

Research Article

Knowledge, Practice, and Barriers of Nurses About Early TB Detection in Selected Health Centre IVs in a District in South-western Uganda

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Abstract

Tuberculosis (TB) is a major health issue globally, especially in low- and middle-income countries. Early detection and management of TB are crucial, but nurses encounter various obstacles that highlight the need for focused interventions. In Southwestern Uganda, there is a lack of studies on nurses' knowledge, practices, and barriers related to early TB detection. This study aimed to explore these factors among nurses at Health Centre IVs in Southwestern Uganda. Using Lewin's Theory of Organizational Change, the study focused on the "unfreezing" stage to examine nurses' knowledge and practices. A cross-sectional research design was used, surveying 60 nurses from three Health Centre IVs. The results showed only 20% had excellent knowledge of TB detection, and 67% displayed poor practices. Many faced significant barriers, including lack of training and resources, which hinder early detection. The study concluded that there are notable gaps in nurses' knowledge and practices regarding early TB detection and recommended ongoing training and standardized guidelines to improve these issues and reduce stigma surrounding TB.

Keywords

Knowledge, Practices, Barriers, Tuberculosis, Early TB Detection, Nurses, Southwestern Uganda

1. Introduction

Mycobacterium Tuberculosis is the bacterium that causes one of the earliest known human diseases, tuberculosis (TB) [20]. As of 2023, the World Health Organization (WHO) estimated 10.8 million people to have fell ill with TB worldwide with an incidence of 134 per 100,000 population, including 6.0 million men, 3.6 million women and 1.3 million children [56]. In fact, TB has returned to being one of the world's leading cause of mortality globally from a single infectious agent, following 3 years in which it was replaced by COVID-19 [56].

Early TB detection refers to the identification of TB infection at its initial stage, before it advances and becomes severe [45].

Early detection involves identifying individuals with TB symptoms, including weight loss, fever, chills, and coughing, and providing them with prompt testing, diagnosis, and treatment [40]. Even though early detection and prompt management are the key principles for effective control of TB, in situations where resources are scarce, early detection through systematic screening for active TB at all entry points

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in the facility remains an area of difficulty [30]. Practices of the nurses on early TB detection remains critical in the control measures of TB since when cases are not identified or diagnosed and treated, they remain in communities spreading the TB infection to other community members [30]. This study aimed at describing knowledge, barriers, and practices of nurses about Early TB detection in selected health center IVs in a District in Southwestern Uganda.

1.1. Background to the Study

TB remains a significant issue for public health worldwide, especially in low- and middle-income nations [47]. The *Mycobacterium tuberculosis*, which accounts for most TB, 85% of cases involve the lungs, however it can also affect other body parts. After COVID-19, TB is considered to be the second most lethal infectious disease globally, surpassing HIV/AIDS [12]. Tuberculosis (TB) is the primary cause of mortality for those living with HIV and plays a significant role in the development of antibiotic resistance [9].

An estimated 2.5 million cases of tuberculosis were reported in Africa in 2019, making almost 25% of the global case total. Each year, the disease claims the lives of almost 500,000 Africans [19]. There are 1.4 million TB diagnoses in Sub-Saharan Africa. However, the epidemiologists projected that at least a million individuals suffered from tuberculosis but were not identified or treated [19]. An estimated 87,000 new cases of tuberculosis are reported in Uganda each year, with a prevalence of 253 cases per 100,000 people [31]. The high incidence rate has been made worse by the nation's high HIV/AIDS prevalence. Early detection and treatment are essential to stop the TB disease from spreading and to enhance patient outcomes [55].

Nurses form the largest group of health workers worldwide and through infection control measures, play a critical part in the early diagnosis, treatment, and prevention of tuberculosis transmission [13, 48]. They have a critical role in the early diagnosis and treatment of instances of suspected tuberculosis and multidrug-resistant tuberculosis since they frequently see patients with TB symptoms initially [34]. By ensuring patients receive the care they require, this practice restores health and alleviates suffering by allocating support for patients based on their specific requirements [23].

In order to improve the management of TB cases, there needs to be knowledgeable and trained nurses [5]. Nurses with good knowledge have the capacity to raise the number of presumed tuberculosis cases, which in turn could raise the number of patients receiving TB diagnoses and treatments [10].

Many studies have been conducted on nurses' knowledge, barriers, and practices in the early detection of tuberculosis. For example, in southern Mozambique, [39] revealed lack of

knowledge among nurses, especially in early detection, treatment and a good understanding of TB disease management are less likely to practice early TB detection. Several other studies have noted that nurses had inadequate knowledge regarding Early TB detection, and control [3, 9, 35].

Nurses also face multiple barriers in early tuberculosis (TB) detection. These include inadequate training, limited healthcare accessibility, and constrained clinic resources affecting counseling and examination. Patient-related challenges, such as mistrust and logistical issues, further hinder timely detection. Systemic barriers involve insufficient diagnostic facilities in rural areas, inconsistent referral mechanisms, and healthcare worker-related factors like stigma and fear [18].

