladie et le « non-propriétaire », ce constat montre que la tuberculose est associée à des conditions précaires et spécifiquement associée au surpeuplement des personnes. En ce sens, bon nombre des mauvaises conditions des personnes peuvent être améliorées avec une approche intersectorielle qui concentre l'action sur les déterminants socio-économiques pour améliorer les conditions de vie par des mesures de prévention primaire, telles que la mise en œuvre de programmes de logement social, l'amélioration des conditions éducatifs de la population et l'amélioration de l'état nutritionnel de la population vulnérable.

En ce qui concerne les coûts liés à la tuberculose dans la recherche de soins médicaux, le système de santé publique doit prendre en charge les patients en temps opportun, en accordant une priorité particulière à la prise en charge des patients suspects de tuberculose. En ce qui concerne les coûts pendant le traitement, puisque ces coûts sont indirects liés à la nourriture et au transport, il est nécessaire de développer des programmes de subvention alimentaire et de transport. Des politiques publiques doivent également être générées pour parvenir à l'immobilité au travail jusqu'à la guérison et mettre en œuvre des programmes visant à protéger la population des effets économiques et sanitaires de la tuberculose, car les coûts indirects sont les plus élevés de tout l'épisode tuberculeux, principalement en raison de la perte de revenus.

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AIDS	Acquired Immunodeficiency Syndrome
BCG	Bacillus Calmette - Guérin
COVID-19	Coronavirus Disease 2019
DILOS	Directorio Local de Salud
DOTS	Directly Observed Treatment, Short-course
ENDSA	Encuesta Nacional de Salud
ETB	Extrapulmonary Tuberculosis
GDP	Gross Domestic Product
HIV	Human immunodeficiency Virus
INE	Instituto Nacional de Estadísticas
IOM	International Organization for Migration
MDR-TB	Multidrug-Resistant Tuberculosis
MDGs	Millennium Development Goals
MTB	Mycobacterium Tuberculosis
NGOs	Non-governmental Organizations
OMS	Organización Mundial de la Salud
PAI	National Immunization Program
PCR	Polymerase Chain Reaction
PPS	Probability-Proportional-to-Size
RR-TB	Rifampicin-Resistant Tuberculosis
RS	Respiratory Symptomatic
SEDES	Servicio Departamental de Salud
SDGs	Sustainable Development Goals
SUS	Seguro Universal de Salud

TB	Tuberculosis
TBP	Pulmonary Tuberculosis
TCP	Tuberculosis Control Program
TSF	Tuberculosis In All Its Forms
WHA	World Health Assembly
WHO	World Health Organizat

CHAPTER 1: TUBERCULOSIS ISSUE

Chapter 1 Tuberculosis Issue

1.1 Epidemiological situation

1.1.1 Global Situation

Tuberculosis is a communicable disease which is a major cause of morbidity, one of the world's top ten causes of mortality, and the leading cause of mortality caused by a single infectious agent (above HIV / AIDS) (1) (27)

At a global level, the WHO Global Tuberculosis Report 2020 estimates that 10 million people became ill with tuberculosis in 2019, a figure that has been decreasing very slowly in recent years. It is also estimated that in 2019, there were 1.2 million deaths from tuberculosis among HIV-negative people (compared to 1.7 million in 2000), and another 208,000 deaths among HIV-positive people (compared to 678,000 2000). Men (age ≥15 years) accounted for 56% of all tuberculosis cases. In comparison, women made up 32% and children (age ≥15 years) 12%. Of all the cases, 8.6% were people with HIV. (1)

The national tuberculosis incidence rate ranges from less than 5 cases to more than 500 new cases and relapses per 100,000 inhabitants per year. In 2019, 54 countries had a low incidence of tuberculosis (≤ 10 cases per 100,000 inhabitants per year) (Figure 1)

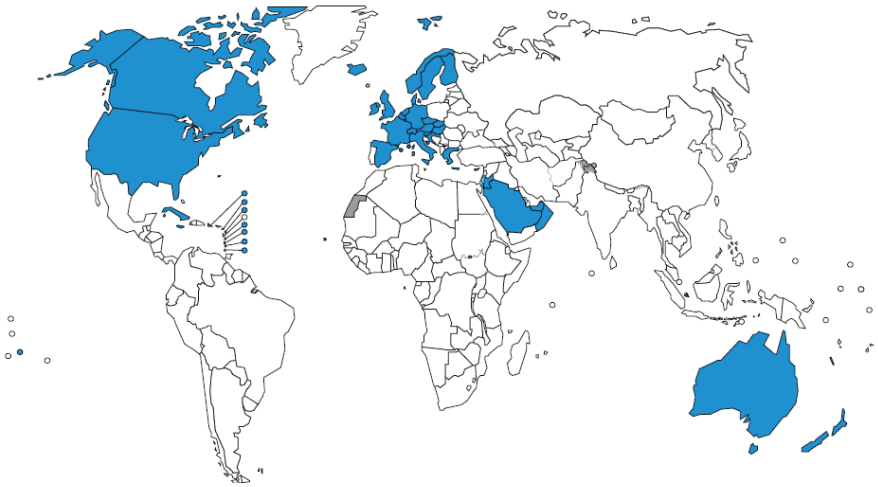
Drug-resistant tuberculosis remains a significant public health risk. Worldwide, about half a million people developed rifampicin-resistant tuberculosis (RR-TB), 7 of which 78% had multidrug-resistant tuberculosis (MDR-TB).

Starting in 2016, the objective was to eliminate tuberculosis through the implementation of the “End Tuberculosis Strategy”, adopted by the World Health Assembly in May 2014, and whose objectives are linked to the Sustainable

Development Goals (SDGs). These are models for countries to reduce the number of tuberculosis deaths by 90% by 2030 (compared to 2015 levels), the new cases by 80% and ensure that no family faces catastrophic costs due to tuberculosis (4).

Figure 1 TB incidence rate of less than 10 per 100 000 population in 2019

Countries (in blue) that had an estimated TB incidence rate of less than 10 per 100 000 population in 2019



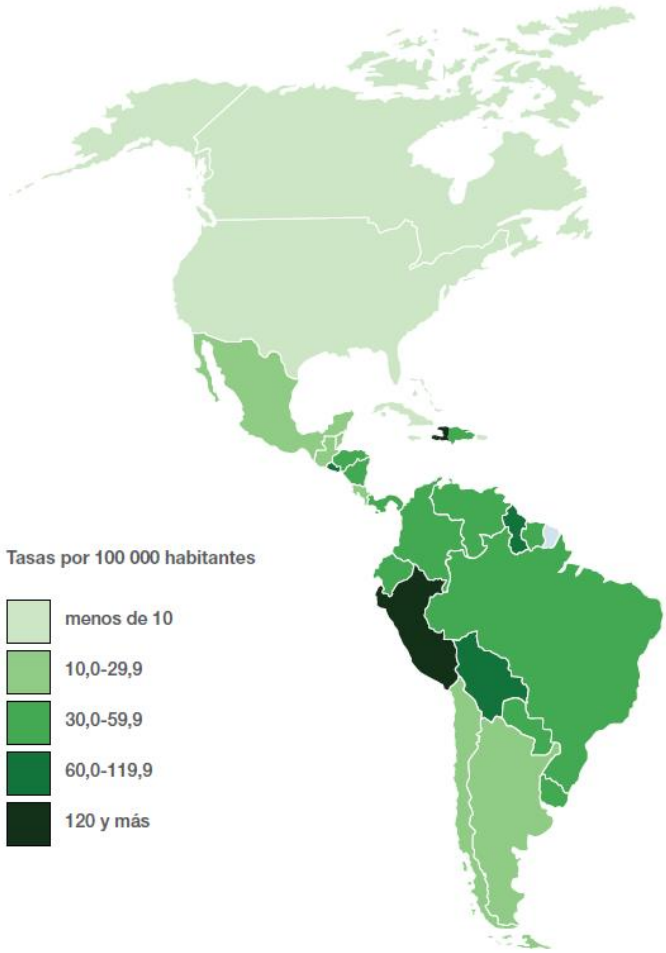
Fuente: World Health Organization. Global Tuberculosis Report. Ginebra: OMS; 2020. Available en : https://www.who.int/tb/publications/global_report/.

1.1.2 Situation in the Americas.

In the Region of the Americas, 289,000 incident TB cases were estimated in 2018 (3% of global cases). Of these, 185,000 (64%) corresponded to men aged 15 years or over. 15,000 (5.5%) were people under 15 years of age. The estimated incidence rate for the Region was 28.7 per 100,000 inhabitants, with a tendency to increase in the last 5 years. Between 2017 and 2018, the number of estimated TB cases in the Americas increased 2.5% (8,000 more TB cases estimated), mainly due to increased estimates for Brazil (4,000), Peru (2000), Mexico (1000) and the Bolivarian Republic of Venezuela (1000). (2)

Regarding the estimated TB incidence rate the highest estimated rates in the Region in 2018 corresponded to Haiti (179.8), Peru (121.9) and Bolivia (105.7), all of them with more than 100 cases per 100,000 inhabitants. (2) (Figure 2)

Figure 2 Estimated incidence rate of tuberculosis, Region of the Americas 2018



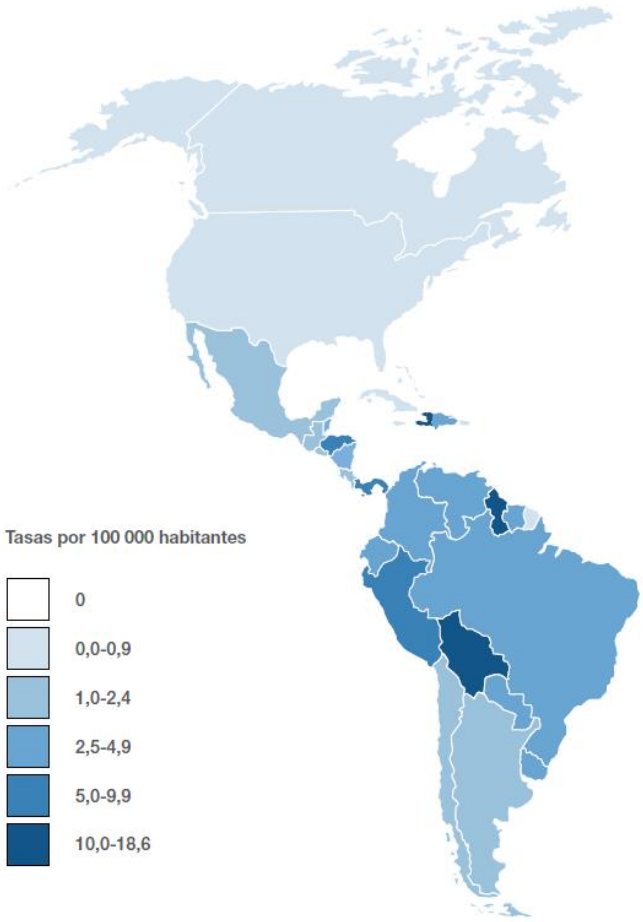
Fuente: Organización Mundial de la Salud. Informe mundial sobre la tuberculosis 2019. Ginebra: OMS; 2019. Available en: https://www.who.int/tb/publications/global_report/es/.

On the other hand, in 2018, the estimated deaths due to TB for the Region of the Americas were 22,900, of which 26% (5,900) corresponded to people with co-infection by TB and HIV (co-infection by TB / HIV).

Between 2010 and 2018, the average rate of decline in the estimated TB death rate was 3.1% per year for deaths not associated with HIV. The decrease in mortality associated with HIV was lower in the same period, averaging 2.4% per year. (2)

The estimated mortality rate from TB in countries of the Region ranges from less than one death per 100,000 inhabitants (Canada, Cuba, and the United States of America) to 10 or more deaths per 100,000 inhabitants (Bolivia, Guyana and Haiti). Figure (3)

Figure 3 Estimated mortality rate of tuberculosis, Region of the Americas 2018



Fuente: Organización Mundial de la Salud. Informe mundial sobre la tuberculosis 2019. Ginebra: OMS; 2019. Available en: https://www.who.int/tb/publications/global_report/es/

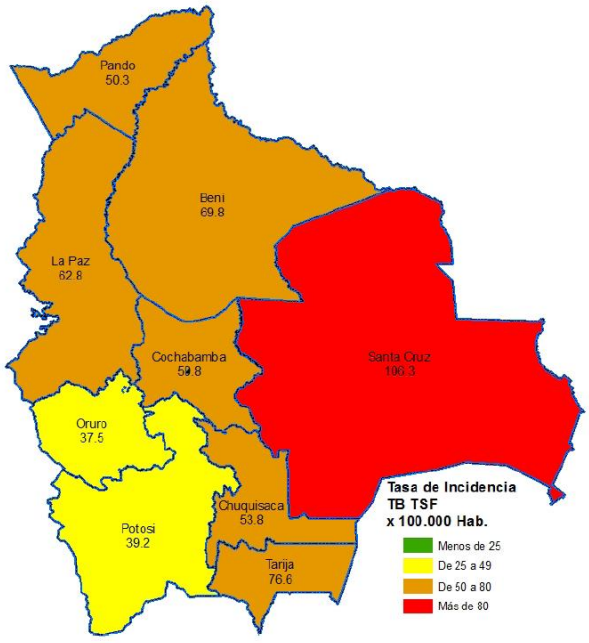
1.1.3 Situation in Bolivia

The incidence rate of TB in 2020 was 105 /100,000 hab. Therefore, in Bolivia, tuberculosis continues to be a public health problem of great magnitude and importance that requires priority attention by all sectors and civil society in the country. In 2020, 7140 cases of TSF were detected, of which 4998 correspond to TBP cases (99).

The age groups most affected are in the productive, reproductive and social contact ages (15 to 34 years), with a predominance of males, with a ratio of 1.5 males per female, a trend that has not changed for several years (35). The treatment success rate of the TBP cohort from 2012 to 2014 exceeds 85%, meeting the established goal.

The drug resistance identification process began in 2004 with standards established for its management (34). From 2005 to 2015, 570 MDR multidrug resistant TB cases have been detected, of which 320 have started treatment at the national level, but its surveillance should be strengthened (7). In Cochabamba, the incidence of TB was 59.8 cases/100,000 inhabitants in 2014 (Figure 4), according to data from the TB Control Program of the Ministry of Health (11).

Figure 4 Incidence rate of tuberculosis in all its forms (TSF) by department, Bolivia 2014



Fuente: Ministerio de Salud, Programa Nacional de Control de la tuberculosis. Available en: https://www.minsalud.gob.bo/images/Libros/Tuberculosis/Plan_de_control_de_la_TB_2016-2020.pdf

1.1.4 Implications of the COVID-19 pandemic in the fight against tuberculosis

The COVID-19 pandemic threatens to affect the progress that have been made in reducing tuberculosis morbidity. The global number of TB deaths could increase by about 0.2 to 0.4 million in 2020, due to the interruption of health services, as the number of people diagnosed and treated for tuberculosis would have fallen by 25 to 50 % in a period of 3 months (1).

In India, Indonesia, The Philippines and South Africa, four countries accounting for 44% of global tuberculosis cases, there was a decrease of 25% to 30% in the number of people diagnosed with tuberculosis between January and June 2020 compared to the same period in 2019. In the same way, the economic repercussions of the pandemic are expected to exacerbate at least two of the main determinants of the incidence of tuberculosis: poverty and malnutrition. Modelling has suggested that the number of people developing TB could increase by more than 1 million per year in the period 2020–2025. Impacts on livelihoods from loss of income and unemployment can also increase the percentage of people with TB and their households facing catastrophic costs (1).

In Cochabamba, the Covid19 pandemic had a negative effect on tuberculosis for two reasons. The first was that assistance to health facilities was reduced due to fear of contagion among the population and TB patients were not exception. The activities of health facilities were focused on mitigating the pandemic, leaving apart from essential care such as vaccines and the prevention and control of prevalent diseases such as tuberculosis, the impact of the pandemic was more important in countries like Bolivia with weak health systems that were further weakened by the pandemic.

1.2 Magnitude of the problem

1.2.1 End Tuberculosis Strategy

A clear example of the global determination to intensify the fight against TB and achieve the end of the global epidemic (37) was the adoption by the World Health Assembly (WHA) of the World Health Organization (WHO) End TB Strategy in 2014 (36), as well as the inclusion of the expression “ending the TB epidemic” as a goal within the third Sustainable Development Goal (SDGs) (30) by the United Nations General Assembly in September 2015 (4).

Historically through the implementation of the DOTS strategy (1994-2005) and the Stop TB Strategy (2006-2015), countries – especially those with a high burden of TB established the basics required for providing high-quality TB diagnosis and treatment (29).

These efforts contributed greatly to meeting the TB-related target of the Millennium Development Goals (MDGs) of halting and beginning to reverse the TB epidemic. Between 2000 and 2014, improvements in quality-assured diagnosis and treatment of TB contributed to saving 43 million lives worldwide. It was apparent, however, that while enhancing access to diagnosis and treatment remarkably improved outcomes in terms of reducing suffering and death, it had very little effect on achieving the desired impact in terms of declining the incidence rates and slowing down the TB epidemic (38).

The Essentials emphasize that transitioning from “stopping TB” to “ending the TB epidemic” will call for major transformations, beginning with a transformation of the outlook of those in charge of national TB control efforts. The End TB Strategy, whose aim is to end the TB epidemic, therefore combines a holistic mix of health

and social interventions. In the same way this strategy envisions universal access to high-quality TB care and goes beyond it to promote TB prevention.

In order to end the TB epidemic, countries need to strengthen their health and social sectors by achieving universal health coverage and social protection (31), which are also emphasized within the framework of the new SDGs agenda.

The End TB Strategy has three pillars (4):

Pillar 1 Integrated, patient centered TB care and prevention

A. Early diagnosis of TB including universal drug susceptibility testing, and systematic screening of contacts and high-risk groups.

B. Treatment of all people with TB including drug resistant TB, and patient support.

C. Collaborative TB/HIV activities, and management of co-morbidities.

D. Preventive treatment of persons at high risk, and vaccination against TB.

Pillar 2 Bold policies and supportive systems

A. Political commitment with adequate resources for TB care and prevention.

B. Engagement of communities, civil society organizations, and public and private care providers.

C. Universal health coverage policy, and regulatory frameworks for case notification, vital registration, quality and rational use of medicines, and infection control.

D. Social protection, poverty alleviation and actions on other determinants of TB.

Pillar 3 Intensified research and innovation

A. Discovery, development and rapid uptake of new tools, interventions and strategies.

B. Research to optimize implementation and impact, and promote innovations.

1.3 General aspects of tuberculosis

1.3.1 Infection and disease and transmission mechanisms

Tuberculosis is an infectious-contagious disease, of chronic evolution, preventable and curable, which is caused by *Mycobacterium tuberculosis* (Koch's bacillus), affecting mainly socially vulnerable groups.

Tuberculosis infection is the period in which these bacteria come into contact for the first time with a healthy person (called primary tuberculosis infection), which triggers a defense response of the person's immune system (5). When the immune system does not control the tuberculosis infection or reinfection and the bacillus begin to multiply actively producing lesions in the affected organs, symptoms and signs appear, which means that the disease is installed (33). About 10% of those infected develop the disease at some stage in life; but in the presence of HIV (39), the risk of progression from infection to the disease is 7% to 10% each year, increasing the risk of disease.

Transmission is the passage of the bacillus from a sick person to a healthy one, the airway being the transmission mechanism of tuberculosis (a sick person infects a healthy person by talking, laughing, sneezing, singing and especially by coughing). The factors that favor the transmission are: Bacilli concentration, poor ventilation and lighting, and degree of closeness and length of contact with the patient (32).

1.3.2 Case definitions

Bacteriologically confirmed case of tuberculosis.

It is one who has a positive biological sample by smear microscopy, culture or rapid molecular test (such as GeneXpert MTB / RIF and others), such cases must be notified regardless of whether or not a treatment was started (6).

Clinically diagnosed tuberculosis case.

It is someone who has been diagnosed with tuberculosis by a doctor who decided to give the patient a full cycle of treatment. This definition includes cases diagnosed on the basis of X-ray abnormalities, suggestive histology, and extrapulmonary cases without laboratory confirmation.

Bacteriologically confirmed or clinically diagnosed cases of tuberculosis are also classified by anatomical location of the disease, history of previous treatment, and HIV status.

1.3.3 Classification of tuberculosis

Classification based on anatomical location of disease

According to the anatomical location, the disease is classified as: **a)** Pulmonary tuberculosis (TBP) which refers to any bacteriologically confirmed or clinically diagnosed case of tuberculosis, which involves the lung parenchyma or the bronchial trachea tree. **b)** Extrapulmonary tuberculosis (ETB) which refers to any bacteriologically confirmed or clinically diagnosed case of tuberculosis that involves organs other than the lungs, for example, pleura, lymph nodes, abdomen, genitourinary tract, skin, joints, bones and meninges (13).

Classification based on previous treatment history

According to the history of previous treatment, it is cases are classified into: **a)** New patients, who have never been treated for tuberculosis or who have received anti-tuberculosis drugs for less than one month, or **b)** Previously treated patients, who have received at least a month TB drugs in the past. They are further classified by the results of their most recent treatment cycle as follow (13):

-*Relapsing patients* have previously been treated for TB, declared cured or complete treatment at the end of their last treatment cycle, and are now diagnosed with a recurrent episode of TB.

-*Failing patients* are those previously treated for TB and whose treatment failed at the end of their most recent treatment.

-*Patients lost to follow-up* were previously treated for TB and declared lost to follow-up of their most recent treatment.

-*Other previously treated patients* are those whose outcome after the most recent treatment is unknown or undocumented.

Classification based on HIV status

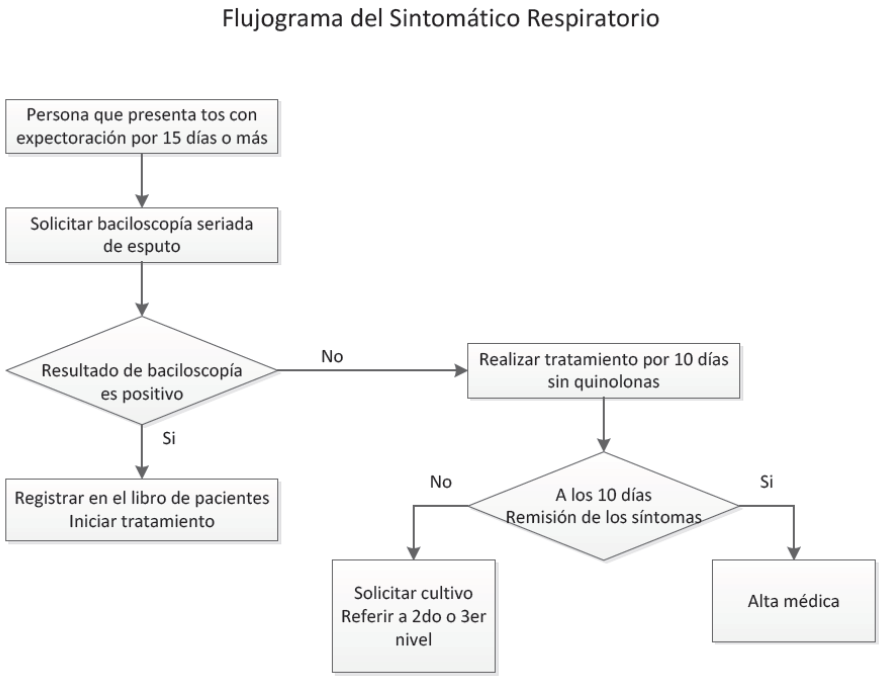
According to HIV status, a patient is also classified in three categories: **a)** Patient with TB and HIV, refers to any bacteriologically confirmed or clinically diagnosed case of TB and who has a confirmed HIV result at the time of TB diagnosis or after it, **b)** Patient with TB and without HIV, refers to any bacteriologically confirmed or clinically diagnosed case of TB that has a negative result of the HIV test performed at the time of TB diagnosis, **c)** Patient with TB and unknown HIV status, refers to any bacteriologically confirmed or clinically diagnosed case of TB that has no HIV test result and there is no other documented evidence of enrollment in HIV care (13).

1.3.4 Disease pattern

The clinical pattern of tuberculosis includes general and specific symptoms. The general symptoms are: hyporexia or anorexia (decreased or loss of appetite), asthenia and adynamia (loss of muscle strength and energy), weight loss, fever and night sweats (night sweats), and general malaise. The specific symptoms are: cough with expectoration for more than 15 days, hemoptoic expectoration (stained with blood), hemoptysis (abundant living blood coming from the lungs), dyspnea (difficulty in breathing) and in extrapulmonary tuberculosis the symptoms and signs will be of according to the affected organ. (7)

Coughing is the main symptom of the disease, which allows the patient to be classified as respiratory symptomatic and to raise the diagnosis of presumptive tuberculosis. A respiratory symptomatic SR is the person who has a cough with expectoration for more than 15 days. See in Figure 5 the Respiratory symptom flow chart.

Figure 5. Respiratory symptom flow chart



***Source*:** Programa Nacional de Control de Tuberculosis y Lepra, Ministerio de Salud 2018. Manual de Normas Técnicas en Tuberculosis. Available from: https://www.minsalud.gob.bo/images/Libros/Tuberculosis/Manual_de_Normas_TB_2017.pdf

1.3.5 Passive detection and active case finding

Passive detection consists of the identification of the Respiratory Symptomatic (RS) in patients who consult for respiratory conditions or other pathologies at the level

of health establishments, hospitals, emergency rooms, mobile teams, etc. (5). Passive detection is important to reduce late diagnosis.

The active finding of cases consists in the search of cases with signs and symptoms suggestive of TB in subgroups of population at risk: contacts, prisons, indigenous people and others according to the region.

