

Research Article

Access to Tuberculosis Prevention and Treatment for Persons Deprived of Liberty in Southern Benin in 2023

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Abstract

Background: Access to tuberculosis (TB) preventive services in prisons is a performance indicator for disease reduction strategies in the general population. People deprived of liberty often face constraints in utilizing these services. This survey aimed to study prisoners' access to TB prevention in 2023. **Methods:** This was a cross-sectional analytical study, including a retrospective analysis, on a non-probabilistic sample. It was conducted at the Abomey-Calavi remand center and involved 60 people deprived of liberty. Interviews were conducted with the head nurse and their deputy, followed by a review of the curative care registers from the prison infirmary. Coverage rates for screening, awareness, and isolation during and after treatment were determined, and associations with factors were assessed at a significance threshold of $p=5\%$. **Results:** Less than half (43.75%) of prisoners with a cough lasting two weeks or more were screened. Among the 60 surveyed prisoners, 38.33%, 46.67%, and 10% had access respectively to screening, awareness and isolation for TB prevention. The care pathway for prisoners includes several key steps from screening to isolation, but it faces discontinuities that compromise effective TB treatment. Factors associated with TB screening were the effectiveness of awareness-raising activities ($OR=6.21$; 95% $CI=[1.67; 23.05]$) and perception regarding seeking TB screening and treatment ($OR=9.36$; 95% $CI=[1.44; 60.79]$). **Conclusion:** The decrescendo decrease in coverage indicates the presence of several bottlenecks limiting prisoners' access to TB prevention. Their consideration by health interventions will be necessary to ensure the protection of prisoners against TB.

Keywords

Access, Tuberculosis, Inmates, Persons Deprived of Liberty, Prevention, Treatment, Prison, Benin

1. Introduction

Access to health care and services for people with tuberculosis is a public health imperative, intrinsically linked to the respect for fundamental human rights [1]. This requirement is

enshrined in Sustainable Development Goal 3 (SDG3), which promotes universal and equitable access to healthcare without any form of discrimination [2, 3]. Despite this international

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recognition of the right to health for all and the efforts made in countries, several diseases like tuberculosis (TB) remain major health concerns, characterized by increasing morbidity and mortality, especially among vulnerable groups.

In 2021, nearly 10.6 million cases of tuberculosis were reported worldwide, including 1.4 million deaths. The geographical distribution of this disease is uneven, with nearly 80% of cases concentrated in Africa and Southeast Asia [4]. Vulnerable groups, including inmates, are particularly affected by tuberculosis [5]. In low-income countries, TB prevalence in prisons is 10 to 30 times higher than in the general population [6, 7]. TB in prison is even more concerning as this environment constitutes a high-risk setting for transmission. Overcrowding and promiscuity, unsanitary conditions, and violence that often characterize the prison environment foster the spread of infection within penitentiary facilities. Inmates carrying the disease can contribute to its dissemination in the general population, either during visits from relatives or after their release [8, 9].

To reduce the prevalence of tuberculosis within the general population and prevent its spread into communities from penitentiary facilities, access for prisoners to TB care and prevention services must be considered a public health priority [10]. To this end, it is necessary to establish the level of access to services in the prison setting as well as the major obstacles limiting their availability and accessibility [11].

It is within this context that the present study, conducted in 2023 in southern Benin, aims to promote the improvement of access for Inmates to the care and services system for tuberculosis control in the prison environment.

2. Materials and Methods

2.1. Study Setting

The Abomey-Calavi remand center, one of the two penitentiary facilities in the Atlantique department, served as the setting for this study. Located in the Akassato borough, it has a prison infirmary which provides healthcare for inmates. It comprises a main consultation room, a consultation room for women, a consultation room for men, and a hospitalization room. The consultation rooms also serve as treatment rooms. The infirmary has a hall which serves as a waiting room during consultations. Four healthcare staff ensure its operation: one nurse and three nursing assistants, including one head of service and one psychologist nurse. The infirmary receives an average of nearly eighty (80) patients per day. The prison receives interventions from the national tuberculosis control program. It has an isolation room used to isolate both inmates with a confirmed TB diagnosis and vulnerable, elderly, or disabled inmates who are subjected to violence.