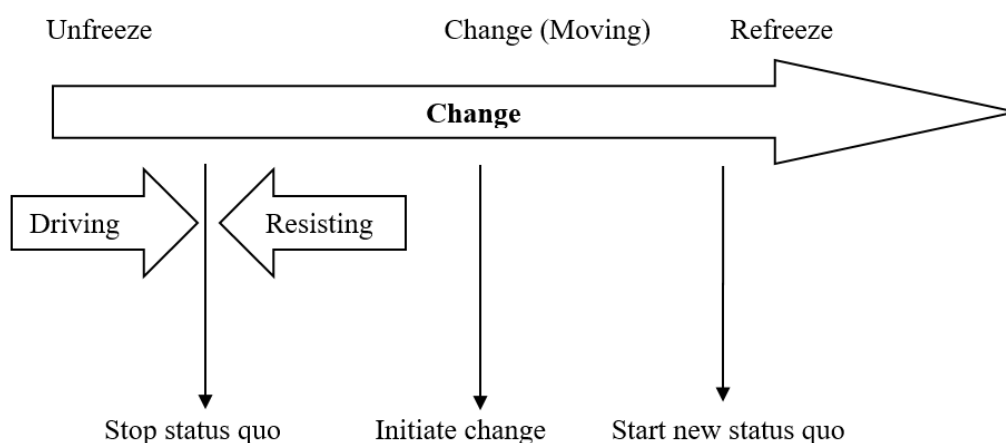
Additionally, issues such as poor awareness, suboptimal screening practices, and a lack of infection control measures contribute to the complex challenges nurses encounter in TB detection [14, 51]. Furthermore, stigma, work culture, lack of risk awareness, inadequate provision and use of tuberculosis infection prevention and control measures, and low awareness and little familiarity with TB among healthcare workers have also been reported as barriers to TB detection and control [46]. These barriers highlight the complex challenges that nurses face in early TB detection and emphasize the need for targeted interventions to address these issues.

In Uganda, health centers like health center IVs are essential in the early detection of TB cases [26]. Health center IVs are district-level referral health facilities that offer a range of services which includes the diagnosis and treatment of tuberculosis. For effective service provision, the District Health teams in collaboration with Ministry of Health have tried interventions such as onsite training, support supervision, and continuous training of focal persons.

Despite the various interventions that have led to a decline in TB infection, the end TB strategy of 20% reduction has not been met as expected in Uganda [28]. In Southwestern Uganda, reports from Health Management Information Systems (HMIS), all health center IVs in the districts were found to be below 50% of the recommended TB detection targets [22].

Even though the nurses in these facilities are the main healthcare providers and are essential in the early detection of tuberculosis, no study has been conducted in a district in Southwestern Uganda as the few studies conducted have been done in other settings [3, 4, 9, 39]. This lack of information regarding the practices, barriers, and knowledge of nurses in Southwestern Uganda may hinder effective TB control programs. Therefore, a descriptive study was conducted to describe nurse's knowledge, barriers, and practices about Early TB detection in selected health Center IVs in a District in Southwestern Uganda.

1.2. Theoretical Framework



Note: Peterson, S. J., & Bredow, T. S. (2020, page 283).

Figure 1. Lewin's force field analysis.

This study utilized the "Lewin's Theory of Organizational Change" (Figure 1) as the theoretical framework to be used to help in understanding the concept.

Lewin's theory outlines three fundamental stages of change: Unfreeze, Change (or move), and Refreeze. During the unfreeze stage, the goal is to "stop status quo" by creating awareness of the need for change and preparing individuals or organizations to let go of their current state. In the change stage, we "initiate change" by implementing new practices or behaviors. Finally, in the refreeze stage, we "start new status quo" by stabilizing and reinforcing the changes, ensuring that the improved practices become a permanent part of the routine.

Throughout the process, organizations must identify and strengthen the driving forces that support change while recognizing and mitigating the restraining forces that oppose it [41]. By operationalizing Lewin's theory in this structured way, transformation can be more effectively managed and positive outcomes achieved [50].

In Lewin's theory of change, the first step is called "Unfreeze." This stage aims to break away from the current stable state, known as the status quo [37]. The status quo often resists change due to personal and collective habits [25]. Unfreezing helps individuals or organizations overcome this resistance and become open to change. Lewin identified two key forces: driving forces and restraining forces. Driving forces encourage change through motivation or external demands, while restraining forces serve as obstacles, such as fear of change or limited resources. For change to happen, driving forces must be stronger than restraining forces, allowing individuals or organizations to become ready for new practices.

The second step is called "Moving." In this phase, the change is put into action after successfully unfreezing the

status quo [2, 43]. During the moving stage, individuals work together to find new solutions and align their efforts with leaders who support the change [21]. They recognize that sticking to old ways is not beneficial and explore different options through experimentation. This stage is critical, as it involves engaging all stakeholders, effective communication, and learning from both successes and failures.

The final phase, "Refreezing," focuses on solidifying the changes made in the moving stage. It aims to integrate the new behaviors into a stable new equilibrium [43]. The objective is to prevent regression to old habits by ensuring that new actions align with individuals' personalities and environments [21]. This may require changes to culture, norms, and practices [41]. Reinforcing new behaviors with positive feedback and support is crucial. By embedding the changes into the organization, the refreezing phase helps secure long-term success and promotes ongoing improvement.

