




Prevalence of Pulmonary Tuberculosis and HIV Co-Infection among Women in Bogodogo, Burkina Faso

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Abstract

Introduction: The tuberculosis (TB) and HIV co-infection is a deadly combination, each accelerating the progression of the other. TB, caused by *Mycobacterium tuberculosis* (*M. tuberculosis*), is the leading cause of deaths among people living with HIV, accounting for around 40% of all HIV-positive deaths. The aim of this study was to estimate the prevalence of the tuberculosis-HIV co-infection in women. **Material and Methods:** The study population consisted of all suspected patients visiting the laboratory of the Bogodogo University Hospital, from May 2023 to January 2024, to be screened for *M. tuberculosis*. This was a descriptive cross-sectional study. Socio-demographic data were collected during individual interviews with consenting patients. *M. tuberculosis* was identified using the GeneXpert device, and HIV was diagnosed using the Abbott Determine diagnostic test. **Results:** Our study population was aged, on average, 37 ± 17.5 years. The overall tuberculosis infection rate was 65%, and 35% were married. Housewives were the most infected with 22.5%. The most infected age group was the [20 - 40], with 32.5%. Some 37.5% of the women were anorexic and 45% had asthenia. Of the suspected cases, 47.5% were people who had contact with infected persons. TB/HIV co-infection was 5%. **Conclusion:** Tuberculosis is still rife in many parts of the world. It infects both men and women very quickly. HIV-tuberculosis co-infection is

a reality, with HIV accelerating the progression of tuberculosis and vice versa. Raising awareness of HIV and tuberculosis should be done in tandem, as their co-infection leads to a poor vital prognosis.

Keywords

Tuberculosis, Prevalence, Pulmonary, Co-Infection, HIV, Women

1. Introduction

Tuberculosis (TB) caused by *Mycobacterium tuberculosis* (*M. tuberculosis*) is endemic, epidemic, preventable and generally a curable infectious disease. Despite significant progress on treatment in 2022, tuberculosis was the world's second leading cause of death from a single infectious agent, after the coronavirus disease (COVID-19), and caused almost twice as many deaths as HIV/AIDS. More than 10 million people still contract tuberculosis each year [1], including 3.2 million women and 1 million children, with 1.3 million deaths [2]. *M. tuberculosis*, also known as Koch's bacillus (BK), is the causative agent of tuberculosis. It belongs to the order Actinomycetales, the Mycobacteriaceae family and the *Mycobacterium* genus. The *Mycobacterium* genus is made up of aerobic or micro-aerophilic bacilli, which grow more or less slowly and have a wall that is very rich in long-chain fatty acids (mycolic acids). Mycobacteria are small rod-shaped bacilli. All mycobacteria are acid-fast bacilli (AFB) and are so called because of the resistance of their walls to discoloration by alcohol-acid after staining. This principle is used for microscopic examination of samples (Ziehl-Neelsen staining and Auramine staining). *M. tuberculosis* multiplies more slowly than most bacteria, which is why tuberculosis develops more slowly than most other bacterial infections. The tuberculosis bacillus is transmitted from person to person, mainly by air. The source of infection is a patient with bacteriologically confirmed pulmonary tuberculosis. When coughing, talking, or sneezing, the bacilliferous patient produces fine infectious droplets called Pflüger droplets. These can remain airborne for several hours, depending on how well ventilated the environment is. Contamination occurs when the infectious droplets are inhaled. Other modes of transmission, such as the oral route, are much less common. Inoculation into the skin or mucosa is rare. Transmitted Koch's bacillus can cause either a latent infection or an active infection, depending on the immunological state of the person who contracted it. In both cases, the BK can remain "dormant" for a long time, or even indefinitely, in various parts of the body. In the second stage, which can last from a few weeks to several years, a person can develop the tuberculosis disease, most frequently in the lungs, but which can affect any organ. This occurs, in particular, when there is a breakdown in the balance between the host immune system and Koch's bacilli. In over 90% of cases, the penetration of *M. tuberculosis* into the lung does not cause any clinical symptoms in immunocompetent

individuals. It becomes an active infection in immunocompromised people, which explains why TB is the leading cause of death among people living with HIV, accounting for around 40% of HIV-positive deaths. The tuberculosis and HIV co-infection constitute a deadly combination, each accelerating the progression of the other.

