



Social determinants of tuberculosis risk in patients with Human Immunodeficiency Virus infection. A single-center observational study.

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Abstract

Introduction: Human immunodeficiency virus (HIV) compromises the immune system, increasing the susceptibility of infected patients to opportunistic infections such as tuberculosis. The objective of this research was to describe the social determinants that act as risk factors for tuberculosis in HIV-infected patients.

Methodology: This observational study was conducted at the “Dr. José Daniel Rodríguez” Hospital in Guayaquil, Ecuador, from December 2022 to December 2024. Patients over 14 years of age with HIV/TB coinfections were included. The variables were age and social determinants (overcrowding, poor nutritional status, drug use, limitations in accessing medical care, poor adherence to treatment, low socioeconomic status, stigma, and discrimination). The source was indirect. The sample was probabilistic, and descriptive statistics were used.

Results: Seventy-six patients with coinfections were registered. Seventy-nine percent were between 27 and 59 years old. Eighty-three percent (63) of the HIV/TB-coinfected population were men. The social determinants were low socioeconomic status (86%); 80% of the participants reported living in overcrowded conditions; likewise, 79%, 76%, 74%, 72% and 55% reported having poor nutritional status, suffering from stigmatization and discrimination due to their condition, having poor adherence to treatment due to their economic deficiencies, having limited access to health and using drugs, respectively.

Conclusions: Social determinants act as risk factors for tuberculosis in HIV-positive patients, such as low socioeconomic status, overcrowded living conditions, poor nutritional status, stigma and discrimination, poor adherence to treatment, limited access to health care, and drug use.

Keywords:

Human immunodeficiency virus, tuberculosis, coinfection, social determinants.

Abbreviations

TB: Tuberculosis.
HIV: Human immunodeficiency virus.

Additional information

No supplementary materials are declared.

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Authors' contributions

Jhoel Alfonso Calva Alberca: Conceptualization, research, writing—original draft, resources, software, supervision.

Ramón Miguel Vargas Vera: Conceptualization, research, writing – original draft, resources, software, supervision.

Carlos Efrén Calva Alberca: Methodology, Data curation, Formal analysis, Funding acquisition, Project management, Validation, Visualization, Writing – review and editing.

Martha Verónica Placencia Ibadango: Conceptualization, Research, Writing – original draft.

Kalid Stefano Vargas-Silva: Conceptualization, Research, Writing – original draft. All the authors read and approved the final version of the manuscript.

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Availability of data and materials

The datasets used and analyzed during the present study are available from the corresponding author upon reasonable request.

Introduction

Coinfection in patients with human immunodeficiency virus (HIV) and tuberculosis (TB) is common; HIV weakens the immune system, which increases the susceptibility of infected patients to opportunistic infections [1–3]. The bacterium *Mycobacterium tuberculosis* causes tuberculosis and can manifest itself in an active or latent form [4].

According to the Joint United Nations Programme on HIV/AIDS (UNAIDS), in 2022, an estimated 10.6 million people worldwide developed TB, with 16% living with HIV. An estimated 30% of AIDS-related deaths are due to TB, making it the leading cause of death among people living with HIV. TB/HIV coinfection is common in sub-Saharan Africa, where high HIV rates and socioeconomic factors promote transmission [5].

For the Pan American Health Organization (PAHO), coinfection is a global issue affecting various regions, including Latin America. In 2019, the region reported 289,000 new TB cases, of which 29,000 were among HIV-positive patients, accounting for 10% of all TB cases. It was also estimated that in that year, 26% of TB deaths occurred in people with coinfection and living in vulnerable conditions [6].

The Ministry of Public Health revealed that the burden of HIV/TB coinfection is concentrated in countries such as Brazil, Haiti, Mexico, Peru, Colombia, the Dominican Republic, and Venezuela, which account for 80% of cases. In Ecuador, HIV/TB coinfection accounted for 1,194 new cases in 2023, including confirmed tuberculosis relapses in HIV-positive patients. This also involved 25 cases among children aged 0–14 years living in limited conditions and areas with high poverty levels [7].

Considering HIV/TB coinfection as a health problem influenced by various factors and social determinants that increase complexity and hinder control, as well as research on these cases [8].

This research aimed to describe the social determinants that act as risk factors for tuberculosis in patients with HIV.

Materials and methods

Study design

This study is observational. The source is retrospective.

