

Knowledge, Attitudes, and Practices of People Living with HIV Regarding Tuberculosis Screening in Nyarugenge District, Rwanda

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Abstract: Background: This study investigates tuberculosis (TB) screening among people living with HIV (PLHIV) in Nyarugenge District, Rwanda—a region facing high rates of TB-HIV co-infection. Although timely TB screening is essential for early diagnosis and treatment, its uptake among PLHIV remains low due to barriers such as limited knowledge, stigma, and healthcare access challenges. The study aims to assess the knowledge, attitudes, and practices (KAP) of PLHIV regarding TB screening to identify factors influencing screening behavior and inform targeted public health interventions.

Materials and Methods: Using a cross-sectional design, researchers surveyed 423 PLHIV using structured questionnaires that captured socio-demographic data, knowledge of TB, attitudes toward screening, and actual screening practices. Statistical analyses included descriptive statistics, chi-square tests, and multivariate logistic regression to explore associations between KAP variables and screening behavior.

Results: Findings revealed that only 28.1% of participants demonstrated good TB screening practices. Several factors were significantly associated with higher screening uptake. Older adults (ages 51–60) were much more likely to undergo screening compared to younger individuals. Educational attainment also influenced practices, with those having primary or secondary education showing better screening behaviors than those with no formal education. Additionally, the duration of HIV diagnosis was a significant factor—particularly among those with congenital HIV. Knowledge and attitudes emerged as critical behavioral predictors. Participants with positive or neutral attitudes toward TB screening were more likely to get screened compared to those with negative attitudes.

Conclusion: The study concludes that TB screening among PLHIV is suboptimal and influenced by a combination of demographic and psychosocial factors.

To address these gaps, the study recommends targeted interventions focusing on education, attitude change, and healthcare system improvements. Enhancing awareness, reducing stigma, and integrating TB and HIV care services more effectively could significantly improve screening uptake and health outcomes in resource-limited settings like Rwanda.

Keywords: KAP, People, HIV, Tuberculosis Screening, Nyarugenge District.

I. INTRODUCTION

tuberculosis (tb) remains a significant public health threat worldwide, particularly among individuals living with HIV (PLHIV). according to the world health organization (who), in 2022, approximately 10.6 million new tb cases were reported globally, leading to around 1.6 million deaths attributed to tb (who, 2023). the burden of tb is especially pronounced among PLHIV, who are up to 26 times more likely to develop active tb disease than those without HIV (Migliori et al., 2023). this co-infection complicates treatment regimens and increases mortality rates, making it crucial to implement effective screening and treatment strategies to control both diseases. Sub-Saharan africa bears the highest burden of tb and PLHIV,

with approximately 3.6 million new tb cases reported in this region in 2021 (who, 2022). around 50% of global tb cases occur in sub-saharan africa, which contributes significantly to overall tb morbidity and mortality (unaids, 2023). the who has indicated that HIV is the strongest risk factor for developing tb, responsible for approximately 37% of tb-related deaths in this region (who, 2022). therefore, effective tb screening programs for PLHIV are vital for reducing tb incidence and improving health outcomes in these populations.

in the east african region, countries face significant challenges in addressing tb and HIV co-infection. studies indicate that awareness and accessibility to tb screening among PLHIV remain critically low. for example, a cross-sectional study conducted in Uganda revealed that only 38% of PLHIV were aware of their eligibility for tb screening (Nakanjako et al., 2023). additionally, in Kenya, research has shown that stigma and fear of diagnosis deter many PLHIV from accessing tb screening services, emphasizing the need for integrated healthcare approaches (Muchemi et al., 2022). the interrelation between tb and PLHIV necessitates a comprehensive understanding of the factors influencing screening behaviors in this population.

Rwanda has made considerable strides in combating both tb and HIV, but challenges persist. according to the national tuberculosis control program (ntcp), there were approximately 4,800 new tb cases reported in 2022, with a prevalence rate of 85 per 100,000 people (Rwanda biomedical centre, 2022). among PLHIV, the burden of tb remains a significant public health concern, with co-infection rates estimated at 23% (ministry of health, rwanda, 2023).

Understanding the dynamics of tb and HIV co-infection in Rwanda is essential for implementing targeted interventions and improving health outcomes for HIV. Rwanda's health policy emphasizes the integration of tb and HIV services, which is critical to improving screening rates and treatment outcomes for co-infected individuals. the government has implemented strategies to provide integrated care, including training healthcare workers to manage both conditions effectively (ministry of health, Rwanda, 2023). however, studies indicate gaps in knowledge and awareness of tb screening among PLHIV. a study in Kigali found that while awareness of tb was relatively high, misconceptions about transmission and stigma hindered screening uptake (Ndayambaje et al., 2023). these findings highlight the need for tailored health education initiatives to address knowledge gaps among PLHIV.

research has consistently shown that knowledge gaps regarding tb screening are prevalent among PLHIV in Rwanda. a study conducted by Ndayambaje et al. (2023) highlighted that many PLHIV lack adequate understanding of tb symptoms and the importance of regular screening. misconceptions about the nature of tb transmission and treatment can lead to reluctance in seeking screening services, exacerbating the risk of disease progression. to mitigate these challenges, it is essential to develop targeted educational programs that enhance awareness of tb and its relationship with HIV.

the attitudes of PLHIV towards tb screening significantly influence their willingness to participate in screening programs. research suggests that negative attitudes, often fueled by stigma, can deter individuals from seeking necessary healthcare services (Mthethwa et al., 2022). fear of a tb diagnosis and the associated social stigma can lead to avoidance of healthcare settings, limiting access to life-saving interventions. therefore, addressing these attitudes through community engagement and awareness campaigns is crucial to promote positive perceptions of tb screening among PLHIV.

the practices surrounding tb screening among PLHIV in Rwanda require careful examination to identify barriers and facilitators to screening uptake. studies have indicated that while some PLHIV may be aware of tb screening services, they may not actively seek them due to logistical barriers, such as transportation costs and long waiting times at healthcare facilities (Nduwayezu et al., 2023). additionally, insufficient follow-up after initial screenings may lead to missed opportunities for treatment and care. understanding these practices can inform the design of more accessible and patient-centered tb screening programs.

