Research, Society and Development, v. 14, n. 10, e147141049781, 2025
(CC BY 4.0) | ISSN 2525-3409 | DOI: http://dx.doi.org/10.33448/rsd-v14i10.49781

A cross-sectional epidemiological study reveals a strong link between tuberculosis, social vulnerability, and HIV-Tuberculosis co-infection in Central Mozambique

Um estudo epidemiológico transversal revela uma forte ligação entre a tuberculose, a vulnerabilidade social e a co-infecção HIV-Tuberculose na região Central de Moçambique

Un estudio epidemiológico transversal revela una fuerte relación entre la tuberculosis, la vulnerabilidad social y la coinfección HIV-Tuberculosis en la región central de Mozambique

Received: 10/10/2025 | Revised: 10/22/2025 | Accepted: 10/23/2025 | Published: 10/24/2025

Amade Carlos Miguel
ORCID: https://orcid.org/0000-0001-5180-2423
District Services for Economic Activities of Búzi – Ministry of Agriculture, Environment and Fisheries, Mozambique
E-mail: amiguel.carlos@gmail.com
Abílio Paulo Changule
ORCID: https://orcid.org/0000-0003-4697-0339
Center for Genetic Resources and Animal Assisted Techniques (CRGTRA), Directorate of Animal Science (DCA), Agricultural Research Institute of Mozambique, Mozambique
E-mail: abilio.changule1991@gmail.com
Sebastião Job Cuata
ORCID: https://orcid.org/0000-0002-0592-7812
Faculty of Health Science, Universidade Aberta ISCED, Mozambique
E-mail: scuata@unisced.edu.mz
Mafalda Franklim António Changule
ORCID: https://orcid.org/ 0009-0001-6356-8037
Faculty of Education, Eduardo Mondlane University, Mozambique
E-mail: kessyamafalda@gmail.com
Custodio Gabriel Bila
ORCID: https://orcid.org/0000-0002-7580-1246
Department of Animal and Public Health, Faculty of Veterinary Medicine, Eduardo Mondlane University, Mozambique
E-mail: custodio.bila@uem.mz

Abstract
This study aims to describe the socio-demographic characteristics of TB patients in Buzi, assess the clinical features, including TB type and HIV co-infection, and review TB control strategies in the district. Tuberculosis (TB) remains a significant public health challenge in Mozambique, especially in Búzi. This study characterized the epidemiological profile of TB patients treated in Búzi district, between 2020 and 2022. A descriptive, cross-sectional study was conducted using secondary data from patient registers at four public health units: Búzi Rural Hospital and the health centers of Bandua, Estaquinha, and Barada. The sample included all patients aged 18 or older with a confirmed TB diagnosis. Data were analyzed using SPSS version 20 to generate descriptive statistics and identify patterns of TB-HIV co-infection. A total of 1,065 TB cases were identified, with 53% of patients being female and 52.9% aged between 36 and 60 years. A significant proportion had no formal education and were either unemployed or engaged in domestic occupations. TB-HIV co-infection was found in 28.1% of cases. Treatment completion was reported in 77.8% of patients, while 2.5% died. TB-HIV co-infection was significantly associated with sex, age group, place of residence, and TB type. The study highlights the strong association between TB, social vulnerability, and HIV co-infection in Búzi. Strengthening access to diagnostics, expanding treatment coverage, and implementing integrated care strategies are essential to improving outcomes in similar rural contexts.
Keywords: Tuberculosis; HIV co-infection; Socio-demographic factors; Epidemiological profile; Public Health.

Resumo
Este estudo tem como objetivo descrever as características sociodemográficas dos pacientes com tuberculose (TB) em Búzi, avaliar as características clínicas, incluindo o tipo de TB e a coinfecção por VIH, e analisar as estratégias de controlo da TB no distrito. A tuberculose (TB) continua a ser um importante desafio de saúde pública em Moçambique, especialmente em Búzi. Este estudo caracterizou o perfil epidemiológico dos pacientes com TB tratados no distrito de Búzi entre 2020 e 2022. Foi realizado um estudo descritivo e transversal utilizando dados secundários provenientes dos registos de pacientes de quatro unidades sanitárias públicas: Hospital Rural de Búzi e os centros de saúde de Bandua, Estaquinha e Barada. A amostra incluiu todos os pacientes com 18 anos ou mais e diagnóstico

confirmado de TB. Os dados foram analisados utilizando o software SPSS versão 20 para gerar estatísticas descritivas e identificar padrões de coinfecção TB-VIH. Foram identificados 1.065 casos de TB, dos quais 53% eram do sexo feminino e 52,9% tinham entre 36 e 60 anos. Uma proporção significativa não possuía educação formal e encontrava-se desempregada ou envolvida em atividades domésticas. A coinfecção TB-VIH foi observada em 28,1% dos casos. A conclusão do tratamento foi reportada em 77,8% dos pacientes, enquanto 2,5% faleceram. A coinfecção TB-VIH esteve significativamente associada ao sexo, faixa etária, local de residência e tipo de TB. O estudo destaca a forte associação entre TB, vulnerabilidade social e coinfecção por VIH em Búzi. O fortalecimento do acesso ao diagnóstico, a expansão da cobertura de tratamento e a implementação de estratégias de cuidados integrados são essenciais para melhorar os resultados em contextos rurais semelhantes.
Palavras-chave: Tuberculose; Coinfecção VIH; Fatores sociodemográficos; Perfil epidemiológico; Saúde Pública.