2.2. Study Participants and Eligibility Criteria

The primary target of the study was inmates. The sample

included inmates diagnosed with tuberculosis between November 2022 and April 2023. The secondary target included relatives of inmates diagnosed positive for TB in the six months preceding the study, healthcare staff stationed at the prison infirmary for at least the six months preceding the study, other inmates who had presented a persistent cough for at least two weeks (≥ 2 weeks) and general symptoms suggestive of tuberculosis.

2.3. Study Design

A cross-sectional study with descriptive and analytical aims, comprising a quantitative component and a qualitative component, was conducted from May to June 2023 to analyse inmates' access to preventive and curative TB services. Within the penitentiary facility, the infirmary consultation registers were reviewed to identify managed cases of tuberculosis and cough. Inmates who had suffered from tuberculosis were systematically selected to be surveyed, while their relatives considered as contact subjects were selected conveniently, based on their availability to participate in the study. The surveyed healthcare staff from the prison infirmary were selected by reasoned choice.

2.4. Variables and Data Collection Tools

The dependent variable of the study was "access to tuberculosis prevention and treatment" in the prison setting. Other variables included characteristics related to the health system (cough ≥ 2 weeks, initiation on curative treatment, effective uptake of curative treatment, duration (in days) between care request and admission to the infirmary, awareness about tuberculosis, isolation of TB cases, access to psychological care and others). There were also individual characteristics (age, sex, medical history, education level, and others); and characteristics related to detention conditions.

A questionnaire and an interview guide were used to collect data from the respondents. A data extraction grid was used to collect data from the infirmary consultation registers.

TB screening, the entry point into the TB care process, was selected as the dependent variable to explore associated factors.

2.5. Data Processing and Analysis

Data collected directly via a data entry mask designed in the Kobo collect software were cleaned and then analysed using Stata version 14 software to generate proportions and odds ratios with their 95% confidence intervals. These indicators, along with those from multiple logistic regression, were assessed at a significance level of 5%. Furthermore, the use of Firth penalized logistic regression (firth logit in Stata) helped overcome limitations arising from small numbers noted for some categories of explanatory variables, reduced the bias of coefficients due to the small sample size, and thus provided more reliable estimates.

The discourses collected during the qualitative survey underwent content analysis, grouped by theme to generate verbatims used to explain the findings.

2.6. Ethical and Deontological Considerations

The study received a non-objection opinion from the penitentiary facility Directorate; this facilitated access to the site and participants. Data collection was carried out under the supervision of prison officials to ensure compliance with security and confidentiality rules specific to the prison environment. Data were processed in an aggregated manner to prevent any identification of respondents. Furthermore, the research protocol was validated by a scientific jury from the Comlan Alfred Quenum Regional Institute of Public Health, in accordance with prevailing ethical and deontological requirements.

3. Results

3.1. Individual Characteristics

Among the 60 inmates surveyed, 15 were tuberculosis patients undergoing treatment at the time of the survey or had completed treatment less than six months earlier. The others were inmates who had lived in the immediate vicinity of TB patients (same building or same cell). The average age of the surveyed inmates was 41.53 years (+/- 16.49 years). TB patients were on average 39.13 years old (+/- 11.33 years).

The surveyed prison population was exclusively male. Among the respondents, 37 (61.61%) were educated, the majority (60%) were Christian compared to 15% Muslim, and 68.33% had already been sentenced. Medical histories were dominated by diabetes and malaria (38.33%) followed by gastroenteritis (23.33%) (Table 1).

Table 1. Distribution of surveyed inmates according to sociodemographic and individual characteristics at the Abomey-Calavi prison in 2023 (n=60).