1.4 Diagnosis

The diagnosis of tuberculosis can be made in two ways: a) Clinical method, includes the complete elaboration of the patient's medical history, taking into account: Reason for consultation (symptoms), non-pathological personal history, pathological personal history, especially previous treatments, family history, gynecological-obstetric history in women, general clinical examination and by systems (8), b) Bacteriological methods, are methods that allow evidence of the presence of the bacteria in the individual's body (40). Within these methods we can mention:

-*Sputum smear microscopy* is the easiest and most accessible diagnostic method. It allows to identify the sources of transmission of tuberculosis. Direct microscopic examination of a sputum sample that has been spread on a slide and stained using the Ziehl-Nielsen technique is performed, in which acid-fast bacilli are observed (9, 41). Every Respiratory -Symptomatic should undergo two smear microscopies with representative samples of expectoration. When a sample is positive, the laboratory has to immediately notify the health personnel in charge of the patient (33).

Culture, that is the method with the highest sensitivity for the diagnosis and monitoring of tuberculosis treatment (42, 45). It is carried out in solid egg-based media: Ogawa, Lowenstein Jensen and in liquid media: Middlebrook 7H9, Middlebrook 7H10 (46).

-*Molecular biology* genexpert MTB / RIF, the GeneXpert MTB / RIF test is a fully automated real-time Polymerase Chain Reaction (PCR) in a cartridge that can detect Mycobacterium tuberculosis (MTB) and Rifampicin resistance (RR-TB), in less than 2 hours (9,43, 44).

-*Imaging studies*. Chest radiography, which is a sensitive technique, but quite nonspecific since TB does not have any pathognomonic radiological image (10). Even if radiological images are compatible with TB, bacteriological test should always be requested to verify it. Chest computed tomography, although sensitive, is not specific and must also be completed with bacteriological studies.

-*Anatomopathological study*, in some forms of the disease, especially in extrapulmonary. The diagnosis is based on the demonstration of caseating granulomas, with Langhans cells that are quite suggestive of tuberculosis. However, it should be kept in mind that other diseases can produce similar granulomas, especially mycobacteriosis and some mycoses, pathologies that can present with a clinical and radiological picture similar to those of tuberculosis (10)

1.5 Treatment of tuberculosis

The treatment of tuberculosis has bacteriological, pharmacological and operational bases (12).It must be: a) Associated, thanks to the use of a minimum of four anti-tuberculosis drugs to avoid the selection of resistant bacterial strains b) Prolonged, for a minimum of 6 months to achieve the elimination of all bacillary populations in their different phases of metabolic growth c) In a single dose, because the therapeutic action is greater when the drugs are administered together and the intake must be separated from the meal d) Supervised, to guarantee the taking and compliance of the treatment until completion and its cured condition e) Controlled, with monthly smear microscopies from the 2nd month of treatment and culture to

the 4th or 5th month of treatment (in case of prolongation of the intensive phase) f) In dose kilogram weight / day and according to the form of presentation of the drugs, to avoid both over and under dosage (7). The dose has to be adjusted according to kilo / weight in the monthly controls.

It is important that health caregivers ensure patient adherence to treatment and monitor its evolution, including prevention and treatment of adverse side effects that may occur (47, 48). They have to ensure that the medication is strictly supervised in both phases and in very exceptional cases by other trained persons. Outpatient treatment has to be supervised within the Health Facility, except in exceptional cases that require hospitalization.

1.5.1 Anti-tuberculosis drugs

First-line drugs are the basis of the treatment of cases of sensitive tuberculosis and should be administered as shown in the Table 1. However, after 2021 new recommendation were formulated for first-line drugs: 4-month regimen consisting of 8 weeks of daily treatment with rifapentine (RPT), isoniazid (INH), pyrazinamide, and moxifloxacin (MOX), followed by 9-weeks of daily treatment with RPT, INH, and MOX in patients with drug-susceptible tuberculosis.

Table 1 Tuberculosis Treatment

FASE INTENSIVA	FASE DE CONTINUACIÓN	INDICACIONES	ADMINISTRACIÓN
2 RHZE (2 meses) 52 dosis	4 RH (4 meses) 104 dosis	• Casos nuevos de tuberculosis pulmonar y extrapulmonar (niños y adultos). • Pacientes previamente tratados (con resultado de GeneXpert sensible a Rifampicina) u otro método rápido similar.	• Diaria. • Una sola toma. • Tratamiento Directamente Observado (DOT) por personal de salud. • De lunes a sábado.

***Source*:** Programa Nacional de Control de Tuberculosis y Lepra/UE/DGSS Ministerio de Salud 2018. Manual de Normas Técnicas en Tuberculosis. Available from: https://www.minsalud.gob.bo/images/Libros/Tuberculosis/Manual_de_Normas_TB_2017.pdf

1.6 Prevention of tuberculosis

1.6.1 Primary Prevention.

It is important to strengthen health promotion and risk prevention actions in the general population and populations of greater vulnerability. But to do so, there is a need to identify the social determinants of the health-disease process (cross-cutting or health inequities such as gender, violence, environmental health, interculturality, discrimination in all its forms), for promoting practices that favor health (11).

On one hand, health promotion actions focus on ensuring that the population has sufficient knowledge about tuberculosis through the actions of health caregivers or health promoters who develop educational sessions in communities or neighborhoods. On the other hand, social organizations have to articulate with health facilities to participate in the planning of health management activities (49).

Vaccination with BCG (Bacillus Calmette - Guérin).

BCG vaccination is mandatory in Bolivia. This vaccine protects from acute and severe forms of miliary and meningeal tuberculosis (7), and so preventing death from these causes (50). The National Immunization Program (PAI) is the one that assumes the management and evaluation of the application of the BCG. The BCG vaccine is administered to newborns and children under 1 year of age in all first, second and third Level structures.

Chemoprophylaxis or preventive therapy.

It consists in the administration of Isoniazid to people at risk of developing tuberculosis disease. However, in other countries there is chemoprophylaxis with rifapentine, which is apparently less toxic and more effective.

It is mainly intended for children under 5 years of age, intimate contacts of cases of pulmonary tuberculosis, but not exclusively. The purpose of chemoprophylaxis is to prevent infection in those who are not infected and to reduce the risk of developing tuberculosis disease in those who are already infected (51, 52). Chemoprophylaxis can be administered in the following situations: under 5 years of contact with Pulmonary TB, HIV (+) child weighing less than 25 kilos, HIV (+) cases weighing more than 25 kilos and Immunosuppressed patients (kidney transplants, collagen diseases, etc.)

1.6.2 Secondary prevention.

The best way to prevent tuberculosis is by cutting the chain of transmission through early diagnosis of contagious cases and timely treatment, strictly supervised until cure is certified (56).

Contact control.

Contact control is the active detection of cases among groups of population at risk of becoming ill with tuberculosis. It should be done in close contacts of cases of pulmonary tuberculosis (which are those who spend at least six hours a day in close

relationship with the patient). It is important to carry out contact control as soon as Pulmonary or Extrapulmonary case has been identified (53).

Protection measures.

Health caregivers have to recommend the following protection measures for patients and their families (7):

• Cover your mouth when coughing, don't spit on the floor; do it in a tissue or toilet paper, dispose it in a closed plastic bag or burn it (55).
• Ventilate and keep the house clean, allowing sunlight to enter (54).
• Maintain good family hygiene conditions.
• Try to consume dairy products, vegetables, fruits, meats, cereals and legumes.
• Avoid the consumption of alcoholic beverages and drugs.

Finally, successful prevention results from the joint, multidisciplinary task from the timely diagnosis, the established treatment and its follow-up, the study of contacts, the adherence of the patients, the good treatment of the patients in all Health Facilities and the participation of the population articulated with the organized community for information, training and education.

CHAPITRE 2: THE SETTINGS

Chapter 2 The settings

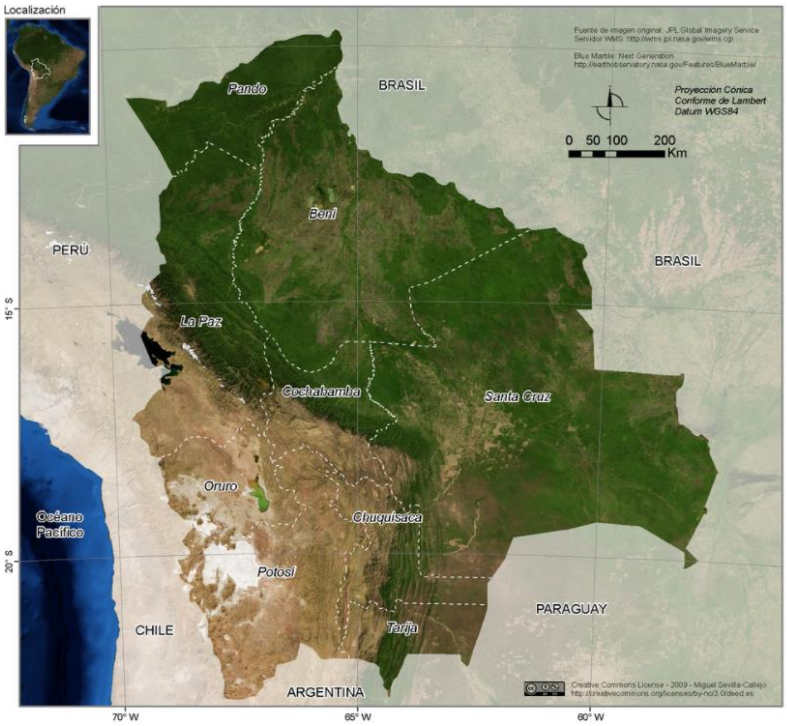
2.1 Bolivia

Bolivia, is a country located in the heart of South America. Politically and administratively, it is divided into 9 departments, 112 provinces and 339 municipalities. Approximately, 70% of the population is found in the departments of the central axis of the country: La Paz (27.0%), Santa Cruz (26.4%) and Cochabamba (17.5%). The population is predominantly urban with a proportion of 67.5% living in capital cities, and intermediate cities (57).

Bolivia has a population of 11,383,094 inhabitants (17), estimated in 2019, with an approximate population growth of 1.71% per year (58). The distribution of the population by age and sex concentrates 31.4% of the population in the group under 15 years of age, still finding a structure by young age. Women represent 54% of the population pyramid showing a predominantly young population with a mean age of 24.6 years (2018).

The population is spread over an area of 1,098,581 km2, which corresponds to a population density of 10.36 inhabitants / km² (2019). Three defined ecological levels are distinguished (Figure 6): The Altiplano, that occupies 28% of the national territory, with a cold and dry climate during most of the year and with the highest mountains. The Valley, that occupies 13% of the national territory, with an average height of about 2,000 meters above sea level, characterized by exuberant vegetation, and the Llano, that occupies 59% of the national territory with an average height of less than 1,000 meters above the sea level, that is completely covered by areas of jungle and jungle of the Amazonian type.

Figure 6 Geographic Regions of Bolivia



***Source*:** Satellite image of Bolivia from google earth. Available from:http://www.viajesur.com/mapa-satelital-bolivia/

The Department of Cochabamba is located in the center of Bolivia, It is one out of nine departments of Bolivia and it shares borders with six of the eight other departments of thie country. It has great geographical contrasts and a great diversity of ecosystems. It has a total area of 67,918 km2, 16 provinces and 47 municipalities which are grouped into five regions, each with unique characteristics (16). It is the third most economically important department in Bolivia, with a population of 1,758,000 inhabitants (17).

2.1.1 Sociodemographic Context

According to estimates by the Instituto Nacional de Estadísticas INE (17), life expectancy at birth reaches 69 years. The lack of access to education and family planning services helps to maintain a high fertility rate in Bolivia, with 3.5 children

per woman at the global level, but it is 2.8 children per woman in urban areas, and 4.9 children per woman in rural areas. The specific fertility rate is 88 births per thousand women in adolescents between 15 and 19 years, according to the Encuesta Nacional de Salud ENDSA 2008 (18).

Public education is of poor quality and educational opportunities are among the most unevenly distributed in Latin America, although official data show that 94.9% of the population aged 15 years or more can read and write. The literacy rate is 92.3% for women and 97.6% for men. 24.2% of the population aged 19 or more has a high education level (61). There were 69.7% of women who attended their last childbirth in a health facility; that was 80% in urban areas and 40.8% in rural areas (59). 46.8% of the Bolivian population prefers to self-medicate when facing a health problem and 44.8% resort to homemade solutions.

The lack of potable water and basic sanitation in Bolivia, especially in rural areas, contributes to health problems, since the potable water coverage in homes reaches 85.2% and electricity coverage 85.4%. Among all the households, 75.5% are equipped with a radio device, 66.5% with a television, 65.1% with a landline or cell phone, and 23.6% with computer equipment (17).

According to the International Organization for Migration (IOM) (60), there are approximately 1.6 million of Bolivians who have emigrated abroad in search of better living conditions. The traditional countries of migration were Argentina, Chile and the United States. However, in the 1990s most of Bolivian migration went to Spain, where an estimated 230,000 Bolivians reside.

2.1.2 Macroeconomic Context

The Bolivian economy rests mainly on activities related to hydrocarbons, mining and agriculture, that represent about 3/4 of the Gross Domestic Product GDP by

economic activity. Bolivia's income inequality is the highest in Latin America and one of the highest in the world (62).

The value of GDP at market prices exceeded USD 30,824 million, which means a GDP per capita of approximately USD 3,000 per person (2013) (19). Annual economic growth for the year 2017 exceeded 6%, maintaining a growing trend, which has allowed a better redistribution of income.

Total health spending for 2013 adds up to 10,054 million BOB, registering an increase of more than 250% compared to 2005, and representing approximately 6.1% of GDP (19).

The open unemployment rate in urban areas reached 4.02% in 2013. The overall participation rate of the population in the labor market of the same year amounts to 58.5%: 68.1% in men and 49.7% in women. The expansion of the economy made possible to improve salary levels.

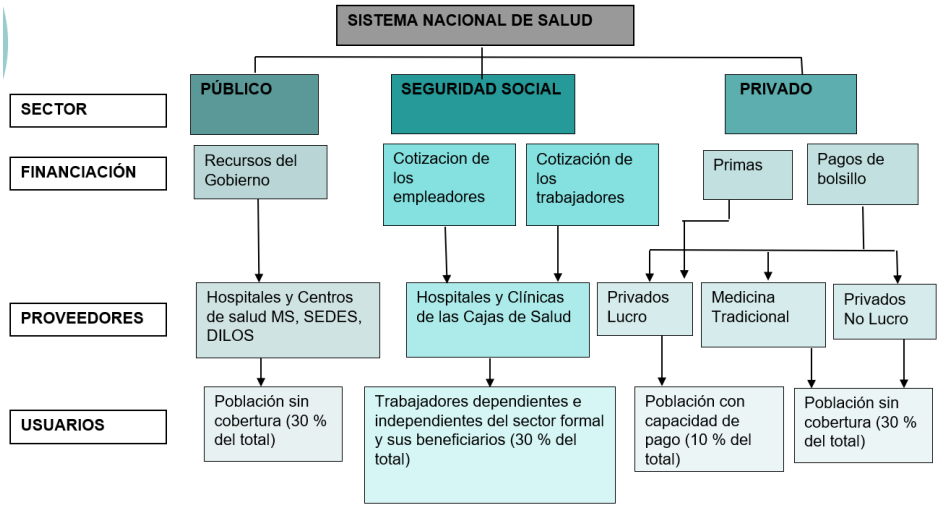
In recent years, social policies oriented to the poor and rural areas were also developed in Bolivia, but in 2014 the moderate poverty, that represents the people living on less than two dollars a day, was 39%; the Gini coefficient was 0.47 (20) and the rural municipalities still had bad socioeconomic indicators (21). Poverty, malnutrition, poor sanitation, high population density, acquired immunodeficiency syndrome and population aging are currently some of the factors involved in the spreading and the severity of tuberculosis (22, 23).

2.2 General organization of the health system in Bolivia

The Bolivian health system is a fragmented and segmented system (64), made up of three sectors (14): the public sector, the private sector, and the social security sector (Figure 7). Social security covers people in the formal economy sector that

are equivalent to 30% of the population and is financed with contributions by employers and workers, and with state resources when the latter functions as an employer. It has its own network of health facilities (63).

Figure 7 Bolivia Health System



***Source*:** Own elaboration based on the article Sistema de Salud de Bolivia by Carmen Ledo and Rene Soria. Available from:https://www.researchgate.net/publication/221930849_The_health_system_of_Bolivia

For the rest of the people not protected by Social Security, since 2019, the state has ensured universal, equitable, timely and free access to health care through the implementation of the Seguro Universal de Salud (SUS)**,** provided by the network of health facilities in the public sector, which is the largest in the country (15).

Although the intention is weighty, the implementation of the SUS is gradual and becomes difficult especially in a historically weak health system in terms of infrastructure, equipment and human resources, which in fact translates into a lack of access of the population to health facilities. In this sense, the population continues to turn to the private sector. Those with the ability to pay to the private sector for profit (insurance and private services, clinics) remain 10% of the total

population, and those without the ability to pay to the private sector without profit-making, such as traditional medicine or health facilities of churches or NGOs, is equivalent to 30% of the total population. The public sector is financed with public resources allocated to municipalities.

From a health management point of view, the national level corresponds to the Ministry of Health and at a Departmental level, it corresponds to the Servicio Departamental de Salud (SEDES), under the authority the departmental government. The municipal level corresponds to the Directorio Local de Salud (DILOS) as shown in Table 2.

Table 2 Management levels of the Bolivian health system

NIVEL CENTRAL **MINISTERIO DE SALUD**	NIVEL NORMATIVO	**RED NACIONAL DE SERVICIOS DE SALUD**
NIVEL DEPARTAMENTAL SEDES	GESTIÓN DEPARTAMENTAL	**3 NIVEL GERENCIA DE RED**
NIVEL MUNICIPAL Y LOCAL **RED SOCIAL**	GESTION LOCAL Y CONTROL SOCIAL	**2 NIVEL** **1 NIVEL**

***Source*:** Own elaboration that takes into account the levels of management and the levels of care of the Health System in Bolivia

Levels of health care are organized in a pyramid-like model with first, second, and third levels of care. The first level of care constitutes the gateway to the Health System, where approximately 85% of health problems should be solved. The second level is made up of hospitals that have four basic specialties: obstetrics-gynecology, pediatrics, internal medicine and surgery, where approximately 10% of health problems should be solved. The Autonomous Municipal Governments finance the First and Second Level of care.

The Third Level is made up of hospitals that have all specialties, which should solve 5% of the population's health problems. The financing of this Level is covered with resources from the General Treasury of the Nation through the governments.

2.3 Health System organization in relation to Tuberculosis

Given that promotion and prevention rely more on individual, family and community work and not so much on the health system, diagnosis, care, treatment and cure involve the Tuberculosis Control Program at all levels of care.

Thus, the Tuberculosis Control Program TCP is implemented in the public health system, which carries out the diagnosis, treatment and free monitoring of patients. In other words, any person with suspected pulmonary or extrapulmonary tuberculosis must be diagnosed and must start treatment in the public health facilities network. On the other hand, an also important activity is the vaccination of the entire population, since in Bolivia all people after birth receive the BCG vaccine against tuberculosis, in order to avoid sever cases of tuberculosis such as meningeal tuberculosis or tuberculosis miliary.

The monitoring and evaluation of the activities is also in charge of the TCP, which has a specific technical team in each of the departments and in the health facilities.

2.4 Main Challenges in tuberculosis control

The current epidemiological context of tuberculosis raises the need to act not only on patient care, but also, on health promotion and socio-economic determinants with an intersectoral perspective and a broad participation of the actors involved, incorporating the public sector, private sector and organized civil society. This means improving living conditions, gradually reducing poverty, improving both, the level of income and closing the gaps in the lack of education, health, housing and basic services (11).

To achieve this task, it will be very important to act on socioeconomic determinants with the following actions:

• Improve living conditions through social housing programs that allow people to have a home of their own, and thus, reduce the overcrowding in which many of the Bolivian households live. In addition, universal access to basic services must be achieved.

• Improve the nutritional status of the vulnerable population and of people affected by tuberculosis, increasing both the quantity and the quality of food, which in general terms means overcoming the barriers of food insecurity, improving the diversity of foods, the systems of production and supply in both, urban and rural contexts. And specifically, it has to set up direct actions that allow the provision of nutritional guidance corresponding to the family, the community and the health center, and strengthen support for patients with tuberculosis with the provision of nutritional support.

• Improve the educational conditions of the population. In general terms, strategies that prevent school dropout should be strengthened, promoting that people achieve higher levels of schooling, closing the man-woman and urban-rural gaps. And in specific terms, health promotion issues and tuberculosis risk prevention should be included in the educational curriculum.

2.5 Access and adherence to treatment

Leaving treatment is considered as the main cause of concern in the control of tuberculosis that causes a break in the transmission chain, since people with TB not adhering to treatment remain ill and continue to contaminate. Likewise, it increases morbidity and mortality and generates bacterial resistance. Near factors related to

the treatment itself and to the healthcare team the socioeconomic factor stands out as an adherence determinant.

Patients with TB usually incur in large costs related to their disease, since they begin with the symptoms looking for the solution to their health problem, and even when they are already diagnosed and treated by the health system Although the diagnosis and treatment are free, these costs can create barriers of access and adherence that can affect the healing of patients and increase the risk of disease transmission.

In low and middle-income countries, patients with TB suffer costs that are on average, the same amount as half of their annual income (24); therefore, the aforementioned costs can also increase the economic burden of households. In all contexts, TB affects the poorest segment of society; as a consequence, the aggravating effects of poverty due to TB are even more serious for those who are already the most vulnerable.

The out-of-pocket medical expenses of these patients, which are made worse by the loss of income, can be significant (25). This is often a contributing factor to economic difficulties. Direct non-medical costs, such as transportation and food costs during the period of seeking health care, can also be significant taking into account that this period is often long and the treatment period lasts from six months to two years (24).

To overcome the barriers of access and adherence, as well as minimize the economic burden for patients with TB (and their households), it is essential to address both direct and indirect costs. Interventions are necessary to address high medical costs, as well as food and transportation costs, and loss of economic income. Therefore, both financing and health service delivery models and social protection mechanisms must be considered (26).

For that reason, it is important to determine the socioeconomic impact of tuberculosis on patients and their households by assessing the magnitude and main causes of the costs, as well as the direct and indirect costs incurred by TB patients before and after diagnosed with the disease to help in improving adherence to treatment and financial protection.

2.6 Particularities of the system and anthropological barriers

The tuberculosis situation in Bolivia and in the world has a direct relationship with people's living conditions (66), and not with anthropological barriers, which do not allow the prevention or adequate control of the disease.

Many of these conditions can be improved with an intersectoral approach at the head of the state, for example, with the improvement of educational conditions, habitability conditions, access to basic services and the nutritional status of both, the vulnerable population, as well as the TB patients themselves (67).

These conditions can be improved with health promotion activities (68) using health education as the main pillar, for example, including in the educational curriculum topics of health promotion and prevention of tuberculosis risks and carrying out nutritional guidance to the family, the community and the patients themselves.

Additionally, it is imperative to work on improving adherence to treatment and avoiding the economic repercussions on TB patients and their families in order to improve tuberculosis prevention and control.

CHAPTER 3: OBJECTIVES

Chapter 3 Objectives

3.1 Conceptual framework

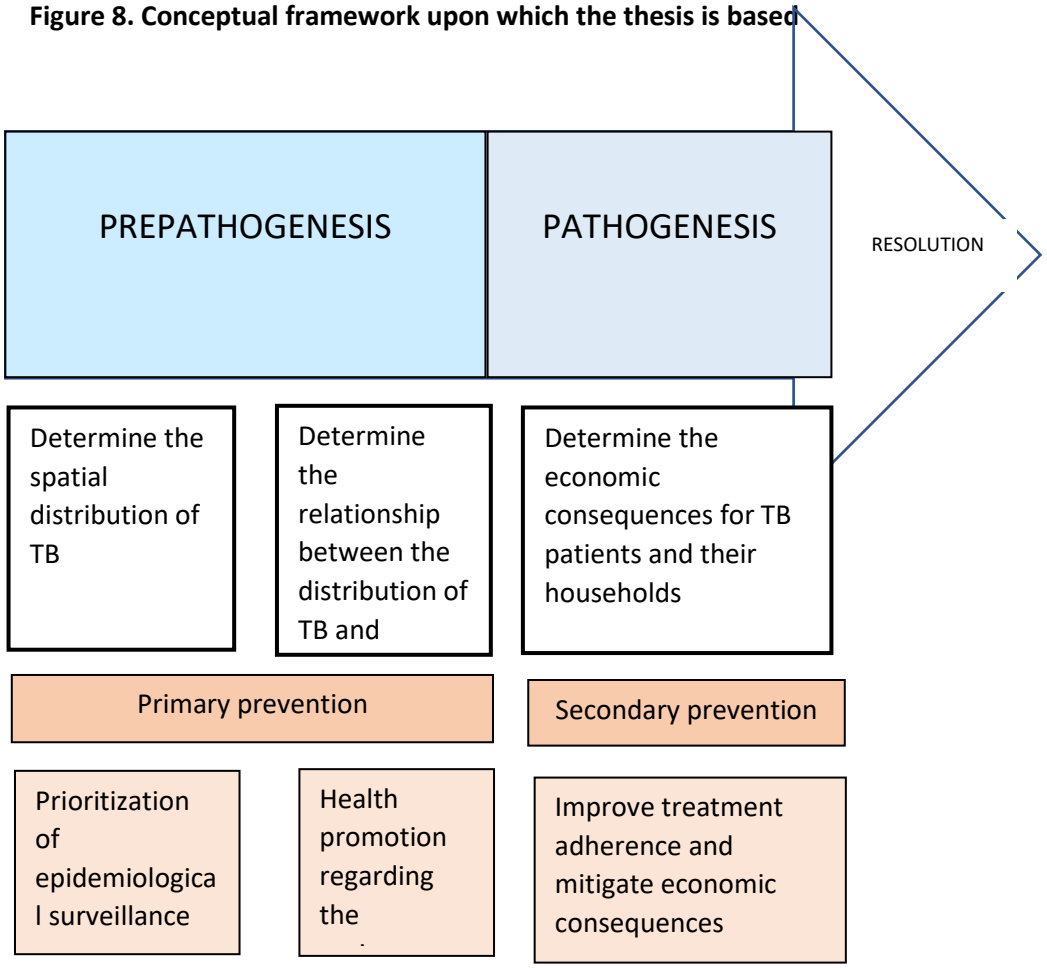
In the natural history of TB, the pre-pathogenic period is related to the balance between the host, agent and the environment, and in the latter, we refer especially to the socioeconomic factors that surround people.