In 2017, WHO estimated the incidence of HIV-TB co-infection at 99 cases per 100,000 inhabitants, with an estimated death rate of 43% [3]. In 2022, 55% of people with tuberculosis were men, 33% were women and 12% were children (aged under 18). It is true that men have the highest rate of infection, but women and children are also at risk. Women are the pillars of the family and society, so infection in women has more disadvantages and an impact on public health. Because they are the ones who look after the family in Africa, they are closer to the children and could easily transmit the bacillus to their children and to the majority of people, given that they go to places where there are large numbers of people, such as the marketplace, water points, schools, etc. This could lead to a tuberculosis epidemic. Even though national HIV prevalence (0.6% in 2021) in Burkina Faso has been falling for the past ten years, according to UNAIDS, the infection rate among women remains high at 0.8% [4]. Since HIV works by weakening the body's immune system, co-infection with tuberculosis would worsen the general state of health and have a poor vital prognosis in patients, hence the interest of this study. Tuberculosis and HIV form a deadly duo, each accelerating the pathological development of the other.

The aim of this study is to estimate the prevalence of tuberculosis and tuberculosis-HIV co-infection in women, in order to adopt a better control strategy.

2. Material and Methods

This was a descriptive cross-sectional study. The study population consisted of all suspected and consenting patients attending the screening and treatment center of the Bogodogo university hospital between May 2023 and January 2024, to be screened for *M. tuberculosis*. This study was approved by the institutional ethics committee of the Bogodogo University Hospital (N ° 2023-03-010). Socio-demographic data were collected during individual interviews with consenting patients using a tablet and CS-Pro data collection software. Patients under 15 years of age were excluded from the study as they were considered to have been vaccinated against tuberculosis and, therefore, immunized. The samples consisted of saliva for tuberculosis diagnosis and blood for HIV diagnosis. *M. tuberculosis* was identified using the GeneXpert device, which detects and quantifies *M. tuberculosis* nucleic acids in saliva samples. HIV serology was diagnosed after centrifugation of blood samples for patients who did not know their serological status. The test was performed on patients' serum using a rapid diagnostic test called "Determine" from Abbott, following the manufacturer's protocol. Statistical analyses were performed using SPSS version 25 software and a P value < 0.05 was considered statistically significant.

3. Results

3.1. Socio-Demographic Characteristics

A total of 40 women were recruited for this study. The mean age of our study population was 37 ± 17.5 years, with extremes of 16 and 73 years. The]20 - 40] age group was the most represented with a proportion of 52.5%, followed by the]40 - 60] age group with 20% (**Table 1**). Married participants were the most numerous with a proportion of 62.5%.

Table 1. Socio-demographic characteristics of participants.

	Characteristics	Numbers (n = 40)	Proportion (%)
Age group	≤20	4	10.0
	]20 - 40]	21	52.5
	]40 - 60]	8	20.0
	]60 - 80]	7	17.5
Marital status	Single	15	37.5
	Married	25	62.5
Number of children	No children	15	37.5
	At least one child	25	62.5
Profession	Employees	17	42.5
	Housewives	17	42.5
	Students	6	15.0
Outside residence in the previous month	Yes	3	7.5
	No	37	92.5
Status	Voluntary screening	21	52.5
	Contact cases	19	47.5

3.2. Prevalence of Tuberculosis Infection According to Socio-Demographic Characteristics

The overall rate of tuberculosis infection in our female population was 65% and 40% were married (**Table 2**) with a p-value of 0.02. HIV prevalence was 7.5% in this study population.