Operationalization of Lewin's Theory of Organizational Change

Only the unfreezing step from the Lewin's theory was applied to determine the knowledge, barriers, and practices of nurses regarding Early TB detection in a health center IV in Southwestern Uganda. The decision to focus on the unfreezing step is based on the specific objectives and scope of my study regarding Early TB detection in a health center IV in Southwestern Uganda. By concentrating on the unfreezing step, I aimed to gain a comprehensive understanding of the current knowledge, barriers, and practices of the nurses in the health center. This step allows me to identify the driving and restraining forces that influence their behavior and attitudes towards Early TB detection. Here is how I applied Lewin's unfreezing step in my study:

(1) Status Quo

The researcher designed survey questions to describe the

existing knowledge, barriers, and practices of nurses regarding Early TB detection in the health center IV in Southwestern Uganda. This involved assessing the current level of understanding, skills, and adherence to TB detection WHO protocols.

(2) Driving Forces

These are factors that motivate and encourage nurses to improve their knowledge, barriers, and practices related to Early TB detection. These may include factors such as existence of training programs, awareness campaigns, access to updated guidelines, supportive leadership, or recognition for excellence in TB detection from the health faculties.

(3) Restraining Forces

These were barriers, challenges, or obstacles that hinder nurses' adoption of improved knowledge, barriers, and practices in Early TB detection in Southwestern Uganda. This included factors like lack of resources, limited training opportunities, inadequate supervision or feedback, organizational culture, or conflicting priorities.

2. Methodology

2.1. Method and Design

A cross-sectional quantitative research design was chosen for this study because it allows for the systematic collection and analysis of data at a single point in time, which is ideal for assessing current knowledge, barriers, and practices without manipulating the study environment [49].

2.2. Setting

The research setting for this study was selected health center IVs in a district in Southwestern Uganda. In Uganda, health centers like health center IVs are essential in the early detection of TB cases [26]. Health center IVs are district-level referral health facilities that offer a range of services which includes the diagnosis and treatment of tuberculosis.

The study randomly sampled three HCIVs in Rubanda. This involved generating a comprehensive list of eligible health centers, assigning each a unique random number, and then randomly selecting three HCIVs from the list. Since each facility had about 20 nurses, the study sample size was easily achieved.

2.3. Population

The population for this study comprised all nurses working at Health Center IVs in Uganda. However, the accessible population was nurses from selected Health Center IVs in a district in Southwestern Uganda.

2.4. Sample

The study included nurses working in three health center

IVs in a district in Southwestern Uganda. This was because nurses are involved in screening and triaging patients with signs and symptoms suggestive of TB and able to provide the necessary data which answered research question of this study.

2.4.1. Sampling Frame

Based on the staffing levels at the health center IVs in Uganda, the maximum sample size was 60 nurses. This was obtained from 3 HCIVs in a district in Southwestern Uganda where each health center IV had about 20 nurses. Consecutive sampling was used in this research study. Consecutive sampling entails selecting every member of the accessible population who satisfies eligibility requirements over a predetermined period of time [44]. The possibility of bias is significantly decreased when every member of an accessible population is requested to participate in a study over a predetermined length of time in order to achieve a given sample size [44]. Due to its ability to incorporate all potential respondents, consecutive sampling was regarded as the most effective nonprobability sampling technique for reducing sample bias [53]. In this study, the researcher ensured that all the necessary data was collected from the participants in one-week period. This involved selecting participants in a sequential manner, without skipping any potential participant within my sampling frame. The sampling frame, in this case, constituted the entire population who were nurses from whom the study findings could be generalized.

2.4.2. Sample Size Determination

To get the sample size that represented all nurses working in health center IVs in Southern Uganda, the formula developed by [29] was used. Krejcie and Morgan formula which helped me determine this study's sample size has been shown below.

$$s = X^2NP(1 - P) \div d^2(N - 1) + X^2P(1 - P)$$

Where; s = required sample size, X^2 = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841), N = the population size. For this study, the expected population size were 60 nurses from the three HCIVs that was considered, P = the population proportion (assumed to be 0.50 since this would provide the maximum Sample size) and d = the degree of accuracy expressed as a proportion (0.05).

All available and willing nurses were invited to participate in the study. Including all eligible nurses in the study limited biases and allowed for some generalization among the nurses in selected health center IVs in a district in Southwestern Uganda. The study results were directly influenced by the sample size. Extremely smaller samples undermine study's external and internal consistence whereas extremely larger samples present practical challenges [16].

2.5. Data Collection

Once permission was granted, data collection was conducted in all the three health centers between July 2024 and Sep 2024. Each of three health centers were given two full days for data collection. Daily scheduling involved hosting two meetings, one in the morning and another in the afternoon. This strategic arrangement accommodated participants from both day and evening shifts, enabling me collect data from all the participants who were willing to participate in the study.

Employing a consecutive sampling method, data collection spanned a one-week duration, covering various work shifts of the nursing staff from all three health centers. To ensure privacy and a quiet environment for data collection, a private room in the health center IVs was used, away from patients and other staff. The administrators of the health centers were asked to arrange for group meetings where the nurses were met and told them about my study. During these sessions, detailed explanations were provided, and nurses were invited to voluntarily sign consent forms to participate in the study.

After they had signed the consent forms, they were put in an envelope and sealed. Then proceeded to give them questionnaires to complete. Once the participants finished filling out the questionnaires, they were placed in an envelope and kept under lock and key where the researcher was the only one who accessed them when entering data into a codebook.

2.6. Description of the Tool

A self-administered structured questionnaire was used as the primary data collection instrument to assess knowledge, practices, and barriers related to Early TB detection among nurses working at selected Health Center IVs in a district in Southwestern Uganda. This questionnaire was developed by the researcher and was not translated into another language, as the targeted participants-registered nurses and enrolled nurses-were literate and proficient in English.