In this sense, knowing where the tuberculosis cases are distributed from a spatial point of view through the determination of the incidence rate standardized by municipality, and analyzing the relationship that this distribution has with socioeconomic factors with an ecological study crossing the information on the incidence rate by municipality with socioeconomic data from the last population and housing census, will allow us to prioritize epidemiological surveillance actions and implement primary prevention measures. All this through health promotion, acting on the socioeconomic factors related to the onset of the disease.

The pathogenic period where TB develops entails a series of expenses for the patient and their families due to the disease, despite the fact that the diagnosis and treatment are free and in charge of the public health services network.

The determination through a cross-sectional study of the economic consequences for patients and their households affected by tuberculosis, measuring the main costs (direct and indirect) incurred by the disease, which may even be catastrophic, will allow us to improve adherence to treatment and the implementation of measures to deal with the economic repercussions of patients and their families. (Figure 8)

Figure 8. Conceptual framework upon which the thesis is based



***Source*:** Own elaboration

3.2 General Objective

To determine the distribution of tuberculosis, its relationship to socio-economic determinants and assess the socio-economic consequences for patients and their households affected by the disease.

3.3 Specific objectives

- ✓ To describe the spatial distribution of tuberculosis by identifying geographic areas with a higher disease burden.
- ✓ To analyze the relationship between socio-economic determinants and the spatial distribution of tuberculosis.
- ✓ To determine the economic consequences for households affected by TB and the main causes of costs, measuring the direct and indirect costs incurred before and after being diagnosed with the disease.
- ✓ To determine catastrophic expenditures for households affected by TB.

CHAPTER 4: MATERIAL AND METHODS

Chapter 4 Material and methods

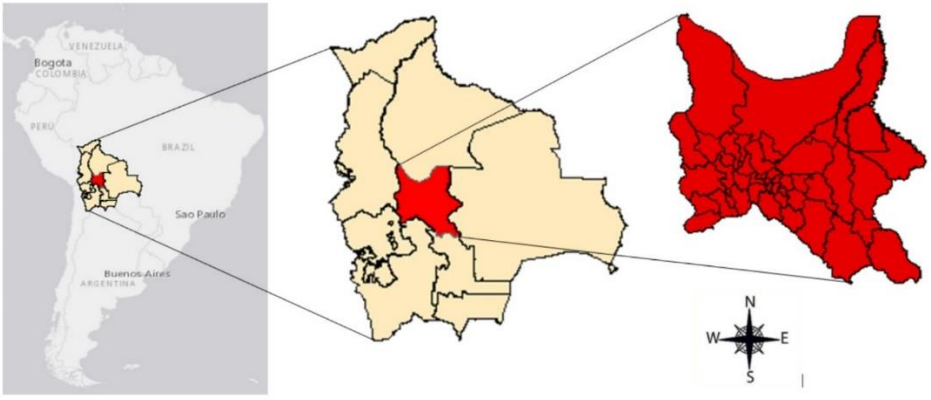
4.1 Ecological survey

An ecological study was conducted in Cochabamba to assess the association between the incidence of tuberculosis in 2016 and the socioeconomic indicators. These indicators were retrieved from the last census conducted in Bolivia, the Censo de Población y Vivienda (Population and Housing Census) in 2012. The data obtained from the census were aggregated at the municipal level, so the unit of analysis was the municipality.

4.1.1 Study area

The Department of Cochabamba has a total area of 67,978 km² **(Figure 9)**. It is divided into 16 provinces and in 47 municipalities, which are grouped into five regions: Tropic, Metropolitan, Andean, Southern Cone and Valleys**.**

Figure 9. Map of South America, Bolivia and the Department of Cochabamba with its 47 municipalities



***Source*:** Image of South America, Bolivia and Cochabamba from google

The Tropical Region has a warm and humid climate and it represents 64% of the territory of the Department. In the seventies and eighties of the last century, it was

colonized by people from the Andean area, which sought better opportunities for life. A great part of its population work for the cultivation of the coca leaf because it generates better economic incomes, even if this production is destined to the illegal production of cocaine. Likewise, the Tropical Region has reached a very important development in recent years, thanks to the fact that it was prioritized by the government's policies, probably because the Bolivian president is originated from this region and he maintain up to now his title of President of the Federation of coca producers of the tropic of Cochabamba.

The Metropolitan Region is a political name used in Bolivia for a precise area of the Department of Cochabamba. Within this area there are municipalities with high or low population density; this is why there is a large variability in densities within this region.

The Andean and the Southern Cone Regions have high altitudes with very low temperatures and they are characterized by a much-dispersed population with a low to very low density. They also have high levels of poverty, with few natural resources, especially due to their arid and not very fertile lands. Finally, the Region of the Valleys is a region located between the Andean and the Southern cone regions characterized by an agricultural production from a very rich and fertile soil. These last three regions have mainly indigenous inhabitants who speak the native Quechua language.

4.1.2 Data sources

The incidence of tuberculosis in each municipality was estimated from the systematic registry of new cases in 2016, provided by the National Tuberculosis Control Program. The patients who were diagnosed and started treatment against tuberculosis were taken as tuberculosis cases. Incidence rates were standardized by age using the indirect method, and using the population of the department of

Cochabamba as standard, with age groups defined as zero to 4 years, 5 to 9 years, 10 to 14 years, 15 to 19 years, 20 to 39 years, 40 to 49 years, 50 to 59 years, and 60 years or over. The resulting Standardized Incidence Rates were mapped to visualize the spatial distribution of the disease.

The socioeconomic data were collected from the population and housing census. Surveys are conducted with questionnaires to families regarding issues related to education, basic services, income levels and home ownership. Such surveys are conducted each 10 years at the national level in Bolivia, and the last one was in 2012.

4.1.3 Statistical analysis

To measure the magnitude of the relationship between the incidence of tuberculosis and socioeconomic variables, the Pearson correlation coefficient (r) was calculated since both the dependent and the independent variables were continuous. We used the square root of the Standardized Incidence Rate as the dependent variable to make the variances homogeneous. Socioeconomic variables were standardized in Z-scores by subtracting the mean and dividing by the standard deviation. A correlation matrix was then constructed on these standardized variables. For the interpretation, values of r less than 0.40 and above -0.40 were not taken into account because of a low to very low correlation.

4.2 Costs survey

A cross-sectional survey with retrospective data collection was carried out in January 2017, using the protocol proposed by the WHO Global TB Program for survey to determine direct and indirect costs due to TB and to estimate proportion of TB-affected households experiencing catastrophic total costs due to TB (69).

4.2.1 Survey population

The survey population included all patients (even children accompanied by a guardian) who were on drug-susceptible DS-TB or multi-drug resistant tuberculosis (MDR-TB) treatment, either in the continuation or in the intensive phase, within the public health services network, which is the only one in charge of carrying out the diagnosis and treatment of all patients with tuberculosis.

The impact of TB costs was analyzed at the household level, so if more than one household member was registered for treatment, costs for all the patients in that household were estimated by interviewing all household members on treatment. Nevertheless, in our study there was no household with more than one patient with TB.

4.2.2 Inclusion and exclusion criteria

Eligible patients were all patients registered for a TB treatment on January 2017 in the Department of Cochabamba in Bolivia, regardless of age, and whether they were affected by drug-susceptible or resistant TB, who were attending a sampled facility and who were for at least 14 days into the intensive or continuation treatment phase at the time of study.

Ineligible patients were patients even if confirmed TB cases who had not started TB treatment yet or who had been in the treatment phase for less than two weeks at the time of the study. Children younger than 15 years were excluded if without their guardian.

4.2.3 Sampling

A random sampling of health facilities as clusters was carried out. A weighted probability-proportional-to-size (PPS) cluster sampling technique was used. A weakness of a cluster sampling is that sample size needs to be increased, as compared to simple random sampling due to clustering effects since people within clusters may be more similar to each other than to the rest of the TB patients in the

department of Cochabamba. Within the sampled facilities, consecutive patients on TB treatment visiting the facility were eligible for inclusion. It is expected to weight cases in analysis when a cluster correlation has been considered in calculating the size of a study. We didn´t introduce weights in the analysis because the numbers of patients per facility was very low, between 1 and 6.

The number of notifications per cluster was available from the Tuberculosis Control Program TCP of the department of Cochabamba. In a selected health facility, all consecutive patients attending a follow-up visit, a DOTS, or picking up drugs were enrolled until the required number has been obtained.

4.2.4 Sample size calculation

At the time of sampling, the total patient population being treated in the health services network was n=764. From that it was necessary to make a number of assumptions for the sample size calculation, using available information.

From a pilot study, the proportion of households experiencing catastrophic total costs due to TB illness (πg) was estimated at 20%.

The relative precision around the estimate drawn from the survey (d) was set to 4%.

The cluster effect (DEFF) was set to 2, based on similar studies conducted in other countries (65).

Then required sample size was then N=512, calculated with the following formula [11]:

$$N = DEFF + \frac{1.96^2 n\,(1-\pi g)\,\pi g}{d^2(n-1) + 1.96^2\,(1-\pi g)\,\pi g}$$

Since the calculated sample size represented a large proportion of the survey population of TB patients treated in the entire health network (N=512 out of

n=764), the sample size had to be corrected to account for the added precision gained by sampling a large percentage of the population, through the following formula:

$$N_{FPC} = \frac{N}{1 + \frac{N-1}{T}}$$

where N_{FPC} stands for the finite population corrected sample size, and T is the size of the sampling frame of TB cases notified departmentally per year (764). The final calculated sample size was N_{FPC}=308 patients. We therefore managed to interview 310 individuals.

4.2.5 Cluster Selection

To determine the number of patients per cluster, the sample size 308 was divided by the number of clusters 50. We chose 50 clusters out of 175 facilities in the public health services network where patients can receive a tuberculosis treatment. The first reason was to have a feasible number of health facilities. The second reason was that the number of patients per cluster was 6 we had to interview 308 patients, so 308/6 equals 50 clusters. In all selected health facilities, consecutive patients were enrolled in the survey until the required number of new cases was reached. The following steps were followed for enrolling patients. **a.** A list of health facilities was established with their number of TB patients at the time of the study out of (764), from which survey clusters were selected. **b.** The cumulative number of patients was calculated and recorded in an additional column. **c.** The sampling interval was determined: 764/50 = 15. **d.** Using a random numbers table, a number between 0 and 15 was selected. In our case, the selected number was 2. **e.** The first cluster was selected as the number 2in the list. Selection of the subsequent cluster

was made by adding the sampling interval of 15 to this first number of 2. After selecting, the second cluster, the cumulative number of patients was computed. The same procedure was then followed until the targeted number of clusters was reached.

4.2.6 Data collection

The generic survey instrument proposed by WHO for cost survey in TB the tuberculosis patients (Annexe 1) was used with a local adaptation of health care provider terminology (typologies and categories) in order to reflect local wordings (69). In order to carry out the surveys, interviewers were hired if their profile was to be health personnel, a doctor or a nurse who have knowledge about the disease, and they were also trained on how to carry out the survey before visiting the health services. It also should be noted that the survey was not done in the local language, but the interviewers knew the local language to translate any doubts in case the interviewer understood Spanish. Besides any compensation was given to the people who participated in the survey.

Interviewed patients reported on expenditures retrospectively. Some patients were interviewed during the intensive treatment phase and others in the continuation treatment phase, and expenditure data were collected for that particular phase.

Data collection during different treatment phases allowed to impute data of future and past costs during an entire illness episode. Such cross-sectional approach is easier to implement than a longitudinal study since most patients who attend a facility during the study period can be enrolled into the survey and there is no need to identify patients for follow-up.

This WHO survey instrument has four parts (Figure 10):

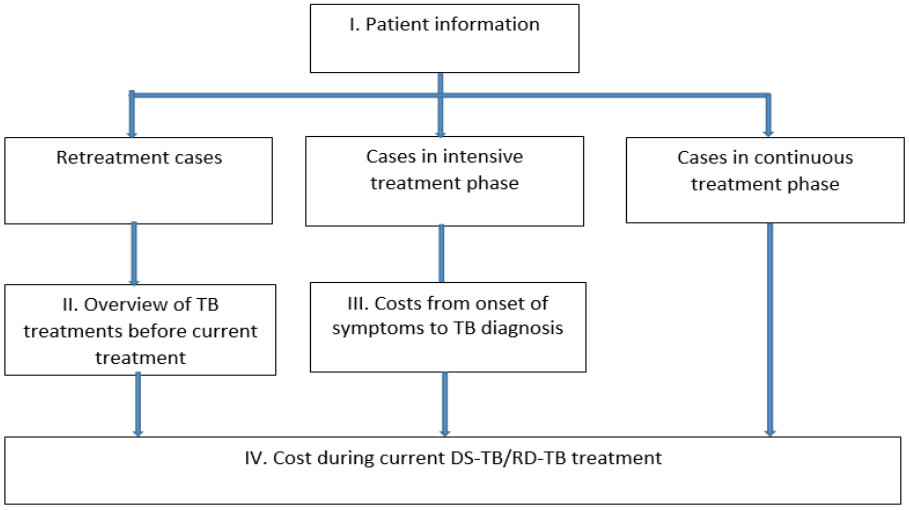
Part I Patient information

Part II Overview of TB treatments before current treatment (for re-treatment cases only)

Part III Costs before the current TB treatment (for cases in the intensive phase only)

Part IV Cost and coping during current TB/MDR-TB treatment (for all patients)

Figure 10. Interview instrument parts



***Source*:** Own elaboration based to the protocol proposed by the WHO Global TB Program for survey to determine direct and indirect costs and to estimate proportion of TB-affected households experiencing catastrophic total costs due to TB. Available from :https://www.who.int/publications/m/item/protocol-for-survey-to-determine-direct-and-indirect-costs-due-to-tb-and-to-estimate-proportion-of-tb-affected-households-experiencing-catastrophic-total-costs-due-to-tb

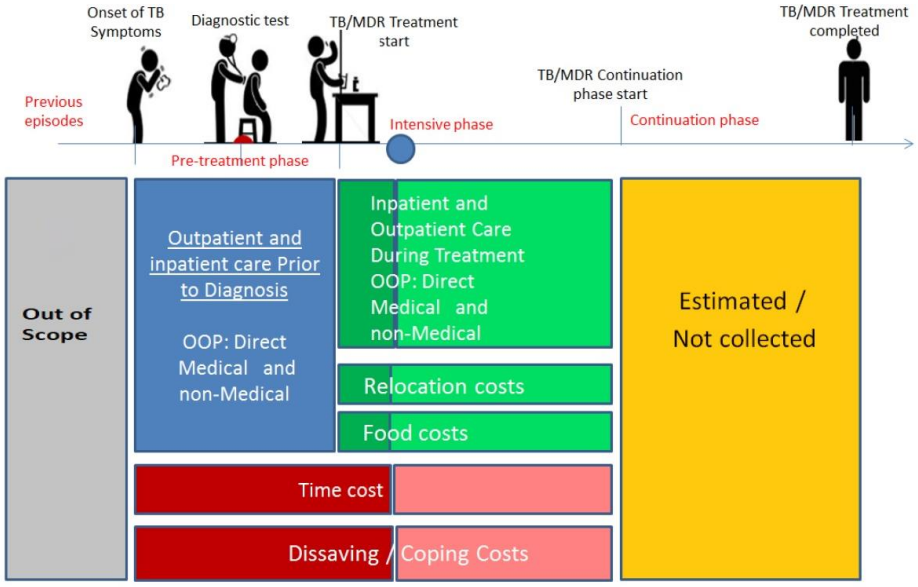
Patient information (Part I) and information about costs related to the current TB treatment (Part IV), were collected for all patients. Information about costs related to health seeking and diagnostic procedures before the person was registered as a TB patient (Part III) were collected only from patients who were in the intensive phase of either a 1st line treatment or a drug resistant. For patients who were

interviewed during the continuous phase, information was collected only about costs related to the continuous phase.

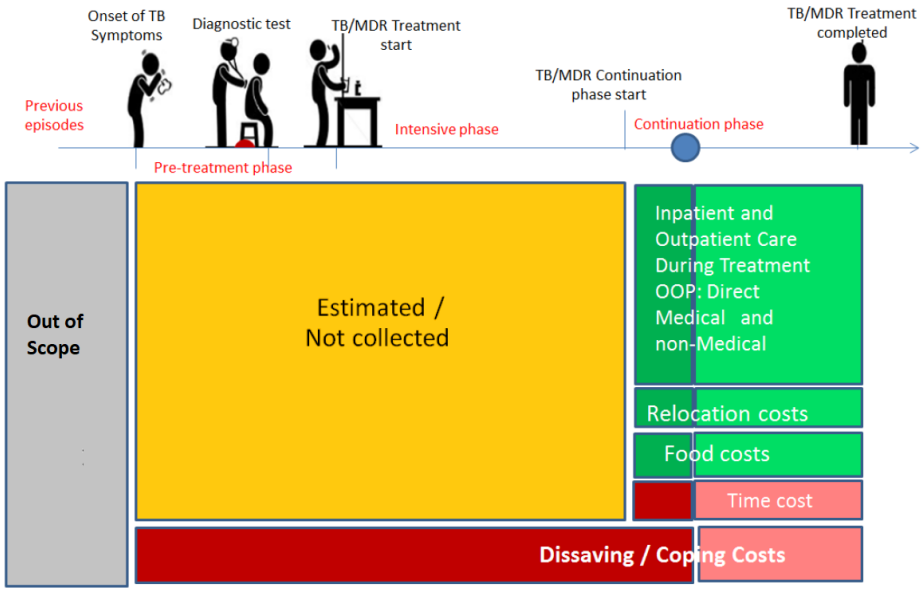
Using the same procedure all previously treated cases were also interviewed and questioned with brief summary questions on previous TB treatments (Part II). This was collected for previous treatments up to 2 years before the starting of the present treatment episode. Information collected in part III from cases interviewed in the intensive phase were used to impute data costs for patients interviewed in the continuation phase and for re-treatment cases. Similarly, information about costs in the continuation phase collected from patients interviewed in this phase, were used to project costs for patients interviewed in the intensive phase (Figure 11). The unit of analysis was the patient, but we also considered the economic consequences in the context of the patients' household. The costs were first analyzed using bolivianos, the local currency, since it was the patients who provided the information directly. All amounts in local currency were converted to USD dollars. For this, we use the conversion rate for the year 2017 provided by the World Bank.

Figure 11. Overview of the analytical approach with respect to data collection timing

New cases (first-line treatment or MDR-TB) Interviewed in intensive phase



New cases (first-line treatment or MDR-TB) Interviewed in continuation phase



Blue dots refer to the time of interview. Lighter shades of green and red, correspond to extrapolation of past costs into the future. Yellow refers to costs estimated based on some answers and on other patient's data. MRD-TB refers Multidrug resistant tuberculosis. OOP refers to Out of pocket payments

***Source*:** Protocol proposed by the WHO Global TB Program for survey to determine direct and indirect costs and to estimate proportion of TB-affected households experiencing catastrophic total costs due to TB. Available from :https://www.who.int/publications/m/item/protocol-for-survey-to-determine-direct-and-indirect-costs-due-to-tb-and-to-estimate-proportion-of-tb-affected-households-experiencing-catastrophic-total-costs-due-to-tb

4.2.7 Data analysis

First a descriptive analysis of the patient population was carried out regarding sociodemographic characteristics and TB treatment.

Estimating cost. The most important direct medical payment, such as payments for medications, laboratory tests, consultation fees, etc. and direct non-medical payments such as payments for travel, food, etc. were calculated in a disaggregated manner. The remaining costs of the patient's current treatment phase were extrapolated from costs of patients who were in that treatment phase at the same health district and at the time of the study. The calculation of indirect costs for the entire TB episode was carried out through the results-based approach where the loss of income was calculated from the report of household income before TB episode and household income during the TB episode, multiplied by the duration of the entire episode. The household income was a self-reported household monthly income.

Determining catastrophic costs. The percentage of households experiencing an economic burden or a total catastrophic cost, defined by a loss of at least 20% of annual income, was determined. For this, the total cost of the episode was calculated as direct costs plus indirect costs divided by the annual household income before the TB episode. Each household was given a binary value for whether or not they incurred catastrophic total costs due to TB. These binary values allowed a calculation of the percentage of TB respondents treated in health

networks who incurred catastrophic total costs. These percentages were analyzed by income quintile, sex, type of TB and HIV status.

Multivariable logistic regression modeling was used to find factors significantly associated with the risk of a total catastrophic cost for a TB patient.

4.2.7 Ethical aspects

The study protocol and the WHO adapted questionnaire were approved by the Ethics Review Committee of the Medical Faculty of Universidad Mayor de San Simón, Cochabamba, Bolivia (Annexe 2). All patients who agreed to be interviewed signed an informed consent form after receiving information about their rights.

CHAPTER 5: RESULTS

Chapter 5 Results

5.1 Spatial distribution of tuberculosis and socioeconomic inequalities in Cochabamba, Bolivia

Abstract

Background: Through their associations with the incidence of tuberculosis, socioeconomic variables contribute to the burden and the spread of the disease, especially in developing countries. Because there is no such data in Bolivia, we conducted an ecological study to evaluate the spatial distribution of tuberculosis and its relationship with socioeconomic determinants in the Department of Cochabamba.

Methods: Incidence of tuberculosis was computed from the 2016 data reported from the Tuberculosis Control Program and the socioeconomic indicators were retrieved from the Bolivian Population and Housing Census of the National Institute of Statistics conduced in 2012 at the municipality level. Incidence rates were standardized by age and were mapped to visualize the spatial distribution. Pearson correlation coefficients were used for associations.

Results: The spatial distribution of tuberculosis showed a high incidence in the Tropical Region with 163 cases/100,000. The Metropolitan Region showed a lower incidence of 52 cases/100,000 and the Valleys, Southern Cone and Andean Regions showed an ever-lower incidence, with 26 cases/100,000. In the Tropical Region where there was a high incidence in all five municipalities, there was a negative correlation with school attendance (r = -0.46) and a positive correlation with population density (r = 0.62). In the Metropolitan Region presented with medium incidences, a positive correlation with population density was observed (r = 0.52) across de 8 municipalities. In the joint analysis of the 34 municipalities of the

Regions Andean, Southern Cone and Valleys having the lowest incidences, a quite low correlation was observed with all socioeconomic variables. In all regions, a moderate to highly positive correlation was observed with the variable “not be owner of its housing”: Tropical Region (r = 0.65), Metropolitan Region (r = 0.82) and Valleys, Southern Cone and Andean Regions (r = 0.51).

Conclusions: The pattern of the distribution of the incidence of tuberculosis showed a high incidence in all areas of the Tropical Region. Each of the 3 regions had its own socioeconomic variables associated with tuberculosis incidence but the variable “not be owner of its housing” was however positively associated with TB incidence in all regions.

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Spatial Distribution of Tuberculosis and Socioeconomic Inequalities in Cochabamba, Bolivia

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Abstract

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Methods: Incidence of tuberculosis was computed from the 2016 data reported from the Tuberculosis Control Program and the socioeconomic indicators were retrieved from the Bolivian Population and Housing Census of the National Institute of Statistics conduced in 2012 at the municipality level. Incidence rates were standardized by age and were mapped to visualize the spatial distribution. Pearson correlation coefficients were used for associations.

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Conclusions: The pattern of the distribution of the incidence of tuberculosis showed a high incidence in all areas of the Tropical Region. Each of the 3 regions had its own socioeconomic variables associated with tuberculosis incidence but the variable "not be owner of its housing" was however positively associated with TB incidence in all regions.

Keywords: Tuberculosis; Space distribution; Socioeconomic determinants; Correlation

Abbreviations: TB: Tuberculosis; HIV/AIDS: Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome

Background

Tuberculosis is a neglected disease. It is the ninth leading cause of death in the world and the principal cause of death due to an infectious disease, including overcoming HIV/AIDS [1]. In 2016, an estimated 10.4 million people developed the disease and there were 1.3 million deaths. The majority of incident cases

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occurred in developing countries. In the Americas` region in 2016, the incidence rate was 27 cases/100,000 inhabitants. However, in South America, Bolivia ranked second in the incidence of TB, with a rate of 114 cases/100,000 inhabitants [2]. In Cochabamba, the incidence of tuberculosis in 2016 was 60 cases/100,000 inhabitants, according to data from the Tuberculosis Control Program of the Bolivian Departmental Health Service.

The department of Cochabamba is located in the centre of Bolivia and shares borders with six out of eight departments in this country. It is the third largest department, and its estimated population in 2016 was 1,915,621 inhabitants [3]. About two third (68%) of this population live in urban areas and 32% in rural areas. Cochabamba is a department with great geographical contrasts and a great diversity of ecosystems. There are 47 municipalities grouped in five regions, each one having unique features [4].