given the complex interplay between tb and HIV, addressing the gap of PLHIV regarding tb screening is essential for informing public health policies. enhancing knowledge, shaping positive attitudes, and improving practices related to tb screening can contribute to better health outcomes and reduced tb incidence among PLHIV. policymakers should prioritize integrated tb and HIV care models that include comprehensive education and outreach strategies to raise awareness and reduce stigma associated with tb (Rwanda biomedical centre, 2022).

this study aims to explore the KAP of PLHIV regarding tb screening in Nyarugenge district, Rwanda, to identify existing knowledge gaps and barriers to screening uptake. by understanding these dynamics, the research was providing valuable insights that can inform the development of tailored interventions to improve tb screening rates among PLHIV. ultimately, this research seeks to contribute to the overarching goal of reducing tb morbidity and mortality in vulnerable populations,

aligning with global and national health priorities. the main objective of this study was to assess the level of knowledge, attitudes, and practices of PLHIV concerning tuberculosis screening. it was guided by the following specific objectives:

- i. To assess the level of knowledge of PLHIV about tuberculosis symptoms and the importance of tb screening in Nyarugenge district, Rwanda
- ii. To explore the attitudes of PLHIV towards regular tb screening and prevention measures in Nyarugenge district, Rwanda.
- iii. To determine the practices of PLHIV regarding their engagement with tb screening services in Nyarugenge district, Rwanda.

II. THEORETICAL FRAMEWORK

Health Belief Model (HBM)

The Health Belief Model is a widely utilized framework in public health that helps explain individuals' behaviors regarding health screenings. According to HBM, the likelihood of engaging in health-promoting behavior, such as TB screening, is influenced by several factors:

Perceived Susceptibility: Individuals must believe they are at risk for TB, especially if they are HIV positive.

Perceived Severity: The belief about the seriousness of TB, including potential health consequences, influences the decision to seek screening.

Perceived Benefits: Individuals are more likely to engage in TB screening if they believe that screening can effectively reduce the risk of severe health outcomes.

Perceived Barriers: Individuals' perceptions of obstacles to screening (e.g., cost, stigma, transportation issues) can hinder their willingness to participate in screening programs.

By applying the HBM, this study was assessed how knowledge and attitudes about TB influence the likelihood of engaging in screening practices among PLHIV (Rosenstock, 1974; Champion & Skinner, 2008).

Theory of Planned Behavior (TPB)

The Theory of Planned Behavior posits that an individual's intention to perform a behavior (in this case, TB screening) is influenced by three key factors:

Attitude Toward the Behavior: The individual's positive or negative evaluation of TB screening, shaped by their knowledge and beliefs about TB.

Subjective Norms: The perceived social pressure to engage in TB screening, influenced by family, friends, or community perceptions of TB and HIV.

Perceived Behavioral Control: The individual's belief in their ability to perform the behavior, including access to screening facilities and resources.

This theory was instrumental in understanding how attitudes, perceived social pressures, and control factors affect TB screening practices among PLHIV (Ajzen, 1991; Armitage & Conner, 2001).

Social Cognitive Theory (SCT)

Social Cognitive Theory emphasizes the role of observational learning, imitation, and modeling in behavior change. Key components of SCT include:

Reciprocal Determinism: The interaction between individual factors (cognition, emotions), behavior (TB screening), and environmental influences (healthcare access, community support).

Self-Efficacy: An individual's belief in their ability to successfully engage in TB screening behaviors. Higher self-efficacy is associated with an increased likelihood of participating in health-promoting behaviors.

Observational Learning: Individuals may be influenced by the behaviors of others in their community regarding TB screening, shaping their own attitudes and practices.

SCT washelp explore how personal and environmental factors impact KAP regarding TB screening among PLHIV (Bandura, 1986; Bandura, 1997).

Stigma Theory

Stigma theory explains how societal attitudes and beliefs about TB and HIV can significantly affect individuals' health-seeking behaviors. Key aspects include:

Internalized Stigma: PLHIV may internalize negative societal attitudes toward TB, leading to feelings of shame or fear that prevent them from seeking screening.

Social Stigma: Fear of discrimination or rejection by peers and family may deter individuals from accessing TB screening services.

Structural Stigma: Institutional policies or practices that create barriers to accessing care can contribute to reduced screening uptake.

Understanding stigma is essential for addressing the barriers to TB screening among PLHIV and developing effective interventions (Herek, 2009; Earnshaw et al., 2013).

Incorporating these theories into the framework provides a comprehensive approach to understanding the KAP of PLHIV regarding TB screening. By exploring these theoretical perspectives, the study can identify key factors influencing screening behaviors and inform the development of targeted interventions to improve TB screening uptake in Nyarugenge District.

III. CONCEPTUAL FRAMEWORK

The following framework was adapted based on the literature on knowledge, attitudes, and practices (KAP) related to TB screening among PLHIV reveals several critical issues.