Scenery

The study was conducted at the “Dr. José Daniel Rodríguez Maridueña” Infectious Diseases Hospital, part of the Ministry of Public Health of Ecuador, located in Guayaquil, Guayas Province, from December 1, 2022, to December 31, 2024.

Participants

Records of patients over 14 years old with HIV/TB coinfections were included. Patients with one of the positive but unconfirmed diagnoses were excluded.

Variables

The variables included age and social determinants (overcrowding, poor nutritional status, drug use, limited access to medical care, poor treatment adherence, low socioeconomic status, stigma, and discrimination). Other variables included the type of tuberculosis and the presence of other coinfections.

Data sources/measurements

The data source was indirect; an electronic form was completed using information from the institutional medical records. For case screening, multiple searches were conducted for patients diagnosed with HIV using the following ICD-10 codes and derived diagnoses: HIV B 20--B 24; for tuberculosis, the ICD-10 codes were A 15--A 19.

Biases

Observation and selection biases were minimized by applying the participant selection criteria. To reduce potential interviewer, information, and recall biases, the principal investigator maintained the data at all times via a guide and records approved in the research protocol. Two researchers independently analyzed each record in duplicate, and the variables were entered into the database after verifying their consistency.

Study size

The sample was probabilistic. In 2024, 49,000 patients were living with HIV in Ecuador. Guayas accounted for 31.68% of the national cases, corresponding to 15,523 cases. Ninety percent of cases occurred in individuals over 14 years of age, representing a total of 13,970 cases in the study population. With a confidence level of 80%, a 5% confidence limit, and an expected frequency of 13.3%, the calculated sample size was 75 cases. Epi Info™ version 7.7.2 (CDC, Atlanta, March 9, 2025) was used.

Quantitative variables

Descriptive statistics were employed. The results are expressed as frequencies and percentages. Scale variables were not converted to categorical variables.

Statistical analysis. Qualitative variables are presented as frequencies and percentages. The statistical package used was IBM Corp. (released from 2018). IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp.

Results

Participants

Data were collected from a total of 76 patients who met the inclusion criteria, thus meeting 100% of the sample calculations.

Characteristics of the study group

Among the 76 patients, 79% were aged between 27 and 59 years, 12% were between 14 and 26 years, and 9% were over 60. Eighty-three percent (63) of the HIV/TB-coinfected population were men, while the remaining 17% (13) were women. The main social determinant risk factor for HIV/TB coinfection in the studied population was low socioeconomic status, at 86%, followed by 80% of participants reporting living in overcrowded conditions. Additionally, 79%, 76%, 74%, 72%, and 55% of those affected by poor nutritional status, stigmatization and discrimination due to their condition, poor treatment adherence because of financial constraints, limited healthcare access, and harmful substance use, respectively ([Table 1](#)).

Types of tuberculosis

Among the most common types of tuberculosis in the studied population, extrapulmonary tuberculosis was the most prevalent, making up 67% of all cases. Of these patients, 31% had miliary tuberculosis; 25% had tuberculous meningitis; 24% had disseminated tuberculosis affecting the intestines, peritoneum, and mesenteric lymph nodes; and 14%, 4%, and 2% had tuberculosis of the nervous system, peripheral tuberculous lymphadenopathy, and, to a lesser extent, tuberculosis of the bones and joints, respectively. ([Figure 1](#)). The remaining 33% had pulmonary tuberculosis ([Table 1](#)).

Complications and coinfections

Regarding the complications observed in the study population, after reviewing medical records, 68% of patients showed no issues beyond their HIV/TB coinfection; however, 11% had bacterial pneumonia, and 8% and 4% had toxoplasmosis and bacterial sepsis, respectively. Similarly, 3% and 1% of subjects with secondary diagnoses of candidiasis, cryptococcosis, histoplasmosis, herpes zoster, and hepatitis B can be considered to have significant immunosuppression and are more likely to become infected with other diseases ([Table 1](#)).

Table 1. Clinical characteristics of the study group.

	Frequency n=76	Percentage
Age		
14-26 years old	9	12.0%
27-59 years old	60	79.0%
60 or more	7	9.0%
Sex		
Man	63	83.0%
Women	13	17.0%
Social determinants		
Low socioeconomic status	65	86%
Overcrowding	61	80%
Poor nutritional status	60	79%
Stigma and discrimination	58	76%
Poor adherence to treatment	56	74%
Limited access to health care	55	72%
Drug use	42	55%
Type of tuberculosis		
Pulmonary	25	33%
Extrapulmonary	51	67%
Type of tuberculosis		
None	52	68%
Pneumonia bacterial	8	11%
Toxoplasmosis	6	8%
Bacterial sepsis	3	4%
Candidiasis	2	3%
Cryptococcosis	2	3%
Histoplasmosis	1	1%
Shingles	1	1%
Hepatitis B	1	1%

Table 2. Clinical characteristics of the study group.