The Bolivian health system is made up of three sectors: the public sector, the private sector and the social security sector. The levels of medical care are organized in a pyramid type model with first, second and third level of care. The Tuberculosis Control Program that carries out the free diagnosis and treatment of this disease is implemented in the public health system. In other words, any person with suspected pulmonary or extra pulmonary tuberculosis should be diagnosed and should begin treatment in the public health service network. Likewise, in Bolivia, all people after birth receive the BCG vaccine against tuberculosis, which is specially focused on avoiding serious cases of tuberculosis such as meningeal tuberculosis.

In recent years, social policies oriented to the poor and rural areas were developed in Bolivia also, but in 2014 the moderate poverty that represents the people living on less than two dollars a day was 39%, the Gini coefficient was 0.47 [5] and the rural municipalities still had bad socioeconomic indicators [6]. Poverty, malnutrition, poor sanitation, high population density, acquired immunodeficiency syndrome and population aging are currently some of the factors involved in the spreading and severity of tuberculosis [7,8].

Besides the contact with patients with smear-positive tuberculosis, the probability for an individual to be infected and to develop the disease depends on several factors, such as socioeconomic conditions but also on the existence of comorbidities, particularly immunosuppressive ones like HIV [7]. Associations between incidence of tuberculosis and socioeconomic variables have been pointed in several studies, contributing to the heavy disease burden observed in the so-called developing countries [7,9-13]. The objective of the present study was to assess the spatial distribution of the incidence of tuberculosis and its socioeconomic determinants in Cochabamba, Bolivia.

Material and Methods

An ecological study was conducted in Cochabamba to assess the association between the incidence of tuberculosis in 2016 and the socioeconomic indicators. These indicators were retrieved from the last census conducted in Bolivia, the Censo de Población y Vivienda (Population and Housing Census) in 2012. The data obtained from the census were aggregated at the municipal level, so the unit of analysis was the municipality.

Settings

The Department of Cochabamba has a total area of 67,978km^2 (Figure 1). It is divided into 16 provinces and in 47 municipalities, which are grouped into five regions: Tropic, Metropolitan, Andean, Southern Cone and Valleys.

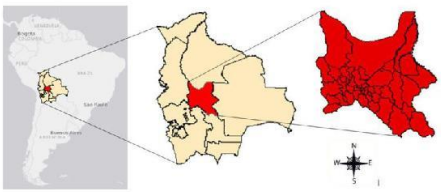

Figure 1: Map of South America, Bolivia and the Department of Cochabamba with its 47 municipalities.

The Tropical Region has a warm and humid climate and it represents 64% of the territory of the Department. In the seventies and eighties of the last century, it was colonized by people from the Andean area, which sought better opportunities for life. A great part of its population work for the cultivation of the coca leaf because it generates better economic incomes, even if this production is destined to the illegal production of cocaine. Likewise, the Tropical Region has reached a very important development in recent years, thanks to the fact that it was prioritized by the government's policies, probably because the Bolivian president is originated from this region and he maintain up to now his title of President of the Federation of coca producers of the tropic of Cochabamba.

The Metropolitan Region has a temperate climate. It gathers the municipality of Cochabamba as the capital of the department, jointly with other seven adjacent municipalities to this great city. This region is characterized by a high population density. In the same way, it is an urbanized region, with high levels of coverage in primary and secondary education, and basic services.

The Andean and the Southern Cone Regions have high altitudes with very low temperatures and there are characterized

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by a much dispersed population with a low to very low density. They also have high levels of poverty, with few natural resources, especially due to their arid and not very fertile lands. Finally, the Region of the Valleys is a region located between the Andean and the Southern cone regions characterized by an agricultural production from a very rich and fertile soil. These last three regions have mainly indigenous inhabitants who speak the native Quechua language.

Data Sources

The incidence of tuberculosis in each municipality was estimated from the systematic registry of new cases in 2016, provided by the National Tuberculosis Control Program. The patients who were diagnosed and started treatment against tuberculosis were taken as tuberculosis cases. Incidence rates were standardized by age using the indirect method, and using the population of the department of Cochabamba as standard, with age groups defined as zero to 4 years, 5 to 9 years, 10 to 14 years, 15 to 19 years, 20 to 39 years, 40 to 49 years, 50 to 59 years, and 60 years or over. The resulting Standardized Incidence Rates were mapped to visualize the spatial distribution of the disease.

The socioeconomic data were collected from the population and housing census. Surveys are conducted with questionnaires to families regarding issues related to education, basic services, income levels and home ownership. Such surveys are conducted each 10 years at the national level in Bolivia, and the last one was in 2012.

Statistical analysis

To measure the magnitude of the relationship between the incidence of tuberculosis and socioeconomic variables, the Pearson correlation coefficient (r) was calculated since both the dependent and the independent variables were continuous. We used the square root of the Standardized Incidence Rate as the dependent variable because incidences were very small proportions. Socioeconomic variables were standardized in Z-scores by subtracting the mean and dividing by the standard deviation. A correlation matrix was then constructed on these standardized variables. For the interpretation, values of r less than 0.40 and above -0.40 were not taken into account because of a low to very low correlation. The softwares SPSS 25.0 and ArcGis 10.4 were used for processing and analyzing data.

Results

Spatial distribution

In 2016, 1150 new cases of tuberculosis were notified among the 1,915,621 people living in the Department of Cochabamba. Of this total, 87% occurred in the urban municipalities of the Tropical Region and the Metropolitan Region (Figure 2).

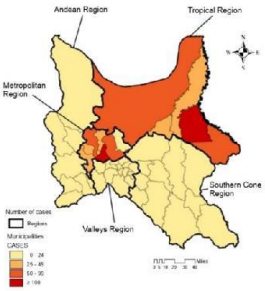

Figure 2: Spatial distribution of the number of new cases of tuberculosis in Cochabamba, Bolivia in 2016.

We observed municipalities without any cases, especially in the Regions of the Valleys, Southern Cone and Andean. In the municipality of Cochabamba within the Metropolitan Region, up to 373 new cases were registered the same year.

The global crude incidence rate during the year 2016 was 60 cases/100,000 inhabitants. The standardized rates were closed to the crude rates in all municipalities. Figure 3 shows the spatial distribution of the standardized incidence rate. After standardization, the rates showed values ranging from 0 cases in some municipalities of the Valleys, Andean and the Southern Cone regions without cases (Alalay, Bolivar, Cuchumuela, Pasorapa, Sacabamba, Tacachi, Tarata and Vacas), to 240.5 cases/100,000 people in the municipality of Puerto Villarroel within the Tropical Region.

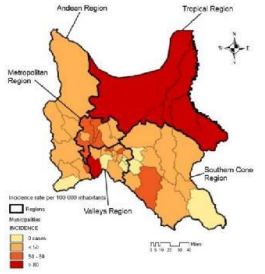

Figure 3: Spatial distribution of the standardized incidence rate of tuberculosis per 100,000 populations in Cochabamba, 2016.

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The visualization of the spatial pattern allowed to identify the Tropical Region as a hot spot, with five municipalities with the highest incidence rates: Villa Tunari (96.6 cases/100,000 inhabitants), Entre Rios (156.7 cases/100,000 inhabitants), Shinahota (161.2 cases/100,000 inhabitants), Chimore (162.2 cases/100,000 inhabitants) and Puerto Villarroel (240.5 cases/100,000). The municipality of Capinota (81.6 cases/100000 inhabitants) within the Region of the Valleys had the sixth position in incidence.

Regions having municipalities with moderate incidence rates were the Metropolitan Region (Colcapirhua, Quillacollo, Sipe Sipe, Tiquipaya and Cochabamba), and even less for municipalities in the Valleys Region (Punata and Tolata), Southern Cone Region (Mizque) and Andean Region (Sicaya).

The remaining municipalities, especially in the Valleys, Southern Cone and Andes regions, had a low incidence: Standardized Incidence Rate≤50 cases/100,000 or even no cases.

Socioeconomic characteristics

Table 1 shows the description of the socioeconomic variables by region. Regarding variables related to education, it can be observed that the highest percentage of illiteracy was found in the Andean Region with an average of 16.7±4.0% (mean±standard deviation). The lowest percentage of illiteracy was found in the Metropolitan Region with an average 4.9±2.9% (Figure 2).

Variable	Tropical	Metropolitan	Valleys	Southern Cone	Andean
	n=5	n=8	n=15	n=11	n=8
Standardized incidence (cases/100000 p)					
Mean±SD	163±51	52±14	28±24	23±20	26±21
Median	161	55	27	29	21
Min-Max	97-241	28-71	0-87	0-53	0-64
Variables related to the field of education					
Illiteracy rate (%)					
Mean±SD	5.4±0.6	4.9±2.9	9.2±3.2	13±4.2	16.7±4
Median	5.7	3.8	8.7	12.1	16
Min-Max	4.4-5.9	2.4-11.1	5.1-17.2	7.1-20.6	10.1-23.9
School attendance rate (%)					
Mean±SD	83±0.7	89.2 ±1.9	88.4±3.5	82.6±4.5	80.3±3.3
Median	83.1	89.9	89.4	82.5	80.9
Min-Max	81.9-83.9	84.7-90.8	78-91.9	75.7-89.6	73.9-84.3
Variables related to the characteristics of the population					
Population density people (per Km^2)					
Mean±SD	18.1±10.5	626.4±917.7	78.2±67.2	57.1±116	14.1±8.3
Median	18.1	189.3	64.6	10.2	15.6
Min-Max	6.9-31.3	18.1-2240	11.0-236.7	3.2-386.4	1.7-27
Average annual growth rate (%)					
Mean±SD	2.7±0.9	2.6±1.1	0.9±1.9	-0.4±2	-0.3 – 2.2
Median	3.1	2.5	0.6	-0.7	-1.1
Min-Max	1.2-3.4	0.9-4.5	-2.1-5.5	-3.2-3.4	-2.5-4.6
People Speaking Local Language (%)					

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Mean±SD	53.7±5.3	34.9±19.4	67.9±15.5	77.5±25.7	91.1 ±3.8
Median	54.3	29	70.9	88.3	92.9
Min-Max	46.2-60.9	17.2-75.3	42-90.9	6.9-92.9	85.7-95.2
Variables related to the coverage of basic services					
People covered with water service (%)					
Mean±SD	54.5±12.6	76.8±6.9	79.6±12.7	65.1±15.1	61.6± 17.5
Median	58.3	79.2	82.3	70.6	57.6
Min-Max	36.3-68.7	65.5-85.2	54.4-97.9	34.8-81.5	33.9-84.9
People covered with basic sanitation (%)					
Mean±SD	57.4±10.9	55.2±13.7	44.7±13.9	28.8±14.6	22.9±12.3
Median	53.6	59.7	46.1	25.5	23.1
Min-Max	44.6-72.5	32.9-71.1	20-69.7	9.5-53.6	5.9-43.8
People covered with electric service (%)					
Mean±SD	62.4±4.4	92.3±7.4	82.1±14.1	57.5±21.3	49.7±7.4
Median	64.1	93.8	86.2	62.3	50.1
Min-Max	54.7-65.4	76.1-99.4	52.5-96.6	14.7-80.9	37-58.9
People covered with service of garbage (%)					
Mean±SD	25.4±24.9	22.1±27	16.5±14.4	19.5±27.5	13.6±14.7
Median	11.9	13.8	15.5	11.8	9.4
Min-Max	8.2-66.2	0.1-71.6	0.1-42.7	0.1-63.9	0.3-44.2
Variables related to economic income					
Poor population (%)					
Mean±SD	70.2±4.9	39.1±17.2	58.2±16.2	82.5±9.5	92±4.5
Median	69	35.6	56.9	84.5	93
Min-Max	66.8-78.6	17.1-73.1	33.9-86.2	69-96.9	83.8-96.7
Non-salaried workers (%)					
Mean±SD	76.9±4.4	57.8±13	70.8±7.7	85.1±5.8	89.9±2.6
Median	76.4	54.2	69	88.1	90.2
Min-Max	71.5-83.6	10.5-45.5	45.3-87.4	74.9-92.2	84.5-92.7
People not house owner (%)					
Mean±SD	15.6±2.5	33.4±11.4	12.6±5.7	10.6± 6.7	6.5±4.2
Median	15.2	35.5	11.9	8.1	4.9
Min-Max	12.5-19.1	10.5-45.5	5.3-22.2	3.2-25.2	3-13.9

Table 1: Description of socioeconomic variables by region in Cochabamba, Bolivia, 2016.

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The highest percentage of school attendance was observed in the Metropolitan area with an average of 89.2±1.9%. The lowest percentage of school attendance was observed in the Andean area with an average of 80.3%±2.2%. Such differences between Regions paralleled differences in illiteracy rates as illustrated on Figure 4.

Regarding characteristics of the population, the highest population density was found in the Metropolitan Region (626.4±917.7 inhabitants/km^2); this region has very densely populated municipalities such as the municipality of Cochabamba together with municipalities with a low population density such as the municipality of Sacaba (Figure 4).

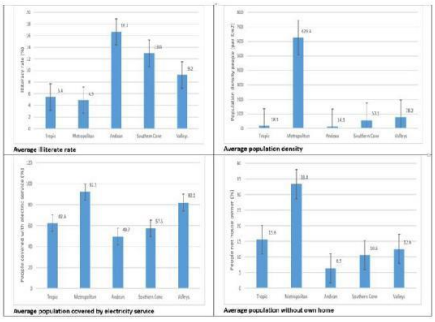

Figure 4: Socioeconomic variables in the five regions of the Department of Cochabamba, Bolivia. Average illiterate rate, Average population density, Average of the population covered by electricity service and Average of the population that does not have own house.

The highest growth rate was found in the Tropical Region with an average of 2.7% and the lowest growth rate was observed in the Andean Region with an average of -0.3%. The migration of the population remains constant from the Andean Region to the Tropical Region.

Andean region had the highest percentage of the population speaking a local native language with an average of 91.1±3.8%. The one with the lowest percentage was the Metropolitan Region with an average of 34.9±19.4%.

Regarding the variables related to the coverage of basic services, the highest percentage of population who had an electricity service coverage was in the Metropolitan Region with an average of 92.29% and the lowest percentage was in the Andean Region with an average of 49.7% (Figure 4).

The highest percentage of population who had access to safe drinking water was in the Valley Region with an average of 79.6%, continuously and not far away was the Metropolitan Region with an average of 76.8%; the lowest percentage was found in the Andean Region with an average of 61.6%.

The largest percentage of the population covered by the basic sanitation services was in the Tropical Region with an average of 57.4% and immediately afterwards was the Metropolitan region with an average of 55.2%; the lowest percentage was found in the Andean Region with an average of 22.9%.

Garbage collection service coverage was the highest in the Tropical Region with an average of 25.4%, followed by the Metropolitan Region with an average of 22.1% and the lowest percentage was found in the Andean Region with an average of 13.6%.

Regarding variables related to the economic income, the highest percentage of house non owner people was observed in the Metropolitan Region with an average of 33.4% with a standard deviation of 11.4%, and the lowest percentage was in the Andean Region with an average of 6.5% and a standard deviation of 4.2% (Figure 4).

Andean Region had also the highest percentage of poor population with an average of 92% with a standard deviation of 4.5% and the lowest percentage was found in the Metropolitan Region with an average of 39.1% and a standard deviation of 17.2%.

Andean Region had also the highest percentage of non-salaried workers with an average of 89.9% with a standard deviation of 2.6%. The lowest percentage was found in the Metropolitan Region with an average of 57.8% and a standard deviation of 13%.

Correlation analysis

Correlation analysis between the incidence of tuberculosis and the socioeconomic variables was computed within each region because characteristics of regions were quite different and scatter plots showed clear clusters of points, without a linear relationship. So, Tropical Region with high incidence, Metropolitan Region with a medium incidence, and the regions of the Valleys, the Southern Cone and the Andean, with low incidence and with similar characteristics, were grouped for the analysis of the socioeconomic indicators (Table 2).

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		High Incidence	Median Incidence	Low Incidence
	All regions	**Tropic**	**Metropolitan**	**Valleys, Andean and Southern cone**
	n=47	n=5	n=8	n=34
Illiteracy rate	-0.40	0.11	-0.74	-0.01
School attendance rate	-0.04	-0.46	0.71	-0.03
Population density per Km^2	0.06	0.62	0.52	-0.02
Average annual population growth rate	0.38	-0.61	0.56	0.17
People Speaking Local Language	-0.36	-0.44	-0.76	-0.09
People covered with basic sanitation	0.43	-0.36	0.16	0.30
People covered with electric service	0.06	0.85	0.81	0.18
People covered with drinking water service	-0.18	0.60	0.53	-0.01
People covered with service of garbage collection	0.23	0.81	0.07	0.08
Poor population	-0.21	-0.70	-0.81	-0.26
Non-salaried workers	-0.21	-0.66	-0.80	-0.16
People not house owner	0.39	0.65	0.82	0.51
r = Cross product correlation coefficient; no p-value because not a sampling design				

Table 2: Correlation between standardized socioeconomic indicators and √ standardized incidence rate in the 47 municipalities of Cochabamba, Bolivia, 2016.

In the Tropical Region, the incidence of tuberculosis and school attendance were negatively correlated (r=- 0.46), showing that the lower the school attendance, the lower the incidence of tuberculosis. Positive correlation was observed (r=0.62) with the population density, the higher the population density, the higher the incidence of tuberculosis. We also observed a moderate positive correlation (r=0.65) with the fact that people didn't own a house; the greater the proportion of non-owner, the higher the incidence of tuberculosis.

In the Metropolitan Region, there was a positive correlation between the incidence of tuberculosis and population density (r=0.52). Incidence of tuberculosis was also increased in municipalities with more people. As in the Tropical Region a high positive correlation was observed with the proportion of people who were not house owner (r=0.82). Surprisingly, in the Metropolitan Region, there was a negative correlation between the incidence of tuberculosis and the variables that have to do with education and basic services. Such correlating mean the lower the proportion of illiterate people and the greater the proportion of people attending school the higher the incidence of tuberculosis. Also, the greater the proportion of people with access to basic services, the higher the incidence of tuberculosis [14,15].

In the joint analysis of the regions of the Andes, the Southern Cone and the Valleys, a very low correlation between the incidence of tuberculosis and each variable was observed, except for the proportion of people who were not house owner, that showed a positive correlation (r=0.51). In this three regions, we also observed a higher incidence of tuberculosis where the proportion of people who were not house owner was lower.

Figure 5 shows a scatter plot of this relationship between the square root of the incidence of tuberculosis and the proportion of non-house owner in municipalities of each region.

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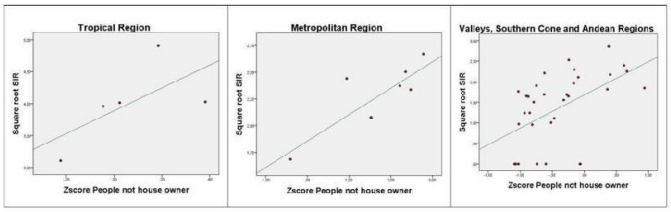

Figure 5: Correlation between √ standardized incidence rate and proportion of people non-house owner Tropical Region, Metropolitan Region and Regions of the Valleys, Southern Cone and Andean.

In the Metropolitan Region, all but one municipality had a proportion of non-house owner far above the mean of the Department. In the Tropical Region, three of the five municipalities were also above the departmental mean. Whereas in the Andean, Southern Cone and Valleys regions, only seven of the thirty-four municipalities had a proportion of non-house owners above the mean of the Department and the rest of municipalities were below.

In all regions there was an unexpected negative correlation with the two indicators related to the economic income. Incidences were higher in municipalities with less poor people and in municipalities with less non-salaried workers [16].

Discussion

Each region of the Department of Cochabamba presents different values and characteristics regarding not only the incidence of tuberculosis but also regarding geography and per se socioeconomic variables.

Across the 47 municipalities, the incidence of tuberculosis varied from 0 to 162 cases/100,000 inhabitants but from 0 to 53 cases/100,000 in the Southern Cone Region, from 0 to 64 cases/100,000 in the Andean Region, from 0 to 82 cases/100,000 in the Region of the Valleys, from 28 to 71 cases/100,000 in the Metropolitan Region and from 97 to 162 cases/100,000 in the Tropical Region.

The distribution pattern of the incidence of tuberculosis highlighted a high incidence in the Tropical Region, a moderate incidence in the Metropolitan Region and a low incidence in the Valleys, Southern Cone and Andean Regions.

Such disparities were also reported in others studies carried out in Brazil, Rio de Janeiro [17], Victoria [18] and Campina Grande [11], however these studies were at the municipal level, using as unit of analysis the neighbourhoods, showing in many cases also very high incidences.

With such disparities and also due to geographical and economic disparities between regions, global results at the Department level reflect different realities [19,20].

The studies noted above, as well as those reported by Munch [12] and Vendramini [13] were carried out in urban areas with high demographic density, showing a positive correlation as in our study in the Tropic Region and Metropolitan Region of the tuberculosis with population density [21].

It must be pointed out a possible underestimation of TB cases in own study. Several studies [11, 22] have reported an underestimation of incident cases linked to the poor organization of health services as well as the non-active detection of cases. The quality of the data of the Tuberculosis Control Program can be subject to variations as all health information systems in developing countries. Interpretations must therefore be careful. The relationship between the incidence of tuberculosis and socioeconomic variables was different across Regions.

However, the variable "not house owner" correlated positively with the incidence of tuberculosis in each Region. Camargo Sierra [15] also shows that this variable has a very important relationship with the economic situation of households, because people who do not have to their own home go to rental contracts in precarious conditions. According to Barcelo [16] these precarious houses are a space that works as a factor of anguish, causing multiple public health problems including tuberculosis. In the same way the precariousness of the houses is related to the overcrowding of people [7,12,18]. Therefore, a situation of overcrowding is associated with an increased risk of tuberculosis contamination, due to the greater likelihood of constant contact between people, as described by Munch [17]. The reliability of this variable is higher than indicators such as poverty or non-wage work; to be a house owner is an objective expression of quality of life.

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Regarding the variables related to economic income, several studies [10,12,14] reported a relationship between the incidence of tuberculosis and economic income. These studies used variables such as annual income linked to minimum wages, income of heads of household and indicators adapted to living conditions.

In our study, none of the regions exhibited a coherent relationship between the incidence of tuberculosis and the variables related to economic income, such as the proportion of poor people or the proportion of non-salaried people. One explanation might be that these indicators used from the population and housing census, do not measure what is expected to be measured, for instance the informal economy or the barter economy are not certified in these indicators. Validity of the data may also be affected by an incorrect information provided by the interviewees, especially regarding their economic income; people are afraid of a possible intervention of the state in their resources.

Conclusions

The pattern of the distribution of the incidence of tuberculosis showed a high incidence in all municipalities of the Tropical Region. Each region had its own socioeconomic variables associated with tuberculosis incidence. However, the variable "not having own housing" was common to all regions and was positively associated with TB incidence. The association between incidence of tuberculosis and a house owning highlights particularities of the country linked to informal or illegal economy that cannot be measured in an ecological study.

Therefore, in order to contribute to the control of tuberculosis, it would be important to carry out studies at individual levels, especially in the region where a high incidence was found, for investigating other possible factors related to the persistence of the disease [21].

This study also contributes to the Tuberculosis Control Program in providing information with respect to the spatial distribution of TB and its relationship with socioeconomic variables. In this way, it will be able to target and act in priority areas and establish epidemiological surveillance systems on a territorial basis that allows an adequate control of the disease.

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Availability of Data and Materials

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Authors Contributions

MR was involved in the conception and design of the study, its implementation, analysis of the data, and interpretation of the findings. DI and AR participated in the drafting of the paper. JA was involved in the merging of data bases. WT participated to the analysis and the interpretation of data. All authors read and approved the final manuscript.

Ethics Approval and Consent to Participate

The Committee of Research Ethics of the Faculty of Medicine of Universidad Mayor de San Simón approved the protocol of this study.

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5.2 Economic burden of tuberculosis for patients and their households in Cochabamba, Bolivia

Abstract

Background: Patients with tuberculosis (TB) usually incur large costs directly related to their disease. Additional indirect costs also increase the economic burden of households creating barriers of access and adherence that can affect the healing of patients. Because TB affects the poorest segment of society the effects can be more serious for poor people. Indirect costs are poorly documented in Bolivia. We therefore conducted a study to determine the socioeconomic impact of TB on patients and their households.

Methods: A cross-sectional survey was carried out on 2017 in the Department of Cochabamba, Bolivia, included all patients who were on TB treatment within the health network. The generic survey instrument proposed by WHO for tuberculosis patients cost surveys was used. The most important direct medical and direct non-medical payments were calculated in a disaggregated manner. The calculation of indirect costs was carried out through the results-based approach where the loss of income was calculated from the report of household income. Catastrophic cost was determined and multivariable logistic regression was run to assess which factors were independently associated with a total catastrophic cost experienced by a TB patient.

Results: The indirect costs during an entire illness episode had a median of USD 768.1 corresponding to 63.4% of the total cost for all patients. In the case of multidrug-resistant TB (MDR TB) patients, the median cost was USD 6454.8 corresponding to 54.3% of their total costs. Direct non-medical costs had a median for all patients of USD 408.7 (33.7%), and of USD 5399.6 (45.4%) for MDR TB patients. The most important non-medical costs were those linked to directly observed treatment (DOT) with a median of USD 419.8 during intensive phase and of USD 108.6 during continuation phase for transport costs. Food and drinks costs had a median of USD 94.5 during intensive phase and of USD 54.8 during continuation phase; consumption of nutritional supplements had a median cost of USD 249.1 and additional food outside the regular diet had a median cost of USD 519 for all patients.