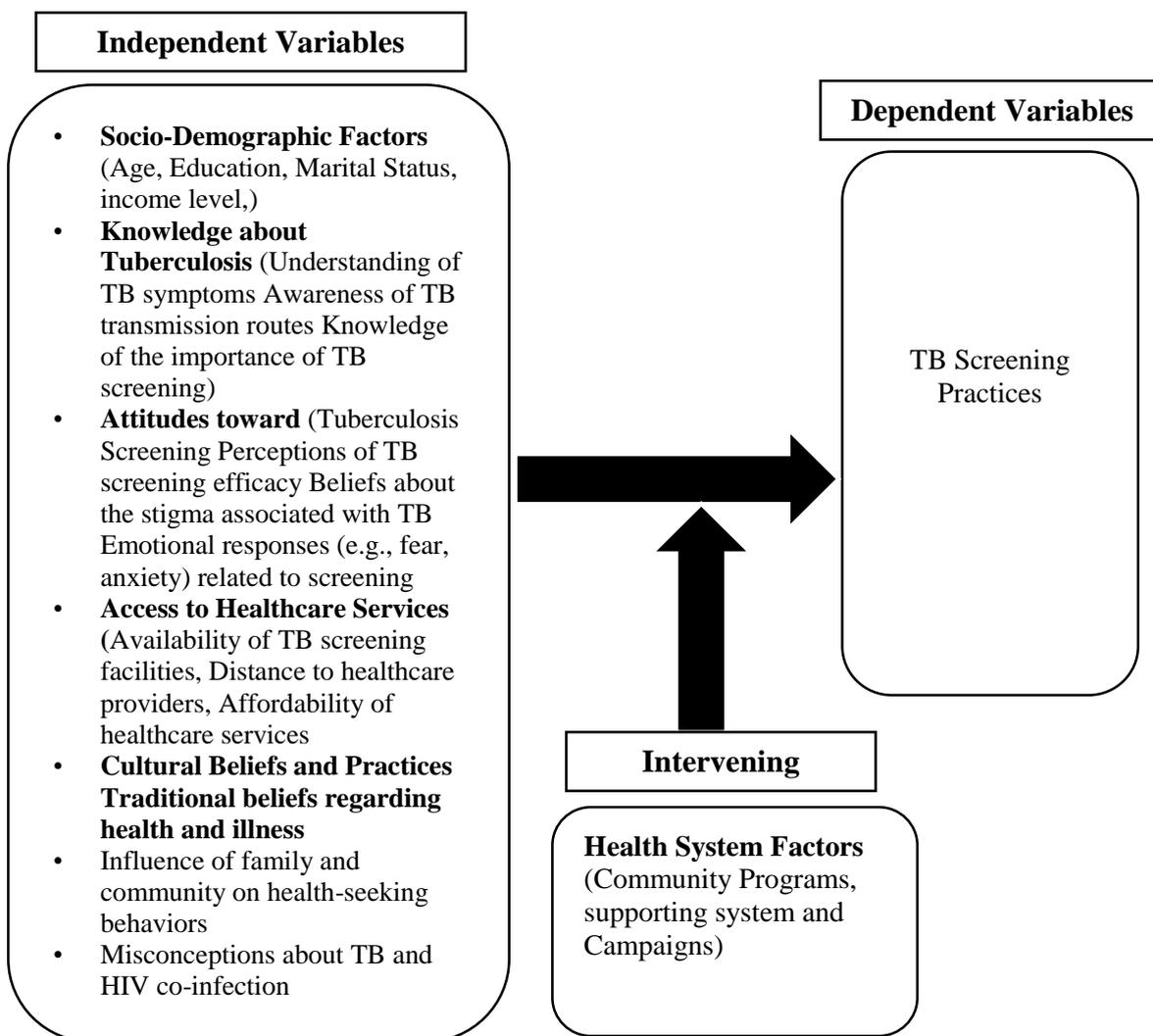


Figure 1: Conceptual framework, Source: Researcher, 2024

IV. RESEARCH METHODOLOGY

Study Design

This was a descriptive cross-sectional study. The study was assessing the knowledge, attitudes, and practices (KAP) of people living with HIV (PLHIV) regarding tuberculosis (TB) screening at a single point in time. A cross-sectional design is appropriate for capturing both quantitative and qualitative data on KAP among PLHIV.

Study Setting

The study was conducted in 10 healthcare centers located within Nyarugenge District, Kigali City, Rwanda such Muhima, Nyaruyenzi, Centre medic socio Corunum, Mwendo, Mageragere, Rwampara, Kanyinya, Centre Medico Socio Biryogo, Kabusunzu and Rugarama Health center. These healthcare centers provide HIV care and TB screening services to PLHIV (Ministry of Health Rwanda, 2020). Specific centers was selected based on their HIV patient load and accessibility to the population of interest.

Study Population

The study population was consisted of PLHIV who are receiving HIV care and treatment (e.g., Antiretroviral Therapy) at Health centers in Nyarugenge District.

Inclusion Criteria

- Individuals aged 18 years and above.
- Diagnosed with HIV and registered for care at one of the participating healthcare centers.
- Have provided informed consent to participate in the study.

Exclusion Criteria

- Individuals who are too ill to participate in the study or unable to give consent.
- Individuals who have been on HIV care for less than 6 months.

Sample Size Determination

The sample size was calculated based on a formula for cross-sectional studies. Assuming a 50% prevalence of adequate knowledge about TB screening (since no previous study may have provided an estimate) and using a 95% confidence interval with a margin of error of 5% (National Center for Biotechnology Information, 2006), the sample size can be calculated as:

$$n^0 = \frac{Z^2 pq}{e^2} = \frac{(1.96)^2 \times 0.5 \times (1 - 0.5)}{(0.05)^2} = 384$$

Where:

- **Z** = 1.96 (standard normal deviation corresponding to 95% confidence level)
- **p** = estimated proportion of PLHIV with adequate knowledge (assumed to be 0.5 or 50%)
- **e** = margin of error (0.05 or 5%)

To account for possible non-response or incomplete questionnaires, the sample size was adjusted by adding 10%, making it approximately 423 participants.

Sampling Technique

The study was used systematic random sampling to select participants from the 10 health centers. Each participating clinic was provided a list of registered PLHIV, and every nth patient on the list was selected until the sample size is achieved. If a selected participant refuses or is unable to participate, the next person on the list was approached.

Data Collection Tools

Data was collected using a **structured questionnaire** designed to assess KAP regarding TB screening. The questionnaire was developed in English and translated into Kinyarwanda for ease of administration. It was having five sections:

- Demographic Information
- Knowledge about TB and Screening
- Attitudes toward TB Screening
- Practices related to TB Screening
- Recommendations for TB Screening Programs

The questionnaire was administered through **face-to-face interviews** conducted by trained research assistants. The use of interviews ensures that participants can provide accurate responses, even if they have low literacy levels.