	Frequency n=76	Percentage
Nonmodifiable factors		
Age : 14 - 26	9	12%
Age: 27 - 59	60	79%
Age: over 60	7	9%
Sex: Female	13	17%
Sex: Male	63	83%
Living conditions: overcrowding	61	80%
Socioeconomic level: low	65	86%
Modifiable factors		
Nutritional status : malnourished	60	79%
Tobacco use	17	22%
Alcohol consumption	15	20%
Drug use	10	13%
Access to health services: poor	55	72%

Social determinants

Information on social determinants as risk factors can be divided into two categories: modifiable and non-modifiable.

Non-modifiable factors included patient age, with 79% in the 27- 59 age group; sex, with a predominance of males at 83%; living conditions, such as overcrowding, which accounted for 80%; and low economic status, which constituted 86% of the study population.

The modifiable social factors mentioned are malnutrition (79%), poor access to healthcare (72%), and substance use (55%), of which tobacco represents 22%, alcohol 20%, and drug use 13% (Table 2).

Discussion

To identify the social determinants that act as risk factors for tuberculosis in HIV-positive patients, a review of the medical records of patients treated at Dr. José Daniel Rodríguez Maridueña Infectious Diseases Hospital in Guayaquil was conducted. The study period included 76 patients from the mentioned health institution who were diagnosed with HIV/TB coinfection from December 2022 to December 2024. This publication describes the social determinants that serve as risk factors for tuberculosis in HIV patients at the Infectious Diseases Hospital, with 86% being from a low economic level, followed by overcrowding, malnutrition, discrimination and stigma, poor adherence to treatment, limited access to health services, and drug use. These results agree with those of previous studies [9], which reported that social determinants related to HIV/TB coinfection include substance use such as alcohol and drugs, youth age, and limited access to timely medical care, which is linked to low economic resources and discrimination against people infected with HIV.

Another study [10] reported that the prevalence of HIV/TB coinfection is high in men, drug users and low-income individuals with poor education, in whom it was found that they have unprotected sex, which has led to HIV infection. This increased the consumption of substances, and not

going to a health center in time caused the progression of the disease and coinfection with tuberculosis, which generated more aggressive clinics and reserved prognoses.

This research categorized social determinants into modifiable and nonmodifiable risk factors. Among the modifiable factors, nutritional status was at 79%, access to health care at 72%, and substance use at 55%. The nonmodifiable factors included age, sex, overcrowding, and low economic resources. This information coincides with another study [11] that describes that classifying determinants in this way makes it easier for the authorities in charge to regulate and search for policies that improve access to health services and patient education, among others; likewise, other studies [12, 13] conclude that there are two groups of social determinants as risk factors that facilitate the comprehensive treatment of subjects, since they aid in clinical management based on the difficulties and individual characteristics of each patient.

To specify the characteristics and complications of tuberculosis in patients infected with HIV, 67% of the population has extrapulmonary TB, while the remaining have pulmonary tuberculosis. Additionally, these patients often have concurrent parasitic infections, bacterial infections, viral infections, and other conditions. The most common infections reported in this group are bacterial pneumonia and toxoplasmosis, which align with the findings of authors [14-16], who identified potential opportunistic pathologies affecting patients with HIV/TB, including herpes zoster, candidiasis, bacterial sepsis, and hepatitis B and C infections, among others.

One limitation of this study is the absence of a control group. Future prospective studies should take these observations into account, as well as the observation of specific alterations such as bone marrow reconversion, renal function, and associated neoplasia in these patient groups [17- 27].

Figure 1. Types of extrapulmonary tuberculosis.

