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Factors associated with the feasibility and acceptability of universal TB screening in primary healthcare clinics in Johannesburg

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FACTORS ASSOCIATED WITH THE FEASIBILITY AND ACCEPTABILITY OF UNIVERSAL TB SCREENING IN PRIMARY HEALTHCARE CLINICS IN JOHANNESBURG.

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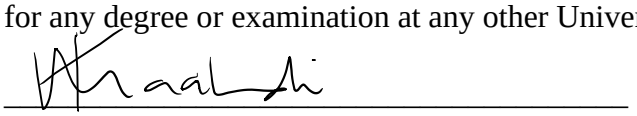
Supervisor: Prof Jonathan Levin

This thesis was submitted to the Faculty of Health Sciences, at the University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree of MSc Epidemiology in the field of Implementation Science

November 2020

DECLARATION

I Tetelo Maakamedi, student number 603667 declare that this Research Report is my own work. It is being submitted for the Degree of MSc Epidemiology in the field of Implementation Science at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.



(Signature of candidate)

7 November 2020 in Johannesburg

DEDICATION

This is for you

For taking risks and never looking back.

ACKNOWLEDGEMENTS

God, thank you.

My supervisor, Prof Jonathan Levin, thank you for everything, for your guidance and patience. I truly cannot thank you enough. May the good Lord bless you abundantly.

Patrick and Maureen Maakamedi, truly I am blessed to have you as my beloved parents. Words fail me. God showed off here and gave me only the best. Ke leboga go menagane.

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ABBREVIATIONS

Acceptability of Intervention Measure	AIM
Confidence Interval	CI
City of Johannesburg Metropolitan Municipality	CoJ
Evidence-based practice	EBP
Exploratory Factor Analysis	EFA
Extensively-drug Resistant TB	XDR-TB
Feasibility of Intervention Measure	FIM
Infection Prevention and Control	IPC
Multi-drug Resistant TB	MDR-TB
National Department of Health	NDoH
Primary Healthcare	PHC
Rifampicin Resistant TB	RR-TB
Tuberculosis	TB
World Health Organisation	WHO

DEFINITION OF TERMS

Universal TB screening is defined, in this study, as screening for TB symptoms in everyone visiting health facilities as soon as they arrive.

TB screening is defined as the identification of symptomatic patients who may be suspected of having active TB by using the TB screening checklist provided in the TB management guidelines 2014, or any other checklist that the health facility may have adapted to suit their needs.

Feasibility "is the extent to which a new treatment, or innovation, can be successfully used or carried out within a given setting" (1). In this study, we define feasibility as the extent to which screening for TB in everyone presenting at a health facility is perceived as being practical for routine practice and can be successfully carried out given the limited resources within government PHC clinics in the City of Johannesburg.

Acceptability "is the perception among implementation stakeholders that a given treatment, service, practice, or innovation is agreeable, palatable, or satisfactory" (1). In this study we define acceptability as the extent to which screening for TB symptoms in everyone presenting at a health facility is well-received by health providers, meaning that health providers approve and welcome the universal TB symptom screening guidelines.

ABSTRACT

Background: TB is an airborne disease that is of great public health importance as every living individual is at risk of infection. Despite TB being a preventable and curable disease, health providers and patients attending healthcare facilities remain at an increased risk of exposure to the disease. This is as a result of the poor implementation of the TB infection prevention and control measures, despite these having been recommended by the National Department of Health and WHO. Particularly, screening for TB symptoms in everyone entering health facilities as soon as they arrive has been identified as one of the first lines of defence against the spread of the disease. The primary aim of screening all who visit health facilities as soon as they arrive is to assist health providers with early identification, diagnosis and treatment of TB suspects, however, studies show that this is not routinely practised. Moreover, many patients attending health facilities are often missed as TB cases despite reporting TB symptoms. Two probable explanations for the poor adherence to the guidelines are that the guidelines 1) are not perceived as feasible and 2) they are not acceptable to health providers. However, this has not been investigated as many feasibility and acceptability studies are usually conducted prior to implementation. Therefore, this study contributes to the Implementation Science literature by investigating the perceived feasibility and acceptability of the guidelines to screen all patients for TB symptoms as soon as they arrive at health facilities.