The tool was conceptually grounded in Lewin's Theory of Organizational Change, specifically the "unfreezing" stage, which emphasizes the need to understand and disrupt existing behavioral patterns to initiate change. The questionnaire items were theoretically aligned to capture the current status quo (knowledge and practices), as well as potential driving and restraining forces (barriers and motivators) affecting Early TB detection in the health setting.

Furthermore, the development of the questionnaire was guided by established global and national protocols for TB screening, diagnosis, and management, including the Intensified TB Case Finding (ICF) guidelines, and Ministry of Health TB diagnostic algorithms for adults and children in Uganda. These sources provided evidence-based content to ensure that the items were contextually relevant, up-to-date, and reflective of national policy standards.

2.7. Item Analysis

2.7.1. Demographic Characteristics of Participants

The first section had eight questions (questions 1-8), which were included in the questionnaire to gather key socio-demographic information from participating nurses, covering aspects such as age, gender, education level, years of nursing experience, employment status, and any prior training in TB detection. This concise set of questions aimed to establish a comprehensive understanding of the demographic profile of the nursing participants. This information played a crucial role in contextualizing the study's findings.

2.7.2. Knowledge about Early TB Detection

The second section had 21 multiple choice questions (questions 9-29), covering the knowledge related to TB in general and those specific to Early TB detection. Each question carried one point and the total points achieved were calculated against the total number of questions and expressed as a percentage to get a final knowledge score. For example, a participant who answered 10 questions correctly, was calculated as $10/21 \times 100\% = 47.6\%$.

The grading of the overall score of the participant was based on the set categories (Mohammed et al., 2024). Individuals who scored $< 50\%$ were classified as having poor knowledge, those who scored 50% to $< 75\%$ were classified as having good knowledge whereas those who scored $\geq 75\%$ were classified as having excellent knowledge [36].

2.7.3. Practice about Early TB Detection

The third section had 16 Likert scaled questions (questions 30-45) about the practice related to Early TB detection. Participants were asked to rate the frequency of their practices, ranging from 0 ("Never") to 4 ("Always"). The questions covered a spectrum of practices, including patient education about TB, referral patterns for specific symptoms, preferences for diagnostic tests, and the consideration of various testing methods.

The participant's responses for all the items in section C of the questionnaire were entered in IBM SPSS Statistics (Version 23) statistical software, and an overall practice score for each participant was determined. The overall practice score was calculated by taking the mean practice score of the participating nurses who completed the questionnaire. For example, if a participant's total responses became 48, his or her mean score was $48/16=3$.

The practice scores were classified into four categories i.e. very poor practice, poor practice, good practice and excellent practice. Individuals who scored (0-1.99) were classified as having very poor practice, those who scored (2-2.99) were classified as having poor practice, and those who scored (3-3.49) were classified as having good practice whereas those who scored (≥ 3.5) were classified as having excellent practice.

2.7.4. Barriers about Early TB Detection

The last section had 15 Likert scaled questions (questions 46-60) that focused on identifying barriers to the early detection of tuberculosis (TB) by nurses. Participants were asked to assess each statement and indicate their level of agreement on a scale ranging from 1 ("Strongly disagree") to 4 ("Strongly agree"). The questions aimed to uncover various factors that were perceived as influencing the effectiveness of early TB detection efforts. The mean score for each individual statement was obtained by summing up the participants' responses and dividing by the total number of statements. This mean score served as the basis for categorizing statements into distinct levels of barriers related to early TB detection. Mean scores ranging from 0.00-0.99 were interpreted as providing a low barrier to practicing early TB detection, 1.00-2.99 were interpreted as moderate barriers, and 3.00-4.00 were interpreted as high barriers.

2.8. Data Quality and Quality Control

2.8.1. Pilot Plan

A pilot study was conducted with about ten nurses who shared similar traits with the target group and worked at nearby health centers. The questionnaire was pretested to gauge completion time, readability, and any potentially offensive questions. The analysis looked at participant responses to assess clarity and completion time. Nurses were also asked for feedback on clarifications needed. The questionnaire was completed in 20 minutes, and results were analyzed using SPSS to create a codebook and tested for performance. The findings were shared with supervisors for approval.

2.8.2. Validity

Validity in measurement is how well an instrument measures its intended concept [44]. This study's questionnaire was designed after reviewing current literature and with help from two faculty members. Feedback from two experts at the National Tuberculosis Reference Laboratory, Uganda. This enhanced its content validity for Early TB detection.

2.8.3. Reliability

Reliability means the consistency and dependability of research findings. It ensures that tools like questionnaires give the same results when used multiple times. In this study, ten nurses were used to calculate Cronbach's alpha, which was found to be 0.817, showing adequate internal consistency.

2.9. Data Analysis

A pre-tested codebook that had been created during the pilot study was used to receive and manage the data. The codebook contained information about the variables in the data, their labels, and their properties. This pre-testing en-

sured clarity, consistency, and relevance of variable definitions, improving the reliability of the data entry process. Data was entered in the codebook on a daily basis as soon as it was collected from the study participants for analysis. All analyses were conducted using SPSS Version 23, which was chosen for its reliability, user-friendliness, and suitability for descriptive statistical analysis.

2.9.1. Demographics

Descriptive univariate analysis of demographics characteristics was performed. Results were reported as frequencies and percentages and also in form of tables. This approach was chosen to provide a clear summary of the study population's characteristics, which are important for contextualizing findings related to knowledge, practice, and perceived barriers.