V. RESEARCH FINDINGS AND DISCUSSION

1. Socio-demographic and Health-related Characteristics of Respondents

This study assessed the socio-demographic and health-related characteristics of 423 individuals living with HIV to understand factors influencing tuberculosis (TB) screening behavior. Most participants were aged between 21 and 40 years (76.9%), indicating a predominance of individuals in their reproductive and working years. Women made up the majority (64.3%), likely reflecting higher healthcare utilization among females. Education levels varied, with 44.0% having primary education and only 7.8% having tertiary education, suggesting potential challenges in comprehending complex health information and the need for simplified health communication.

Marital status showed that 43.5% were married, 35.9% single, and the rest either divorced or widowed, pointing to varying levels of social support that could affect health-seeking behavior. Unemployment was high (50.8%), suggesting financial constraints could limit access to healthcare services, including TB screening. In terms of HIV history, most participants (63.8%) had been diagnosed over five years ago, indicating long-term engagement with healthcare systems and greater potential exposure to TB-related education. A small portion (6.1%) had congenital HIV. Significantly, all participants were on antiretroviral therapy (ART), highlighting robust linkage to HIV care in the Nyarugenge District. TB awareness was nearly universal, with 99.5% of respondents indicating they had heard of TB, providing a solid foundation for promoting TB screening. These findings underscore the need for gender-sensitive, socially supportive, and educationally appropriate TB screening interventions among people living with HIV, especially in contexts with high unemployment and limited educational attainment. The high ART coverage and TB knowledge present a strong platform for integrating TB screening into routine HIV care services.

Table 1: Socio-demographic and Health-related Characteristics of Respondents

Characteristic	Category	Frequency	Percent (%)
Age	Below 20 years	10	2.4
	21–30 years	125	29.6
	31–40 years	200	47.3
	41–50 years	67	15.8
	51–60 years	16	3.8
	61 years and above	5	1.2
	Total		423
Gender	Male	151	35.7
	Female	272	64.3
	Total	423	100.0
Education Level	No formal education	48	11.3
	Primary education	186	44.0
	Secondary education	156	36.9
	Tertiary education	33	7.8
	Total	423	100.0
Marital Status	Single	152	35.9
	Married	184	43.5
	Divorced	68	16.1
	Widowed	19	4.5
	Total	423	100.0

Employment Status	Employed	111	26.2
	Unemployed	215	50.8
	Self-employed	97	22.9
	Total	423	100.0
Duration of HIV Diagnosis	Less than 1 year	29	6.9
	1–5 years	98	23.2
	Congenital HIV	26	6.1
	More than 5 years	270	63.8
	Total	423	100.0
Currently on ART	Yes	423	100.0
	Total	423	100.0
Heard of TB	Yes	421	99.5
	No	2	0.5
	Total	423	100.0

2. Presentations of Findings

1. Knowledge about Tuberculosis Among People Living with HIV (N = 423)

This study assessed the knowledge, attitudes, and practices of people living with HIV (PLHIV) in Nyarugenge District, Rwanda, regarding tuberculosis (TB) screening. The findings provide detailed insight into how informed this population is concerning TB symptoms, transmission, screening, and treatment—crucial factors for early diagnosis and management of the disease. A vast majority of participants, 421 out of 423 (99.5%), reported that they had heard about tuberculosis, suggesting a commendable level of awareness. Only 2 participants (0.5%) stated they had never heard of TB. When asked about the value of regular TB screening, 311 respondents (73.5%) strongly agreed that it helps detect and treat TB early, 89 (21.0%) agreed, and 23 (5.4%) remained neutral. These findings reflect generally positive attitudes toward TB screening among PLHIV.

Regarding symptom recognition, a cough lasting more than two weeks was identified by 408 participants (96.5%), making it the most well-known symptom. Other recognized symptoms included fever by 219 participants (51.8%), night sweats by 124 (29.3%), weight loss by 115 (27.2%), and loss of appetite by 32 participants (7.6%). A small fraction, 10 participants (2.4%), indicated they did not know any symptoms of TB, pointing to a minor but noteworthy gap in knowledge. When examining understanding of TB transmission, 357 respondents (84.4%) correctly indicated that TB is transmitted through the air via coughing or sneezing. However, 133 participants (31.4%) wrongly believed that sharing utensils can transmit TB, and 10 (2.4%) did not know how TB spreads. These figures suggest some remaining misconceptions within the community. On the link between TB and HIV, 407 respondents (96.2%) correctly acknowledged that people living with HIV are at higher risk of developing TB. However, 13 participants (3.1%) were unsure, and 3 (0.7%) believed that there was no such risk. These results point to the need for ongoing sensitization on co-infection risks. In terms of recommended screening frequency, 237 respondents (56.0%) correctly stated that PLHIV should be screened every six months.

Meanwhile, 118 (27.9%) believed screening should be done once a year, 39 (9.2%) said only when feeling sick, and 29 (6.9%) admitted they did not know the recommended frequency. This shows that while many are informed, a considerable portion lacks full knowledge of appropriate screening intervals. Participants also reported varying levels of familiarity with diagnostic methods. The sputum test was the most recognized, cited by 362 participants (85.6%). Only 30 respondents (7.1%) mentioned chest X-ray, and 11 (2.6%) cited blood tests as TB diagnostic methods. Notably, 20 participants (4.7%) stated they did not know any diagnostic methods, revealing knowledge gaps in this critical area.

Regarding treatment knowledge, 406 respondents (96.0%) confirmed that TB can be treated even among PLHIV. However, 1 participant (0.2%) disagreed, and 16 (3.8%) gave unclear or erroneous answers, indicating a generally high but not perfect level of understanding. Lastly, among the 39 participants (9.2%) who reported when they were last screened for TB, 16 (3.8%) had been screened less than 6 months ago, 12 (2.8%) had been screened between 6 months to 1 year ago, and 11 (2.6%) had been screened more than 1 year ago. However, a large number, 384 participants (90.8%), did not report any information on this question, indicating potential gaps in regular screening or poor recall of medical history.