Methods: Data were collected in 14 primary healthcare facilities in the City of Johannesburg district. Within these facilities, 69 health providers who have ever been involved in screening patients for TB symptoms were approached and they consented to participate in the study. A survey was developed and administered via the REDCap application to collect health providers' characteristics, organisational facilitators and guidelines characteristics. Two outcome variables, feasibility and acceptability scores, were measured using the Feasibility of Intervention Measure (FIM) and the Acceptability of Intervention Measure (AIM) scales which are measured on a four-item, five-point Likert scale and they have been validated and deemed reliable. Composite scores of feasibility and acceptability were estimated and the scores ranged from 4, the lowest score possible, to 20, the highest score possible. This meant that the data were censored, and for this reason, Tobit regression models were fitted to examine factors influencing health provider's perceived feasibility and acceptability of the guidelines to screen for TB in everyone entering the health facility. This analysis was conducted in STATA 15 and effects were considered statistically significant at $p<0.05$.

Findings: A total of 69 health providers who have ever screened patients for TB symptoms consented to participate in this study, of whom the majority (83%) were females; the median age was 40 years (IQR 34 - 47) and most (62%) were professional nurses. The majority (62%) of the health providers indicated that they were aware of both the IPC guidelines and the TB management guidelines, with 71% having been trained in at least one of the guidelines, however, less than a quarter (20%) of the participants reported to screening patients immediately after arriving at the facility. Overall, the guidelines to screen patients for TB symptoms were perceived as being feasible and acceptable with both scales having a median score of 16 or 80%. Having a postgraduate degree, having positive attitudes towards the guidelines, having ever been trained on at least one of the guidelines and the clinic having at least one of the guidelines available were significant predictors of an increase in acceptability, while having positive attitudes towards the guidelines was the only significant predictor of an increase in perceived feasibility. On the other hand, an increase in age, being female and receiving little or no help from management were significant predictors of a decrease in acceptability of the guidelines, while receiving little to no help was the only significant predictor of a decrease in perceived feasibility of the guidelines.

Conclusion: Screening for TB in every patient who enters the health facility is one of the important strategies to control and eliminate TB. While health providers in this study perceived the guidelines to screen for TB symptoms in all who enter the facility as feasible and acceptable, this still did not translate into routine practice with fidelity as most health providers report to only screening patients at least an hour after arrival. This, therefore, reveals that while feasibility and acceptability may not be significant barriers towards implementing these guidelines, receiving little to no help when one is overwhelmed may indicate the conditions that most health providers are working under, that is high patient loads and short-staffed facilities. Therefore, there is a need to restructure where patients are screened for TB symptoms, provide training to those who screen these patients and also develop strategies that will leverage on the fact that health providers perceived these guidelines as feasible and acceptable to ensure that they routinely practise screening patients for TB immediately after arrival.

FACTORS ASSOCIATED WITH THE FEASIBILITY AND ACCEPTABILITY OF UNIVERSAL TB SCREENING IN PRIMARY HEALTHCARE CLINICS IN JOHANNESBURG.

CHAPTER ONE: INTRODUCTION

1.1. Introduction

The primary aim of this study was to measure factors influencing the feasibility and acceptability among health providers of screening for TB symptoms in everyone presenting in health facilities. This chapter provides an overview of the burden of TB globally and looks in more detail at the South African context. A review of the literature is also presented to provide an overall picture of work that has already been done and identify existing gaps. Furthermore, a conceptual framework used to guide this study is presented, followed by a problem statement and a justification of the significance of this study. Finally, this chapter concludes by presenting the questions and objectives that this study aims to address.