Resumen

Este estudio tiene como objetivo describir las características sociodemográficas de los pacientes con tuberculosis (TB) en Búzi, evaluar las características clínicas, incluyendo el tipo de TB y la coinfección por VIH, y revisar las estrategias de control de la TB en el distrito. La tuberculosis (TB) sigue siendo un importante desafío de salud pública en Mozambique, especialmente en Búzi. Este estudio caracterizó el perfil epidemiológico de los pacientes con TB atendidos en el distrito de Búzi entre 2020 y 2022. Se realizó un estudio descriptivo y transversal utilizando datos secundarios de los registros de pacientes de cuatro unidades de salud pública: el Hospital Rural de Búzi y los centros de salud de Bandua, Estaquinha y Barada. La muestra incluyó a todos los pacientes de 18 años o más con diagnóstico confirmado de TB. Los datos fueron analizados mediante el software SPSS versión 20 para generar estadísticas descriptivas e identificar patrones de coinfección TB-VIH. Se identificaron un total de 1.065 casos de TB, de los cuales el 53% eran mujeres y el 52,9% tenían entre 36 y 60 años. Una proporción significativa no tenía educación formal y se encontraba desempleada o dedicada a actividades domésticas. La coinfección TB-VIH se encontró en el 28,1% de los casos. La finalización del tratamiento se registró en el 77,8% de los pacientes, mientras que el 2,5% falleció. La coinfección TB-VIH estuvo significativamente asociada con el sexo, el grupo de edad, el lugar de residencia y el tipo de TB. El estudio resalta la fuerte asociación entre TB, vulnerabilidad social y coinfección por VIH en Búzi. Fortalecer el acceso al diagnóstico, ampliar la cobertura del tratamiento e implementar estrategias de atención integrada son medidas esenciales para mejorar los resultados en contextos rurales similares.
Palabras clave: Tuberculosis; Coinfección por VIH; Factores sociodemográficos; Perfil epidemiológico; Salud Pública.

1. Introduction

Tuberculosis (TB) is a chronic infectious disease caused by *Mycobacterium tuberculosis*, primarily affecting the lungs but capable of spreading to other organs. Globally, TB is a leading cause of death, surpassing even HIV/AIDS. In 2018, approximately 10 million people fell ill with TB, and 1.5 million died (WHO, 2019). Despite being preventable and curable, TB remains a significant public health challenge, particularly in low- and middle-income countries with widespread poverty and fragile health systems (Barreto & Garcia, 2021). Mozambique is one of the highest-burden countries, facing a triple challenge of TB, HIV/AIDS, and rising cases of multidrug-resistant TB (MDR-TB) (MISAU, 2022). The Ministry of Health reports a TB-HIV co-infection rate exceeding 30%, complicating diagnosis and treatment adherence (PNCT, 2022).

The Buzi District in Sofala Province is predominantly rural, facing socio-economic challenges such as poor housing, low literacy rates, limited access to healthcare, and high food insecurity. These conditions facilitate TB transmission and hinder control efforts (SDSMAS-Búzi, 2022). Additionally, the 2019 Cyclone Idai disrupted public services, increasing vulnerability to respiratory diseases like TB (IFRC, 2019). TB case notifications in Buzi rose by 7%, from 897 in 2021 to 962 in 2022 (SDSMAS-Búzi, 2022). Despite efforts to decentralize TB services, the incidence remains high, and the HIV co-infection rate of 28.1% is concerning, as HIV accelerates the progression of latent TB to active disease (WHO, 2020). According to the Buzi District Health Statistical Bulletin, TB case notifications rose from 897 in 2021 to 962 in 2022, marking a 7% increase (SDSMAS-Búzi, 2022). Despite the government's efforts to decentralize TB services and improve access to diagnostics and treatment, TB incidence remains high and poorly controlled. The high HIV co-infection rate estimated at 28.1% in this study is of particular concern, as HIV significantly increases the risk of progression from latent to active TB (WHO, 2020).

Epidemiological data on TB is essential for guiding control efforts, and it often highlights vulnerable groups based on age, sex, education, and access to healthcare. In Mozambique and other sub-Saharan countries, TB disproportionately affects economically active adults (15–60 years), those with low educational attainment, and residents of rural or peri-urban areas with limited healthcare infrastructure (Faria & Lopes, 2020; Chissaque et al. 2020). Considering these challenges, a localized understanding of the TB burden is crucial for effective intervention. In Buzi District, such analysis has been limited, and most available data are not systematically analysed or publicly disseminated. This study therefore aims to fill this gap by describing the epidemiological profile of TB cases registered between 2020 and 2022 across four public health units in the district.