2.9.2. Knowledge

For knowledge scores, each individual participant's answer was entered into SPSS according to the created codebook. Each individual participant's overall score was calculated by percentage and by category. Overall group score was analyzed by looking at mean percentage and also by looking at distribution in categories and the mean for the group categories.

Every question in the questionnaire was evaluated for its performance, which assisted in determining its strength and weakness. In order to determine this, each question's percentage score was examined. Questions that were passed by 75% or higher of the participants were deemed to be in their areas of strength. Questions that were passed by less than fifty percent of the participants were categorized as their areas of weakness. For analysis, descriptive statistics were generated for responses and presented as frequencies and percentages [36]. The decision to use descriptive statistics was based on the study's objective to identify knowledge levels and identify the areas of strengths and weaknesses.

2.9.3. Practice

For practice scores, each individual participant's selected option was entered into SPSS and the individual mean was calculated. The overall group scores were then analyzed by looking at the overall mean for the group and the distribution in the categories and the mean for the categories. The mean and percentages of each practice question was calculated. This assisted me in identifying practice-related strengths and weaknesses for each participant. Questions that 75% or higher of the participants answered correctly were deemed to be in their areas of strength. Questions that were not answered correctly by less than fifty percent of the participants were categorized as their areas of weakness. Descriptive statistics were generated for responses and presented as frequencies and percentages. Practice scores were presented in the form of tables [44]. Descriptive analysis was deemed appropriate as the aim was to map out existing practices to determine areas of strengths and weaknesses rather than infer causal links.

2.9.4. Barriers

For perceived barrier scores, each individual participant's selected option was entered into SPSS and the individual mean was calculated. The overall group scores were analyzed by looking at the overall mean, the distribution in the categories and the mean for the categories. The mode of each perceived barrier was calculated. The percentages of participants who perceived a certain barrier as a barrier was described as low, moderate or high barrier and this was based on mode.

For analysis, descriptive statistics was generated for responses and presented as frequencies and percentage. Perceived barrier scores were presented in form of tables of frequency against scores [44]. Tables were used to enhance clarity and facilitate a visual comparison of common barriers. The use of descriptive analysis was appropriate given the descriptive nature of the study's objectives.

3. Results

3.1. Demographic Data

The participants of this study comprised of sixty nurses from three Health Center IVs in Southwestern Uganda. Twenty nurses were recruited from each of the selected Health Center IVs. Majority of the participants belonged to the age group 30-39 (57%). About 62% of the participants were females. The majority of the participants (83%) were from the Outpatient Department. Most participants had Certificate level of education (60%), with Bachelor Degree holders comprising only 5%. For their experiences, 40% of participants had 16 or more years of working experiences. All participants had received training on tuberculosis (100%), with the majority (57%) never receiving any training after the training schools.

Table 1. Demographics Distribution of Study Participants (N=60).

Demographic Characteristics	Frequency (f)	Percentage (%)
Age (years)		
20-29	17	28
30-39	34	57
40-49	7	12
50-59	2	3
Gender		
Female	37	62
Male	23	38
Department		
Maternal Child Health	10	17

Demographic Characteristics	Frequency (f)	Percentage (%)
Outpatient Department	50	83
Education Level		
Bachelor's Degree	3	5
Certificate	36	60
Diploma	21	35
Years of practice (years)		
≤5	11	18
6 - 10	8	13
11- 15	17	28
16 or more	24	40
Training on Tuberculosis		
Yes	60	100
Training Source		
At Training School	34	57
No Training After School	26	43

3.2. Knowledge of Nurses about Early TB Detection

This section describes the knowledge of nurses about Early TB detection. The data collection tool had two knowledge sections: knowledge about TB in general and knowledge specific to Early TB detection. Consequently, the following section begins by describing the combined knowledge before breaking down into two sections: general knowledge about tuberculosis and specific knowledge about early TB detection. Lastly this section looks at how each question performed related to the two specific knowledge areas.

3.2.1. Findings of Combined Knowledge in Early TB Detection

This section describes participants' individual raw scores and categories. The mean combined knowledge of the participants about Early TB detection was 63% as reflected in Appendix F. The combined knowledge of the nurses about Early TB detection is shown in Table 2. About 20% (95% C.I = 9.7-29.0) of the participants scored above or equal to 75% in their responses thus were categorized as having excellent knowledge. About 42% (95% C.I = 29.0-53.2) of the participants scored between 50 to 74% and thus were categorized as having good knowledge, while 38% (95% C.I = 24.2-50.0) of the participants scored below 50% in their responses and were categorized as having poor knowledge.

Table 2. Comparison of Combined Knowledge of Nurses about Early TB detection.

Combined Knowledge Level	Frequency (f)	Percentage (%)	95% C.I
Excellent Knowledge ($\geq 75\%$)	12	20	9.7-29.0
Good knowledge (50% to 74%)	25	42	29.0-53.2
Poor Knowledge ($< 50\%$)	23	38	24.2-50.0

3.2.2. General Knowledge about TB

The following section about general knowledge about TB describes raw scores, categories for general knowledge of TB questions and also describes the performance of the participants on each question. The mean raw score for general knowledge of TB questions was 65%. The distribution by categories of knowledge of the Nurses about TB in General is

shown in Table 3. About 25% (95% C.I = 14.5-35.5) of the participants scored above or equal to 75% in their responses thus were categorized as having excellent knowledge. Fifty percent scored between 50 to 74% thus were categorized as having good knowledge, while 25% (95% C.I = 14.5-35.5) of the participants scored below 50% in their responses and thus were categorized as having poor knowledge.