Variables	Number (n)	Proportion (%)	95% CI (%)
Age (years)			
18-28	16	26.67	16.78 - 39.59
29-38	14	23.33	14.11 - 36.03
39-48	13	21.67	12.81 - 34.23
≥49	17	28.33	18.15 - 41.34
Sex			
Male	60	100	-
Education Level			
Illiterate	23	38.33	26.67 - 51.50
Primary	27	45.00	32.64 - 58.00
Secondary	10	16.67	9.04 - 28.69
Religion			
Christian	36	60.00	46.84 - 71.85
Muslim	9	15.00	7.84 - 26.79
Animist	5	8.33	3.42 - 18.91
None	10	16.67	9.04 - 28.69
Judicial status			
Awaiting trial	19	31.67	20.92 - 44.79
Already sentenced	41	68.33	55.20 - 79.07
Medical history			
None	17	28.33	18.15 - 41.34
Gastroenteritis	14	23.33	14.11 - 36.03
Other (diabetes, malaria, gastric ulcer)	29	48.33	35.70 - 61.17

Variables	Number (n)	Proportion (%)	95% CI (%)
Perception of seeking TB screening and treatment services			
Important	53	88.33	77.08 - 94.45
Not important	7	11.67	5.54 - 22.91

3.2. Characteristics Related to the Health System

3.2.1. Cumulative Incidence of Tuberculosis Over Six Months

The average prison population for the period was 2000 inmates. There were 15 people treated or having been treated in the last six months for tuberculosis confirmed by laboratory tests; resulting in a cumulative incidence of 7.5 cases per 1000 inmates over six months¹.

3.2.2. Tuberculosis Prevention and Care

a) Consultation for Cough

Out of 1250 inmates who consulted the prison infirmary for cough, 34.56% had a cough lasting less than two weeks and 9.04% had a cough lasting two weeks or more. In 56.40% of cases, the duration of the cough was not specified (Table 2).

b) Access to screening, awareness and tuberculosis treatment

Only 44.25% of inmates who consulted the prison infirmary and presented with a cough of two weeks or more had benefited from the screening test (AFB examination). Among the 60 surveyed inmates, 38.33% reported having been screened for tuberculosis. Those not screened were mostly cellmates identified as contacts of TB patients. More than half of the surveyed inmates (53.33%) had not been exposed to any awareness sessions on TB prevention methods (Table 2).

Table 2. Distribution of respondents according to access or utilization of tuberculosis care and detention conditions at the Abomey-Calavi prison in 2023.

Variables	Number (n)	Proportion (%)	95% CI (%)
Consultation for cough (n=1250)			
Cough < 2 weeks	432	34.56	31.96 - 37.24
Cough ≥ 2 weeks	113	9.04	7.56 - 10.76
Cough duration not specified	705	56.40	53.63 - 59.13
TB screening for cough ≥2 weeks (n=113)			
Yes	50	44.25	35.25 - 53.63
No	63	55.75	46.36 - 64.74
TB screening among respondents (n=60)			
Yes	23	38.33	26.67 - 51.50
No	37	61.67	48.49 - 73.32
Awareness on TB (n=60)			
Yes	28	46.67	34.17 - 59.59
No	32	53.33	40.40 - 65.82
Isolation of TB cases (n=15)			
Yes	2	13.33	2.77 - 45.37
No	13	86.67	54.62 - 97.22
Authorization to seek care at infirmary (n=60)			
Yes	23	38.33	26.67 - 51.50