Given the socio-economic deprivation and environmental vulnerability in Buzi District, we hypothesized that TB disproportionately affects adults aged 36–60, women, and individuals with limited education and healthcare access. Furthermore, TB-HIV co-infection likely impacts treatment outcomes and survival rates. This study aims to describe the socio-demographic characteristics of TB patients in Buzi, assess the clinical features, including TB type and HIV co-infection, and review TB control strategies in the district.

2. Methodology

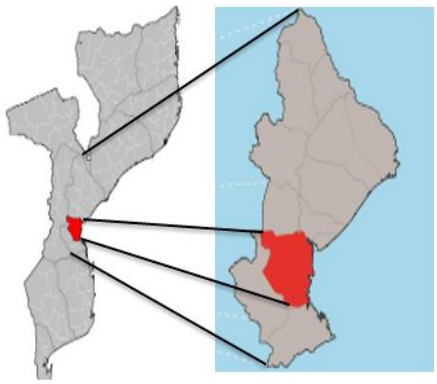
2.1 Study Design

This study utilized a descriptive, observational, cross-sectional design with a quantitative approach (Pereira et al., 2018) using simple descriptive statistics with data classes, absolute frequency values and relative percentage frequency (Shitsuka, 2014). An inductive and descriptive method was applied, based on secondary data analysis. Data were collected from tuberculosis (TB) registers at the Búzi Rural Hospital and three health centers (Bandua, Estaquinha, and Barada), all managed by the District Services for Health, Women, and Social Action of Búzi (SDSMAS-Búzi).

2.2 Study Area

The research was conducted in Búzi District, located in the southwestern part of Sofala Province, Mozambique (Figure 1). Covering an area of approximately 7,160 km², Búzi is bordered by the districts of Dondo and Nhamatanda to the north, Machanga and Chibabava to the south, the Indian Ocean to the east, and Chibabava to the west. The district includes 19 health units, which consist of one district hospital, one rural hospital, 13 health centers, and four health posts.

Figure 1: Map showing Sofala Province and the Buzi District (red).



Source: Research data, 2025

2.3 Study population

The target population consisted of all confirmed TB cases recorded in the district between January 2020 and December 2022. The analysis focused on data from four key health facilities: the Búzi Rural Hospital and the health centers of Bandua, Estaquinha, and Barada, all of which provided TB diagnostic services during the study period.

2.4 Sample size

Initially, the estimated number of TB cases for the period was 2,161. However, due to difficulties in accessing complete data, the minimum required sample size was calculated using the formula provided by (Berquó et al. 1981).

n=z2·p·qe2n = \frac{{z^2 \cdot p \cdot q}}{{e^2}}

Where:

- z = 1.96 (confidence level of 95%)
- p = 0.5 (maximum variability)
- q = 1 - p = 0.5
- e = 0.05 (margin of error)

This calculation resulted in a minimum required sample size of 384 cases per year, totaling 1,152 cases over the three-year period. After data cleaning, 1,065 eligible TB cases were included in the final analysis.

2.5 Inclusion and exclusion criteria

Inclusion criteria:

- Individuals aged 18 years or older.
- Confirmed TB diagnosis through smear microscopy or GeneXpert® MTB/RIF.
- Registered as residents of Búzi District during the study period.
- Listed in the TB patient registry.

Exclusion criteria:

- Individuals under 18 years of age.
- Cases diagnosed solely through chest X-ray without laboratory confirmation.
- Non-residents of Búzi District.

2.6 Data collection procedures

Data were obtained through bibliographic review, observation of patient files, and structured data collection forms developed in Google Forms. The bibliographic review helped establish the theoretical foundation for the study. Patient data were sourced from existing TB registers managed by the TB Program (SAPTB/PNCT) at the selected health facilities.

2.7 Variables studied

Data collection included the following categories of variables:

Socio-demographic variables:

- **Age:** Categorized into youth (18–35 years), adults (36–60 years), and elderly (>60 years).
- **Sex:** Male or Female.

- **Occupation:** Based on declared profession.
- **Residence:** By locality.
- **Education level:** Years of schooling completed.

Clinical and Epidemiological Variables:

- **Case type:** New or Re-treatment.
- **Site of lesion:** Pulmonary or Extra-pulmonary.
- **Diagnostic method:** Smear microscopy, GeneXpert® MTB/RIF, or Chest X-ray.
- **Chronic comorbidities:** HIV status.
- **TB type:** Rifampicin-sensitive TB, Multi-drug resistant (MDR-TB), extensively drug-resistant TB (XDR-TB).
- **Drug resistance:** Primary or secondary.
- **Treatment outcome:** Cured, treatment completed, treatment failure, lost to follow-up, or death.

2.8 Data management and analysis

All data were initially recorded in individual case forms and then entered into Microsoft Excel 2016 spreadsheets. The dataset was analyzed using SPSS version 20. Descriptive statistics were used to summarize the distribution of socio-demographic and clinical variables, with frequencies and percentages calculated to characterize the epidemiological profile of TB cases.