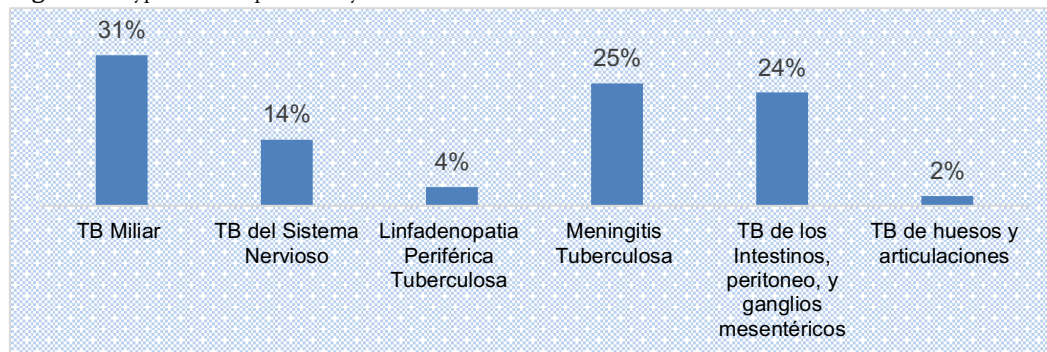
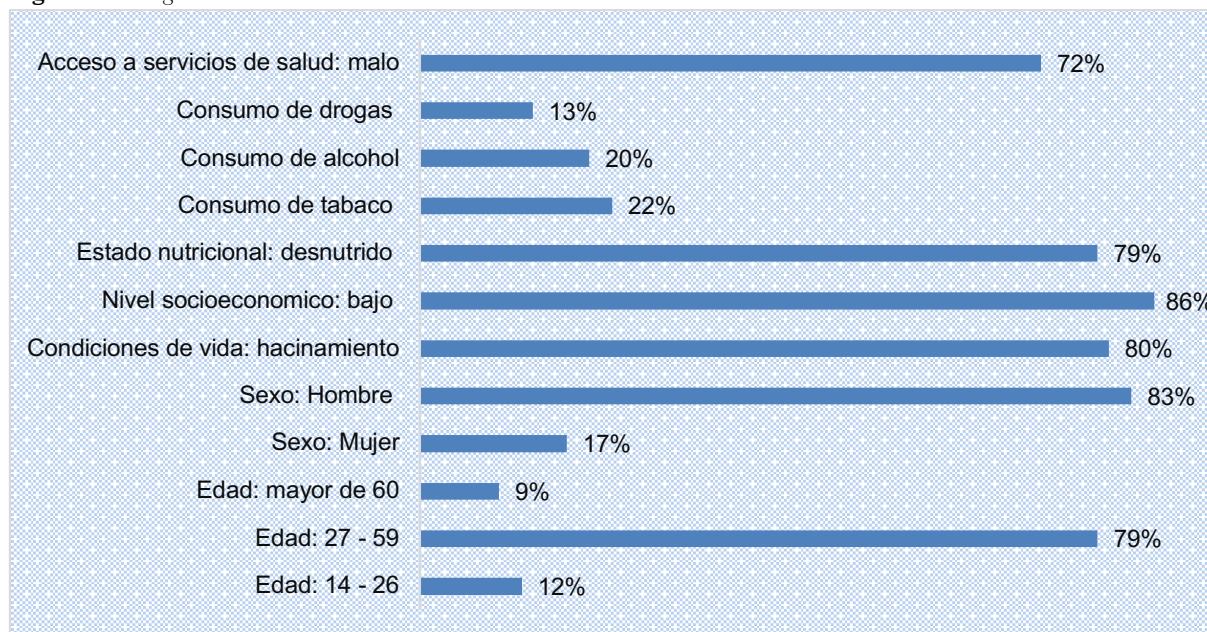


Figure 2. Categorization of social determinants as risk factors.

Conclusions

The social determinants that serve as risk factors for tuberculosis in HIV-positive patients include low socioeconomic status, overcrowded living conditions, poor nutritional status, stigmatization and discrimination, poor adherence to treatment, limited access to healthcare, and substance use. In terms of categorizing these social determinants, they are split into two groups: modifiable factors—such as nutritional status, substance use, and access to healthcare—and nonmodifiable factors—such as age, sex, overcrowding, and socioeconomic status. Concerning the characteristics and complications of tuberculosis in HIV-infected patients, extrapulmonary tuberculosis was found to be more common than pulmonary tuberculosis. Additionally, other infections like *Candida*, bacterial pneumonia, bacterial sepsis, and tuberculous meningeal infections have been observed as complications.

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Statements

Ethics committee approval and consent to participate

The Bioethics Committee of the Faculty of Medical Sciences of the University of Guayaquil approved the study.

Consent to publication

This information was unnecessary because the present study did not publish images, radiographs, or specific patient studies.

Conflicts of interest

The research has no financial interests or conflicts of interest.

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