Variables	Number (n)	Proportion (%)	95% CI (%)
No	37	61.67	48.49 - 73.32
Time between care request and infirmary admission (days) (n=60)			
< 1	11	18.33	10.27 - 30.56
1-3	37	61.67	48.49 - 73.32
> 3	12	20.00	11.53 - 32.40
Initiation on curative treatment (n=15)			
Yes	15	100.00	-
No	0	0.00	-
Effective treatment uptake (n=15)			
Yes	11	73.33	42.93 - 90.95
No	4	26.67	9.04 - 57.06
Access to psychological support (n=15)			
Yes	4	26.67	9.04 - 57.06
No	11	73.33	42.93 - 90.95
Presence of discrimination against TB patients (n=60)			
Yes	41	68.33	55.20 - 79.07
No	19	31.67	20.92 - 44.79
Harassment, abuse or other form of violence in prison (n=60)			
Yes	5	8.33	3.42 - 18.91
No	55	91.67	81.08 - 96.57

Among the 15 TB patients, 73.33% had effectively adhered to anti-tuberculosis treatment, the remainder did not for various reasons (personal choice, resale of medication, or "the hunger the treatment would cause"); only 13.33% would have been isolated, and this in a place where they cohabited with elderly and disabled people. Around three-quarters (73.33%)

of TB patients reported not having received any psychological support throughout their treatment (Table 2).

Furthermore, the majority of surveyed inmates (68.33%) stated that tuberculosis was stigmatizing in prison. Regarding harassment or other forms of violence, 91.67% of respondents reported not having been victims.

Table 3. Associations between selected variables and inmates' access to tuberculosis screening at the Abomey-Calavi prison in 2023 (Bivariate Analysis).

Variables	TB Screening Yes n (%)	TB Screening No n (%)	Odds Ratio (OR)	95% CI	p-value
Age (n=60)					
18-28 (Ref)	7 (30.43)	9 (24.32)	1	-	-
29-38	5 (21.74)	9 (24.32)	1.40	0.32 - 6.10	0.65
39-48	5 (21.74)	8 (21.62)	1.24	0.28 - 5.52	0.77
≥49	6 (26.09)	11 (29.73)	1.42	0.35 - 5.79	0.62
Education level (n=60)					
Illiterate (Ref)	7 (30.43)	16 (43.24)	1	-	-

Variables	TB Screening Yes n (%)	TB Screening No n (%)	Odds Ratio (OR)	95% CI	p-value
Primary	14 (60.87)	13 (35.14)	0.40	0.12 - 1.30	0.13
Secondary	2 (8.70)	8 (21.62)	1.75	0.29 - 10.43	0.53
Religion (n=60)					
None (Ref)	5 (21.74)	5 (13.51)	1	-	-
Christian	15 (65.22)	21 (56.76)	1.40	0.34 - 5.70	0.63
Muslim	2 (8.70)	7 (18.92)	3.50	0.47 - 25.90	0.22
Animist	1 (4.35)	4 (10.81)	4.00	0.32 - 49.59	0.28
Medical history (n=60)					
None (Ref)	5 (21.74)	12 (32.43)	1	-	-
Gastroenteritis	8 (34.78)	6 (16.22)	0.31	0.07 - 1.38	0.12
Other (diabetes, malaria, ulcer)	10 (43.48)	19 (51.35)	0.79	0.21 - 2.88	0.72
Awareness on TB (n=60)					
No (Ref)	17 (73.91)	15 (40.54)	1	-	-
Yes	6 (26.09)	22 (59.46)	4.15	1.33 - 12.97	0.014
Discrimination against TB (n=60)					
No (Ref)	8 (34.78)	11 (29.73)	1	-	-
Yes	15 (65.22)	26 (70.27)	1.26	0.55 - 3.41	0.68
Perception of screening/treatment (n=60)					
Not important (Ref)	5 (21.74)	2 (5.41)	1	-	-
Important	18 (78.26)	35 (94.59)	4.86	0.85 - 27.57	0.074

3.3. Factors Associated with Access to Tuberculosis Screening

3.3.1. Analysis of Associated Factors

According to Table 3, “implementation of TB awareness activities” was the factor identified as associated with access to TB screening. All others, as education level of inmates, medical history, and inmates' perception of seeking health services for TB screening and treatment were not associated with that.