Catastrophic costs were incurred by 43.9% of TB patients. These catastrophic costs were observed in 50% of the population aged over 55 years, in 60% of MDR-TB patients, and in 63% of poor patients. Using logistic regression, factors associated with a higher risk of catastrophic costs were to live in an urban province (OR = 1.82 95%CI 1.11 to 2.98, P = 0.002), to be older than 55 years (OR = 1.21 95%CI: 1.07 to 1.38, P = 0.005), and to have a low economic income (OR = 0.83 95%CI: 0.69 to 0.99, P = 0.049)

Conclusions: Patients with TB treated in health services of Bolivia face a great financial burden. Indirect costs were higher than direct costs in a complete TB episode, especially in MDR-TB patients. During the treatment, the most important costs were those related to transport and food when patients went to DOT; nutritional supplements and additional food to the regular diet accounted also for a non-negligible cost. Almost half of patients suffer a catastrophic cost, especially those who came from an urban province, those who were older than 55 years, and those having a low economic income.

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Research Article

Economic Burden of Tuberculosis for Patients and their Households in Cochabamba, Bolivia

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Keywords: Tuberculosis; Direct costs; Indirect costs; Catastrophic costs; Logistic regression

Introduction

Tuberculosis (TB) is a neglected disease; it is the ninth leading cause of death in the world and the leading cause of death due to an infectious disease, surpassing even HIV / AIDS [1]. In 2019, an estimated 10 million people developed the disease and 1.4 million die of TB, with most cases occurring in developing countries. In 2016, in the region of the Americas the incidence rate was 27 cases / 100,000 inhabitants. However, in South America, Bolivia ranked second in the incidence of TB, with a rate of 114 cases / 100,000 inhabitants [2]. In the Department of Cochabamba in Bolivia, the TB incidence was 60 cases / 100,000 inhabitants, according to data from the TB Control Program of the Departmental Health Service [3].

The Bolivian health system has three sectors: the public, the private and the social security sector [4]. The levels of medical care are organized in a pyramidal model with first, second and third level of care. The TB Control Program carries out the diagnosis and treatment of TB and is implemented in the public health sector where any person suspected of tuberculosis should be diagnosed and treated. From a case definition perspective, TB can be classified as a bacteriologically confirmed TB or as a clinically diagnosed TB. These types, in turn, are classified according to the anatomic location into pulmonary or extrapulmonary tuberculosis [5]. The diagnosis is made by bacteriological methods such as smear, culture and molecular biology, and it can also be done by imaging and pathological studies, especially in cases of extrapulmonary tuberculosis. Sensitivity and resistance tests are also performed in patients at risk of developing drug resistance [5]. Patients with TB are treated with first-line medications and patients with resistant TB are treated with second-line medications. The treatment of TB is carried out in two phases, the intensive phase that lasts 2 months with the administration of 4 antibiotics, and the continuation phase that lasts 4 months with only 2 administrated antibiotics. The Directly Observed Treatment (DOT) is the strategy used by health personnel to guarantee the taking and compliance of the treatment until its completion and cure [5].

Patients with TB usually incur large costs related to their disease, since they begin with the symptoms looking for the solution to their health problem, even when they are already diagnosed and treated within the health system, despite the fact that the diagnosis and the treatment are free. These costs can create barriers of access and adherence that can affect the healing of patients and that can increase the risk of disease transmission. In low and middle-income countries, TB patients suffer costs that are on average, the same amount as half of their annual income [6]; therefore, the aforementioned costs also increase the economic burden of households. In all contexts, TB affects the poorest segment of society. Therefore, the aggravating effects of poverty due to TB are even more serious for those who are already the most vulnerable. The out-of-pocket medical expenses of these patients, which are made worse by the loss of their income, can be significant [7]. This is often a factor contributing to economic difficulties. Direct non-medical costs, such as transportation and food costs during the period of seeking health care, can also be significant considering that this period is often long because a treatment period lasts from six months to two years [6]. To overcome the barriers of access and adherence, as well as minimize the economic burden for patients with TB (and their households), it is essential to address both direct and indirect costs. Interventions are necessary to address high medical costs, as well as food and transportation costs, and lost economic income. Therefore, both financing and health service delivery models and social protection mechanisms must be considered [8]. One of the three objectives of the "End Tuberculosis Strategy" launched by the WHO is that no patient with TB or their households should face "total catastrophic costs" (expenses beyond a defined threshold of the ability to payment of a household) due to TB and this objective should be achieved until the year 2035 [9]. The objective of the present study was to assess the socioeconomic impact of TB on patients and their households through the magnitude and the main causes of direct and indirect costs, and to estimate the catastrophic total costs incurred by TB patients in order to build strategies for improving adherence to treatment and financial protection of persons in Bolivia.

Material and Methods

A cross-sectional survey with retrospective data collection was carried out in January 2017, using the protocol proposed by the WHO Global TB Program for survey to determine direct and indirect costs due to TB and to estimate proportion of TB-affected households experiencing catastrophic total costs due to TB [10].

Survey Population

The survey population included all patients (even children accompanied by a guardian) who were on drug-susceptible DS-TB or multi-drug resistant tuberculosis (MDR-TB) treatment, either in the continuation or in the intensive phase, within the public health services network, which is the only one in charge of carrying out the diagnosis and treatment of all patients with tuberculosis. The impact of TB costs was analyzed at the household level, so if more than one household member was registered for treatment, costs for all the patients in that household were estimated by interviewing all household members on treatment.

Inclusion and exclusion criteria

Eligible patients were all patients registered for a TB treatment on January 2017 in the Department of Cochabamba in Bolivia, regardless of age, and whether they were affected by drug-susceptible or resistant TB, who were attending a sampled

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facility and who were for at least 14 days into the intensive or continuation treatment phase at the time of study. Ineligible patients were patients even if confirmed TB cases who had not started TB treatment yet or who had been in the treatment phase for less than two weeks at the time of the study. Children under 15-years-old were excluded if without their guardian.

Sampling

A random sampling of health facilities as clusters was carried out. A weighted probability-proportional-to-size (PPS) cluster sampling technique was used. The number of notifications per cluster was available from the Tuberculosis Control Program TCP of the department of Cochabamba. In a selected health facility, all consecutive patients attending a follow-up visit, a DOT, or picking up drugs were enrolled until the required number has been obtained.

Sample size calculation

At the time of sampling, the total patient population being treated in the health services network was n=764. From that it was necessary to make a number of assumptions for the sample size calculation, using available information.

From a pilot study, the proportion of households experiencing catastrophic total costs due to TB illness (πg) was estimated at 20%. The relative precision around the estimate we´ll drawn from the survey (d) was set to 4%. The cluster effect (DEFF) was set to 2, based on similar studies conducted in other countries. Then required sample size was then N=512, calculated with the following formula [11]:

$$N = DEFF + \frac{1.96^2 n\,(1-\pi g)\,\pi g}{d^2(n-1) + 1.96^2\,(1-\pi g)\,\pi g}$$

Since the calculated sample size represented a large proportion of the survey population of TB patients treated in the entire health network (N=512 out of n=764), the sample size had to be corrected to account for the added precision gained by sampling a large percentage of the population, through the following formula:

$$N_{FPC} = \frac{N}{1 + \frac{N-1}{T}}$$

Where N_{FPC} stands for the finite population corrected sample size, and T is the size of the sampling frame of TB cases notified departmentally per year (764). The final calculated sample size was N_{FPC}=308 patients. We therefore managed to interview 310 individuals.

Cluster Selection

To determine the number of patients per cluster, the sample size 308 was divided by the number of clusters that were decided to take into account for the study 308/50 = 6 new patients to be selected per cluster. In all selected health facilities, consecutive patients are enrolled in the survey until the required number of new cases is reached. Then the following steps were followed. a. A list of health facilities was established and their number of the TB patients at the time of the study (764), from which survey clusters were selected. b. The cumulative number of patients was calculated and recorded in an additional column. c. The sampling interval was determined: 764/50 = 15. d. Using a random numbers table a number between 0 and 15 was selected. In this case, the number selected was 2. e. The first cluster was selected using the number 2. Selection of the subsequent clusters was made by adding the sampling interval of 15 to this first number of 2. Therefore, the second cluster selected in the center where the cumulative number of patients falls. The same procedure was done until the number of clusters set was completed.

Data collection

The generic survey instrument proposed by WHO for cost survey in TB the tuberculosis patients was used with a local adaptation of health care provider terminology (typologies and categories) in order to reflect local wordings [10]. Interviewed patients reported on expenditures retrospectively. Some patients were interviewed during the intensive treatment phase and others in the continuation treatment phase, and expenditure data were collected for that particular phase. Data collection during different treatment phases allowed to impute data of future and past costs during an entire illness episode. Such cross-sectional approach is easier to implement than a longitudinal study since most patients attend a facility during the study period can be enrolled into the survey and there is no need to identify patients for follow-up. This WHO survey instrument has four parts (Figure 1):

Part I Patient information

Part II Overview of TB treatments before current treatment (for re-treatment cases only)

Part III Costs before the current TB treatment (for cases in the intensive phase only)

Part IV Cost and coping during current TB/MDR-TB treatment (for all patients)

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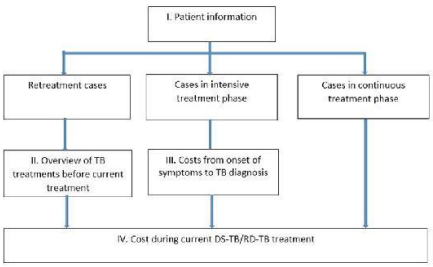

Figure 1: Interview instrument parts.

Patient information (Part I) and information about costs related to the current TB treatment (Part IV), were collected for all patients. Information about costs related to health seeking and diagnostic procedures before the person was registered as a TB patient (Part III) were collected only from patients who were in the intensive phase of either a 1st line treatment or a drug resistant. For patients who were interviewed during the continuous phase, information was collected only about costs related to the continuous phase.

Using the same procedure all previously treated cases were also interviewed questioned with brief summary questions on previous TB treatments (Part II). This was collected for previous treatments up to 2 years before starting of the present treatment episode. Information collected in part III from cases interviewed in the intensive phase, were used to impute data costs for patients interviewed in the continuation phase and for re-treatment cases. Similarly, information about costs in the continuation phase collected from patients interviewed in this phase, were used to project costs for patients interviewed in the intensive phase. The unit of analysis was the patient, but we also considered the economic consequences in the context of the patients' household. The costs were first analyzed using bolivianos the local currency, since it was the patients who provided the information directly. All amounts in local currency were converted to USD dollars. For this, we use the conversion rate for the year 2017 provided by the World Bank.

Data Analysis

First a descriptive analysis of the patient population was carried out regarding sociodemographic characteristics and TB treatment. Estimating cost. The most important direct medical payment, such as payments for medications, laboratory tests, consultation fees, etc. and direct non-medical payments such as payments for travel, food, etc. were calculated in a disaggregated manner. The remaining costs of the patient's current treatment phase were extrapolated from costs of patients who were in that treatment phase at the same health district and at the time of the study. The calculation of indirect costs for the entire TB episode was carried out through the results-based approach where the loss of income was calculated from the report of household income before TB episode and household income during the TB episode, multiplied by the duration of the entire episode. The household income was a self-reported household monthly income. Determining catastrophic costs. The percentage of households experiencing an economic burden or a total catastrophic cost, defined by a loss of at least 20% of annual income, was determined. For this, the total cost of the episode was calculated as direct costs plus indirect costs divided by the annual household income before the TB episode. Each household was given a binary value for whether or not they incurred catastrophic total costs due to TB. These binary values allowed a calculation of the percentage of TB respondents treated in health networks who incurred catastrophic total costs. These percentages were analyzed by income quintile, sex, type of TB and HIV status. Multivariable logistic regression modeling was used to find factors significantly associated with the risk of a total catastrophic cost for a TB patient. Data analyses were performed using SPSS 25.0 statistical software, and the statistical significance level was set to 0.05.

Ethical aspects

The study protocol and the WHO adapted questionnaire were approved by the Ethics Review Committee of the Medical Faculty of Universidad Mayor de San Simón, Cochabamba, Bolivia [10]. All patients who agreed to be interviewed signed an informed consent form after receiving information about their rights.

Results

A total of 310 patients were interviewed, including 183 (59%) men and 127 women (41%). Out of these cases, 237 were diagnosed with pulmonary tuberculosis (76.4%), and 73 with extra pulmonary tuberculosis (23.6%), and 17 (5.5%) patients were HIV positive. There were 282 (91%) new TB cases, 17 (5.5%) retreats and 10 (3.5%) multidrug resistant. Also, 236 (76.1%) were in the continuation phase and 74 (23.9%) in the intensive phase. Table 1 presents the socioeconomic and TB-related information for each subgroup of patients according to the TB type and for the whole study group.

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Characteristcs	MDR-TB[a]		DS-TB[b]		Retreatment		All	
	N	(%)	N	(%)	N	(%)	N	(%)
Sex								
Male	7	70.00%	176	58.70%	13	76.50%	183	59.00%
Female	3	30.00%	124	41.30%	4	23.50%	127	41.00%
Age group								
0-14	0	0.00%	4	1.30%	0	0.00%	4	1.30%
15-24	4	40.00%	81	27.10%	3	17.60%	85	27.50%
25-34	1	10.00%	59	19.70%	3	17.60%	60	19.40%
35-44	1	10.00%	37	12.40%	1	5.90%	38	12.30%
45-54	3	30.00%	27	9.00%	3	17.60%	30	9.70%
55-64	0	0.00%	26	8.70%	2	11.80%	26	8.40%
65+	1	10.00%	65	21.70%	5	29.40%	66	21.40%
Treatment Phase								
Intensive	3	30.00%	71	23.70%	3	17.60%	74	23.90%
Continuation	7	70.00%	229	76.30%	14	82.40%	236	76.10%
Recorded HIV Status								
Positive	1	10.00%	16	5.30%	0	0.00%	17	5.50%
Negative	9	90.00%	273	91.00%	17	100.00%	282	91.00%
Unknown	0	0.00%	11	3.70%	0	0.00%	11	3.50%
Type of TB Pulmonary	9	90.00%	228	76.50%	16	94.10%	237	76.90%
Extra-pulmonary	1	10.00%	70	23.50%	1	5.90%	71	23.10%
Patient's education status								
Illiterate	0	0.00%	1	0.40%	0	0.00%	1	0.30%
Primary school	1	11.10%	47	16.70%	1	7.10%	48	16.50%
Secondary school	0	0.00%	105	37.20%	7	50.00%	105	36.10%
High school	7	77.80%	114	40.40%	5	35.70%	121	41.60%
University and higher	1	11.10%	15	5.30%	1	7.10%	16	5.50%

TB: Tuberculosis; [a]MDR-TB: multidrug-resistant tuberculosis; [b]DS-TB drug-susceptible tuberculosis

Table 1: Characteristics of participants to the present research on costs incurred by tuberculosis patients in Cochabamba, Bolivia, 2017.

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Direct medical and non-medical costs the direct medical and non-medical costs incurred by the patient before diagnosis and during treatment are described in Table 2. The costs before diagnosis that were mainly direct medical costs, such as costs of radiography and/or laboratory test, had a median of USD 9.5, and medicines costs had a median USD 7.4 in the whole group of patients. For patients in retreatment, this median cost was USD 12.4.

During the intensive phase treatment, direct medical costs were mainly due to hospitalization with a median of USD 4.4 in the whole group patients. The median costs related to radiography, laboratory test and medicines were USD 0. Regarding the non-medical costs related to this same phase, they were mainly linked to DOT with a median USD 419.8 due to transport costs and a median of USD 94.5 for food and drinks costs. Moreover, the costs due to the consumption of nutritional supplements had a median of USD 249.1 and that of additional food outside the regular diet had a median USD 519 within the whole group of patients.

In the continuation phase, the most important direct medical costs were for hospitalization with a median of USD 57.3, especially in drug-susceptible or multidrug-resistant TB patients. The most important direct non-medical costs were related to DOT; transport had a median cost of USD 108.6, food and drinks had a median of USD 54.8. Nutritional supplements had a median cost of USD 249.1, and additional food to the regular diet had a median cost of USD 519.

Type of Tuberculosis patients				
	DS-TB[b]	MDR-TB[a]	Retreat	All
	(In USD[c])	(In USD[c])	(In USD[c])	(In USD[c])
Costs	n=300	n=10	n=17	n=310
Before the diagnosis				
Medical				
Consultation fee	0.7	0.7	5.1	0.7
Radiography	9.5	1.7	12.4	9.5
Lab test fees	0.7	0.7	0.7	0.7
Other Procedures	3.6	0	3.6	3.6
Medicines	9.5	0.7	9.5	7.4
Other medical costs	0.7	0.7	0.7	0.7
No Medical				
Travel	2	2.2	2.2	2.2
Food and drinks	0.7	0.2	0.1	0.2
During the treatment				
Intensive Phase				
Medical				
Consultation fee	0	0	0.2	0
Other medical costs	1.3	0	1.3	1.3
Hospitalization	4.4	0	0	4.4
No Medical				
DOT				
Transport	84	419.8	166.2	419.8

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Food and drinks	50.2	94.5	166.2	94.5
Picked up drugs				
Food and drinks	11.7	0	18.7	11.7
Follow-up medical outpatient visit				
Transport	0.8	0.2	0.9	0.8
Nutritional supplements				
Nutritional supplements	249.1	0	249.1	249.1
Food outside regular diet	519	0	519	519
Continuous Phase				
Medical				
Consultation fee	0	0	0.2	0
Other medical costs	1.3	0.6	1.3	1.3
Hospitalization	57.3	0	57.3	0
No Medical				
DOT				
Transport	81.6	108.6	139.9	108.6
Food and drinks	83.5	54.8	167.9	54.8
Picked up drugs				
Transport	7	0	14	7
Food and drinks	3.5	0	7	3.5
Follow-up medical outpatient visit				
Transport	15.6	0	15.6	15.6
Accommodation	32.4	0	32.4	32.4
Nutritional supplements				
Nutritional supplements	249.1	747.4	249.1	249.1
Food outside regular diet	519	1382.7	519	519
[a]MDR-TB: multidrug-resistant tuberculosis; [b]DS-TB drug-susceptible tuberculosis; [c]USD 1 = BS 6.86 (2017)				

Table 2: Median of direct medical and non-medical costs incurred by patients with tuberculosis before the diagnosis and during treatment in 2017, the time of the study in, Cochabamba, Bolivia.

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Total direct and indirect costs

The total direct and indirect costs are detailed in Table 3. Median total costs of an episodes were USD 1211.4 in the whole group. It was USD 855.6, for drug-susceptible patients, USD 932.2 for retreated patients, and USD 11873.2 for multidrug resistant patients. Indirect costs were more important than direct medical and non-medical costs in the whole group of TB patients; with a median of USD 768.1, the indirect cost corresponded to 63.4% of the total costs. In the MDR-TB patients, indirect costs were also higher that direct costs, had they had a median of USD 6454.8, corresponded to 54.3% of the total costs. Direct non-medical costs were also important with a median in the whole group of USD 408.7 (33.7%), and with a median of USD 5399.6 (45.4%) in MDR-TB patients.

		Type of tuberculosis patients		
	DS-TB[b] (In USDc)	MDR-TB[a] Retreat	All (In USD[c])	(In USD[c]) (In USD[c])
Costs	n=300	n=10	n=17	**n=310**
Direct				
Medical	34.7 (40 %)	18.8 (0.1%)	28.9 (3.1%)	34.7 (2.8%)
No medical	242.3 (28.3%)	5399.6 (45.4%)	275.6 (29.5%)	408.7 (33.7%)
Indirect	578.5 (67.6%)	6454.8 (54.3%)	627.7 (67.3%)	768.1 (63.4%)
Total	855.6	11873.2	932.2	1211.4
[a]MDR-TB: multidrug-resistant tuberculosis; [b]DS-TB drug-susceptible tuberculosis; [c]USD 1 = BS 6.86 (2017)				

Table 3: Median of total costs (direct and indirect) incurred by tuberculosis patients enrolled in 2017 in Cochabamba, Bolivia.

Catastrophic costs

Out of the 310 patients, 136 (43.87%) incurred catastrophic costs. Table 4 shows the proportion of patients experiencing catastrophic costs according to demographic characteristics. Proportion of TB patients incurring catastrophic costs increased with age, even reaching more than 50% in people older than over 55 years. Six out of ten MDR-TB patients suffered catastrophic costs and 63% of poor patients also experiencing catastrophic costs.

Characteristics		**Catastrophic cost incurred (n)**		
	Yes	%	No	%
All patients	136	43.80%	174	56.20%
Age group				
0-14	2	50.00%	2	50.00%
15-24	29	34.10%	56	65.90%
25-34	22	36.70%	38	63.30%
35-44	18	47.40%	20	52.60%
45-54	14	46.70%	16	53.30%
55-64	14	53.80%	12	46.20%
65+	37	56.10%	29	43.90%
Sex				
Male	88	48.10%	95	51.90%
Female	48	37.80%	79	62.20%

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DR-TB Status				
MDR-TB	6	60.00%	4	40.00%
DS-TB	130	43.30%	170	56.70%
HIV Status				
HIV positive	7	41.20%	10	58.80%
HIV negative	125	44.30%	157	55.70%
Income Quintile				
Poorest	25	39.10%	39	60.90%
Less Poor	48	63.20%	28	36.80%
Average	27	41.50%	38	58.50%
Less Wealthy	19	41.30%	27	58.70%
Wealthiest	11	23.40%	36	76.60%

Table 4: Characteristics of patients experiencing catastrophic costs for tuberculosis in 2017 in Cochabamba, Bolivia.

Factors independently associated with catastrophic costs

Table 5 shows the factors independently associated with catastrophic costs. In the final logistic regression model, factors showing a significant multivariate association with higher catastrophic costs occurrence were living in an urban province (OR = 1.82 95%CI, 1.11 to 2.98, P = 0.0016 when compared to a rural province) being older than 55 years. (OR = 1.21% CI, 1.07 to 1.38, P = 0.005), and to have a lower income. (high income compared to low income, OR = 0.83, 95%CI: 0.69 to 0.99, P = 0.049).

		Catastrophic costs		
Characteristics	B ± SE	OR	95% CI	P
Living an urban province	0.60±0.25	1.82	1.11 to 2.98	0.016
Age > 55 years	0.19±0.06	1.21	1.07 to 1.38	0.003
High income	-0.18±0.09	0.83	0.69 to 0.99	0.049

Table 5: Factors independently associated with catastrophic costs using a logistic regression model in tuberculosis patients treated in 2017 in Cochabamba, Bolivia.

Discussion

Key findings

The results of this research suggest that patients with TB treated in the health services network of Cochabamba, Bolivia, face a great financial burden as a result of the disease. This affects the most vulnerable stratum of society. Before the beginning of the diagnosis when seeking health care, more medical direct costs are observed, especially by radiography and medicines [12], these costs decrease during treatment, probably because the coverage of the health system allows avoiding these costs when the patient is already diagnosed [12,13] . During the treatment, both in the intensive phase and in the continuation, the most important costs were those related to transport and food due to the administration of the DOT [13], due to the fact that many people have to travel long distances and even consume food outside the home to receive their treatment in the health center. In addition, there are costs for nutritional supplements and additional foods to the regular diet that patients must incur to improve their 272 general condition by medical prescription or own initiative [14]. Indirect costs were the highest in the entire TB episode [6], mainly due to the loss of income due to TB [15,16] especially in MDR-TB patients [17,18]. More than 43.8% of patients suffer a catastrophic cost with a loss greater than 20% of the annual economic income. Older patients have more difficulties to generate economic income [19,20] but age was also a factor independent of income in multiple logistic regression, reflecting maybe increasing absolute indirect costs with age. MDR-TB patients whose duration of treatment is longer

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[17] experienced also catastrophic costs (6 out of ten), population where the economic burden due to illness is greater [18].

Limitations of the study

The main challenge when estimating total costs incurred by a patient is the recall bias, that predominantly affects cost estimates for the pre-treatment period. Nevertheless, the used approach to only interview persons in the intensive phase about diagnostics costs intended to minimize this type of bias. Likewise, given that patients are only interviewed once, many of their costs have to be estimated. On the other hand, although self-reported income can be unreliable, especially in settings where informal economy dominates such as in Bolivia the use of an asset score allows to make a more accurate estimation of house income but we lack of information to estimate such an asset score. Finally, the direct and indirect costs of TB for the patients and their households can be extended well beyond the treatment period, even for people who are declared cured. Additionally, measures of costs need to have a longer-term time-window for the documentation of long-term needs of social and economic support for TB-affected households.

Recommendations

Due to the serious impact of TB-related costs on the well-being of the home, the inclusion of TB services in national health insurance and food and transportation subsidies plans, is recommended. In the work place, it is recommended to generate public policies to achieve labor immobility until healing, and to increase efforts to find cases early to reduce indirect costs related to the inability to work. The results of the study indicate the need for the State to protect its population from the economic and health effects of contracting TB, and in this way, to prevent an increase or deepening of poverty among those suffering from the disease. There is a need to continue researching using methods that allow you to calculate costs and revenues more accurately.