Table 3. Comparison by Category of General Knowledge about TB.

Category	Frequency (f)	Percentage (%)	95% C.I
Excellent Knowledge ($\geq 75\%$)	15	25	14.5-35.5
Good knowledge (50% to 74%)	30	50	35.5-59.7
Poor Knowledge ($< 50\%$)	15	25	14.5-35.5

3.2.3. Specific Knowledge about Early TB Detection

This section describes raw scores and categories for knowledge questions specific to Early TB detection. It also describes the analysis of performance of the participants on each question. The mean knowledge of the participants about Early TB detection was 60%, thus the participants were categorized as having good knowledge.

The distribution by categories of knowledge of the Nurses about Early TB detection is shown in Table 4. About 23% (95%

C.I = 12.9-33.9) of the participants scored above or equal to 75% in their responses thus were categorized as having excellent knowledge about Early TB detection. About 48% (95% C.I = 33.9-58.1) of the participants scored between 50% and 74% thus were categorized as having good knowledge about Early TB detection, while 28% (95% C.I = 16.1-38.7) of the participants scored below 50% in their responses and thus were categorized as having poor knowledge about Early TB detection.

Table 4. Comparison by Category of Specific Knowledge about Early TB detection.

Category	Frequency (f)	Percentage (%)	95% C.I
Excellent Knowledge ($\geq 75\%$)	14	23	12.9-33.9
Good knowledge (50% to 74%)	29	48	33.9-58.1
Poor Knowledge ($< 50\%$)	17	28	16.1-38.7

3.3. Practices of Nurses Towards Early TB Detection

The practices section describes raw scores and categories for practice questions about Early TB detection. The section also describes an analysis of the performance of the participants against each question. The practice scores of the participants about Early TB detection by category are presented in Table 5.

Each individual practice raw scores were calculated. The overall mean score of the total responses for practice was noted to be 2.17. The distribution by categories of practice of

nurses about Early TB detection is shown in Table 4. The overall practice of Early TB detection was categorized as poor. About 32% (95% C.I = 19.0-39.7) of the participants scored between 0 to 1.99 in their responses and thus were categorized as having very poor practices about Early TB detection. Sixty-seven percent of the participants scored between 2 to 2.99 in their responses and were categorized as having poor practices about Early TB detection, while only two percent of the participants scored between 3 and 3.49 and were categorized as having good practice. No participant had an excellent practice.

Table 5. Comparison of Means of Nurses' Practice by Categories (N=60).

Category	Frequency (f)	Percentage (%)	95% C.I
Excellent Practice (≥ 3.5)	0	0	0-0
Good practice (3-3.49)	1	2	0.0-4.8
Poor Practice (2-2.99)	40	67	52.4-74.6
Very Poor Practice (0-1.99)	19	32	19.0-39.7

3.4. Perceived Barriers to the Early Detection of TB

The perceived barriers' section describes raw scores and categories for perceived barriers by nurses about Early TB detection. The section also describes analysis of performance of the participants against each question. The perceived barrier score categories are presented in Table 5. This section also summarizes perceived barriers which were reported by most of the participants as high barriers to Early TB detection (Table 6).

The individual raw scores on each perceived barrier question is reflected in Appendix J. The overall mean score of total responses for perceived barriers was noted to be 3.11. This was categorized as a high level of barriers to Early TB detection. The distribution by categories of perceived barriers about Early TB detection is shown in Table 5. As presented in Table 5, 25% of the participants scored between 1 and 2.99 in their responses thus were categorized as experiencing moderate barriers towards Early TB detection. Seventy-five percent of the participants scored between 3 and 4.00 in their responses thus were categorized as experiencing high barriers towards Early TB detection.

Table 6. Comparison of Nurses Perceived Barriers by Categories (N=60).

Category	Frequency (f)	Percentage (%)	95% C.I
High Barrier (3-4.00)	45	75	61.3-83.9
Moderate Barrier (1-2.99)	15	25	14.5-35.5
Low Barrier (0-0.99)	0	0	0-0

Table 7. Performance of Topical Areas Perceived as High Barriers to Early Detection of TB.

Barrier	Mean	SD
Lack of trainings, awareness and TB guidelines	3.45	0.657

Barrier	Mean	SD
Lack of diagnostic equipment and poor supply of infection prevention materials	3.425	0.716
Stigma and belief that TB is a high risk disease	3.142	0.768
Human resource constraints that may result in delays to receive TB lab results	3.383	0.865

Table 7 summarizes perceived high barriers. The study found that, early TB detection was hindered by: lack of awareness, training, TB guidelines, lack of diagnostic equipment and poor supply of infection prevention materials. In addition, it was noted perceived stigmatization among the nurses at risk of TB and belief that TB is a high risk disease was also noted as one of the high barriers to early TB detection. Furthermore, human resource constraints which may result in delays in getting TB laboratory results was also noted as high barrier to early TB detection. The study also found that early detection is also hindered by lack of access to laboratory services, effect of charges for laboratory use, effectiveness of referral processes, and impact of workload.