Of the four variables with a p-value less than 20% integrated into the initial multivariate model to perform Firth

penalized logistic regression, namely the education level of inmates, medical history, implementation of TB awareness activities, and inmates' perception of seeking TB screening and treatment, only two were identified as associated with access to TB screening after stepwise elimination at the 5% significance level. These were awareness about tuberculosis (OR= 6.21; 95% CI= [1.67; 23.05]) and perception regarding seeking TB screening and treatment (OR= 9.36; 95% CI= [1.44; 60.79]). These results indicate that informed inmates had about 6 times higher odds of being screened than those not informed. Similarly, participants perceiving screening as “very important” had an increased probability of screening, more than 9 times the odds compared to those judging screening less important (Table 4).

Table 4. Final multivariate model of variables associated with inmates' access to tuberculosis screening at the Abomey-Calavi prison in 2023 (n=60) (Multivariate Analysis - Firth).

Variables	TB Screening Yes n (%)	TB Screening No n (%)	Adjusted Odds Ratio (aOR)	95% CI	p-value
Awareness on TB (n=60)					
No (Ref)	17 (73.91)	15 (40.54)	1	-	-
Yes	6 (26.09)	22 (59.46)	6.21	1.67 - 23.05	0.006
Perception of screening/treatment (n=60)					
Not important (Ref)	5 (21.74)	2 (5.41)	1	-	-
Important	18 (78.26)	35 (94.59)	9.36	1.44 - 60.79	0.016

3.3.2. Environmental Barriers

Most surveyed inmates reported insufficient meals provided to TB patients. They believed that taking anti-tuberculosis drugs very early in the morning stimulated their hunger, thus forcing them to interrupt treatment, in the absence of meals served at that time of day.

"Personally, I did not take the medication regularly because it is a medication that must be taken very early in the morning after eating. But here we only eat around noon [...] and when I don't eat in the morning before taking it, it really makes my stomach empty. So, I took the medication some days and skipped other days as well" (Man, 45 years old, primary level).

Some inmates also mentioned difficulties swallowing the tablets due to their large size. Non-adherence to treatment was also explained by the resale of anti-tuberculosis drugs by sick inmates.

"The person I shared my cell with who had tuberculosis is a bit stubborn. When he takes the tablets, he sells them to other illiterate inmates, passing them off as vitamins" (Man, 35 years old, secondary level).

Regarding detention conditions, some respondents mentioned overcrowding within the penitentiary facility, which would not allow better TB care and also expose the non-sick.

Some TB inmates would use drugs, notably cigarettes which they would share with other inmates. This practice, which compromises treatment adherence, promotes the spread of the disease.

"A major problem we have is the use of drugs [cannabis and cigarettes]. To discourage cigarette use, we decided to sell it to them for 75 FCFA per unit instead of 25 FCFA, but despite that they pool money together to buy a cigarette which they share in turns" (Man, 45 years old, higher education level).

3.3.3. Health System Barriers

Inmates reported a lack of healthcare staff, which often makes care unavailable. Most of them said they often did not receive authorization from their block chief to go to the infirmary, because the latter would judge that they go to the infirmary too often or that they should rely more on themselves for treatment, otherwise they will die from a trivial cause. This is reported by the respondent cited below.

"To go to the infirmary, you must first tell the block chief who will put your name on a list and he will schedule the day you will go to the infirmary [...]. Sometimes, he can refuse to put your name down, saying that you go to the infirmary too much and that you can manage on your own." (Man, 42 years old, primary level).

Also, excessively long waiting times and poor reception at the infirmary were also mentioned as reasons for not seeking care.

"To tell you the truth, I am someone who doesn't like being yelled at" (Man, 40 years old, primary level).