1.2. Background

1.2.1. Global burden of TB

Tuberculosis (TB) is a respiratory disease commonly affecting the lungs which is caused by *Mycobacterium tuberculosis*, a bacteria that is primarily transmitted through the air (2). TB infection occurs when an infected person coughs or sneezes, and exhales droplet nuclei containing TB bacilli into the atmosphere, that is then inhaled by another person in the immediate surrounding (3). These droplets can remain in the air for several hours, and they thrive in damp and dark environments (3). Overcrowding and poor ventilation, especially in high prevalence settings, increase the risk of exposure, while delays in identifying, diagnosing and treating infected persons, increase the length of time that they are highly infectious (4).

Globally, TB remains an infectious disease of great public health importance. This is because a person with undiagnosed and untreated active TB can infect 5 to 15 people within the first year of developing the disease (5). In 2018, an estimated 10 million people developed TB worldwide, which is equivalent to 132 cases per 100 000 population (5). While TB affects both

sexes including children, the highest proportion (57%) was estimated among adult men, followed by women of the same age who accounted for 32% of the overall cases and children below the age of 15 years accounted for 11% of the cases (5).

TB continues to be one of the ten leading causes of death globally, despite it being preventable and curable. In 2018, 1.5 million people died of TB, with this total inclusive of 214 000 deaths among those with multi-drug resistant TB (MDR-TB)/ Rifampicin resistant TB (RR-TB) and 251 000 deaths among human immunodeficiency virus (HIV) positive people (5). Of note is that HIV infection remains a profound risk factor for TB, with those living with HIV being at 20 times the risk of developing the disease compared to the general population (6). In 2018, 862 000 HIV positive people were estimated to have developed TB globally, however, only 56% of the cases were notified (i.e. the cases were reported to relevant health authorities which in turn reported them to the World Health Organization). This indicates challenges still faced by the health system to identify and diagnose TB in HIV patients, and also in the general population since only 70% of the 10 million estimated cases were notified in 2018 (5).

In addition, drug-resistant TB continues to plague nations worldwide, with half a million new cases reported as being resistant to rifampicin, which is one of the first-line anti-TB drugs. The majority (78%) of those reported to be infected with RR-TB in 2018, were MDR-TB cases (5). Of much concern is that only 22% of all patients with MDR-TB were initiated on treatment, with just 54% of these patients successfully treated (7). This further perpetuates the risk of transmission to others and threatens global TB control.

1.2.2. TB burden in the WHO African Region

In low- and middle-income countries, TB maintains its position as the leading cause of morbidity and mortality (8). Among the 14 priority countries identified by the World Health Organization (WHO) as having a triple burden of TB, MDR-TB and TB/HIV coinfection, more than half of these countries were from the WHO African Region (3). Moreover, of the eight countries that have been reported to have accounted for two-thirds of the global total of TB cases in 2018, South Africa accounted for 3% of that total (5). Furthermore, estimates show that while most of the 30 high burden countries had between 150–400 TB cases per 100 000 population in 2016-2017, Lesotho, Mozambique and South Africa among other countries had more than 500 TB cases per 100 000 population in that same year (6,9) and this still holds true to date.

1.2.3. South African TB epidemic

Despite being one of the countries that has shown an impressive reduction in TB incidence over the past years, South Africa still has one of the highest burdens of TB and drug-resistant TB globally (5). Between 2006 and 2016, TB remained the leading cause of mortality in the country and is currently still one of the top ten causes of death, even though the number of deaths from the disease has progressively declined throughout the years (10,11).

The South African TB epidemic is fuelled by the high burden of HIV, considering that the country houses one of the largest numbers of people living with the disease globally. Of the total number of people estimated to have developed TB in 2018, more than half (58.8%) were HIV positive (5). Overall, the total TB incidence rates in South Africa in 2018 were estimated at 520 cases per 100 000 population (which is equivalent to 301 000 people) and MDR/RR-TB incidence rates were estimated at 19 per 100 000 population.