4. Discussions

4.1. Demographics

The majority of the participants were within the age group of 30-39 years, indicating that most nurses in this study were in their early to mid-career stages. This aligns with demographic trends in the Ugandan healthcare workforce, where younger professionals are increasingly prevalent [15]. Most of the participants were female, reflecting the gender distribution commonly seen in nursing, both regionally and globally. This finding is in agreement with a report that nursing is a female-dominated profession in Uganda, with women tending to report higher job satisfaction and stronger attachment to their facilities and communities than the men [15].

A significant proportion of the participants were from the Outpatient Department, highlighting the critical role this department plays in TB detection and management. The higher representation of nurses from the Outpatient Department is expected, as this is where most patients, including those with potential TB, are first encountered [1].

The educational background of the participants showed that the majority held a Certificate in nursing, with very few having a Bachelor's degree. This finding is in agreement with [42], who found that majority of the nurses were certificate holders or diploma holders. Very few nurses in this study were found to have bachelor's degree. This finding suggests that while most nurses have foundational training, there may be gaps in advanced education that could impact Early TB detection practices. The low percentage of bachelor's degree holders may also reflect limited opportunities for higher ed-

ucation in nursing in Southwestern Uganda due to admission barriers, financial constraints, a scarcity of educational institutions, and workforce priorities [8, 42].

In terms of experience, more than a third of the participants had 16 or more years of working experience. This substantial level of experience suggests that many of the nurses are seasoned professionals, potentially bringing a wealth of practical knowledge to their roles. This finding was also in agreement with [6], who reported that majority of the nurses had experience of more than 10 years.

All participants had received training on tuberculosis, which is encouraging. However, a concerning finding is that more than half of the participants had not received any additional training after their initial education at training schools. This agrees with findings from South Africa that reported that receipt of training on TB transmission was low among the health workers [32]. This lack of ongoing professional development could hinder the ability of nurses to stay updated with the latest guidelines and practices in Early TB detection, potentially impacting the effectiveness of TB control programs.

4.2. Knowledge of Nurses about Early TB Detection

The study aimed to assess the knowledge levels of nurses regarding early TB detection in Health Center IVs in Southwestern Uganda. The combined knowledge of nurses in this study regarding early TB detection was moderate. The combined knowledge is composed of general knowledge of the nurses regarding TB and early TB detection. Notably, only 20% of the participants demonstrated excellent knowledge, while the majority fell into the good knowledge category, and 38% exhibited poor knowledge. These results indicate that while many nurses have a basic understanding of TB and its early detection, significant knowledge gaps persist.

Most nurses were able to correctly identify the pathogen causing TB and recognize common symptoms of active TB. However, there were noticeable gaps in their knowledge of risk groups, challenges in early detection, diagnostic methods, and treatment protocols. These discrepancies likely stem from insufficient training or exposure to specific aspects of TB management, which is an area that demands urgent attention [7]. The gaps are concerning, as effective early TB detection is crucial for timely intervention and reducing transmission in healthcare settings.

The findings align with global studies that report similar patterns in nurse knowledge of TB. Studies have reported that healthcare professionals often have a foundational understanding of TB but lack depth in critical areas, such as symptom recognition, early detection strategies, and specialized areas of TB management [11, 27, 52]. However, these studies also emphasize the importance of continuous professional development in ensuring that healthcare workers maintain up-to-date knowledge on evolving TB management protocols.

Despite a reasonable level of knowledge about TB treatment protocols and drug combinations, some nurses provided incorrect responses, particularly concerning the duration of TB treatment. This is a critical area requiring immediate trainings, as adherence to accurate treatment guidelines is essential for preventing drug resistance and ensuring successful patient outcomes [54]. Further, the failure to provide correct treatment information could lead to treatment failure, which is a major public health concern.

Encouragingly, the majority of nurses correctly identified the appropriate age for TB vaccination, indicating a good understanding of preventive measures—an important aspect of TB control in high-burden settings like Uganda [33]. These findings suggest that while nurses have a solid foundation in TB knowledge, targeted training programs are needed to address the specific gaps in early detection and management. Such programs should be designed with input from both the healthcare providers and experts in the field to ensure their relevance and effectiveness.

4.3. Practices of Nurses towards Early TB Detection

This study found that the overall practices of nurses regarding early TB detection were categorized as poor. Specifically, many nurses did not consistently follow early detection protocols, including routine screening, use of diagnostic tools, and timely referral of suspected TB cases. These findings suggest a gap between knowledge and the practical application of early TB detection strategies, despite the nurses having a basic understanding of TB. For example, while some nurses were aware of the importance of screening, only a small proportion performed routine TB screenings for all patients presenting with respiratory symptoms. Additionally, inconsistencies were observed in the use of diagnostic tools, which are critical for confirming TB cases. These gaps in practice indicate potential barriers such as lack of training, time constraints, or inadequate resources in the healthcare facilities in Southwestern Uganda.

The findings of this study are consistent with global research on nurses' practices in early TB detection. Studies from Nigeria, Ethiopia, and South Africa have highlighted that, despite adequate knowledge, nurses often fail to effectively implement early TB detection practices [3, 38, 52]. Studies in various regions have recommended targeted

training initiatives to ensure that nurses' practices align with the recommended guidelines, thereby enhancing early TB detection efforts [17, 24]. These findings highlight the importance of ensuring that nurses are adequately trained and supported to perform their role in TB detection effectively.