3.3.4. Care Provision

According to one of the surveyed healthcare workers, the infirmary has adequate infrastructure for care provision. It consists of a consultation room for men and another for women. The staff would be knowledgeable about screening and care protocols, but these reference documents were not seen during data collection. When an inmate complained of a productive cough lasting more than two weeks, the AFB examination was performed automatically. For inmates with a positive test result, initiation of treatment was systematic, while isolation was not. Inmates in contact with TB patients were neither screened nor followed up. Awareness sessions on tuberculosis had not covered the entire prison population. **Figure 1** shows the inmate pathway in the TB care circuit at this penitentiary facility. It highlights the limitations in accessing various care services.

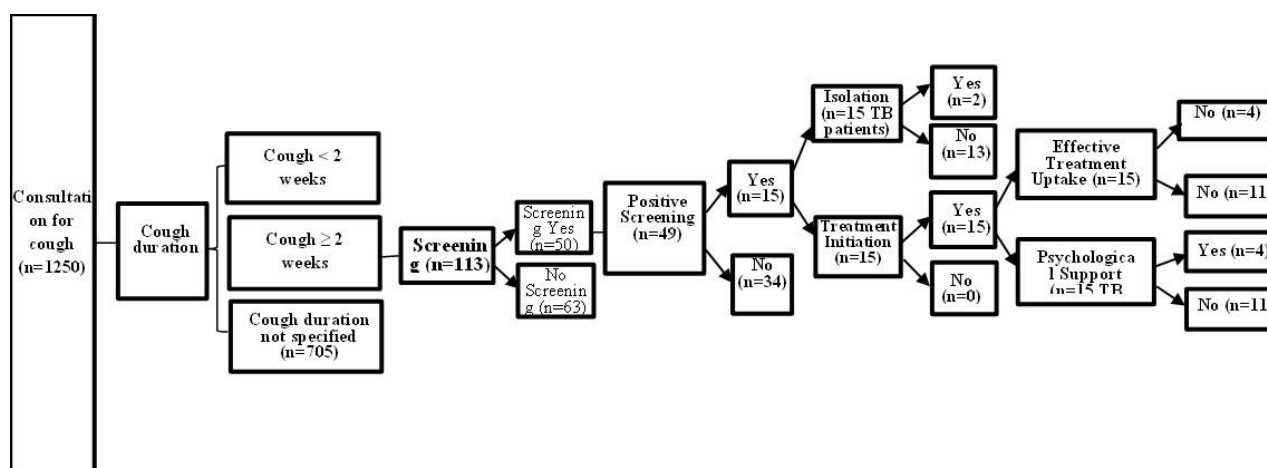


Figure 1. Algorithm of the care pathway for inmates presenting with a cough in the prison infirmary of the Abomey-Calavi prison in 2023.

4. Discussion

4.1. Incidence of Tuberculosis

The cumulative incidence of tuberculosis among inmates of the prison in 2023 was 7.5 cases per 1000 inmates over the six months preceding the study. This incidence is much lower than the frequencies reported in Sub-Saharan African prisons (4.02%) [12], Niger (0.84%) [13], and Ecuador (1.9%; 95% CI=1.6%-2.1%) [14]. These differences could be related to the number of sites or prisons involved in those studies, their duration, as well as several other characteristics of the contexts.

4.2. Cough Status of Inmates

Cases of cough with unspecified duration were predominant (56.40%) followed by cases of cough lasting less than two weeks (34.56%). The proportion of chronic coughers (duration more than 2 weeks) recorded in this study (9.04; 95% CI=7.56%-10.76%) is similar to the 10.8% (95% CI=10.2%-11.3%) reported in Ecuadorian prisons [14].