Among infected patients, the age group most represented was that between]20 - 40] with 32.5% in this study population. Housewives were the most infected with 22.5%. Patients with at least one child had a higher infection rate of 40%, a p-value of 0.02 and an OR of 0.7. In our study 22.5% of the women had no formal education. Of the suspected cases, 32.5% were contacts.

Table 2. Prevalence of tuberculosis infection according to socio-demographic characteristics.

Socio-demographic characteristics		Prevalence of tuberculosis				
		Number	Percentage	p-value	IC (OR)	OR
Age	≤20	3	7.5%	0.8	0.0 - 0.0	17131770765.605
	]20 - 40]	13	32.5%			
	]40 - 60]	6	15.0%			
	]60 - 80]	4	10.0%			
Marital status	Single	10	25.0%	0.02	0.1883 - 9.8	0.865
	Married	16	40.0%		0.005 - 9	0.550
Number of children	No children	10	25.0%	0.02	1.171 - 3.333	0.756
	At least one child	16	40.0%			
Profession	Civil servant	3	7.5%	0.07	0.112 - 15.6	1.321
	Self-employed	8	20%		0.120 - 0.7.9	0.976
	Households	11	27.5%		0.119 - 8.53	1.08
	Student	4	10%			
Education level	Not instructed	9	22.5%	0.1	0.141 - 3.160	0.669
	Instructed	17	42.5%			
Status	Voluntary screening	13	32.5%	0.1	0.09 - 15.657	1.19
	Contact case	13	32.5%			

3.3. Prevalence of Tuberculosis Infection with Clinical Signs

Regarding the clinical appearance of the patients (**Table 3**), 55% reported weight loss, 50% had a chronic cough, 42.5% had chest pain, 45% of the women were anorexic and 60% had asthenia. Those with night sweats represented 15%, with a statically significant p-value of 0.01 and an odd ratio of 1.10.

Table 3. Prevalence of tuberculosis infection with clinical signs.

Characteristics		Prevalence of tuberculosis				
		Numbers	Percentage	p-value	IC (OR)	OR
Clinical signs	Weight loss	22	55%	5.46	1.23 - 24.5	5.5
	Anorexia	15	37.5%	4.8	1.1 - 22.29	5.00
	Fever	13	32.5%	0.7	0.47 - 6.85	1.8
	Night sweats	6	15%	0.01	0.22 - 5.2	1.10
	Chest pain	17	42.5%	0.8	0.5 - 7.09	1.8
	Cough	20	50%	1.60	0.028 - 2.38	0.25
	Asthenia	18	45%	2.67	0.10 - 12.336	1.127
	Clinical anemia	5	12.5%	3.07	0.0 - 0.0	0.00
	Amenorrhea	1	2.5%	3.1	0.014 - 1.57	0.1

3.4. Tuberculosis and HIV Co-Infection

The overall rate of tuberculosis infection in our female population was 65% and HIV prevalence was 7.5%. The rate of co-infection with tuberculosis and HIV in our study population was 5% (**Table 4**).

Table 4. Tuberculosis and HIV co-infection.

Characteristics		HIV prevalence %				
		Positive	Negative	p-value	IC(OR)	OR
Tuberculosis prevalence	Positive	5% (2/40)	50% (20/40)	0.5	0.078 - 51.59	2
	Negative	2.5% (1/40)	30% (12/40)		0.23 - 24.06	2.4

3.5. HIV-Tuberculosis Co-Infection and Clinical Signs

Cough and weight loss were the most predominant clinical signs in these cases of co-infection (**Table 5**). The correlation of co-infection with anorexia gave a statistically significant result with a p-value of 0.02 and an OR of 0.00.

Table 5. Clinical signs in participants with TB-HIV co-infection.