Table 2: Knowledge about Tuberculosis Among People Living with HIV (N = 423)

Question / Statement	Response Category	Frequency	Percent (%)
Have you ever heard of tuberculosis (TB)?	Yes	421	99.5
	No	2	0.5
Do you think regular TB screening can help detect and treat TB early?	Strongly agree	311	73.5
	Agree	89	21.0
	Neutral	23	5.4
What are the common symptoms of tuberculosis? (Select all that apply)	Cough lasting more than two weeks	408	96.5
	Weight loss	115	27.2
	Night sweats	124	29.3
	Fever	219	51.8
	Loss of appetite	32	7.6
	I don't know	10	2.4
How is TB transmitted?	Through the air (coughing, sneezing)	357	84.4
	Sharing utensils	133	31.4
	I don't know	10	2.4
Can a person with HIV develop TB?	Yes	407	96.2
	No	3	0.7
	I don't know	13	3.1
How often should PLHIV be screened for TB?	Every 6 months	237	56.0
	Once a year	118	27.9
	Only when they feel sick	39	9.2
	I don't know	29	6.9
What tests are used to screen for TB? (Select all that apply)	Sputum test	362	85.6
	Chest X-ray test	30	7.1
	Blood test	11	2.6
	I don't know	20	4.7
Do you know TB can be treated even if you are living with HIV?	Yes	406	96.0
	No	1	0.2
	Other (Unspecified / "3")	16	3.8
If yes, when was the last time you were screened for TB? (n = 39)	Less than 6 months ago	16	3.8 (41.0% of 39)
	6 months to 1 year ago	12	2.8 (30.8% of 39)
	More than 1 year ago	11	2.6 (28.2% of 39)
	Not screened / missing data	384	90.8

2. Classification of Participants' Knowledge Levels on Tuberculosis Screening Based on Knowledge Scores

The assessment of knowledge levels regarding tuberculosis (TB) screening among participants revealed varying degrees of understanding. The knowledge levels were categorized based on participants' scores, with score ranges defining each level of knowledge. A total of 423 participants were included in the study, with knowledge scores classified into three levels: low, moderate, and high knowledge. Low knowledge was identified among participants who scored between 16 and 18, representing 10.6% of the sample (45 participants). These individuals demonstrated limited awareness about key aspects of TB screening, indicating a need for targeted educational interventions.

The majority of participants, 72.3% (306 participants), demonstrated moderate knowledge, scoring between 19 and 22. This group possessed a fair understanding of TB symptoms, transmission, and screening practices but may benefit from further education to enhance their knowledge and practices related to TB prevention and control. A smaller proportion, 17.0% (72 participants), exhibited high knowledge, scoring between 23 and 27. These individuals showed a comprehensive

understanding of TB screening, symptoms, and the risks associated with tuberculosis, indicating a high level of awareness and preparedness to engage in regular screening practices.

This distribution highlights the need for continued education and awareness programs targeting individuals with low and moderate knowledge levels to improve TB screening practices and ultimately reduce TB transmission within the community. This classification method is informed by standard academic approaches to knowledge assessment, such as those described by Lwanga & Lemeshow (1991) in their work on sample size determination and statistical analysis for health surveys. The use of score ranges to determine "low," "moderate," and "high" knowledge levels is a common method in health research, particularly in knowledge, attitudes, and practices (KAP) studies.

Table 3: Classification of Participants' Knowledge Levels on Tuberculosis Screening Based on Knowledge Scores

Knowledge Level	Score Range	Frequency	Percent (%)
Low Knowledge	16–18	45	10.6
Moderate Knowledge	19–22	306	72.3
High Knowledge	23–27	72	17.0
Total	-	423	100.0

3. Attitudes and Perceptions toward Tuberculosis Screening Among People Living with HIV in Nyarugenge District

This section examines the attitudes toward tuberculosis (TB) screening among people living with HIV (PLHIV) in Nyarugenge District, Rwanda. Understanding these attitudes is crucial for promoting regular TB screening and improving early detection and treatment, especially considering the heightened vulnerability of PLHIV to tuberculosis. The findings presented here highlight the perceptions, concerns, and motivations of PLHIV regarding TB screening. A majority of respondents (75.2%, n = 318) expressed the belief that it is "very important" for people living with HIV to undergo regular TB screening. An additional 24.1% (n = 102) considered it "important," while only 0.7% (n = 3) viewed it as "not important." This overwhelming agreement underscores the recognition among PLHIV of the critical role that regular screening plays in detecting and managing TB early, which is vital for those with compromised immune systems. These attitudes suggest a general acceptance of TB screening as an essential part of healthcare for PLHIV.

When asked whether regular TB screening can help detect and treat TB early, 73.5% (n = 311) of participants strongly agreed, and 21.0% (n = 89) agreed, with only 5.4% (n = 23) remaining neutral. This indicates that the majority of respondents are convinced that early detection and treatment of TB through regular screening are essential. However, a small portion of respondents still remain uncertain, highlighting the need for further education on the benefits of regular screening. Despite the general support for TB screening, concerns about being diagnosed with TB were prevalent. About 33.3% (n = 141) of participants reported being "very worried" about being diagnosed with TB, while 23.2% (n = 98) were "somewhat worried." On the other hand, 43.5% (n = 184) of the respondents indicated that they were "not worried" about the possibility of a TB diagnosis. This mixed response suggests that while many PLHIV may understand the importance of screening, the emotional and psychological impact of a potential diagnosis could act as a barrier for some individuals.