4.4. Perceived Barriers to the Early Detection of TB

This study revealed a significant perception of barriers to early TB detection among nurses at Health Centre IVs in Southwestern Uganda. Most of the participants reported encountering numerous challenges in performing early TB detection, with none indicating that barriers were minimal. These findings emphasize the widespread and deeply rooted nature of the obstacles nurses face in early TB detection.

The most commonly reported barriers included inadequate training and irregular training sessions, with a majority of participants acknowledging that these factors hinder their ability to carry out effective TB detection. This suggests that while nurses are generally aware of TB detection protocols, their ability to apply them in practice is hampered by a lack of regular capacity-building opportunities. The irregularity of training sessions further limits the reinforcement of key knowledge and skills, which may affect their confidence in applying early detection protocols consistently. Additionally, many nurses highlighted stigma as a significant barrier, reflecting broader social and cultural factors that limit open TB discussion and early diagnosis. Delays in receiving TB test results from laboratories were also frequently mentioned, pointing to logistical challenges that impede timely detection and diagnosis.

These findings align with global research highlighting similar barriers. For example, [18] identified comparable human-related challenges, such as insufficient training and logistical constraints, which mirror the barriers found in this study. The widespread nature of these barriers suggests that healthcare systems in resource-limited settings, like Uganda, face shared challenges in scaling up early TB detection efforts.

Additionally, systemic issues such as the absence of TB diagnostic laboratories and inconsistent referral mechanisms, as reported by [51, 14], resonate with the delays in lab results identified by nurses in this study. These systemic challenges underscore the need for infrastructure improvements to enhance TB detection capabilities. The lack of proper referral mechanisms may also contribute to delays in diagnosis, as patients are often transferred to other facilities with insufficient follow-up. Moreover, the issue of stigma, frequently mentioned by participants, aligns with sociocultural barriers identified in other research, emphasizing the need for targeted interventions to reduce the stigma surrounding TB and promote early detection [46].

4.5. Application of the Theoretical Framework

The study used Lewin's Theory of Organizational Change to assess nurses' knowledge, practices, and barriers in early TB detection at Health Center IVs in Southwestern Uganda. The unfreezing step involved designing a questionnaire to evaluate existing knowledge and behaviors. The findings showed that while nurses are aware of TB detection protocols, barriers like inadequate training and logistical challenges hinder their application and the unfreezing process.

5. Recommendations

The study recommends continuous professional development and comprehensive training programs for nurses to improve their knowledge, collaboration, and practices in early TB detection. Clear, standardized guidelines for early TB detection are needed, along with efforts to reduce stigma surrounding the disease, which is a significant barrier to early detection.

Policy makers should also focus on addressing systemic barriers that hinder early TB detection, such as human resource constraints, high workloads, and geographical challenges. Health center policies that promote better staffing, reduce workloads, and facilitate easier access to TB diagnostic services are crucial in improving early detection rates.

Study Limitations

One potential limitation is the reliance on self-reported questionnaire responses. Self-reporting can introduce response bias, where participants may provide socially desirable answers rather than reflecting their true knowledge or practices. Also another limitation was that, I developed the data collection tool myself and its validity did not include the use of Content Validity Index (CVI).

Although this study was conducted across three Health Center IVs in Southwestern Uganda, future studies could benefit from including a broader range of healthcare facilities and regions across Uganda to ensure a more comprehensive understanding of early TB detection practices in diverse settings. Including nurses from other healthcare levels, such as Health Center IIIs or referral hospitals, may offer a more holistic view.

6. Conclusions

There were significant gaps in the knowledge and practices of nurses regarding early TB detection, along with high levels of perceived barriers like: inadequate training, stigma, and delays in diagnostic processes, which significantly impact the effectiveness of early TB detection. Therefore, it is crucial to implement targeted interventions that enhance both knowledge and practical skills while addressing the identified barriers. By doing so, early TB detection can be improved, contributing to more effective TB control and management.

Abbreviations

AIDS	Acquired Immune Deficiency Syndrome
COVID-19	Corona Virus Disease-2019
HIV	Human Immuno-deficiency Virus
HMIS	Health Management Information System
ICF	Intensified TB Case Finding
REC	Research Ethics Committee
SPSS	Statistical Package for the Social Sciences
TB	Tuberculosis
UCU	Uganda Christian University
WHO	World Health Organization

Ethical Approval

Administrative approval was obtained by the researcher from a district in Southwestern Uganda. The research proposal was submitted to Uganda Christian University Research Ethical Committee for approval and it was approved, REC approval number: UCU REC 2024-847. Following UCU REC approval of this research proposal, the head of nursing department UCU was approached for an introductory letter. This is the one used when approaching the district health officer and the health center IV's administrator where data collection took place.

Benefits and Risks

There were no individual benefits for the study participants in this study. There were also no risks related to this study.

Informed Consent

Informed consent involved explanation of the study and its purpose, the type of data needed and its use. Participants in the study were notified that they could leave the study at any time, and participation was entirely voluntary. The signed authorization statement at the conclusion of the form indicated the participant's willingness to participate in the study [44].

Privacy and Confidentiality

The researcher ensured confidentiality by signing consent forms, locking questionnaires, and password-protecting electronic data. Only the researcher, statistician, and supervisor had access to participant data. Data was presented in aggregate form and destroyed after analysis. Participants' names and phone contacts were not included in the questionnaire. A unique coding system was used to protect participant privacy.

Conflicts of Interest

The authors declare no conflicts of interest.

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