Moreover, drug-resistant TB remains a growing problem and a significant threat to efforts to eliminate TB in the country. This is especially because more than half of patients diagnosed with XDR-TB is as a result of person-to-person or hospital-based transmission, rather than resulting from inadequate or poor adherence to treatment (12). As such, this increases the risk of exposure to everyone in contact with these people and most importantly those attending health facilities as they too have weakened immune systems. This is, unfortunately, a persistent problem that needs immediate attention, as mathematical models predict that in 2040, MDR-TB and XDR-TB among the TB incident cases will increase by 5.7% and 8.5%, respectively, in the country if no action is taken to control the disease (13).

1.2.4. TB infection prevention and control

In response to the slow decline of TB incidence and rising rates of MDR-TB and XDR-TB, the National Department of Health (NDoH) established the National Infection Prevention and Control (IPC) guidelines for TB, MDR-TB and XDR-TB in 2015, based on international recommendations (14). These guidelines are efforts by the NDoH to reduce the risk of TB transmission in health facilities and other crowded settings, and further help the country move towards control of the disease. These guidelines are based on three levels of hierarchy of IPC measures, which include administrative control, environmental control and personal respiratory protection (14). Figure 1 below shows a graphical representation of this hierarchy.

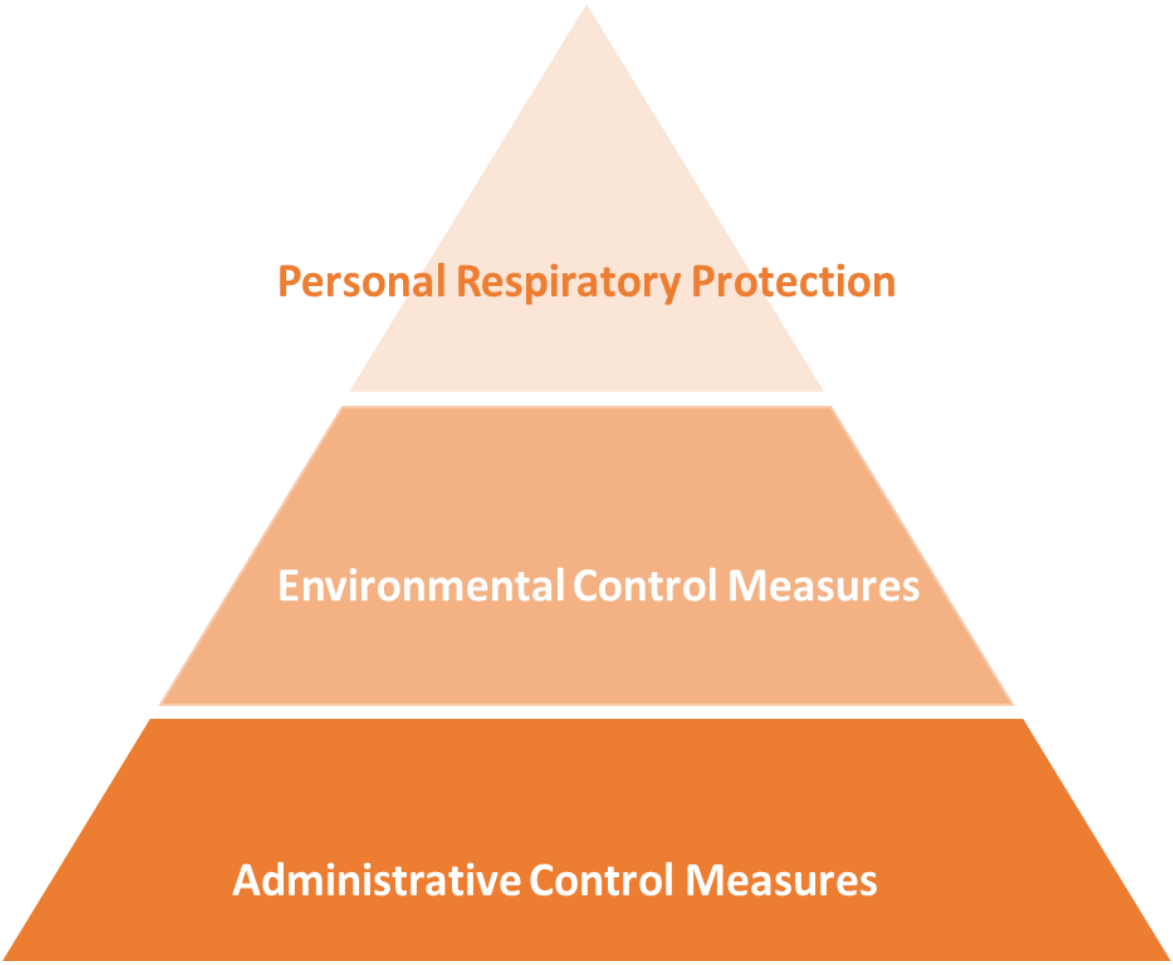


Figure 1: Hierarchy of Infection Prevention and Control measures as according to the NDoH

The guidelines specify that administrative control measures should be prioritized in any setting, irrespective of resource availability (14). This is because, the primary objective of the administrative control measures is to prevent health providers, support staff and people attending health facilities from being exposed to TB. These control measures also aim to reduce the transmission of infection by encouraging prompt identification of TB suspects, diagnosis of those with active TB and ensuring that they are placed on treatment (15). Administrative control measures include TB symptom screening, patient education about TB and cough etiquette, separation or fast-tracking of confirmed TB cases, prompt diagnosis and treatment of TB and staff training (14).

Specific to this study, is the administrative control measure focusing on TB symptom screening. According to the IPC guidelines for TB, MDR-TB and XDR-TB, all patients visiting a health facility should be screened for TB soon after arrival using the TB symptom screening tool, and a staff member should be designated for this task (14). Related to the IPC guidelines