Stigma and embarrassment surrounding TB screening were significant concerns for many participants. More than half of the respondents (51.8%, n = 219) admitted feeling embarrassed or stigmatized about undergoing TB screening. This fear of stigma could deter individuals from seeking screening and may contribute to underreporting or avoidance of TB services. In contrast, 48.2% (n = 204) of participants indicated they did not feel stigmatized by the screening process, suggesting that there is some variation in the degree of perceived stigma among PLHIV. Fear of being diagnosed with TB and the associated stigma also played a role in shaping attitudes. About 35.0% (n = 148) of participants reported fearing the potential diagnosis of TB, while 37.4% (n = 158) expressed concern about the stigma from others if diagnosed with TB. These emotional barriers highlight the complex intersection between health concerns and social perceptions, emphasizing the need for strategies that reduce stigma and create supportive environments for those seeking TB screening. Interestingly, a small number of respondents (3.1%, n = 13) expressed a lack of trust in the healthcare system, with 96.9% (n = 410) reporting no such concerns. This lack of trust could be a potential barrier to accessing TB screening, as individuals who do not trust the healthcare system may be less likely to seek out preventive services.

Despite the various concerns, a significant portion of respondents (41.6%, n = 176) indicated that they would encourage other people living with HIV to undergo regular TB screening. However, 51.3% (n = 217) of participants were not sure or would not encourage others, which suggests that while some PLHIV may recognize the importance of screening, they may still be hesitant to promote it due to their own fears or stigmas surrounding TB. Overall, the findings indicate a generally

positive attitude toward TB screening among people living with HIV in Nyarugenge District, although concerns about stigma, fear of diagnosis, and emotional distress are still prevalent. Addressing these concerns through targeted education and stigma reduction initiatives is crucial to increase the uptake of TB screening and ensure early detection and treatment for PLHIV.

Table 4: Attitudes and Perceptions Toward Tuberculosis Screening Among People Living with HIV in Nyarugenge District

Question	Answer	Frequency	Percent (%)
How important do you think it is for people living with HIV to undergo regular TB screening?	Very Important	318	75.2
	Important	102	24.1
	Not important	3	0.7
Do you think regular TB screening can help detect and treat TB early?	Strongly agree	311	73.5
	Agree	89	21.0
	Neutral	23	5.4
Are you worried about being diagnosed with TB?	Yes, very worried	141	33.3
	Somewhat worried	98	23.2
	Not worried	184	43.5
Do you feel embarrassed or stigmatized about being screened for TB?	Yes	219	51.8
	No	204	48.2
Fear of being diagnosed with TB	Yes	148	35.0
	No	275	65.0
Fear of stigma from others	Yes	158	37.4
	No	265	62.6
Lack of trust in the healthcare system	Yes	13	3.1
	No	410	96.9
I have no concerns	Yes	176	41.6
	No	247	58.4
Would you encourage other people living with HIV to undergo regular TB screening?	Yes	176	41.6
	No	217	51.3
	Not sure	30	7.1

4. Classification of Participants' Attitude on Tuberculosis Screening Based on Knowledge Scores

The table presented categorizes the attitudes toward tuberculosis (TB) screening among people living with HIV (PLHIV) based on scores, dividing the participants into three distinct attitude levels: negative, neutral, and positive attitudes. These classifications are informed by score ranges that reflect the participants' perceptions and beliefs about TB screening. The overall findings provide a deeper understanding of how PLHIV in the study population perceive TB screening, which is critical for addressing barriers to early detection and treatment of TB.

The negative attitude category, encompassing scores from 10 to 13, included 124 participants, or 29.3% of the total sample. This group of individuals expressed a less favorable view toward TB screening, indicating concerns, fears, or potentially misconceptions regarding the procedure. Participants in this category may perceive TB screening as unnecessary or may be worried about the stigma associated with being tested for TB, particularly in the context of HIV. Such attitudes are a critical area for intervention, as they reflect a lack of engagement with TB prevention and early detection measures. This group highlights the need for targeted communication strategies to address misconceptions and fears, especially in vulnerable populations like PLHIV, who are at higher risk for co-infections like TB.

The largest proportion of respondents, 226 individuals (53.4%), were classified in the neutral attitude category, with scores ranging from 14 to 16. This neutral stance suggests that while many participants are neither strongly opposed nor strongly supportive of TB screening, they remain unsure about its importance or necessity. The neutrality may arise from a lack of information or personal experience with TB screening, making it crucial to provide comprehensive education on the benefits of regular TB testing. These individuals may not actively seek out TB screening but are not entirely dismissive of it either.

This group represents an opportunity for education and engagement, where clearer communication could shift their attitudes toward more positive views on TB screening.

Lastly, positive attitudes toward TB screening, represented by scores between 17 and 20, were observed in 73 participants (17.3%). This group of individuals demonstrated a strong belief in the importance of regular TB screening and was likely to support its use as a preventative health measure. These individuals recognize the critical role of early detection in managing TB and preventing its spread, particularly in a population at heightened risk like PLHIV. Their positive attitudes indicate a higher level of awareness about TB and its potential impact on their health. Fostering and expanding this positive attitude is essential for increasing participation in TB screening programs and ensuring the early identification of TB cases.

Overall, the distribution of attitudes suggests that while many participants are neutral or supportive of TB screening, a significant portion holds negative attitudes, which may hinder efforts to promote widespread TB testing among PLHIV. The study emphasizes the importance of addressing the concerns and misconceptions of those with negative attitudes and engaging those with neutral attitudes through targeted educational campaigns. By doing so, health organizations can improve TB screening uptake and ultimately contribute to better health outcomes for PLHIV. This classification method, using score ranges, follows established academic approaches to health survey analysis, as outlined by Lwanga and Lemeshow (1991), which helps to systematically categorize and interpret survey data for effective public health interventions.