Characteristics		Co-infection				
		Numbers	Percentage	p-value	IC (OR)	OR
Clinical signs of TB	Weight loss	2	5%	0.7	0.0 - 0.0	0.2
	Anorexia	1	2.5%	0.02	0.0 - 0.0	0.00
	Fever	0	0.0%	1.7	1.4 - 2.56	1.90
	Night sweats	1	2.5%	0.9	0.0 - 0.0	0.00
	Chest pain	1	2.5%	0.08	0.038 - 11.24	0.6
	Cough	2	5%	0.4	1.05 - 1.4	1.22
	Asthenia	1	2.5%	0.08	0.038 - 11.24	0.65
	Clinical anemia	1	2.5%	2.7	0.0 - 0.0	0.00
	Amenorrhea	0.0	0.0%	0.2	1.02 - 1.24	1.11

TB: tuberculosis.

4. Discussion

The aim of this study was to estimate the prevalence of tuberculosis and co-infection with HIV in women in order to adopt a better control strategy. A tuberculosis infection rate of 65% was observed, with a tuberculosis co-infection rate of 5%.

4.1. Socio-Demographic Characteristics

Of the patients recruited, 30% were selected for this study. The sample consisted mainly of women, as the aim of the study was to investigate the prevalence of tuberculosis and co-infection with HIV in women. The frequency of the female gender in our study is consistent with that of Zida *et al.* in 2014 (28.8%) and with

the literature, because women are indeed less infected than men, according to the World Health Organization (WHO 2023). In 2020, 33% of women worldwide were infected with tuberculosis [1].

The mean age of our study population was 37 ± 17.5 years with extremes of 16 and 73 years. This mean age was higher than that of Dagnra and colleagues in Togo [5] and Wa Ilunga and colleagues in Lubumbashi in 2015 [6], who had mean ages of 35 ± 2 years and 32.84 ± 15.32 years respectively. It was lower than that of Abessolo Abessolo *et al.* in Yaoundé in 2023 [3], who had a mean age of 42.34 ± 0.60 years. The average age of our patients was in line with that of Zida *et al.* in Burkina Faso [7] and Kabore *et al.* in Mali [8], who had an average age of 37.8 \pm 15.4 years and 37.2 years respectively. Generally reported in the literature, tuberculosis affects adults because most young people have been immunised with the bacillus Calmette-Guérin (BCG) vaccine at birth.

4.2. Prevalence of Tuberculosis and Socio-Demographic Characteristics

The overall tuberculosis infection rate was 65% in our study. This result was higher than those of Lupande *et al.* in 2012 in Congo, who reported a prevalence of 16.4%, and those of Zida *et al.* in 2014 in Burkina Faso, who reported a prevalence of pulmonary tuberculosis of 27.7% in women. Our results can be explained by the fact that our study population consisted exclusively of women and by the explosion in new cases of tuberculosis in our countries. This explosion in new cases can be explained by the displacement of populations due to terrorism and promiscuity.

The age group most infected with tuberculosis was the]20 - 40] age group, with 32.5%. This result is consistent with those found by several other authors [3] [7] [8]. This could be explained by the fact that Burkina Faso's population is young and not ageing. The majority of our study population were married (35%). Housewives were the most infected with 27.5%. Married people were more infected with 40% and a statistically significant p-value of 0.02. This trend could be explained by the fact that non-working women do not have sufficient access to tuberculosis education. As men are generally more affected by tuberculosis, married women could have been infected by their spouses.

Patients with at least one child had a higher rate of infection of 40% compared with x% for those without children. This result was statically significant with a p-value of 0.02 and an OR of 0.7, which could mean that having children reduces the risk of non-contagion of tuberculosis. Of the suspected cases, 32.5% were contacts. This could be explained by the fact that tuberculosis is essentially transmitted from person to person, and by the fact that people live in close proximity [9].