are the 2014 National Tuberculosis Management Guidelines (16). Although not as detailed as in the IPC guidelines, as the TB management guidelines aim to detect and treat any untreated TB that may be present in at-risk population, TB symptom screening of all patients visiting the facility is also recommended in these guidelines (16). Moreover, the symptom screening tool referred to in the IPC guidelines which health providers are to use to identify TB symptoms in patients is provided in the TB management guidelines.

1.2.5. Effectiveness of symptom screening for ruling-out TB

TB symptom screening is the main entry point to TB diagnosis and treatment. In high burden countries, TB symptom screening has increasingly become an acceptable method for ruling out active pulmonary TB, as it has been shown to have 73% sensitivity and a specificity of 76.5% (17). Moreover, for both HIV positive and HIV negative patients, acute and chronic cough, and unintended weight loss have been found to be independent predictors of the TB disease (18) with chronic cough showing a specificity of 94.3% (17). Mathematical models of TB transmission in South Africa, have also demonstrated that a combination of TB prevention strategies, including clinic-based TB symptom screening, can significantly reduce TB incidence and mortality by 55% and 72% respectively, by 2025 compared with the 2015 levels (19,20).

1.2.6. Poor compliance with the guidelines in South Africa

Regardless of the evidence, previous studies particularly those conducted in high burden countries, have shown that these guidelines are not being well implemented (21–29). Even though South Africa contributes a substantial proportion of TB cases globally, and the City of Johannesburg (CoJ) is one of the cities with the largest absolute number of people with confirmed TB in the country (30), reports show that patients are still not being screened for TB as they enter health facilities. In particular, the 2016/2017 District Health Barometer report revealed that only 51.6% of people aged 5 years and older were screened for TB symptoms as they entered health facilities nationally (31). In the CoJ district, the percentage screened (57.6%) during the same period was slightly above the national average (31). Due to the poor performance and reporting of the TB symptoms screening, the 2016/2017 report recommended that all facilities rigorously implement and report TB symptoms screening in the following financial year (31). Although these percentages have since improved during the period

2017/2018 to 71.3% nationally and 81.2% in the CoJ district, these still fell short of the 90% targets set by the NDoH (32), implying that more still needs to be done.