2.9 Ethical considerations

This study used only secondary data collected through routine public health service delivery. The following ethical principles were adhered to:

1. Anonymity and confidentiality of patient information were ensured.
2. Personal addresses were not collected beyond the locality level.
3. Only age and sex were recorded for analysis purposes.
4. No discrimination was made based on ethnicity, religion, political affiliation, or social group.
5. Findings will be disseminated exclusively in academic settings, and patient data will not be published in identifiable form.

3. Results

3.1 Sociodemographic aspects of TB cases in Búzi

Table 1 presents the sociodemographic characteristics of tuberculosis cases based on their entry type into the National Tuberculosis Control Program (PNCT). A total of 1,065 cases were identified, of which 940 were new and 125 were re-entries. Among these cases, 565 (53.0%) were female, 564 (52.9%) were adults aged 36 to 60 years, 279 (26.2%) were residents of the locality of Bândua, 517 (48.5%) were homemakers, and 1,020 (96.1%) had no recorded level of education.

Table 1. Distribution of Sociodemographic Characteristics of Tuberculosis Cases Based on Entry Type into the National Tuberculosis Control Program, Búzi District, Sofala, 2020–2022.

Variables	Type of case/entry			
	New		Re-entry	
	n	%	n	%
Sex				
Male	432	(46.0)	68	(54.4)
Female	508	(54.0)	57	(45.6)
Age group				
Youth	300	(31.9)	32	(25.6)
Adult	489	(52.0)	75	(60.0)
Eldelry	151	(16.1)	18	(14.4)
Area of residence				
Inharongue	112	(11.9)	18	(14.4)
Buzi – Sede	143	(15.2)	31	(24.8)
Guara – Guara	63	(6.7)	9	(7.2)
Inhamichindo	5	(0.5)	1	(0.8)
Ampara	11	(1.2)	3	(2.4)
Grudja	25	(2.7)	5	(4.0)
Nova Sofala	80	(8.5)	2	(1.6)
Bandua	252	(26.8)	27	(21.6)
Estaquinha	225	(23.9)	29	(23.2)
Chissinguana	23	(2.4)	0	(0.0)
Sem informação	1	(0.1)	0	(0.0)
Level of education				
Basic secondary education (10th grade)	13	(1.4)	0	(0.0)
Primary education (7^{th} grade)	16	(1.7)	5	(4.0)
Pre-university or technical vocational education	10	(1.1)	0	(0.0)
Higher education	1	(0.1)	0	(0.0)
Missing data	900	(95.7)	120	(96.0)
Occupation				
Farmer	350	(37.2)	42	(33.6)
Domestic worker	453	(48.2)	64	(51.2)
Trader	24	(2.6)	3	(2.4)
Fisherman	32	(3.4)	2	(1.6)
Teacher	13	(1.4)	1	(0.8)
Student	18	(1.9)	1	(0.8)
Cattle breeder ou herder	2	(0.2)	0	(0.0)
Other	48	(5.1)	12	(9.6)

Source: Authors.

3.2 Sociodemographic and Clinical-Epidemiological Aspects of TB Cases in Búzi

Table 2 presents the distribution of TB cases in Búzi, considering sociodemographic and clinical-epidemiological factors, according to the type of tuberculosis diagnosed and TB-HIV co-infection status. Of the total number of cases studied, 1,053 patients had TB-RIF, 12 had TB-MDR/RR, 299 were co-infected with TB-HIV+, and 766 were TB-HIV. Among those diagnosed with TB-HIV+, 156 were men, 160 were adults aged 36 to 60, 89 were residents of the locality of Bândua, 145 were homemakers, 61 were re-entry cases, and 7 had primary resistance to anti-TB drugs. As shown in the table, the results for TB-HIV co-infection were statistically significant for sex, age, place of residence, and case type (new or re-entry).

Table 2. Distribution of sociodemographic and clinical-epidemiological characteristics according to Tuberculosis Type and TB-HIV+ Co-Infection, Búzi District, Sofala, 2020–2022.