Conclusions

The results of this study are similar to those shown by other TB patients in other parts of the world, with TB patients especially facing a great financial burden, without sufficient social protection. Therefore, the free diagnosis and treatment of TB is not sufficient to alleviate the vulnerability of financial constraints due to the disease. Most of the costs before diagnosis were direct medical due to radiographies and medicines. With respect to the direct non-medical costs incurred by the patients during the treatment, both in the intensive phase and in the continuation phase, the most important costs were related to transport and food by the DOT and the costs for nutritional supplements and additional foods to the regular diet. The total costs were high, indirect costs being the highest in the entire episode of TB compared to direct medical and non-medical costs, and mainly due to the loss of income because of the disease being even higher in TB-MDR patients. 43.87% of the patients in the study incurred catastrophic costs with more than 60% in patients older than 55 years, with MRD-TB, and in less poor patients. The three factors associated with higher catastrophic costs for patients were to live an urban area, to be older than 55 years and to have a low income.

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CHAPTER 6: DISCUSSION

6 Discussion

6.1 Main findings

Distribution of tuberculosis and its relationship with socioeconomic determinants

Each region of the Department of Cochabamba presents different values and characteristics regarding not only the incidence of tuberculosis but also regarding geography and socioeconomic variables, reflecting different realities in the five regions of Cochabamba.

The distribution pattern of the incidence of tuberculosis highlighted a high incidence in the Tropicals Regions, a moderate incidence in the Metropolitans Regions and a low incidence in the Valleys, Southern Cone and Andean Regions.

Such disparities were also reported in other studies (70, 71, 72) carried out at the municipal level, using neighborhoods as the unit of analysis, showing in many cases also very high incidences.

The relationship between the incidence of tuberculosis and socioeconomic variables was also different between Regions. Likewise, the inverse correlation between the incidence rate of tuberculosis, illiteracy and the school enrollment rate can be explained by changes in politics over years. In 2006, a new socialist government entered, and decided to open education to whole population, even implementing the education in native languages such as Quechua, thus having a high level of school attendance and a decrease in illiteracy. However, this does not mean that the quality of education is good or that the standard of living has improved. But surprising results as our findings can be observed.

However, the variable "not homeowner" correlated positively with the incidence of tuberculosis in each Region. This variable has a very important link with the economic situation of households (73), because people who do not have their own

home go to rental contracts that are usually associated with precarious conditions in Bolivia.

These houses for renting are usually precarious and are a space that works as a factor of anguish, causing multiple public health problems including tuberculosis (74). In the same way the precariousness of the houses is related to the overcrowding of people (75, 76, 72). Therefore, a situation of overcrowding is associated with an increased risk of tuberculosis contamination, due to the greater likelihood of constant contact between people (71). The reliability of this variable is higher than indicators such as poverty or non-wage work; to be a house owner is an objective expression of quality of life in Bolivia.

Although there is evidence of a relationship between the incidence of tuberculosis and economic income (77, 76, 78), variables such as annual income linked to minimum wages, income of heads of household; adapted indicators should therefore be used to measure the relationship with living conditions.

In our study, none of the regions exhibited a coherent relationship between the incidence of tuberculosis and the variables related to economic income, probably because the population and housing census variables used to measure this relationship, such as the proportion of poor people assessed by the governmental poor ticket, or the proportion of non-salaried people do not measure what is expected to be measured, for instance the informal economy or the barter economy are not certified in these indicators.

Socio-economic consequences for patients affected by the TB and their households

Patients with TB treated in the health services network of Cochabamba, Bolivia, face a great financial burden as a result of the disease. This affects the most vulnerable stratum of society. Before the beginning of the diagnosis when seeking

health care, more medical direct costs are observed, especially by radiography and medicines (79), these costs decrease during treatment, probably because the coverage of the health system allows avoiding these costs when the patient is already diagnosed (79, 80).

During the treatment, both in the intensive phase and in the continuation, the most important costs were those related to transport and food due to the administration of the DOTS (80), due to the fact that many people have to travel long distances and even consume food outside the home to receive their treatment in the health center. In addition, there are costs for nutritional supplements and additional foods to the regular diet that patients must incur to improve their general condition by medical prescription or own initiative (81).

Indirect costs were the highest in the entire TB episode (82), mainly due to the loss of income due to TB (83, 84) especially in MDR-TB patients (85, 86). More than 43.8% of patients suffer a catastrophic cost, with a loss greater than 20% of the annual economic income. Older patients have more difficulties in generate economic income (87, 88), and there is also an increase in absolute indirect costs with age. MDR-TB patients whose duration of treatment is longer (85) experienced also catastrophic costs; they are those with the highest economic burden due to illness is greater (86).

6.2 Limitations and strengths

In the ecological study there is a possible underestimation of TB cases in own study. Several studies (70, 89) have reported an underestimation of incident cases linked to the poor organization of health services as well as the non-active detection of cases. The quality of the data of the Tuberculosis Control Program can be subject to variations, as observed in many health information systems in developing countries.

Likewise, the validity of the data obtained during the population and housing census may also be affected by an incorrect information provided by the interviewees, especially regarding their economic income; people are afraid of a possible intervention of the state in their resources.

The fact that the data on the incidence of tuberculosis date from the year 2016 and the data on the socioeconomic variables from the year 2012 may induce variations in the results of the study. Since 2012 there has been no other census so there was no other way to have official data. Carrying out a similar study with updated socioeconomic data might give quite different results than what we found in the present study.

It is not worth carrying out similar studies at the same scale or at a larger scale in the future without first correcting all the possible biases that may exist in our study. It would be worth taking advantage of the new data that will result from the new population and housing census to be carried out this year 2022 to carry out a new study, but this time at the community level.

In the case of a cross-sectional survey to estimating total costs incurred by a patient the main challenge was the recall bias, that predominantly affects cost estimates for the pre-treatment period. Nevertheless, the used approach to only interviewed persons in the intensive phase about diagnostics costs intended to minimize this kind of bias. Likewise, given that patients are only interviewed once, many of their costs have to be estimated.

On the other hand, although self-reported income can be unreliable, especially in settings where informal economy dominates such as in Bolivia the use of an asset score allows to make a more accurate estimation of house income but we lack of information to estimate such an asset score. Finally, the direct and indirect costs of

TB for the patients and their households can be extended well beyond the treatment period, even for people who are declared cured.

Additionally, measures of costs need to have a longer-term time-window for the documentation of long-term needs of social and economic support for TB-affected households.

The fact that the study participants were patients that who receiving their medications and care at the health facility where the survey was conducted could generate a patient acceptance bias by the health staff that can explain the high rate of participation since people do not were able to say no to the survey and also so potential risk of bias of information since the patient could answer falsehoods just to please the health center.

The studies carried out are the first in Bolivia to generate scientific evidence regarding the distribution of tuberculosis, its relationship to socio-economic determinants and assess the socio-economic consequences for patients and their households affected by the disease.

For the study aimed at determining the distribution of tuberculosis, a close and permanent coordination was carried out with the Tuberculosis Control Program for the study of costs, primary data was generated through conducting surveys training of healthcare workers, leaving the knowledge for future studies, likewise the sample size and the type of sampling were very rigorous to have greater precision in the estimates.

CHAPTER 7: CONCLUSION AND PERSPECTIVES

7 Conclusions and Perspectives

7.1 Conclusions

The pattern of the spatial distribution of tuberculosis showed a high incidence in the Tropical Region. Each region had its own socioeconomic variables associated with tuberculosis incidence. However, the variable “not having its own housing” was common to all regions and was positively associated with TB incidence. Even is informal or illegal economy cannot be measured in an ecological study, a variable as house ownership highlighted how to target people at a higher risk of TB or people at risk of stopping treatment.

TB patients are facing a great financial burden, without sufficient social protection. Therefore, the free diagnosis and treatment of TB is not sufficient to alleviate the vulnerability of financial constraints due to the disease.

Most of the costs before diagnosis were directly medical due to radiographies and medicines. With respect to the direct non-medical costs incurred by the patients during the treatment, the most important costs were related to transport and food by the DOTS and the costs for nutritional supplements and additional foods to the regular diet.

The total costs were high, indirect costs being the highest in the entire episode of TB compared to direct medical and non-medical costs, and mainly due to the loss of income because of the disease being even higher in TB-MDR patients. Almost half of the patients in the study incurred catastrophic costs, the three factors associated with higher catastrophic costs were patients living in an urban area, being over 55 years of age, and having a low income.

7.2 Recommendations and Perspectives

Regarding the spatial distribution of the disease

Due to the differences in the distribution of the disease in the different regions, adapted actions must be developed for each one of them. For this the following activities must be carried out:

• *Active detection of cases by health personnel and the community participation*

Given that there are regions with a high incidence in the Department of Cochabamba, active search activities for respiratory symptoms must be implemented in these regions, on the one hand, by health personnel who will not only look for cases in routine medical consultations but also in health activities such as vaccination campaigns or vaccination points, as well as in other health activities such as fairs organized by health facilities.

On the other hand, there are many social organizations at the local level that they can play a very important role in the detection of respiratory symptoms through training on the recognition of TB, especially for community leaders, health promoters, clubs of mothers and the population in general, focusing their activity on vulnerable populations. In this way, their participation in the identification and referral of respiratory symptoms to health facilities will be important.

• *Coordination between the Tuberculosis Control Program and the HIV/AIDS Program*

Although tuberculosis affects the general population, there are populations of greater vulnerability, such as people infected with the human immunodeficiency virus. They are more likely to get tuberculosis than people without HIV. However, in order to understand the real state of co-infection in Cochabamba, it is recommended that the HIV/AIDS program organized a greater coordination with the Tuberculosis Control Program, to diagnose HIV in patients with TB and also to

execute an active detection of HIV cases in the population at risk in the regions with the highest incidence, since the cases of this disease could be underestimated. We worked with the TB program but patients with both TB and HIV can be in HIV program.

Regarding the relationship of the disease with socioeconomic determinants

Our results showed that the relationship between the disease and socioeconomic determinants is different between regions for all covariates but the "non-owner" variable. These findings show that tuberculosis is associated with precarious conditions and bad life conditions of the population of Cochabamba. The work should focus on the following area:

• *Involving NGOs in tuberculosis prevention*

In Cochabamba there are NGOs that have a lot of knowledge of the field and have motivated human resources with many years of experience, especially in educational activities. We recommend to involve these institutions to work with the community on the prevention of tuberculosis risk and especially on the recognition of signs and symptoms for the control of the disease.

• *Incorporation of patients with tuberculosis in the Bolivian state's food supply program*

In order to improve the nutritional status of patients with tuberculosis, the necessary advocacy should be implemented with the scientific evidence obtained in our study, so they are incorporated into the program that already exists in the Bolivian state for the monthly granting of food products, with high nutritional quality during the time of the treatment. Although it is a program originally intended for women in the prenatal stage, the financial conditions exist so that this program can also cover the population of patients with tuberculosis.

Regarding costs related to tuberculosis

Given that the main costs were related to feeding and transportation to comply with directly observed treatment (DOTS), in addition to the indirect costs due mainly to the loss of income, the following actions are recommended:

• *Implementation of Directly Observed Video Therapy (VDOT)*

To avoid expenses related to transportation and food that patients carry out due to DOT, an alternative is to implement the Directly Observed Video Therapy (VDOT) strategy, which consists of the use of electronic technologies such as a cell phone or a computer with a camera in order to remotely monitor tuberculosis patients when they take their medications in real time through a video call or videoconference between the patient and the health worker. This modality requires the person's access to internet connection in real time, as well as for the health personnel who supervises.

In the current era where technology is accessible to everyone, most people in Cochabamba have a mobile phone with a camera. This strategy will not only reduce the costs related to DOT, but will also avoid unnecessary displacement by people and the reorganization of their lives to attend the health service, that is, they will not need to leave their work or resign for daily visits to the health service so, indirect costs due to the loss of income will be reduced. According to some research (91.92), VDOT can save up to US$1,000 per patient, and studies show that compliance and completion rates are similar to rates achieved with traditional DOT. However, this strategy poses some problems that must be taken into account before its implementation, such as the inability to connect to the network at some point for technical reasons.

• *Implementation of community DOT*

Although access to mobile devices that have a camera is widespread in Cochabamba, it should not be overlooked that there may be some population that

still lacks access to an electronic device or that cannot manage it due to age. There can have a lack of internet signal, especially in rural areas. For such situations we propose the community DOT strategy as an alternative, which consists of generating capacities, for example, in community leaders, popular health officials, community teachers, religious organizations, protection centers for people, Non-Governmental Organizations, among others, for support in the supervision and administration of tuberculosis treatment, in coordination with health facilities

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9. Annexes

9.1 Adapted questionnaire proposed by WHO for cost survey in TB the tuberculosis patients

Parte I. Información sobre el paciente que se debe obtener de la tarjeta de tratamiento anti-TB antes de la entrevista

Pregunta	Categorías de las respuestas (encierre en un círculo el número apropiado o escriba la respuesta en la línea correspondiente)	Acción del entrevistador Las preguntas de la Parte I no forman parte de la entrevista y deben ser completadas previamente	**Código de la variable** (el contenido de esta columna es para el análisis –no requiere traducción ni adaptación)
1. Fecha de la entrevista	(Día/mes/año) … …/ … …/ … … …		*Date_interv*
2. Provincia	… … … … … … … … … … …. .		*Provin_interv*
3. Municipio	… … … … … … … … … … …. .		*M_interv*
4. Red de Salud	… … … … … … … … … … …. .		*Distr_interv*
5. Lugar de la entrevista (nombre del establecimiento)	… … … … … … … … … … …. .		*Facilt_interv*

6. Nombre del entrevistador	… … … … … … … … … … ….		*Facil_name_interv*
7. Categoría del establecimiento de tratamiento	1. Puesto de Salud 2. Centro de Salud 3. Hospital de Segundo Nivel 4. Otro _____	El "establecimiento de tratamiento" es el lugar donde se guarda la tarjeta de tratamiento del paciente	*Facility*
8. Nombre del paciente			*Patient*
9. Género	1. Hombre 2. Mujer	Encierre en un círculo el número apropiado	*Sex*
10. Edad del paciente:	____años		*Age*
11. Fecha de la primera prueba bacteriológica para tuberculosis	(Día/mes/año) … …/ … …/… … … se realizó o se desconoce	Normalmente se refiere a la baciloscopía	*Date_test*
12. Prueba utilizada para el diagnóstico de TB	1. Baciloscopía 2. Cultivo 3. Diagnóstico clínico (incluido radiografía)	Información en la tarjeta	*Bc_ss* *Bc_c*
13. Fecha del diagnóstico	(Día/mes/año) … …/ … …/… … …		*Date_diagn*
14. Lugar del diagnóstico	1.Puesto de Salud 2.Centro de Salud 3.Hospital de Segundo Nivel 4.Hospital de Tercer Nivel	Esta información se obtiene de la tarjeta, donde se registra la transferencia recibida	*Place_diagn*

	5.Centro de salud u hospital de ONG o de la beneficencia 6.Clínica u hospital privado Otro _____		
15. Tipo de tuberculosis	1. Pulmonar, confirmada bacteriológicamente 2. Pulmonar, sin confirmación bacteriológica 3. Extrapulmonar		*tb-type*
16. ¿Se ha realizado pruebas de sensibilidad a fármacos? (con resultado)	1. Sí 2. No/ se desconoce	Si la respuesta es "sí" significa que el paciente ha suministrado una muestra para una prueba de sensibilidad a fármacos (PSF). Si la respuesta es “no” pasar a la pregunta 20	*dst*
17. En caso afirmativo, qué pruebas	1. Cultivo con prueba de sensibilidad (PSF): sí/no/se desconoce 2. Otra: sí/no/se desconoce	Encierre en un círculo el resultado	*dst_cu* *dst_oth*
18. En caso afirmativo, resultados de la PSF	1. TB Monoresistente 2. TB Poliresistente 3. TB Multidrogo resistente (MDR) 4. TB Extensamente resistente (XDR)		*dst_mon* *dst_pol* *dst_mdr* *dst_xdr*

	5. TB Totalmente resistente (TDR) 6. Se desconoce		*dst_tdr* *dst_unk*
19. En tratamiento por tuberculosis multirresistente	1. Sí 2. No		*mdr*
20. Esquema de tratamiento indicado	1. Esquema I Casos nuevos 2. Esquema II o Retratamiento 3. Esquema III o Pediátrico:_____ 4. Otro esquema : _____		*regimen* *regimen_sl* *regimen_tl* *regimen_other*
21. Duración total de tratamiento planificado desde el comienzo	_____meses fase I _____meses fase II _____meses fase III (retratamiento)		*Duration_tt_int* *Duration_tt_cont*
22. Grupo de registro del tratamiento	**No MDR** 1. Caso nuevo 2. Retratamiento-recaída 3. Retratamiento-abandono recuperado 4. Retratamiento-fracaso **MDR** 5. MDR, nuevo (MDR inicial) 6. MDR, recaída	Si la respuesta fue “otro” (respuesta 10), excluir del estudio	*register*

	7. MDR, abandono 8. MDR, fracaso al 1er tratamiento 9. MDR, fracaso del retratamiento 10. Otro, especificar: … … … … … … … … … …		
23. Fecha de inicio del tratamiento actual	(Día/mes/año) … …/ … …/… … …		*Start_dstb*
24. ¿Actualmente en qué fase de tratamiento está el paciente?	1. Fase I, ___ semanas de la fase completadas 2. Fase II, ___ semanas de la fase completadas 3. Fase III, ___ semanas de la fase completadas	Si el paciente ha completado menos de 2 semanas de la fase de tratamiento actual, excluirlo La entrevista se realiza después de que se hayan completado por lo menos 2 semanas La tercera fase solo se aplica en retratamiento	*Phase*
25. Estado respecto a la infección por el VIH (según se indica en la tarjeta de tratamiento)	1. Positivo 2. Negativo 3. No se realizó la prueba 4. Se desconoce	Según se indica en la tarjeta de tratamiento anti-TB	*Hivstatus*
26. Si el paciente se encuentra hospitalizado en el momento de	(Día/mes/año) … …/ … …/… … …	Si todavía no ha iniciado el tratamiento ambulatorio, no	*Discharged*

la entrevista, ¿cuál es la fecha prevista para el alta?	Se desconoce	puede responder a las preguntas de la Parte V que se refieren a los costos de la atención ambulatoria En ese caso, el costo del tratamiento ambulatorio de esta persona se extrapolará de datos de otros pacientes	

Parte II. Consentimiento Informado

Introducción para el paciente:

Mi nombre es……. La Universidad Mayor de San Simón, está interesada en los costos a los que las personas deben hacer frente durante el tratamiento antituberculoso, así como en los costos que han tenido que afrontar antes del diagnóstico, en su búsqueda de atención de salud.

La información que usted decida compartir se usará con fines de investigación. Se compartirá con otros investigadores para el análisis posterior y se publicará, pero antes se suprimirá toda su información personal para preservar la más absoluta confidencialidad.

Es importante que entienda que su participación en este estudio es completamente voluntaria. Estaríamos realmente agradecidos si decide participar en él, pero puede negarse a hacerlo. Si decide negarse, no habrá ninguna consecuencia y usted recibirá toda la atención y el tratamiento que necesita en el establecimiento de salud, como de costumbre. Si rehúsa a participar no perderá ningún beneficio al que tenga derecho, como recibir la atención y el apoyo que se presta en el establecimiento.

En caso de que decida participar, quisiera recalcar que no recibirá reembolso alguno de los gastos sobre los que informe en esta entrevista.
Si decide participar en este estudio, puede retirarse en cualquier etapa sin dar explicación alguna. Sus respuestas serán confidenciales. En algún momento le preguntaré acerca de sus ingresos personales y los ingresos de su hogar. NO suministraremos esta información a ninguna autoridad fiscal, tampoco después de la finalización del estudio.

El investigador principal es el Dr. Marcelo Rojas Mattos, dirección Av. Aniceto Arce N 371, facultad de medicina UMSS, correo electrónico: marcelorojasmattos@yahoo.com quien es el responsable de este estudio. Los resultados serán difundidos en una revista de código abierto y usted puede solicitarle una copia al investigador principal.

Esta encuesta tomará de 60 a 90 minutos, aproximadamente.

Pregunta	Categorías de la respuesta (encierre en un círculo el número apropiado o escriba la respuesta en la línea correspondiente)		Acción del entrevistador	**Código de la variable**
¿Tiene alguna duda?			Responder a las preguntas del paciente	Add_qu
27. ¿Quiere participar?	Sí No, porque:	1. No domina bien el Idioma 2. Limitaciones de tiempo 3. No se siente cómodo 4. Otra razón, especificar: … … … … … … … … … …	Sí → ¡Gracias! Pasar a la entrevista No → Concluir la entrevista en este momento, habiendo rellenado la Parte I con la información de la tarjeta del paciente	quest nquest

Firma del paciente _____(Se entregará al paciente un duplicado de este cuestionario firmado)

Inclusión o exclusión

Pregunta	Categorías de la respuesta (encierre en un círculo el número apropiado o escriba la respuesta en la línea correspondiente)	Acción del entrevistador	**Código de la variable**
28. Decisión sobre la inclusión o exclusión	1. Incluido 2. Excluido	Si se incluye, pasar a la pregunta 31	Incl
29. Si se excluye, razones para la exclusión	1. No hay consentimiento informado 2.Tratamiento menor a 2 semanas 3. El grupo de registro del tratamientos es “otro” (respuesta 10 en pregunta 22)	Después de completar esta pregunta, la encuesta termina para este paciente excluido	Incl_y

	4. Otra _____		
30. Identidad del entrevistado	1. Paciente 2. Tutor 3. Otro (sírvase especificar) _____		Interviewee

Lista de verificación de las partes del cuestionario que se completan para diferentes categorías de tratamiento						
Respues-ta a la pregunta 22	Respues-ta a la pregunta 24	Categoría de tratamiento y fase del tratamiento en el momento de la entrevista	Parte III del cuestionario (marcar la casilla correspondiente cuando se llena)	Parte IV del cuestionario (marcar la casilla correspondiente cuando se llena)	Parte V del cuestionario (marcar la casilla correspondiente cuando se llena)	Control del super-visor
		Sensible				
1	1	Caso nuevo , entrevistado en la primera fase del tratamiento	No rellenar	Rellenar □	Rellenar □	
1	2	Caso nuevo, entrevistado en la segunda fase del tratamiento	No rellenar	No rellenar	Rellenar □	
2-4	2-3	Retratamiento	Rellenar □	No rellenar	Rellenar □	

		Multirresistente				
5	1	Multirresistente, caso nuevo, entrevistado en la primera fase de tratamiento	No rellenar	Rellenar □	Rellenar □	
5	2	Multirresistente, caso nuevo, entrevistado en la segunda fase del tratamiento	No rellenar	No rellenar	Rellenar □	
6-9	1 o 2	Multirresistente, recaída o retratamiento	Rellenar □	No rellenar	Rellenar □	

Parte III. Resumen de los tratamientos antituberculosos antes del tratamiento actual (solo en caso previamente tratado)

¡Esta parte se completará solo si el paciente recibe retratamiento de primera línea y para casos de retratamiento de tuberculosis multirresistente ***(en los pasados dos años)*** únicamente. Si se trata de un caso nuevo (tratamiento para tuberculosis multirresistente o no multirresistente): pasar a la sección IV

.