Table 5: Classification of Participants' Attitude on Tuberculosis Screening Based on Knowledge Scores

Attitude Level	Score Range	Frequency	Percent (%)
Negative attitude	10–13	124	29.3
Neutral attitude	14–16	226	53.4
Positive attitude	17–20	73	17.3
Total	-	423	100.0

5. Practices and Suggestions Related to TB Screening Among PLHIV (N = 423)

A significant majority of participants (n = 382, 90.3%) reported that they had previously undergone screening for tuberculosis (TB), while a smaller group (n = 41, 9.7%) had never been screened. These findings indicate that TB screening is widely practiced among people living with HIV (PLHIV), potentially due to increased awareness or integration of TB screening into routine HIV care. However, when delving deeper into the timing of the last TB screening among those who had been screened, only 39 individuals responded. Of these, 16 participants (3.8%) had been screened within the past six months, 12 (2.8%) between six months to a year ago, and 11 (2.6%) more than a year ago. This distribution suggests some gaps in routine follow-up, which could be addressed through more structured screening schedules. Regarding the frequency of screening, the majority of respondents (n = 228, 53.9%) reported undergoing TB screening every six months, which aligns with recommended guidelines for high-risk groups such as PLHIV. Another 130 individuals (30.7%) indicated they were screened once a year, while 65 participants (15.4%) stated they only sought screening when feeling unwell. These findings highlight that while a large number follow preventive screening timelines, a notable segment only acts when symptomatic, which could delay early detection. Adherence to regular screening practices was primarily attributed to following healthcare provider advice, as cited by 329 respondents (77.8%). Other methods included self-reminders (n = 28, 6.6%) and clinic or SMS notifications (n = 6, 1.4%). However, 60 participants (14.2%) acknowledged that they did not follow a regular schedule for TB screening. This suggests that despite high general uptake, there remains a need for more consistent engagement strategies and follow-up systems. When asked about measures that could improve TB screening uptake, the majority of participants (n = 364, 86.1%) agreed that enhancing education on the importance of TB screening would be beneficial. In contrast, only 59 respondents (13.9%) did not believe additional education was necessary.

A smaller proportion (n = 123, 29.1%) supported efforts to reduce stigma associated with TB and HIV, while the majority (n = 300, 70.9%) did not perceive stigma as a primary concern affecting screening behavior. In terms of financial accessibility, only 30 participants (7.1%) believed that offering free or more affordable screening would improve participation, whereas 393 (92.9%) felt that cost was not a barrier likely due to existing support systems in public health services. Accessibility of services was mentioned by 147 individuals (34.8%) as an area needing improvement, indicating potential challenges in reaching screening facilities. Furthermore, 138 respondents (32.6%) advocated for increasing awareness through community health workers, suggesting that community-level engagement could reinforce positive screening behaviors.

Table 6: Practices and Suggestions Related to TB Screening Among PLHIV (N = 423)

Category	Question/Variable	Response	Frequency	Percent (%)
Practice	Have you ever been screened for TB?	Yes	382	90.3
		No	41	9.7
Practice	If yes, when was the last time you were screened? (<i>n</i> =39)	Less than 6 months ago	16	3.8
		6 months to 1 year ago	12	2.8
		More than 1 year ago	11	2.6
		Every 6 months	228	53.9
Practice	How often do you go for TB screening?	Once a year	130	30.7
		Only when I feel sick	65	15.4
		Follow healthcare provider's advice	329	77.8
Practice	How do you ensure adherence to screening?	Remind myself	28	6.6
		Clinic/SMS reminders	6	1.4
		No regular schedule	60	14.2
Suggestions	Improve education on TB screening	Yes	364	86.1
		No	59	13.9
Suggestions	Reduce stigma around TB and HIV	Yes	123	29.1
		No	300	70.9
Suggestions	Provide free or more affordable screening	Yes	30	7.1
		No	393	92.9
Suggestions	Make screening services more accessible	Yes	147	34.8
		No	276	65.2
Suggestions	Increase awareness through community health workers	Yes	138	32.6
		No	285	67.4

6. Association Between Socio-Demographic and Clinical Characteristics and Tuberculosis Screening Practices Among People Living with HIV

The table below presents the association between various socio-demographic and clinical variables with the level of practice regarding tuberculosis (TB) screening among the study participants. Practice levels were categorized into poor and good practices, and the Chi-square test was employed to determine the significance of associations between these variables and TB screening behavior. Age demonstrated a statistically significant association with TB screening practices ($p = 0.001$). Among participants aged 31–40 years, a higher proportion (145 poor vs. 55 good) showed both good and poor practice. Interestingly, participants aged 51–60 years had a relatively higher percentage of good practice (13 out of 16), suggesting increased adherence to TB screening in this older subgroup. Conversely, younger participants under 20 years had the lowest number of good practice scores (only 1 out of 10), indicating a need for targeted interventions for youth. The relationship between gender and TB screening practice was not statistically significant ($p = 0.907$). Both males and females demonstrated similar distributions in their practice levels. Among males, 108 had poor practice and 43 had good practice, while among females, 196 had poor practice and 76 had good practice. This suggests that gender does not significantly influence TB screening behavior in this sample. Education level showed a significant association with TB screening practice ($p = 0.008$). Participants with tertiary education had the highest proportion of good practice (15 out of 33), while those with no formal education had the lowest (only 6 out of 48). This indicates that higher educational attainment positively correlates with better TB screening practices, underlining the importance of educational outreach in public health interventions. Marital status was not significantly associated with TB screening practice ($p = 0.553$). Although married individuals showed the highest number of good practices (58), the differences across categories such as single, divorced, and widowed were not statistically meaningful. This implies that marital status may not be a strong determinant of TB screening behavior. Employment status also had no statistically significant association with practice level ($p = 0.491$).

All categories—employed, unemployed, and self-employed—had comparable proportions of poor and good practices. This suggests that employment status alone does not determine TB screening behavior, possibly due to uniform health access regardless of job status in the study population. There was a significant relationship between duration of HIV diagnosis and

TB screening practice ($p = 0.025$). Participants diagnosed with HIV for more than 5 years had the highest good practice rate (84 out of 270), indicating that longer duration with HIV may lead to better engagement with TB screening services. Meanwhile, those with a diagnosis of less than one year or with congenital HIV showed lower levels of good practice, possibly due to reduced exposure to health education or limited experience navigating the healthcare system. Variables such as age, education level, and duration of HIV diagnosis were significantly associated with TB screening practices. These findings highlight specific subgroups (youth, less-educated individuals, and newly diagnosed HIV patients) that may benefit from targeted TB screening awareness and engagement strategies.