Additionally, poor compliance with the guidelines to screen patients for TB as they enter health facilities undermines any efforts made towards controlling and eliminating TB. The implication of poor compliance to guidelines is a delay in controlling and eliminating TB as a global public health problem as well as DR-TB. Consequently, treating and managing patients with DR-TB consumes an excessive amount of the country's total annual TB budget (33). This could be prevented if health providers routinely screen patients for TB symptoms, as this serves as the first line of defence against the spread of any form of TB.

1.2.7. Feasibility and acceptability among health providers

While various studies have looked at factors related to the poor compliance with TB symptom screening, few studies have investigated the acceptability of these guidelines and the perceived feasibility of implementing these guidelines. Undoubtedly, health providers' perceptions of the tasks they are meant to routinely carry-out, such as screening for TB symptoms in everyone entering health facilities, are important. This is because health providers play a critical role in translating guidelines into practice, as such, measuring the perceived feasibility and acceptability of these guidelines will help inform future development of strategies aimed at encouraging good infection control practices.

1.3. Literature Review

1.3.1. Risk of TB infection among health providers

Health providers in low resource countries play a critical role in delivering healthcare services to the population. However, their increased risk of nosocomial infections threatens the limited health workforce and fragile health systems. It has been well documented that TB infections disproportionately affect health providers more than the general population (34–36). In a summary review of studies by Uden and colleagues (34), health providers were found to be at twice the risk of having latent TB infection and 3 times at risk of developing active TB compared to the general population.

The review also showed that health providers in high burden countries had 2.23 (95% CI, 1.37–3.62) times the odds of having latent TB infection, and the risk was also high among those working in countries with a high burden of TB/HIV coinfection (34). In addition, studies conducted in South Africa have revealed that health providers who have previously worked in TB wards had an increased incidence (IRR 2.03; 95% CI, 1.11-3.71) of developing TB infection, and the risk was even greater (IRR 3.2; 95% CI 1.54-6.66) for those who were HIV positive (35,36).

1.3.2. Missed TB cases at primary healthcare facilities

The risk of TB transmission, especially to health providers, is perpetuated by a large number of undiagnosed and untreated individuals (37). The WHO Global TB report (2019) revealed that despite increases in the number of notified TB cases in 2018, 30% of the total TB cases still went unreported, undiagnosed or untreated (5,38). Likewise, a population-based study conducted in Northwest Ethiopia discovered that two-thirds of the cases with sputum smear-positive TB were undiagnosed and as a result untreated (39).

Missed TB cases still present a major obstacle to efforts to interrupt TB transmission. Of much concern is that a large number of patients presenting at health facilities for TB-related symptoms and/or for other health-related reasons are often missed as TB cases (22,24,40–42). A study conducted in primary health care (PHC) facilities in the Western Cape province, estimated a 5% prevalence of sputum positive TB in symptomatic patients who visited a health facility but remained unidentified (22). Furthermore, a similar study conducted in South Africa reported that a large proportion of patients exiting PHC facilities were missed as cases, with only those presenting at the facilities with multiple TB symptoms being likely to have their sputum requested (24).

At the same time, studies have also shown that patients who present at health facilities for reasons other than TB suspicion and HIV negative patients are less likely to be screened for and diagnosed with TB, even though they report having at least one of the TB symptoms (22,40). This is deeply troubling, as there are also gender disparities with regards to TB diagnosis in health facilities, and this presents a hindrance to early TB detection efforts (24,25). For instance, a study conducted in PHC facilities in the Western Cape, South Africa, revealed that more symptomatic males (77.2%) than females (63.3%) were asked to provide a sputum sample, even though females were more likely to seek care for their symptoms (25).