The lack of precision regarding cough duration for more than half of the cases is not in agreement with the prescriptions of the care protocol applied in the country [15] and therefore constitutes an indicator of poor quality of TB care and surveillance. It may be accompanied by the presence of undiagnosed TB cases, similar to the situation in Ethiopian prisons where nearly half of TB cases were not diagnosed [16]. Persistent cough being a crucial warning symptom of tuberculosis [15], its non-systematic documentation reflects a failure in the application of screening and care protocols, which were not available at the time of the study. In the penitentiary facility, screening is done only upon request based on a persistent cough for two weeks or more. Although this approach complies with the protocol and is corroborated

by results from Niger, where 100% of pulmonary TB cases in inmates presented often chronic cough [13], TB screening in a penitentiary facility should be systematic or mandatory in the presence of other symptoms or parameters [14-16]; because close contact also increases the risk of exposure [16]. In summary, it is essential to make updated screening and care protocols available in care units and sensitize medical staff to their application and to clinical warning signs to avoid late diagnosis of tuberculosis [10].

4.3. Screening and Management of Tuberculosis

Among the 60 TB patients or contacts of TB patients who were surveyed, 38.33% had been screened for tuberculosis. The proportion of access to screening found in this study is higher than that reported in the Zambian Lusaka Central Prison (18%) in 2011 [17] where several factors were linked to the low prevalence, including being female, a minor, or a migrant inmate. In many cases, screening relies on self-reporting by inmates; this can lead to delays, as prisoners sometimes hesitate to report their symptoms, either for fear of reprisals or because they believe their concerns will not be taken seriously [7, 18]. Also, tuberculosis often constitutes a late differential diagnosis in inmates presenting with chronic cough, empirical treatments for upper respiratory tract infections being preferred first-line [19, 20]. Similarly, to the findings of the present study that screening is done on request, medical authorities in Lusaka facilities confirm the absence of systematic TB screening within the prison population [21-23] which could have helped reduce long case detection delays and especially the persistence of undiagnosed cases within the penitentiary facility [24, 25]. Similarly, in a study conducted in 157 Indian prisons, only 18% of inmates were screened [26]. Another study revealed that in a South African prison, 93.8% of inmates consented to be screened for tuberculosis. This study highlighted the importance of systematic screening, although screening was not always performed in a standard-

ized manner [27]. The low prevalence of undiagnosed tuberculosis in the Niger prison could be explained by the systematic screening of new inmates admitted to that penitentiary facility. These results corroborate those found in a study conducted in Brazil between 2017 and 2021 where over 80% of the prison population was screened [28].

The present study revealed that, in this penitentiary facility where meals are served in the middle of the day, around noon, 100% of inmates diagnosed with tuberculosis had received treatment; 73.33% had effectively followed it. This level of access to treatment, higher than that recorded in Central African Republic penitentiary facilities (70%) [5], is beyond the Global Fund's target that "90% of people in prison should have access to screening, preventive measures, and tuberculosis care" [6]. This reflects the efforts of the country, which overall is on track to achieve this goal, with disparities between penitentiary facilities [29]. The 73.33% of inmates who effectively followed treatment is higher than the 61.5% who completed it in Malawi, where only 89.7% of inmates had started anti-tuberculosis treatment [30].

Anti-tuberculosis drugs must be taken early in the morning after eating; the absence of a meal encourages inmates to interrupt their treatment; because taking the medication in the morning on an empty stomach can cause abdominal pain or intense feelings of hunger, as reported by inmates [31]. Non-compliance with this nutritional protocol appears as one of the direct causes of treatment non-adherence. TB treatment being long-term, only regular intake can guarantee cure. Some inmates resort to reselling their medication to obtain other goods. Possession of medication by inmates already indicates that directly observed therapy (DOT) is not fully applied. These findings specific to the prison setting and the lack of harmonization between the diet and medication protocol compromise treatment follow-up and the effectiveness of overall care. Non-adherence to treatment, as reported by inmates, can favour the emergence of resistant strains, making future cases management more complex and costly.