Variables	Type of TB			TB-HIV Co-infection		
	TB-RIF	TB-MR	*p-value*	TB-HIV+	TB-HIV-	*p-value*
	n (%)	n (%)		n (%)	n (%)	
Sex			0.831			0.033
Male	494 (98.8)	6 (1.2)		156 (31.2)	344 (68.8)	
Female	559 (98.9)	6 (1.1)		143 (25.3)	422 (74.7)	
Age group			0.641			<0.001
Youth	327 (98.5)	5 (1.5)		128 (38.7)	203 (61.3)	
Adult	561 (98.9)	6 (1.1)		160 (28.3)	406 (71.7)	
Eldelry	165 (99.4)	1 (0.6)		11 (6.5)	157 (93.5)	
Area of residence			0.770			0.002
Inharongue	128 (98.5)	2 (1.5)		26 (20.0)	104 (80.0)	
Buzi – Sede	173 (97.7)	4 (2.3)		67 (37.9)	110 (62.1)	
Guara – guara	70 (97.2)	2 (2.8)		23 (31.9)	49 (68.1)	
Inhamichindo	6 (100)	0 (0.0)		1 (16.7)	5 (83.3)	
Ampara	14 (100)	0 (0.0)		7 (50.0)	7 (50.0)	
Grudja	30 (100)	0 (0.0)		3 (10.0)	27 (90.0)	
Nova Sofala	81 (98.8)	1 (1.2)		20 (24.4)	62 (75.6)	
Bandua	277 (99.3)	2 (0.7)		89 (31.9)	190 (68.1)	
Estaquinha	253 (99.6)	1 (0.4)		56 (22.3)	195 (77.7)	
Chissinguana	20 (100)	0 (0.0)		10 (38.5)	16 (61.5)	
No information	1 (100)	0 (0.0)		0 (0.0)	1 (100)	
Level of education			0.111			0.462
Basic secondary education (10th grade)	13 (100)	0 (0.0)		3 (23.1)	10 (76.9)	
Primary education (7th grade)	21 (100)	0 (0.0)		5 (23.8)	16 (76.2)	
Pre-university or technical vocational education	9 (90.0)	1 (10.0)		4 (40.0)	6 (60.0)	
Higher education	1 (100)	0 (0.0)		1 (100)	0 (0.0)	
Missing data	1009 (98.9)	11 (1.1)		286 (28.0)	734 (72.0)	
Occupation			0.159			0.061
Farmer	390 (99.5)	2 (0.5)		100 (25.5)	292 (74.5)	
Domestic worker	513 (98.8)	6 (1.2)		145 (27.9)	374 (72.1)	

Trader	26 (96.3)	1 (3.7)		12 (44.4)	15 (55.6)	
Fisherman	34 (100)	0 (0.0)		9 (26.5)	25 (73.5)	
Teacher	13 (92.9)	1 (7.1)		5 (35.7)	9 (64.3)	
Student	19 (100)	0 (0.0)		4 (21.1)	15 (78.9)	
Cattle breeder ou herder	2 (100)	0 (0.0)		0 (0.0)	2 (100)	
Other	56 (96.6)	2 (3.4)		24 (41.4)	34 (58.6)	
Type of case/entry			0.163			<0.001
New	931 (99.0)	9 (1.0)		238 (25.3)	702 (74.7)	
Re-entry	122 (97.6)	3 (2.4)		61 (48.8)	64 (51.2)	
Type of resistance			<0.001			0.163
Sensitive	1047 (99.8)	2 (0.2)		292 (97.7)	757 (98.8)	
Primary	6 (37.5)	10 (62.5)		7 (43.7)	9 (56.3)	

Source: Authors.

3.3 Treatment outcomes according to sociodemographic and clinical-epidemiological aspects

Table 3 presents the distribution of sociodemographic and clinical-epidemiological characteristics of tuberculosis cases according to treatment outcomes in Búzi District. Among the 1,065 patients diagnosed with TB, 829 completed treatment, 182 were cured, 27 died, 20 were lost to follow-up or abandoned treatment, and 3 were declared as therapeutic failures. Of the recorded deaths, 16 were male, 14 were TB-HIV+, 11 were adults, 11 were from the locality of Bândua, 3 had TB-MDR/RR, and 3 had primary resistance to anti-TB drugs.

Table 3. Distribution of sociodemographic and clinical-epidemiological aspects of tuberculosis cases according to treatment outcomes, Búzi District, Sofala, 2020–2022.

Variables	**Treatment outcome**					
	Complete treatment	**Death**	**Cured**	**Loss of follow-up or abandonment**	**Moves to second-line treatment**	**Therapeutic failure**
	n (%)	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**
Sex						
Male	367 (73.3)	16 (3.2)	99 (19.8)	15 (2.9)	2 (0.4)	2 (0.4)
Female	462 (81.9)	11 (1.9)	83 (14.7)	5 (0.9)	2 (0.3)	1 (0.3)
Age group						
Youth	246 (74.3)	6 (1.8)	70 (21.4)	6 (1.8)	1 (0.3)	2 (0.6)
Adult	452 (80.1)	11 (2.0)	87 (15.4)	11 (2.0)	3 (0.5)	0 (0)
Eldelry	131 (77.1)	10 (5.9)	25 (14.4)	3 (1.8)	0 (0)	1 (0.6)
Area of residence						
Inharongue	107 (82.3)	2 (1.5)	16 (12.3)	4 (3.1)	1 (0.8)	0 (0.0)
Buzi - Sede	122 (69.3)	9 (5.1)	36 (20.5)	6 (3.4)	1 (0.6)	2 (1.1)
Guara - Guara	53 (73.6)	3 (4.2)	14 (19.4)	1 (1.4)	1 (1.4)	0 (0.0)
Inhamichindo	4 (66.7)	0 (0.0)	2 (33.3)	0 (0.0)	0 (0.0)	0 (0.0)
Ampara	11 (78.6)	0 (0.0)	3 (21.4)	0 (0.0)	0 (0.0)	0 (0.0)
Grudja	24 (82.8)	0 (0.0)	5 (17.2)	0 (0.0)	0 (0.0)	0 (0.0)
Nova Sofala	71 (86.6)	0 (0.0)	11 (13.4)	0 (0.0)	0 (0.0)	0 (0.0)