4.3. Prevalence of Tuberculosis and Clinical Signs

Our patients showed the clinical signs that are generally encountered in the literature. Fifty-five per cent reported weight loss, 50% had a chronic cough and 42.5% had chest pain. 45% of the women were anorexic and 60% had asthenia. All these

symptoms contributed to the deterioration in patients' general condition. Night sweats accounted for 15%, with a statically significant P-value of 0.01 and an odds ratio of 1.10. This could mean that those who had night sweats as a symptom were more likely to have tuberculosis as a disease.

4.4. Frequency of Tuberculosis-HIV Co-Infection

In 2020, the global prevalence of HIV-TB co-infection was 8% [1]. The proportion of TB cases co-infected with HIV was highest in countries in the WHO African Region, exceeding 50% in some parts of southern Africa [1]. The frequency of tuberculosis co-infection with HIV was 5% in our patients and concerned patients aged between]20 - 40]. Patients aged]20 - 40] are the most sexually active and often use HIV prevention methods incorrectly. This rate of co-infection is higher than that reported by Kolamou and collaborators, showing a prevalence of 1.37% among women in Guinea [10]. The prevalence of co-infection in women was higher than in men (1.18%). In terms of gender, women are more exposed to HIV-TB co-infection, as HIV is more prevalent among women [6]. Meda *et al.* in 2014 also reported the same trends for females [11]. Kolamou *et al.* also observed that the rate of TB-HIV co-infection progressed in a sawtooth pattern over the years [10]. However, our co-infection rate is lower than those reported by Dangra *et al.* in Togo, Meda and Zida *et al.* in Burkina Faso, which were 23.7%, 13.8% and 12.2% [5] [7] [11]. Meda *et al.* reported significantly higher results for women with $p = 0.02$. Fiogbé *et al.*, in their 5-year study in Benin reported a predominance of TB-HIV co-infection in women with a rate of 56.7% [12]. These differences in prevalence rates may be due to the sampling method, collection time, sample size and the implementation of prevention programmes. However, in 2023 in Yaoundé, Abessolo Abessolo *et al.* found a co-infection rate of 60.4% [3]. This large difference is due to his sampling, which lasted 4 years and he only included confirmed cases of tuberculosis in his study.

4.5. Tuberculosis-HIV Co-Infection and Clinical Signs

Cough and weight loss were the most predominant clinical signs in these cases of co-infection. Our results are consistent with those of Abessolo Abessolo *et al.*, and Kabore *et al.*, who also found a predominance of weight loss and cough [3] [8]. Our results corroborate those of Ammouri *et al.* in Morocco, who also found a predominance of asthenia and emaciation with co-infection [13]. The correlation of co-infection with anorexia gave a statically significant result with a p-value of 0.02 and an OR of 0.00. This statically significant result could mean that HIV worsens the general clinical condition of patients, because it weakens the patients' immune system, causing immunodepression and making them less resistant to tuberculosis.

Limitations of this study: Our sample is not sufficiently representative because these data come from a single collection site.

5. Conclusion

Tuberculosis remains a major public health problem in our countries, with

worrying socio-economic consequences. HIV-TB co-infection is a reality. In our study, we observed 65% cases of tuberculosis, 7.5% cases of HIV and 5% cases of co-infection. This problem affects young female adults much more. According to our study, 55% said they had lost weight, 50% had a chronic cough, and 42.5% had chest pains. About 45% of the women were anorexic and 60% had asthenia. All these symptoms contributed to the deterioration in the patients' general condition. HIV increases the tuberculosis epidemic in populations where these two infections co-exist. This co-infection, therefore, has an impact on family life and society in general. In our study, married women with children were the most infected, although they are the pillars of society and are most involved in bringing up their children. The National Tuberculosis Control Programme and the National HIV Control Programme should, therefore, focus their control strategies more on women and children in order to offer them better protection, because it is women who give life, and without women, there is no society.

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Ethical Approval

This study was approved by the Health Research Ethics Committee (n° 2022-02-023).

Data Availability

The datasets used in this study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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