In sub-Saharan Africa, although some countries have implemented systematic screening programs upon prison entry, access to treatment remains limited due to insufficient financial and human resources. Fragmented referral systems also complicate the continuity of care when inmates enter and leave facilities [32]. Despite the implementation of strategies advocating standardized supervised treatment and continuous pharmaceutical supply, many difficulties persist in penitentiary facilities [33]. Several studies highlight the persistence of unsupervised treatment practices, due notably to constraints related to human and material resources, as well as sociocultural factors specific to the prison environment [6, 34, 35]. Sociocultural factors affecting treatment adherence: the set of norms and practices specific to the prison environment, fear of release, and hierarchical relationships among inmates can negatively impact treatment adherence [6, 8, 36].

This study revealed that 90% of inmates with tuberculosis are not isolated. This absence of systematic isolation of TB

inmates was also reported by studies conducted in Zambia [17] and Senegal where only 29.3% of facilities have an isolation room for contagious cases [8].

The non-systematic isolation of TB inmates is linked to the limited capacity of prison infrastructure. Overcrowding and promiscuity, often characteristic of the prison environment, aggravate the spread of tuberculosis. The grouping of TB patients with other vulnerable inmates (elderly or disabled people) is a risky practice that directly exposes the latter to the disease. This result illustrates an issue of construction standards and obsolescence of facilities, which do not allow adequate application of infection control measures.

4.4. Factors Determining Tuberculosis Screening

Two factors stood out as being associated with TB screening among inmates. These were awareness about tuberculosis and the positive perception of the importance of screening and treatment. Inmates who had received awareness and those considering screening as "very important" had a significantly higher probability of being screened, compared to other categories. These results indicate that even in this prison context where screening and awareness are mostly opportunistic (often at the time of a consultation for cough), health education and positive attitudes play a central role in leading inmates to spontaneously present for consultation.

Several studies have shown that improving awareness can increase screening rates by more than 50% and, consequently, help control TB in these high-risk environments [37]. Better awareness among inmates about the risks associated with TB and the symptoms of the disease can encourage more people to request screening. Educational programs that inform about transmission, symptoms, and the importance of treatment can reduce stigma and encourage inmates to seek care [8, 38]. Other initiatives such as targeted workshops and educational campaigns in prisons can help destigmatize tuberculosis and encourage inmates to get screened.

In other contexts, despite increased awareness, some inmates perceived screening as useless or ineffective, decreasing the motivation of others to get screened [39]. Also, awareness programs, although necessary to inform inmates about TB, do not always lead to an increase in screening. This situation stems from the fact that being informed is considered by prison authorities as sufficient to avoid the disease without the need for medical intervention [40].

Awareness, a realistic and low-cost lever to improve inmate health practices, thus seems to improve symptom recognition, reduce fear or stigma, and foster proactivity in seeking care. These findings suggest strengthening strategic interventions in prisons such as targeted awareness campaigns and actions to modify individual perceptions.

5. Study Limitations

This study allowed to explore access to services among all eligible targets at the prison with the facilitation provided by the penitentiary facility and the full application of the planned approach and tools. However, the small number of respondents, below the required minimum size, and the use of convenience sampling techniques to select the survey site and enrol targets reduce the possibilities of extrapolating the results to all penitentiary facilities in Benin. These findings on protocol application induce a reduction in the external validity of the results without, however, annihilating their contribution to public health interventions in the prison setting.

6. Conclusions

This study highlights significant gaps in inmates' access to tuberculosis prevention and treatment services in southern Benin. The progressively decreasing coverage rates for screening, awareness, and isolation reveal the existence of bottlenecks that compromise effective disease management. Factors associated with screening, such as awareness and inmate perceptions, underscore the importance of public health interventions adapted to this environment. It is imperative to improve infrastructure, strengthen the harmonization of treatment protocols with prison living conditions and their effective application, as well as the implementation of awareness activities to ensure better protection of inmates and the general population against tuberculosis.

Abbreviations

TB	Tuberculosis
FCFA	Franco of African Financial Community

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Author Contributions

All authors participated in the development of this manuscript. Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Writing original draft, Writing - review.

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The data is available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare no conflicts of interest.

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¹ Cumulative incidence = (15/2000) x 1000 = 7,5 per 1000 inmates