Bandua	208 (74.6)	11 (3.9)	54 (19.4)	4 (1.4)	1 (0.4)	1 (0.4)
Estaquinha	206 (81.7)	2 (0.8)	39 (15.5)	5 (2.0)	0 (0.0)	0 (0.0)
Chissinguana	21 (91.3)	0 (0.0)	2 (8.7)	0 (0.0)	0 (0.0)	0 (0.0)
No information	2 (100)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Level of education						
Basic secondary education (10th grade)	10 (76.9)	1 (7.7)	2 (15.4)	0 (0.0)	0 (0.0)	0 (0.0)
Primary education (7th grade)	13 (61.9)	1 (4.8)	5 (23.8)	2 (9.5)	0 (0.0)	0 (0.0)
Pre-university or technical vocational education	3 (30.0)	1 (10.0)	5 (50.0)	0 (0.0)	1 (10.0)	0 (0.0)
Higher education	1 (100)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Missing data	802 (78.6)	24 (2.4)	170 (16.7)	18 (1.8)	3 (0.3)	3 (0.3)
Occupation						
Farmer	317 (80.9)	9 (2.3)	59 (15.0)	7 (1.8)	0 (0.0)	0 (0.0)
Domestic worker	406 (78.2)	9 (1.7)	92 (17.7)	7 (1.3)	3 (0.6)	2 (0.4)
Trader	21 (77.8)	0 (0.0)	6 (22.2)	0 (0.0)	0 (0.0)	0 (0.0)
Fisherman	28 (82.4)	2 (5.9)	3 (8.8)	1 (2.9)	0 (0.0)	0 (0.0)
Teacher	7 (50.0)	1 (7.1)	5 (35.7)	0 (0.0)	1 (7.1)	0 (0.0)
Student	12 (63.2)	1 (5.3)	4 (21.1)	2 (10.5)	0 (0.0)	0 (0.0)
Cattle breeder ou herder	0 (0.0)	0 (0.0)	1 (50.0)	0 (0.0)	0 (0.0)	1 (50.0)
Other	38 (65.5)	5 (8.6)	12 (20.7)	3 (5.2)	0 (0.0)	0 (0.0)
Type of case/entry						
New	734 (78.1)	25 (2.7)	161 (17.1)	13 (1.4)	4 (0.4)	3 (0.3)
Re-entry	95 (76.0)	2 (1.6)	21 (16.8)	7 (5.6)	0 (0.0)	0 (0.0)
Type of TB						
TB-RIF -	827 (78.5)	24 (2.3)	177 (16.8)	19 (1.8)	3 (0.3)	3 (0.3)
TB-MR/RR	2 (16.7)	3 (25.0)	5 (41.7)	1 (8.3)	1 (8.3)	0 (0.0)
Type of resistance						
Sensitive	827 (78.5)	24 (2.3)	177 (16.8)	19 (1.8)	3 (0.3)	3 (0.3)
Primary	2 (0.2)	3 (25.0)	5 (41.7)	1 (8.3)	1 (8.3)	0 (0.0)
Co-infection TB-HIV						
TB-HIV+	225 (75.3)	14 (4.7)	51 (17.1)	6 (2.0)	3 (1.0)	0 (0.0)
TB-HIV-	604 (78.9)	13 (1.7)	131 (17.1)	14 (1.8)	1 (0.1)	3 (0.4)

Source: Authors.

Table 4 presents the distribution of clinical-epidemiological aspects of tuberculosis cases based on lesion site and TB type. Among the 1,065 patients diagnosed with TB, 1,046 (98.2%) had pulmonary tuberculosis of various types, while only 19 (1.8%) were diagnosed with extrapulmonary tuberculosis of the TB-RIF– type.

Table 4. Distribution of clinical-epidemiological aspects of tuberculosis cases by lesion site and TB Type, Búzi District, Sofala, 2020–2022.

Type of TB	Lesion site				Total	
	Extra pulmonary		Pulmonary			
	n	(%)	n	(%)	n	(%)
TB-MR/RR	0	(0.0)	12	(100)	12	(1.1)
TB-RIF -	19	(1.8)	1034	(98.2)	1053	(98.9)
Total	19	(1.8)	1046	(98.2)	1065	(100)

Source: Authors.

Table 5 presents the distribution of clinical-epidemiological aspects of tuberculosis cases based on lesion site and TB-HIV co-infection. Among the 1,065 patients diagnosed with TB, 1,046 (98.2%) had pulmonary tuberculosis, of which 757 were TB-HIV– cases and 289 were TB-HIV+ cases.

Table 5. Distribution of clinical-epidemiological aspects of Tuberculosis cases by lesion site and TB-HIV co-infection, Búzi District, Sofala, 2020–2022.