31. ¿Cuántas veces, en los pasados dos años, ha sido tratado por tuberculosis antes del tratamiento actual, incluidos los tratamientos completados y los no finalizados?	_____veces	Para cada tratamiento, complete los detalles a continuación	Pretrt
Primer tratamiento			
32. ¿En qué año fue tratado por primera vez por tuberculosis, dentro los dos años anteriores?	____		Pretrt_1
33. ¿Dónde se trató, en los últimos dos años?	1.Puesto de Salud 2.Centro de Salud 3.Hospital de Segundo Nivel Otro_____		Pretrt_1_facil
34. ¿Recibió tratamiento de primera línea o tratamiento para tuberculosis multirresistente?	1. Tratamiento antituberculoso de primera línea 2. Tratamiento para tuberculosis multirresistente 3. Desconoce	Explicar al paciente que “primera línea significa tratamiento estándar para tuberculosis no multirresistente ”	Pretrt_1_type
35. ¿Cuántos meses del tratamiento completó?	____meses		Pretrt_1_nmths

36. ¿Fue hospitalizado durante este tratamiento? En caso afirmativo, ¿por cuánto tiempo en total?	1. Sí, por __días 2. No		Pretrt_1_hosp
Segundo tratamiento			
37. ¿En qué año fue tratado por primera vez por tuberculosis, dentro los dos años anteriores?	____		Pretrt_2
38. ¿Dónde se trató, en los últimos dos años?	1.Puesto de Salud 2.Centro de Salud 3.Hospital de Segundo Nivel Otro_____		Pretrt_2_facil
39. ¿Recibió tratamiento de primera línea o tratamiento para tuberculosis multirresistente?	1. Tratamiento antituberculoso de primera línea 2. Tratamiento para tuberculosis multirresistente 3. Desconoce	Explicar al paciente que "primera línea significa tratamiento estándar para tuberculosis no multirresistente"	Pretrt_2_type
40. ¿Cuántos meses de tratamiento completó?	____meses		Pretrt_2_nmths
41. ¿Fue hospitalizado durante este tratamiento? En caso afirmativo, ¿por cuánto tiempo en total?	1. Sí, por __días 2. No		Pretrt_2_hosp

Tercer tratamiento			
42. ¿En qué año fue tratado por primera vez por tuberculosis, dentro los dos años anteriores?	____		Pretrt_3
43. ¿Dónde se trató, en los últimos dos años?	1.Puesto de Salud 2.Centro de Salud 3.Hospital de Segundo Nivel Otro_____		Pretrt_3_facil
44. ¿Recibió tratamiento de primera línea o tratamiento para tuberculosis multirresistente?	1. Tratamiento antituberculoso de primera línea 2. Tratamiento para tuberculosis multirresistente 3. Desconoce	Explicar al paciente que "primera línea significa tratamiento estándar para tuberculosis no multirresistente en su país"	Pretrt_3_type
45. ¿Cuántos meses de tratamiento completó?	meses		Pretrt_3_nmths
46. ¿Fue hospitalizado durante este tratamiento? En caso afirmativo, ¿por cuánto tiempo en total?	1. Sí, por __días 2.No		Pretrt_3_hosp

Parte IV - Costos antes del tratamiento antituberculoso actual (solo para nuevos casos en primera fase)
• Nuevos casos en la primera fase de tratamiento, tratamiento para tuberculosis sensible y también pacientes en tratamiento por tuberculosis multirresistente • En caso de retratamiento o de un nuevo caso entrevistado en la segunda o tercera fase: pase a la Parte V

Gastos en efectivo y reembolsos antes y durante el diagnóstico de tuberculosis (antes de iniciar el tratamiento antituberculoso)			
Pregunta	Categorías de las respuestas (marque todo lo que corresponda o escriba la respuesta en la línea)	Instrucciones para el entrevistador y acciones	**Código de la variable**
47. En este episodio de tuberculosis, ¿cuándo tuvo por primera vez síntomas?	Semanas antes de iniciar el tratamiento:_____	Primero confeccione una cronología de los hechos; puede comenzar por el primer síntoma de tuberculosis o empezar en el momento del diagnóstico y retroceder. Utilice el calendario local adaptado con los principales eventos estacionales que el paciente pueda relacionar y úselo como punto de referencia temporal (calendario folclórico). Para ayudar al paciente a recordar cuándo comenzó la enfermedad, puede preguntarle qué síntoma de tuberculosis fue el primero, después de haber investigado tos, pérdida de peso, dolor torácico y sudoración nocturna. Si tuviera dificultades para diferenciar entre síntomas de	*sympt*

		tuberculosis y otros problemas de salud, pregunte qué síntoma lo llevó a buscar atención, luego pregunte cuándo apareció ese síntoma o cuándo empeoró y comenzó a preocupar al paciente.	
48. Antes de comenzar el <u>tratamiento actual</u> en este establecimiento, ¿a cuáles de los siguientes tipos de establecimientos de salud se dirigió en busca de atención o asesoramiento para los síntomas de su enfermedad? (Incluidas las hospitalizaciones; se pueden mencionar varios tipos de establecimiento). ¿Cuántas semanas antes de iniciar el tratamiento en el establecimiento de salud acudió a cada uno de estos prestadores?	<u>Primera consulta:</u> Tipo de prestador ___ N° Semanas antes del inicio del tratamiento:___ <u>Segunda consulta:</u> Tipo de prestador ___ N° Semanas antes del inicio del tratamiento:___ <u>Tercera consulta:</u> Tipo de prestador ___ N° Semanas antes del inicio del tratamiento:___	Ingrese los datos en orden cronológico, utilizando una de las categorías de prestador para cada consulta e indicando cuántas semanas antes del inicio del tratamiento actual tuvo lugar cada consulta. También informe en la tabla más abajo. **1.Puesto de salud** **2.Centro de salud** **3.Hospital de segundo nivel** **4.Hospital de Tercer Nivel** **5.Centro de salud u hospital de ONG o de la iglesia** **6. Farmacia/droguería** **7.Curandero** **8. Médico tradicional**	*Firstvisit* *Secondvisit* *Etc…* *Firstvisweeks* *Secvisweek* *Etc*

	Cuarta consulta: Tipo de prestador ___ N° Semanas antes del inicio del tratamiento:___ Quinta consulta: Tipo de prestador ___ N° Semanas antes del inicio del tratamiento:___ Sexta consulta: Tipo de prestador ___ N° Semanas antes del inicio del tratamiento:___ Séptima consulta:	**9.Consultorio privado** **10.Hospital o clínica privado** **11.Agente sanitario de la comunidad** **12.Vecinos o familiares** **13. Seguridad Social (Cajas de Salud)** **14. Otro establecimiento:…… … … … … … …. .**	

	Tipo de prestador ___ N° Semanas antes del inicio del tratamiento:___ <u>Octava consulta:</u> Tipo de prestador ___ N° Semanas antes del inicio del tratamiento:___ <u>Novena consulta:</u> Tipo de prestador ___ N° Semanas antes del inicio del tratamiento:___		
49. ¿Aproximadamente cuánto dinero y tiempo le llevó cada una de estas consultas antes de que le diagnosticaran tuberculosis, incluida la consulta en la que finalmente obtuvo el diagnóstico?	• Ver el cuadro siguiente y preguntar sobre cada punto • Rellenar una línea por consulta • Para todo lo que no sea aplicable, marque o seleccione NA • Si hubo costos, pero el paciente no recuerda el monto, marque NR • ¡Agregue más filas si el paciente realizó más consultas antes de que le diagnosticaran tuberculosis! Explicación de los títulos del cuadro:		

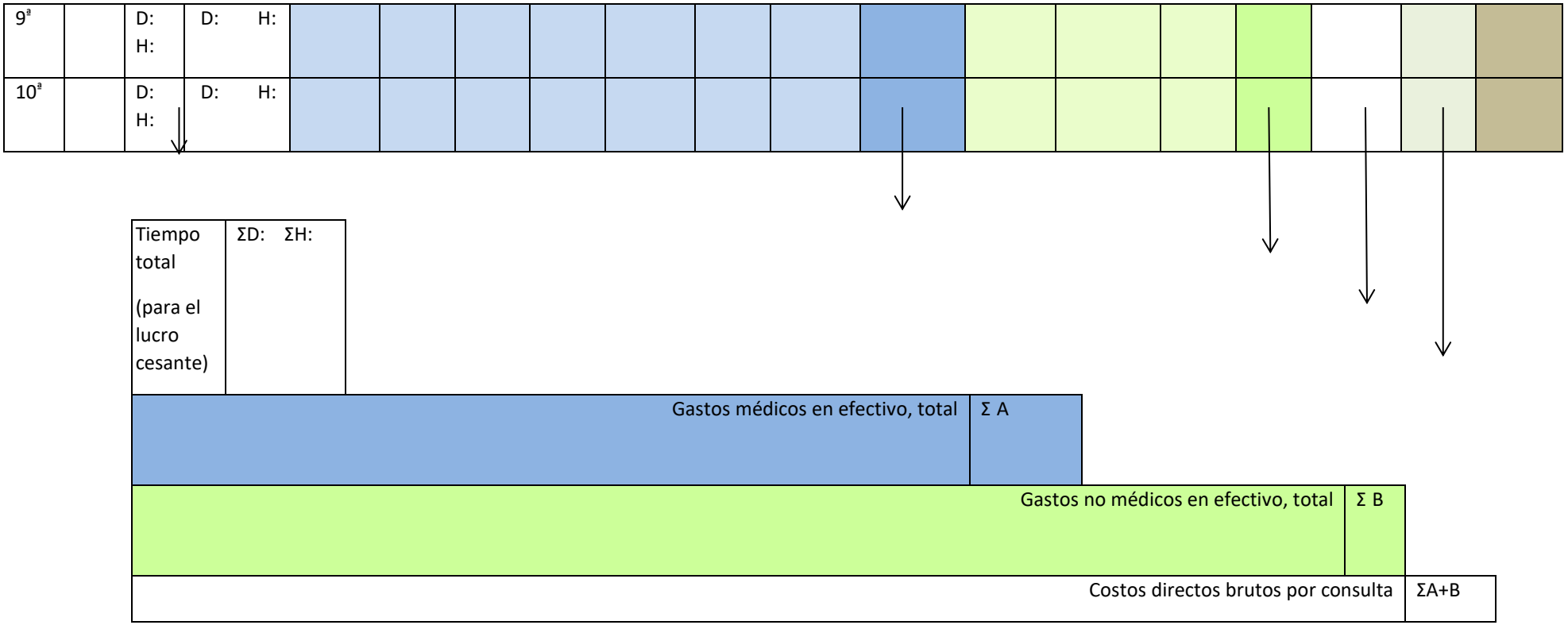
	Consultas: Incluye consultas ambulatorias y hospitalizaciones. Debe completarse en orden cronológico, primera consulta = consulta 1 Tipo de prestador: Indicar el tipo de prestador según las categorías en la pregunta 51, dónde acudió el paciente en busca de tratamiento o asesoramiento Tiempo invertido: Horas para las consultas ambulatorias (incluye tiempo de traslado, espera y consulta) y días para las hospitalizaciones Tarifa diaria: Honorarios por día de hospital. Solo para las hospitalizaciones y solo para completar en caso de que el gasto no esté comprendido en los gastos incluidos más abajo (honorarios por consulta, radiografías, etc.) Honorario por consulta: Otros cargos, no comprendidos en tarifas diarias, incluido el pago directo al personal de atención de salud Radiografías y otros estudios por imágenes: Toda investigación mediante estudios por imágenes (radiografía, tomografía computarizada, ecografía) específicos para tuberculosis y otros Tarifas por pruebas de laboratorio: Incluye todas las pruebas, específicas para tuberculosis y otras Otros procedimientos: Incluye biopsia, lavado broncoalveolar, etc. pero no cirugía no relacionada con la tuberculosis Costo de los medicamentos: Todo medicamento (antituberculoso u otro) recetado antes de que se diagnosticara la tuberculosis Otros, incluidos suplementos nutricionales: cualquier otro tratamiento, como suplementos nutricionales por indicación médica Gastos por traslado: Costo directo del viaje al establecimiento (no incluye la pérdida de ingresos por no trabajar) tanto de los pacientes como de cualquier integrante del grupo familiar Gastos de alimentación: Se refiere a los costos adicionales en comidas en relación con el traslado a la consulta de atención médica y durante la visita u hospitalización, tanto del paciente como de cualquier integrante del grupo familiar

	Otro, incluido el alojamiento: Incluye el costo de rentar una habitación/cama durante las consultas y cualquier otro gasto no médico relacionado con la consulta de atención de salud, tanto del paciente como de cualquier integrante del grupo familiar Costos directos brutos: Calculados como suma de los gastos médicos directos (A) y los gastos directos no médicos (B). Si el paciente no puede recordar los detalles de los costos anteriores, pregunte por los costos directos totales de la consulta, hospitalización Reembolso del seguro médico: Monto reembolsado al paciente por el seguro médico (privado o de la seguridad social) hasta el momento, no incluye los reembolsos previstos en el futuro Costos netos directos, total de gastos médicos en efectivo, total de gastos no médico en efectivo, total de reembolsos y costo neto total: Debe calcularlos el supervisor después de la entrevista. No se calculan durante la entrevista

	Total de gastos médicos directos en efectivo, total por consulta (A)	Total de gastos no médicos directos en efectivos, total por consulta (B)	Costo bruto directo por consulta A+B	(C)	Costo neto directo por consulta (A+B-C)

Consulta	Tipo de prestador (véase lista)	Tiempo en traslados: Días: Horas:	Tiempo en consultas Días: Horas: Incluye tiempo de espera	Tarifas diarias (solo para hospitalizaciones) A1	Honorario por consulta A2	Radiografía y otros estudios por mágenes A3	Pruebas de laboratorio A4	Otro procedimiento A5	Medicamentos A6	Otros, incluidos suplementos nutricionales A7	Costos médicos totales El entrevistado responderá a esta pregunta sólo si no se pueden obtener los costos desagregados Σ A1-7	Transporte B1	Alimentos durante consulta de atención de salud o estadía hospitalaria B2	Otro, incluido el alojamiento B3	Total costos no médicos El entrevistado responderá a esta pregunta sólo si no se pueden obtener los costos desagregados Σ B1-3	Costos directos totales Σ A1-7) + (Σ B1-3)	Reembolso del seguro médico	

1ra		D: H:	D: H:															
2da		D: H:	D: H:															
3ra		D: H:	D: H:															
4ta		D: H:	D: H:															
5ta		D: H:	D: H:															
6ta		D: H:	D: H:															
7ma		D: H:	D: H:															
8ª		D: H:	D: H:															


9ª
D:
H:
D:
H:
10ª
D:
H:
D:
H:
Tiempo total
(para el lucro cesante)
ΣD:
ΣH:
Gastos médicos en efectivo, total
Σ A
Gastos no médicos en efectivo, total
Σ B
Costos directos brutos por consulta
ΣA+B

Reembolsos totales	ΣC	
Costos directos totales (netos) (A)+(B)-(C), total		

Parte V. Gastos durante el actual tratamiento para tuberculosis sensible o tuberculosis multirresistente (se debe completar para todos los pacientes) A los pacientes en la segunda fase se les debe preguntar por hospitalizaciones y consultas solo en esta fase			
Pregunta	Categorías de las respuestas (encierre en un círculo el número apropiado o escriba la respuesta en la línea correspondiente)	Instrucciones para el entrevistador y acciones	**Código de la variable**
50. ¿Está hospitalizado actualmente?	1. Sí 2. No		Hosp

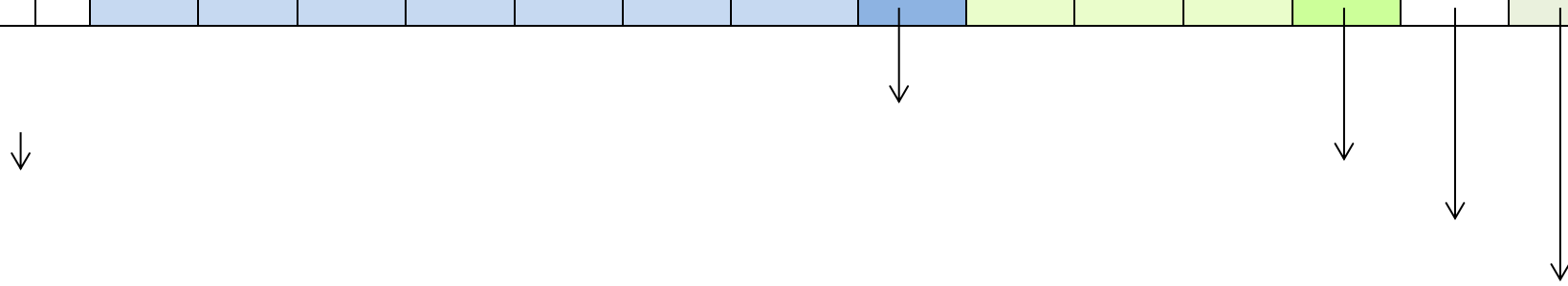
51. ¿Ha sido hospitalizado <u>durante su fase de tratamiento antituberculoso actual</u> y debido a la tuberculosis? ¿En caso afirmativo, cuántas veces?	1.Sí _____ veces 2.No	1. Concierne solo a la hospitalización durante la actual fase de tratamiento: Para pacientes en la segunda fase, preguntar solamente por la hospitalización en esta fase. 2. No incluye hospitalizaciones antes del inicio del actual tratamiento antituberculoso: • Para casos nuevos, las hospitalizaciones antes del inicio del tratamiento antituberculoso se deben consignar en la Parte IV. • Para casos de retratamiento, las hospitalizaciones durante los tratamientos anteriores se deben consignar en la Parte III.	Hosp _prev
52. ¿ Aproximadamente cuánto dinero y tiempo le demandó cada una de estas consultas u hospitalizaciones?	• Ver el cuadro siguiente y preguntar sobre cada punto • Para todo lo que no sea aplicable, marque o seleccione NA • Si hubo costos, pero el paciente no recuerda el monto, marque NR • ¡Agregue más filas si el paciente realizó más consultas u hospitalizaciones durante esta fase. Explicación de los títulos del cuadro: Tipo de prestador: Indique el tipo de prestador según las categorías en la pregunta 51 Número de días de hospitalización: Incluye **consultas ambulatorias y hospitalizaciones**. Debe completarse en orden cronológico Tarifas diarias: Tarifas totales por los días de hospitalización para toda la estadía. Solo se completará si no está incluido en los gastos consignados más abajo) Honorarios por consulta: Otros costos no cubiertos en el punto de tarifas diarias, incluidos pagos directos al personal de atención de salud Radiografías y otros estudios por imágenes: Toda investigación mediante estudios por imágenes (radiografía, tomografía computarizada, ecografía) específicos para tuberculosis y otros	

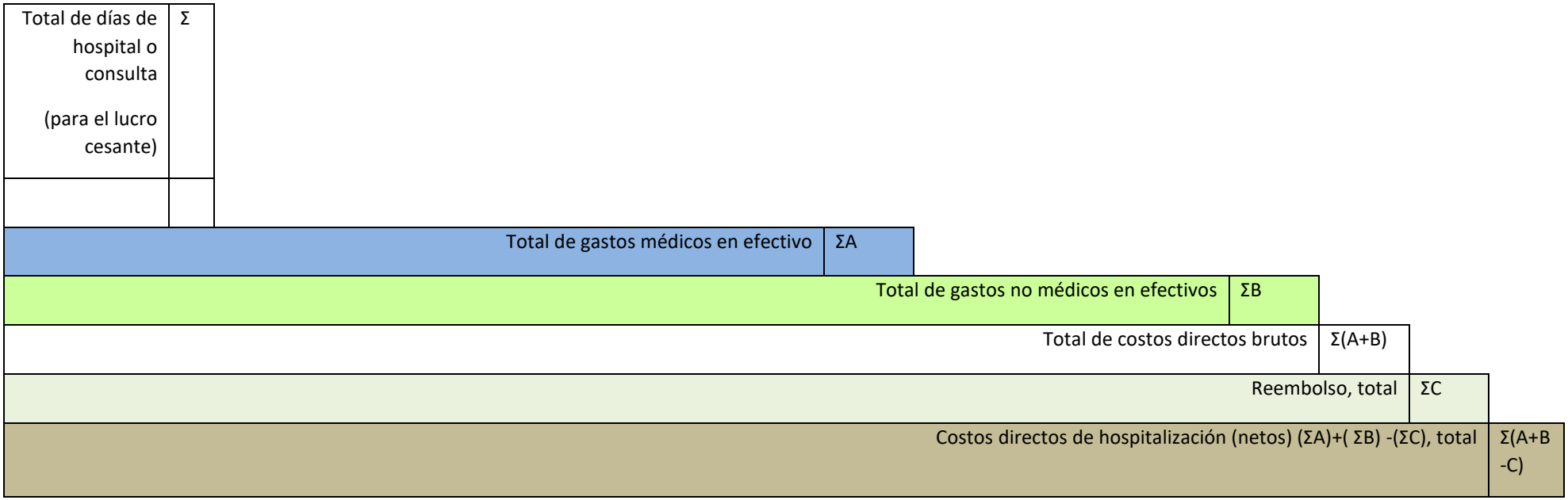
	Costo de las pruebas de laboratorio: Incluye todas las pruebas, específicas para tuberculosis y otras; incluye el costo del transporte de las muestras, si lo pagó el paciente Otros procedimientos: incluye biopsia, lavado bronquial, etc. pero no intervenciones quirúrgicas no relacionadas con la tuberculosis Medicamentos antituberculosos: Costo de medicamentos antituberculosos solamente, comprados dentro o fuera de hospital Otros medicamentos, incluidos los suplementos nutricionales: Cualquier otro medicamento, incluidos los suplementos nutricionales Costos médicos totales directos: Suma de todos los costos directos en efectivo. Si el paciente no puede recordar el costo de cada uno, pregunte por los costos médicos totales e ingréselos solo aquí Gastos por traslado: Costo directo del viaje al establecimiento (no incluye el lucro cesante) tanto de los pacientes como de cualquier integrante del grupo familiar Gastos de alimentación: Se refiere a los costos adicionales en comidas en relación con el traslado a la consulta de atención médica y durante la visita u hospitalización, tanto del paciente como de cualquier integrante del grupo familiar Otro, incluido el alojamiento: Incluye el costo de rentar una habitación/cama durante las consultas y cualquier otro gasto no médico relacionado con la consulta de atención de salud, tanto del paciente como de cualquier integrante del grupo familiar Reembolso del seguro médico: Monto reembolsado al paciente por el seguro médico hasta el momento, no incluye los reembolsos previstos en el futuro Costos directos brutos calculados como suma de los gastos médicos directos (A) y los gastos directos no médicos (B). Si el paciente no puede recordar los detalles de los costos anteriores o tiene una factura del hospital para todos los costos combinados, pregunte por los costos directos totales de la hospitalización

	Costos netos directos, total de gastos médicos en efectivo, total de gastos no médico en efectivo, total de reembolsos y costo neto total: Debe calcularlos el supervisor después de la entrevista. No se calculan durante la entrevista

				Costos médicos directos en efectivo, total por estadía en el hospital(A)								Costos no médicos directos en efectivo, total por estadía en el hospital(B)				Costos brutos directos por estadía A+B	(C)	Costo neto directo por estadía (A+B-C)
Consulta u hospitalización	Tipo de prestador (véase lista)	Días de hospitalización Incluye consultas ambulatorias	Tiempo de viaje	Tarifas diarias (total para la estadía) A1	Honorarios por consulta (total para la estadía) A2	Radiografía y otros estudios por imágenes (total para la estadía) A3	Pruebas de laboratorio incluido costo de transporte de las muestras (total para la estadía) A4	Otros procedimientos, incluidas cirugía, biopsia, etc. A5	Medicamentos antituberculosos (total para la estadía) A6	Otros medicamentos, incluidos suplementos nutricionales (total para la estadía) A7	Costos médicos totales directos El entrevistado responderá a esta pregunta sólo si no se pueden obtener los	Viajes (total para la estadía) B1	Alimentos (total para la estadía) B2	Otro (ropa blanca, jabón, otros costos administrativos y por servicios) (total para la estadía) B3	Total costos no médicos directos en efectivo El entrevistado responderá a esta pregunta sólo si no se pueden obtener	Costos directos totales	Reembolso del seguro médico	

											costos desagregados ΣA1-7				los costos desagregados ΣB1-3			
1ra																		
2da																		
3ra																		
4ta																		
5ta																		
6ta																		





Costos relacionados con el DOT y gastos en alimentos durante el tratamiento ambulatorio

Pregunta	Categorías de las respuestas (encierre en un círculo el número apropiado o escriba la respuesta en la línea correspondiente)	Acción del entrevistador	**Código de la variable**
53. ¿Tratamiento bajo observación directa (DOT)?	1. DOT 2. Otro _____	• La consulta del DOT(tratamiento bajo observación directa) es para la supervisión de la toma diaria de los medicamentos; es decir que se hacen todos los días Estas preguntas no se refieren a los viajes menos frecuentes para recoger los medicamentos (por ejemplo semanalmente) que se abordarán de la pregunta 60 en adelante • Esta pregunta concierne a la fase de tratamiento en la que se encuentra actualmente el paciente	Saf Dot
54. Si es DOT, cuantas veces a la semana?	De facto es 6 días para sensibles y MDR	Lo máximo deberá ser 7 veces a la semana	Dot n

55. ¿Si está en tratamiento bajo observación directa, quién lo administra y quién actúa como apoyo?	1. Establecimiento de salud 2. Agente sanitario de la comunidad o voluntario 3. Lugar de trabajo 4. Miembro de la familia 5.Otro_____		*Drug_admin_type_bis*
56. Si está en tratamiento bajo observación directa, ¿cuánto tiempo le demandó la última asistencia a su tratamiento DOT, incluidos el tiempo de viaje y el tiempo de espera (tiempo total)?	….. minutos		*Travel_dur_dot*
57. ¿Cuál fue el costo del transporte (regreso) para la última asistencia a su tratamiento DOT, incluido todos los costos (peaje, parqueo, etc.), en total para usted y para cualquier miembro del grupo familiar que lo acompañara?			*C_travel_dot*
58. ¿Cuánto gastó en alimentos y bebidas para la última asistencia a su tratamiento DOT (en el camino, mientras esperaba, en el almuerzo etc.), en total para usted y cualquier miembro de la familia que lo acompañara?			*C_food_dot*

Costos relacionados con la retirada de fármacos y alimentos durante el tratamiento ambulatorio			
59. ¿Usted o un miembro de su familia retira los fármacos antituberculosos para llevárselos al supervisor/persona de apoyo del DOT)?	1. Sí .No	Esto no se relaciona con las asistencias al tratamiento DOT, que se deben registrar en las preguntas 54 a 59, pero se debe completar si el paciente u otro miembro de su familia va a buscar los medicamentos para llevárselos al prestador del DOT Si el paciente está en tratamiento DOT y ni él ni un familiar va a buscar los medicamentos para llevárselos al prestador, la respuesta es negativa En ese caso, pasar a la pregunta 68	*4drug*
60. En caso afirmativo, ¿con qué frecuencia usted o un miembro de su familia recoge los fármacos antituberculosos en la fase de tratamiento actual?	Una vez por semana Cada 2 semanas Todos los meses Otro_____		*4drug_n*

61. Hizo algún pago (incluyendo en especie) para recoger los medicamentos	1. Sí .No		*Pay_drugs*
62. ¿Pagó honorarios al prestador del DOT?	1. Sí En caso afirmativo, monto:_____ 2. No		*C_4drug*
63. ¿Dónde recoge usted, o un miembro de su familia, los fármacos antituberculosos?	1. Puesto de Salud 2. Centro de salud 3. Hospital de segundo nivel	Si el paciente ha acudido a diferentes lugares, marcar el más reciente.	*Drug_srce*
64. ¿Cuánto gastaron en alojamiento usted y el miembro de su familia que lo acompañó, cuando fue a retirar los medicamentos la última vez?			C_Lodge_4drug
65. ¿Cuánto tiempo le llevó la última consulta/visita para retirar los medicamentos, incluidos el tiempo del viaje y el tiempo de espera (total de tiempo)?	….. minutos		*visit_dur_4drug*