Table 7: Association Between Socio-Demographic and Clinical Characteristics and Tuberculosis Screening Practices Among People Living with HIV

Variable	Category	Poor Practice	Good Practice	P-Value
Age	Below 20 years	9	1	0.001
	21–30 years	92	33	
	31–40 years	145	55	
	41–50 years	51	16	
	51–60 years	3	13	
	61 years and above	4	1	
Gender	Male	108	43	0.907
	Female	196	76	
Education Level	No formal education	42	6	0.008
	Primary education	137	49	
	Secondary education	107	49	
	Tertiary education	18	15	
Marital Status	Single	112	40	0.553
	Married	126	58	
	Divorced	51	17	
	Widowed	15	4	
Employment Status	Employed	75	36	0.491
	Unemployed	157	58	
	Self-employed	72	25	
Duration of HIV Diagnosis	Less than 1 year	26	3	0.025
	1–5 years	69	29	
	Congenital HIV	23	3	
	More than 5 years	186	84	

VI. DISCUSSION OF KEY FINDINGS

This study aimed to identify factors influencing TB screening practices among people living with HIV (PLHIV). The findings revealed that TB screening practices were significantly influenced by socio-demographic factors (such as age and education level), TB-related knowledge and attitude, and the duration of HIV diagnosis. These findings are consistent with global studies and underscore a persistent challenge in ensuring consistent TB screening among high-risk populations like PLHIV.

The results indicated that 28.1% of participants exhibited good TB screening practices, which is relatively low. This is consistent with the 2020 Rwanda Demographic and Health Survey (RDHS), which found that while awareness of TB symptoms was relatively high among the general population (72.5%), actual screening rates were considerably lower. Specifically, only 30% of adults with chronic cough sought TB testing, reflecting gaps in converting knowledge into practice (NISR et al., 2021). Independent scholars, such as Kariuki et al. (2020), highlighted that although knowledge of TB transmission is widespread in sub-Saharan Africa, low engagement with healthcare services remains a significant barrier.

Age emerged as a significant factor in determining TB screening practices. Those in the 51–60 years age group were more than 16 times more likely to have good TB screening practices compared to those under 20 (AOR = 16.27; 95% CI: 1.26–210.29; $p = 0.033$). This result aligns with RDHS data, which showed that older individuals were more likely to utilize healthcare services, including TB testing. Older age is often associated with greater health awareness and healthcare access, leading to better preventive care. Chakaya et al. (2021) also found that older age groups, especially those with longstanding

health conditions, tend to have better access to screening and treatment services. In terms of education level, participants with primary (AOR = 0.19; $p = 0.005$) and secondary education (AOR = 0.42; $p = 0.043$) were more likely to engage in good TB screening practices compared to those without formal education.

This is in line with the RDHS 2020 findings, where individuals with higher education were found to be more likely to identify TB symptoms correctly and seek appropriate testing. This reinforces the idea that education enhances health literacy, enabling individuals to better recognize symptoms and seek timely care. Wang et al. (2020) also observed that higher educational attainment is a critical factor in improving health-seeking behavior, as educated individuals are more likely to be aware of preventive health measures. Duration of HIV diagnosis also influenced TB screening behavior. Those with congenital HIV were less likely to have poor screening practices (AOR = 0.21; $p = 0.019$), likely due to longer engagement with HIV care services. The RDHS 2020 noted that individuals with chronic health conditions, including long-term HIV patients, were more likely to report having undergone TB testing, highlighting the role of sustained engagement with healthcare services. Ndirangu et al. (2019) found similar patterns, noting that individuals diagnosed with HIV for a longer period were more integrated into regular health check-ups, including TB screening.

While TB knowledge alone did not show a statistically significant influence on screening behavior (moderate knowledge AOR = 0.38; $p = 0.090$), it remains an essential determinant. The RDHS data suggested that, despite high general awareness of TB, significant knowledge gaps remained, particularly in rural areas. This highlights that while awareness campaigns are critical, the depth and quality of knowledge are crucial for ensuring timely health-seeking behavior. Mugisha et al. (2021) pointed out that while many individuals are aware of TB, the practical knowledge necessary to navigate the healthcare system for screening is often insufficient.

Attitudes toward TB screening had a notable impact on TB screening practices. Participants with a neutral (AOR = 0.42; $p = 0.012$) or positive attitude (AOR = 0.46; $p = 0.011$) towards TB screening were significantly more likely to practice good screening. This aligns with RDHS findings, where stigma and fear surrounding TB and HIV were identified as barriers to seeking care. Shaping positive attitudes through community-based education and de-stigmatization could help improve screening uptake, especially among PLHIV. Wagnew et al. (2020) similarly highlighted the role of attitudes and stigma reduction programs in improving TB screening rates in East Africa. In terms of model fit, the study explained 18% of the variance in screening behavior (Nagelkerke $R^2 = 0.179$). Although this is a moderate explanatory power, it suggests that there are additional factors not captured in this model that could influence TB screening practices. These may include health system factors, such as healthcare access and provider engagement, which warrant further investigation. Wang et al. (2020) similarly found that while socio-demographic factors accounted for a portion of the variance, health system factors were crucial in determining access to TB screening.

VII. CONCLUSION

The findings of this study suggest that several socio-demographic, health-related, and behavioral factors play a crucial role in influencing the TB screening practices among people living with HIV (PLHIV) in Rwanda. Age, education level, and the duration of HIV diagnosis significantly impact the likelihood of engaging in TB screening. Specifically, younger individuals, those with less formal education, and individuals diagnosed with HIV for longer periods were less likely to adhere to TB screening practices. Additionally, knowledge about TB and a positive attitude toward screening emerged as key facilitators for better adherence to screening practices.

Moreover, the study emphasizes the importance of addressing stigma and improving healthcare access as critical barriers to regular TB screening. While healthcare interventions like reminders and community health worker education showed promise, their widespread implementation could further enhance the uptake of TB screening services. Given the increasing burden of TB among PLHIV, strengthening these factors particularly knowledge, attitudes, and healthcare accessibility could significantly improve TB screening rates and, ultimately, contribute to better health outcomes for individuals living with HIV.

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