TB-HIV Co-infection	Lesion site		Total	
	Extra pulmonary	Pulmonary		
	n (%)	n (%)	n	(%)
TB-HIV-	9 (1.2)	757 (98.8)	766	(72.0)
TB-HIV+	10 (3.4)	289 (96.7)	299	(28.0)
Total	19 (1.8)	1046 (98.2)	1065	(100)

Source: Authors.

4. Discussion

The study provided information about tuberculosis in Búzi, but some results differed from initial expectations. It confirmed that the disease mainly affects adults aged 36 to 60 and women. However, the link between low education levels and higher vulnerability was not clear, likely due to limited data on occupation and education.The finding that TB and HIV co-infection affected treatment outcomes was also supported, with 28% of cases showing co-infection. The lower co-infection rate compared to other regions suggests that local HIV prevention efforts, like early screening and awareness campaigns, may have helped reduce these rates. Further research is needed to understand this better.Most TB cases were female, adults aged 36 to 60 years, residents of Bândua locality, and homemakers. Both new and re-entry patients with TB-RIF- and TB-MDR/RR were included among the cases entering the National Tuberculosis Control Program (PNCT), indicating the presence of primary resistance to anti-TB drugs. However, most of the diagnosed patients were TB-HIV-negative, had pulmonary lesions, and had a treatment outcome of completed therapy. These findings provide information that can contribute to deeper analysis and research into the causes of the epidemiological situation of tuberculosis in Búzi, thereby enabling the establishment of plans and strategies to control the disease in this region of the country.

The data were collected from health units with functioning SAPTB services. However, a key challenge is the lack of molecular diagnostic tools like GeneXpert® MTB/RIF. Among the four health units involved, only one had this equipment,

which presents an obstacle to mass and accurate TB diagnosis. These findings confirm data from the 2018 PNCT report, which indicated that 25% of health facilities in Mozambique lacked laboratories (Ministério da Saúde, 2019).

Among the studied cases, a higher proportion of female TB patients was observed compared to males, although co-infection with HIV was more frequent among males. These results differ from those found by Torcida (2021), in the city of Chimoio, who reported more TB cases in males. Similar findings were presented by (Cravo & Marques, 2018), who stated that men are more susceptible to TB than women. WHO (2019), similarly reported that 57% of TB cases worldwide were in adult men and 32% in adult women. This trend is likely due to greater exposure to risk factors among men than women (Pires, 2021).

This pattern may also be linked to adults' higher vulnerability to TB infection risks. Furthermore, the need to earn a living in crowded places such as markets and agricultural fairs can increase exposure to the disease. The locality of Bândua, which showed the highest number of TB cases, has a high number of communities 19 in total which may contribute to the formation of population clusters and facilitate disease transmission.

Most TB cases were identified in homemakers. This may reflect the social structure of Búzi's population and possibly the lack of classification tools for correctly identifying occupational profiles at SAPTB service points.

Among the clinical-epidemiological findings, one important aspect was the TB-HIV/AIDS condition. As Rieder (2001) argued, people living with HIV are more susceptible to TB due to weakened immunity. Similarly, Narasimhan (2013) highlighted that TB-HIV co-infection is a risk factor for developing active TB. Coelho et al. (2016), added that TB in HIV-positive individuals negatively affects the progression of immunodeficiency, increasing the risk of death from causes directly and indirectly related to TB. In this study, 28.0% of diagnosed cases were TB-HIV+. WHO (2019), reported a lower figure of 8.6%, while Torcida (2021) in Chimoio, found that more than half of TB cases were co-infected. The lower proportion in the present study may be attributed to the location and time of data collection, as well as to expanded efforts by health authorities and partners to control HIV. Early HIV screening in health units and communities by peer educators, activists, and community leaders allows individuals to discover their status and start treatment promptly, reducing co-infection risks. Additionally, local HIV awareness campaigns despite persistent cultural beliefs have contributed to behaviour change.

Some cases identified in the study were TB-MDR/RR, though in a relatively low proportion 1.1% of all cases. Similar results were found by Torcida (2021) in Chimoio (2.1%). The average age of TB-MDR/RR cases in this study was 48 years, comparable to the 41 years found by Órfão (2017) in a study on multidrug-resistant TB. The prevalence of TB-MDR/RR among new cases was 1%, while for re-entry cases it was 2.3%. Antimicrobial resistance remains a global public health concern.

Treatment abandonment identified in the study may be linked to long distances travelled by patients to collect medication, leading to fatigue or loss of motivation. Cultural preferences for traditional medicine over conventional care may also play a role. Additionally, recurring drug shortages at health units may foster abandonment.

Government and partner strategies to control and prevent TB were also observed, including cough agents, improved access to health services, expanded community DOTS, intensified TB-HIV collaboration, and education campaigns in crowded areas.