66. ¿Cuál fue el costo del transporte (regreso) la última vez que recogió los medicamentos, incluido todos los costos (ejm: peaje, parqueo, etc.), en total para usted y para cualquier miembro del grupo familiar que lo acompañara?			C_travel_4drug
67. ¿Cuánto gastó en total en alimentos y bebidas la última vez que fue a recoger los medicamentos (en el camino, mientras esperaba, en el almuerzo etc.), usted y cualquier miembro de la familia que lo acompañara?			C_food_4drug

Costo relacionado con las consultas ambulatorias de seguimiento (ver al doctor o la enfermera, hacerse pruebas)			
Pregunta	Categorías de las respuestas (encierre en un círculo el número apropiado o escriba la respuesta en la línea correspondiente)	Acción del entrevistador	**Código de la variable**
68. A cuántas consultas de seguimiento médico relacionado con la tuberculosis ha acudido usted hasta el momento, en esta fase del tratamiento (ver al doctor o la enfermera, hacerse pruebas de seguimiento)?	____consultas	Esto se relaciona con el examen clínico, el seguimiento y las consultas adicionales por efectos no deseados u otras cuestiones relacionadas con	fu

		la tuberculosis. No incluye visitas del DOT ni para recoger medicamentos Para los pacientes en fase II o III (retratamiento) preguntar solamente número de consultas desde el inicio de la fase I.	
69. ¿Cuánto tiempo le llevó la última consulta ambulatoria de seguimiento, incluidos el tiempo del viaje y el tiempo de espera (tiempo total)?	….. minutos		*Travel_dur_fu*
70. ¿Cuál fue el costo del transporte (regreso) para la última consulta ambulatoria de seguimiento, incluido el estacionamiento, en total para usted y para cualquier miembro del grupo familiar que lo acompañara?		Costo relacionado con la última consulta Si la entrevista tiene lugar al finalizar esa consulta, utilice el costo de la presente consulta	C_travel_fu
71. ¿Cuánto gastó, en total, en alojamiento cuando acudió a la última consulta, para usted y cualquier miembro de su familia que lo acompañara?		Costo relacionado con la última consulta	C_lodge_fu

		Si la entrevista tiene lugar al finalizar esa consulta, utilice el costo de la presente consulta	
72. ¿Qué honorarios pagó en la última consulta ambulatoria de seguimiento por consulta?	Honorario por consulta … … …	Costo relacionado con la última consulta Si la entrevista tiene lugar al finalizar esa consulta, utilice el costo de la presente consulta	C_visit_Reg
73. ¿Qué honorarios pagó en la última consulta ambulatoria de seguimiento por radiografía y otros estudios por imágenes?			C_visit_xray
74. ¿Qué honorarios pagó en la última consulta ambulatoria de seguimiento por pruebas, pruebas de tuberculosis y otras?	Honorarios por pruebas … … …	Costo relacionado con la última consulta Si la entrevista tiene lugar al finalizar esa consulta, utilice el costo de la presente consulta	C_visit_Test
75. ¿Qué honorarios pagó en la última consulta ambulatoria de seguimiento por otros procedimientos?		Costo relacionado con la última consulta	C_visit_nTBtest

		Si la entrevista tiene lugar al finalizar esa consulta, utilice el costo de la presente consulta	
76. ¿Cuánto pagó en la última consulta ambulatoria de seguimiento por <u>medicamentos antituberculosos</u>, incluidas las prescripciones de medicamentos que compró fuera del establecimiento?	Gastos en medicamentos … … ….	Costo relacionado con la última consulta Si la entrevista tiene lugar al finalizar esa consulta, utilice el costo de la presente consulta	C_visit_Drug
77. ¿Cuánto pagó en la última consulta ambulatoria de seguimiento por <u>otros medicamentos</u>, incluidos los suplementos nutricionales?		Costo relacionado con la última consulta Si la entrevista tiene lugar al finalizar esa consulta, utilice el costo de la presente consulta	C_visit_nTBdrugs
78. ¿Qué <u>otros honorarios</u> no enumerados en las preguntas anteriores pagó en la última consulta ambulatoria de seguimiento?	Otros honorarios … … … ….	Costo relacionado con la última consulta Si la entrevista tiene lugar al finalizar esa consulta, utilice el costo la	C_visit_Other

		presente consulta y proporcione ejemplos locales	

Costo de los suplementos nutricionales			
79. ¿Compra algún suplemento nutricional <u>fuera de su régimen alimentario habitual</u> debido a la tuberculosis, por ejemplo vitaminas por recomendación del personal de atención de salud?	1. Sí 2.No	En caso negativo, pasar a la pregunta 80	Nut_supple
80. En caso afirmativo, ¿aproximadamente cuánto gastó en los suplementos nutricionales por ejemplo en la última semana?			C.nut_supple
Costo por alimentos fuera de la dieta regular recomendado por el personal de atención de salud			
81. ¿Compra algún alimento adicional <u>fuera de su régimen alimentario habitual</u> debido a la tuberculosis, por ejemplo, carne, bebidas energéticas o frutas por recomendación del personal de atención de salud?			*Food_diet*
82. En caso afirmativo, ¿aproximadamente cuánto gastó en los alimentos adicionales por ejemplo en la última semana?			*C_food_diet*
Tiempo utilizado de los tutores (acompañantes)			

• No se debe rellenar si el paciente tiene menos de 15 años. En el caso de los niños, todas las preguntas referidas a costos, tiempo invertido, ingresos y perdida de ingresos económicos en las secciones IV y V conciernen a los costos para los tutores • Nota: Los gastos en efectivo para transporte, alimentos y alojamiento del tutor se deben incluir en las preguntas de la Parte V (cuadros)			
Pregunta	Categorías de las respuestas (encierre en un círculo el número apropiado o escriba la respuesta en la línea correspondiente)	Acción del entrevistador	**Código de la variable**
83. ¿Alguien de su familia lo acompañó a la última: a) Asistencia al DOT b) Consulta para recoger los medicamentos (o fue en lugar suyo a recoger los medicamentos) c) Consulta de seguimiento d) Hospitalización	1. Sí 2. No 1. Sí 2. No 1. Sí 2. No 1. Sí 2. No	Varias respuestas posibles La pérdida de tiempo se calculará a partir de las respuestas anteriores del paciente	guard
84. En caso afirmativo, ¿Cuantas personas lo acompañaron?	____ personas		Number_guards
85. ¿Ese tiempo significó pérdida de ingresos para esa persona?	1. Sí 2. No	Si hubiera varias respuestas a la pregunta 80, preguntar	Yloss_guard

		sobre la última consulta a la que lo acompañó un familiar	

Plan de seguro médico			
Pregunta	Categorías de las respuestas (encierre en un círculo el número apropiado o escriba la respuesta en la línea correspondiente)	Acción del entrevistador	**Código de la variable**
86. ¿Tiene cualquiera de los siguientes tipos de seguro médico?	1. Seguro a corto plazo (Cajas de salud) 2. Seguro médico privado 3. Donante 4. Fondo familiar o comunitario 5. Subsidio 6. Plan de reembolsos		ins1 ins2 ins3 ins4 ins5 ins6 ins7

	7. Otro (especificar) 8. No tiene ningún seguro		ins8

Posición social			
Pregunta	Categorías de las respuestas (encierre en un círculo el número apropiado o escriba la respuesta en la línea correspondiente)	Acción del entrevistador Si el paciente es menor de 15 años, estas preguntas son para el tutor	**Código de la variable**
87. Qué nivel de educación completó?	1. No comenzó todavía la escuela 2. No fue a la escuela 3. Escuela primaria 4. Escuela secundaria 5. Universidad	Convertir al número de años _____	Edu Edu_other

	6. Posgrado 7. Otro O, total de años de escolaridad: _____	Si el paciente es menor de 15 años, estas preguntas son para el tutor	
88. ¿Qué nivel de educación completó el jefe de hogar/principal sostén económico del hogar?	1. No comenzó todavía la escuela 2. No fue a la escuela 3. Escuela primaria 4. Escuela secundaria 5. Universidad 6. Posgrado 7. Otro O, total de años de escolaridad: _____: _____	Convertir al número de _____años Si el paciente es menor de 15 años, estas preguntas son para el tutor	Edu_main Edu_main_oth
89. ¿Cuál es su ocupación principal?	1. Estudiante 2. Técnico 3. Servicios	Si el paciente es menor de 15 años, estas preguntas son para el tutor	Empl_type Empl_oth

	4. Obrero 5. Agricultor 6. Empleado del gobierno 7. Profesor 8. Jubilado 9. Ama de casa 10. Desempleado 11. Comerciante 12. Otro (especificar) _____		
90. ¿Cuál era su empleo principal, o trabajo habitual, u otra actividad habitual, antes de contraer tuberculosis?	0. Desempleado 1. Trabajo remunerado formal 2. Trabajo remunerado informal 4. Jubilado 5. Estudiante 6. Ama de casa 7. Otro (especificar):_____	Si el paciente es menor de 15 años, esta pregunta es para el tutor Esto se refiere a la época anterior al desarrollo de los síntomas de tuberculosis. Mencione primero todas las opciones	Empl_form_prev Empl_oth_prev Automatic check: Empl_*_oth vs Empl_*
Construcción de un índice de situación socioeconómica con preguntas sobre activos del hogar. Las preguntas de esta sección se usan para calcular un rango de ingresos para los cálculos de costos indirectos, y también como una medida de los gastos e ingresos de los hogares para el denominador de la medida del costo			

catastrófico. Los ingresos declarados (preguntas 88 a 92) son el dato que menos se prefiere en países en los que la economía informal es importante, de modo que adaptar correctamente las preguntas es clave para estimar los ingresos o gastos de los hogares. El investigador principal debe diseñar estas preguntas utilizando puntuaciones para activos validadas en base a la última encuesta socioeconómica o de demografía y salud en el país. La selección apropiada de las preguntas es esencial. La puntuación por paciente se obtendrá en relación con la de otros pacientes. La cartografía de quintiles que se puede asignar a los hogares se basa en las puntuaciones de los activos. Las respuestas a las preguntas sobre activos se utilizarán para elaborar una "puntuación de pobreza" para cada uno de los que responden a la encuesta, a través del análisis de componentes. Este procedimiento estadístico pondera las preguntas según su capacidad para separar a los individuos en grupos de riqueza. A continuación se muestran las preguntas que han resultado útiles como indicadores de la distribución del ingreso en la (última) Encuesta de Hogares 2010 de Camboya. El análisis de los componentes principales se utilizó para asignar los hogares a un quintil de ingresos. Las preguntas aparecen aquí meramente como ejemplo. Sírvase recurrir al investigador principal (y al estadístico) para la adaptación de esta sección.			
91. ¿En su hogar hay?	Juego de Living 1. Sí 2. No Computadora (laptop o tablet PC, etc) 1. Sí 2. No Radio o Radiograbador		*Living* *Computer* *Radio* *Wacher m* *motorcycle*

	1. Sí 2. No Lavadora de ropa 1. Sí 2. No Motocicleta (para uso del hogar) 1. Sí 2. No Automóvil (para uso del hogar) 1. Sí 2. No Cocina (a gas, eléctrica, etc.) 1. Sí 2. No Refrigerador o freezer 1. Sí 2. No Minicomponente o Equipo de Sonido 1. Sí 2. No Televisor		*car* *stove* *freezer* *stero* *television*

	1. Sí 2. No		
Ingresos (declarados) antes de enfermar de tuberculosis En países con importante economía informal, las respuestas a estas preguntas se deben examinar críticamente y comparar con los ingresos estimados sobre la base de las puntuaciones de activos (preguntas precedentes)			
92. ¿Era usted la persona que más ganaba en su hogar antes de enfermar de tuberculosis?	1. Si 2. No	Si el paciente es menor de 15 años, esta pregunta es para el tutor	Empl_main
93. ¿Cómo le pagaban habitualmente antes de que enfermara de tuberculosis?	1. En efectivo 2. En especie 3. En efectivo y en especie 4.Sueldo por transferencia bancaria 5. No cobraba	Si el paciente es menor de 15 años, esta pregunta es para el tutor	Paid_type
94. ¿Cuántas horas a la semana trabajaba antes de enfermar de tuberculosis?	_____horas	Si el paciente es menor de 15 años, esta pregunta es para el tutor	Empl_dur_prev

		Esto se refiere a la época anterior a que aparecieran los síntomas de tuberculosis	
95. Si estuviera en un trabajo remunerado, en cuanto estimaría su salario promedio o ingreso bruto promedio por las actividades laborales (ingreso laboral) por mes antes de que enfermara por TB?	1. (salario promedio) 2.(Ingreso bruto)	Si el paciente es menor de 15 años, esta pregunta es para el tutor Puede ser presentado en franjas de ingresos si al paciente le cuesta especificar	Welfare_pat_pre Inc_pat_pre
96. ¿Cuál calcula que era el ingreso mensual promedio de su hogar antes de que usted enfermara de tuberculosis?		Se refiere a todas las personas que integran el grupo familiar Puede ser presentado en franjas de ingresos si al paciente le cuesta especificar	Inc_hous_pre Welfare_hous_pre Gov_hous_pre Other_hous_pre

Modificación de los ingresos y consecuencias sociales

Pregunta	Categorías de las respuestas (encierre en un círculo el número apropiado o escriba la respuesta en la línea correspondiente)	Acción del entrevistador Si el paciente es menor de 15 años, estas preguntas son para el tutor	**Código de la variable**
97. ¿Cuál es su empleo principal, o trabajo habitual, u otra actividad habitual?	1. Gerente 2. Profesional 3. Técnico 4. Personal de apoyo administrativo 5. Trabajadores de servicios o vendedores 6. Agricultor 7. Artesano o comerciante relacionados 8. Operador de plantas o maquinarias 9. Fuerzas armadas	Si el paciente es menor de 15 años, esta pregunta es para el tutor	Empl Empl_oth

	10. Otro (especificar):_____		
98. ¿ Si ahora está en la fase II o III del tratamiento, cuál era su empleo principal, o trabajo habitual u otra actividad habitual en la fase intensiva del tratamiento?	1. Gerente 2. Profesional 3. Técnico 4. Personal de apoyo administrativo 5. Trabajadores de servicios o vendedores 6. Agricultor 7. Artesano o comerciante relacionados 8. Operador de plantas o maquinarias 9. Fuerzas armadas 10. Otro (especificar):_____	Si el paciente es menor de 15 años, esta pregunta es para el tutor Esto se refiere al tiempo desde que comenzó el tratamiento antituberculoso hasta el final de la fase I	Empl_intens

99. ¿Cuál calcula que es su ingreso mensual promedio ahora?	1. (salario promedio) 2.(Ingreso bruto)	Si el paciente es menor de 15 años, esta pregunta es para el tutor Puede ser presentado en franjas de ingresos si al paciente le cuesta especificar	**Inc_pat_tb**
100. ¿Cuál calcula que es el ingreso mensual promedio, de su hogar ahora?	(ingreso bruto mensual)	Se refiere a todos los integrantes del grupo familiar Puede ser presentado en franjas de ingresos si al paciente le cuesta especificar	**Inc_hous_tb**
101. ¿Cuántas horas por semana trabaja ahora?	____horas	Si el paciente es menor de 15 años, esta pregunta es para el tutor	Empl_dur_tb
102. ¿Si usted está ahora en la fase II o III, cuántas horas por semana estuvo trabajando en la fase I ?	____horas	Si el paciente es menor de 15 años, esta pregunta es para el tutor	Empl_dur_intens

		Esto se refiere al tiempo desde que comenzó el tratamiento antituberculoso hasta el final de la fase I.	
103. ¿Aproximadamente cuántos ingresos – en jornadas laborales - perdió por la tuberculosis, en total?	… días hábiles antes del diagnóstico de tuberculosis (pero debido a la enfermedad) Y … días hábiles después del diagnóstico de tuberculosis	Ingresos en días hábiles: si un paciente no pudo ir a trabajar durante 5 medias jornadas y perdió esos ingresos, el número de días perdidos es 0,5*5=2,5 Incluye todos los episodios relacionados con la tuberculosis, incluidos todos los días anteriores y posteriores a los perdidos	lost_tb_pre lost_tb_now lost_tb_tot
104. ¿Usted, o su familia, recibió alguna ayuda monetaria de la asistencia social después de que le diagnosticaran tuberculosis? En caso afirmativo, de qué tipo y por qué monto en el último mes?	0. No 1. Opción 1____por mes 2. Opción 2____por mes 3. Opción 3____por mes 4. Opción 4____por mes	Si el paciente es menor de 15 años, esta pregunta es para el tutor Las categorías son las siguientes:	Welfare_type_TB

		1. Licencia por enfermedad remunerada 2. Subvención por incapacidad 3. Transferencia de dinero para familias pobres 4. Otra transferencia de dinero _____	
105. ¿Actualmente recibe vales o productos para hacer frente a la enfermedad? En caso afirmativo, cuáles	1. Sí: a. Vales para transporte b. Ayuda alimentaria c. Otros, facilitadores etc._____ 2. No	Si el paciente es menor de 15 años, esta pregunta es para el tutor Se permite más de una categoría En caso negativo, pasar a la pregunta 103	*Cop_kind*

106.¿De quién recibe los vales o productos?	1. Gobierno 2. ONG 3. Empleador 4. Donación privada 5. Otro, especificar……..	Si paciente es menor de 15 años, esta pregunta es para el tutor Se permite más de una respuesta	*Cop_kind_srce*
107.¿Cuántos adultos y niños duermen regularmente en su casa? (incluido el paciente, en el momento de diagnóstico)	Adulto # Niños (0 a 14 años) #		Hous_membr
108.¿Cuántas habitaciones tiene la casa sin contar el baño?	#		Hous_room
109.¿Además de usted, alguien más en su hogar recibe tratamiento antituberculoso? En caso afirmativo: ¿cuántas personas?	1. Sí: _____ persona (s) 2.No	En caso negativo, pasar a la pregunta final	Hous_tb
110.¿Ha afectado la tuberculosis su vida social o personal de cualquier manera?	1. No 2. Inseguridad alimentaria 3. Divorcio o separación del cónyuge o la pareja 4. Pérdida del trabajo 5. Interrupción de la escolaridad	Se permite más de una categoría	Social Social_oth

	6. Exclusión social 7. Otro _____		

Estrategias para hacer frente a la enfermedad			
Pregunta	Categorías de las respuestas (encierre en un círculo el número apropiado o escriba la respuesta en la línea correspondiente)	Acción del entrevistador Si el paciente es menor de 15 años, esta pregunta es para el tutor	
111. ¿Usted o su familia tuvieron que recurrir a ahorros (en efectivo o depositados en bancos) para cubrir los costos relacionados con la tuberculosis?	1. Sí 2.No	En caso negativo, pasar a la pregunta 110	*S*
112. En caso afirmativo, cuánto: a) ¿Antes de iniciar el tratamiento antituberculoso? b) ¿En la fase I del tratamiento? c) ¿En la fase II o III del tratamiento? d) En general	_____antes de que el tratamiento antituberculoso comenzara _____en la fase I _____en la fase II o III _____ en general	En caso de no disponer de los detalles por fase de tratamiento, pregunte sobre el total	*S_pre* *S_int* *S_cont* *S_tot*

113. ¿Pidió prestado dinero para sufragar los costos relacionados con la enfermedad?	1. Sí 2.No	En caso negativo, pasar a la pregunta 116	*loan*
114. En caso afirmativo, ¿cuánto pidió prestado a) ¿Antes de comenzar el tratamiento antituberculoso? b) ¿En la fase I del tratamiento? c) ¿En la fase II o III del tratamiento? d) ¿En general?	_____antes de que el tratamiento antituberculoso comenzara _____en la fase I _____en la fase II o III _____en general		Rcvd_loan
115. ¿A quién le pidió prestado?	1. Familia 2. Vecinos o amigos 3. Banco privado 4. Cooperativa 5. Empleador 6. "Prestamista extraoficial" (mercado negro)	Se permiten múltiples respuestas Encierre en un círculo todas las respuestas	*Rcvd_loan_srce*

	7. Otro, especificar		
116. ¿Se espera que reembolse el o los préstamos?	1. Sí 2.No	En caso negativo, confirmar que es una donación y pasar a la pregunta 116	*Rcvd_donation*
117. ¿Ha comenzado a reembolsar el préstamo? En caso afirmativo, ¿cuándo?	1. Sí, antes de que el tratamiento comenzara 2. Sí, durante la fase I del tratamiento 3. Sí, durante la fase II o III 4. No	Si la respuesta es negativa saltar a la pregunta 116	*Loan_back*
118. ¿Cuál es el monto mensual del reintegro del préstamo, incluidos los intereses?	1. Cantidad_____ por mes 2. No ha comenzado a pagar el préstamo ni los intereses	En caso de pagos informales, dilucide el monto mensual promedio, si hubiera	*C_loan*
119. ¿Ha vendido algún bien de su propiedad para financiar el costo de la enfermedad?	1. Sí 2. No	En caso negativo, pasar a la pregunta 121	*cop*
120. En caso afirmativo, ¿qué vendió?	1. Terreno 2. Ganado 3. Transporte/vehículo	Se permite más de una respuesta Encierre en un círculo todas las respuestas	*Cop_srce*

	4. Enseres domésticos 5. Productos agrícolas 6. Oro/joyas 7. Otro (especificar): _____		
121. En caso afirmativo, ¿cuándo vendió?	1. Antes de que el tratamiento antituberculoso comenzara 2. En la fase I 3. En la fase II o III	Se permite más de una respuesta Encierre en un círculo todas las respuestas	*Cop_t*
122. ¿Cuánto dinero recibió por la venta de todos los bienes de su propiedad a) ¿Antes de comenzar el tratamiento antituberculoso? b) ¿En la fase I del tratamiento? c) ¿En la fase II o III del tratamiento? d) ¿En general?	_____antes de que el tratamiento antituberculoso comenzara _____en la fase I _____en la fase II o III _____en general		*cop_pre* *cop_int* *cop_cont* *cop_tot*

123. ¿Cuál era el ingreso mensual que generaban anteriormente los bienes que ahora ha vendido?	1. Sí, (monto)____ 2. No		*yield*
124. ¿Cuál es el valor de mercado calculado de todos los bienes que vendió?	Monto_____		*Cop_value*
125. ¿Alguien de su familia debió abandonar o interrumpir sus estudios para ayudar en el hogar como consecuencia de su enfermedad?	1. Sí, ____ personas 2. No	Si la respuesta es negativa, pasar a la pregunta 123	*dropschol*
126. ¿Cuál era la edad y sexo (de los familiares) y por cuánto tiempo abandonaron los estudios?	1. Edad:__ Sexo:__ Duración:__ meses 2. Edad:__ Sexo:__ Duración:__ meses 3. Edad:__ Sexo:__ Duración:__ meses	Use una línea por persona que abandonó o interrumpió los estudios	*Dropschol_age* *Dropschol_t* *Dropschol_sex*
127. ¿En una escala de 1 a 5, en la que 1 es ninguna repercusión y 5 es repercusión muy importante, en qué medida la enfermedad afectó la economía del hogar?	1 = Ninguna repercusión 2 = Poca repercusión 3 = Repercusión moderada 4 = Gran repercusión 5 = Repercusión muy importante		*Ecoimpct*

Otros miembros de la familia en tratamiento?			
Pregunta	**Categorías de las respuestas** (encierre en un círculo el número apropiado o escriba la respuesta en la línea correspondiente)	**Acción del entrevistador** Si el paciente es menor de 15 años, esta pregunta es para el tutor	**Nombre de la variable**
128. Cuantos miembros de tu familia están en tratamiento actualmente?	1. Si(Número) ____ 2. No	Si no, pase a final de cuestionario.	Member2
129. Categoría del establecimiento de salud para el miembro(s) de la familia enfermo	1. Puesto de Salud 2. Centro de Salud 3. Hospital de Segundo Nivel Otro _____	Si hay más de un miembro adicional del hogar, por favor anote por separado las respuestas para cada miembro del hogar.	Facility_member2

¡Gracias por su cooperación! ¿Hay algo más que quisiera preguntar o decir?

Observaciones del entrevistador:

Fecha (dd/mm/aaaa):	… …/ … …/ … ….	Firma del entrevistador:	… …

9.2 Approval note by the Ethics Committee of the Faculty of Medicine of the Universidad Mayor de San Simón, Cochabamba, Bolivia

UNIVERSIDAD MAYOR DE SAN SIMON
FACULTAD DE MEDICINA

RECIBIDO
25 ENE. 2017
FACULTAD MEDICINA - UMSS
IIBISMED
Cochabamba - Bolivia

Señor.
Dr. Marcelo Rojas Mattos.
Doctorante del convenio ARES-CCD/UMSS/UCL.
Presente

De: Comité de Bioética de la Facultad de Medicina
UNIVERSIDAD MAYOR DE SAN SIMON
Cochabamba - Bolivia
Fecha: 23 de diciembre de 2016.

En reunión efectuada el día 22 de diciembre de 2016, se ha considerado el protocolo del proyecto de investigación: ***"Determinar los costos directos e indirectos causados por la tuberculosis y estimar la proporción de hogares afectados por esta enfermedad que sufren costos catastróficos, en el departamento de Cochabamba".***

El comité de Bioética de la Facultad de Medicina de la Universidad Mayor de San Simón, **no encuentra obstáculos** desde el punto de vista de la Bioética para la realización del mencionado proyecto de investigación, por tanto, ha sido de consenso el dar el **VISTO BUENO** a la prosecución de este trabajo investigación.

Agradeceremos se nos haga conocer los resultados de avance de esta investigación de manera oportuna para el seguimiento correspondiente.

Sin otro particular nos despedimos de Usted.

Atentamente.

Dra. Ivonne Jordán Rodríguez.
PRESIDENTE COMITÉ DE BIOETICA

Dr. Jorge Villazón Urquidi.
MIEMBRO COMITÉ DE BIOETICA