The results provide guidance for reflecting on the epidemiological profile of TB in Búzi and can help policymakers design more effective control strategies to meet health sector goals. Tuberculosis remains a contagious disease and a global public health challenge. Therefore, it is essential to strengthen social and health system policies, emphasizing investigative approaches that consider the social context of the patient. This can help reduce new infections, treatment abandonment, deaths, and the emergence of resistant TB strains (Sá et al. 2019).

5. Conclusion

This study aimed to analyze the epidemiological profile of tuberculosis patients in Búzi District (2020–2022). It confirmed that the district has functional SAPTB units at three health centers and Búzi Rural Hospital, supported by a well-structured multidisciplinary team.

The findings revealed that the majority of TB cases were among females aged 36–60, residing in Bândua, and mostly homemakers. Most TB patients were HIV-negative, with a high treatment completion rate, although there were instances of treatment abandonment and recorded deaths. Drug-resistant TB was present but in low numbers.

The study also highlighted that government and partner efforts have led to improvements in TB treatment access, reflected in favorable outcomes and reduced mortality and treatment abandonment. Overall, the study provides valuable insights for designing more effective TB control strategies in the region.

References

Barreto, R. M., & Garcia, M. F. (2021). Tuberculose em Moçambique: uma análise epidemiológica crítica. *Revista de Saúde Pública*, 55(3), 202–10.

Berquó, E. S., Sousa, J. M. P., Gotlieb, S. L. D. (1981). Bioestatística. Editora EPU.

Chissaque, A., Nhacolo, A., & Sitoe, N. (2021). Determinants of tuberculosis in central Mozambique: A community-based study. *Mozambican Medical Journal*. 5(2), 35–42.

Coelho, L. E., Escada, R. O. S., Barbosa, H. P. P., Santos, V. G. V., Grinszjn, B. G. J. (2016). O tratamento da coinfecção HIV-TB. https://www.bjid.org.br/en-pdf-X2177511716600168.

Cravo, J., Marques, M. A. T. (2018). Tuberculosis and Gender Factors Inflencing the Risk among Men and Women Age Group. Sociedade Portuguesa de Pneumologia. Editora Elsevier Espana.

Faria, F. P., & Lopes, J. T. (2020). Epidemiological trends of tuberculosis and co-infection with HIV in rural Mozambique. *Journal of Global Health Reports*, 4, e2020046.

IFRC (International Federation of Red Cross and Red Crescent Societies). (2019). *Mozambique: Cyclone Idai Emergency Appeal Update.*

MISAU (Ministério da Saúde). (2019). Manual para o Manejo da Tuverculose na Criança, Adolescente e na Mulher Grávida. https://www.misau.gov.mz/index.php/manuais-directrizes-e-guioes-tb? download=271:manual-para-o-manejo-da-tuberculose-na-crianca-no-adolescente-e-na-mulher-gravida.

MISAU (Ministério da Saúde). (2022). *Relatório Anual de Desempenho do Programa Nacional de Controlo da Tuberculose*.

Narasimhan, P., Wood, J. MacIntyre, C. R., Mathai, D. (2013). Risk Factors for Tuberculosis. https://onlinelibrary.wiley.com/doi/epdf/10.1155/2013/828939.

Órfão, A. C.N. (2017). Tuberculose Multirresstente – a realidade actual. https://repositorio.ul.pt/bitstream/10451/30752/1/AnaCNOrfao.pdf.

Pereira, A. S. et al. (2018). Metodologia da pesquisa científica. [free ebook]. Santa Maria: Editora da UFSM.

Pires, G. M. (2021). Análise das políticas de controlo da tuberculose e do perfil epidemiológico da infecção em Moçambique (2009-2017). https://run.unl.pt/bitstream/10362/118343/1/TESE%20DEFINITIVA_Germano_Manuel_Pires_22-04-2021.pdf.

PNCT (Programa Nacional de Controlo da Tuberculose). (2022). *Boletim Epidemiológico Nacional 2020–2021*.

Rieder, H. L. (2001). Bases epidemiológicas do controle da tuberculose. Lisboa: Direção Geral da Saúde.

Sá, A. M. M., Santiago, L. A., Santos, N. V., Monteiro, N. P., Pinto, P. H. A., Lima, A. M., Iwasaka-Neder, P. L. (2017). Causas de abandono do tratamento entre portadores de tuberculose. https://docs.bvsalud.org/biblioref/2017/11/875434/sbcm_153_155-160.pdf.

SDSMAS-Búzi. (2022). *Boletim Estatístico Distrital de Saúde, 2021–2022*.

Shitsuka, R. et al. (2014). Matemática fundamental para a tecnologia. (2ed). Editora Érica.

Torcida, P. C. I. (2021). Aspectos epidemiológicos da tuberculose e dos serviços de atendimento à pessoa com tuberculose no Município de Chimoio, Moçambique, 2018-2019. https://www.teses.usp.br/teses/disponiveis/6/6143/tde-06012022-204237/publico/TorcidaPCI_MTR_R.pdf.

WHO. (2019). *Global Tuberculosis Report 2019*. Geneva: World Health Organization.

WHO. (2020). *Global Tuberculosis Report 2020*. Geneva: World Health Organization.