Following the high prevalence of TB among people attending health facilities compared to those in the community (43), Claassens and colleagues (22) have suggested that active case finding be conducted within healthcare facilities, since a considerable number of patients are still missed within these settings. Moreover, it has also been demonstrated that clinic-based TB screening could achieve a high overall population coverage, as 45% of people in a study conducted in the Western Cape reported having visited a clinic in the last 6 months (44).

1.3.3. Adherence to TB Infection Control Measures and TB screening

The goal of infection control, including TB symptom screening, is to improve the health of the population through the improvement in early detection, diagnosis and treatment of presumptive patients (23,45). Despite positive attitudes towards TB IPC measures, one of the main issues identified for delayed diagnosis of TB in patients is health providers' poor adherence to TB guidelines (21,22,24–27,46). Previous studies have shown that TB screening of everyone entering health facilities is not routinely practised (29,47,48). Moreover, evidence from a study conducted in Uganda revealed that an alarming number of the participating healthcare facilities (46 of the 51) did not screen for TB in all the patients entering the health facilities (29). While facilities reporting a high patient load in this study were more likely to screen patients for TB, this was however only done in consultation rooms and not as soon as these patients arrived at the facility (29). This revealed that coughing patients were not given priority as they were also observed to be waiting for long hours in the same queue as other patients (29).

Another study conducted in Malawi found that of all the health providers interviewed, only 34% reported screening patients at the health facilities (49). Similarly, a study conducted in 20 TB care facilities in Nigeria revealed that infection control measures were hardly practised in most of these facilities, and patients were not being screened for cough upon arrival at the

hospitals (47). Likewise, a cross-sectional study evaluating infection control of drug-resistant TB in South African hospitals, found that health providers' adherence to infection control varied greatly between healthcare facilities. However, overall infection control practices were poor, especially those related to administrative measures (27).

A study conducted in Mozambican healthcare facilities found that not all the 29 participating facilities had guidelines for diagnosing and treating TB suspects and as such TB infection control was inadequate (50). However, unlike the study in Uganda (29), most (62%) of the departments in these health facilities attended to patients suspected of having TB first, and these patients were separated from other facility users (50). Similarly, a study conducted in South Africa found that 64% of the facilities with TB cases, separated infectious patients from the rest of the patients (35). On the other hand, while 80% of the facilities sampled in a study conducted in two districts in Kwa-Zulu Natal South Africa reported using the TB symptoms checklist, only one facility reported separating TB suspects from other patients (51).

1.3.3.1.Discrepancies between what is reported and what is observed

There were also discrepancies between what was reported by these facilities and what was observed by investigators. For instance, 60% of the facilities reported providing face masks for coughing patients, however, only 20% of these facilities were observed to consistently ensure that coughing patients wore face masks. Likewise, while 95% of the health facilities reported providing patients with coughing etiquette education, only 45% had health educational materials on cough hygiene displayed on the walls with only 20% of the health facilities providing continuous health education (47). A study conducted in South Africa also supported these findings, with discrepancies found whereby 63% of the health providers reported to separating coughing patients from non-coughing patients, however, only 26% of facilities were observed to have separate waiting areas for presumptive TB patients (52,53).

1.3.4. Key challenges to implementing IPC guidelines

Poor adherence to TB guidelines is not the only reason for missed opportunities to diagnose and treat presumptive TB cases. Studies have shown that health system, contextual barriers and patient health-related behaviours are some of the factors that need to be addressed to facilitate infection control practices which will, in turn, assist countries to effectively reduce and eliminate TB transmission (21,29,42,46,54).

1.3.4.1. Inadequate infrastructure

Studies conducted in South Africa, Uganda and Ethiopia revealed that health providers perceived limited or poor infrastructure as a barrier to implementing the TB IPC guidelines. This is because small or poorly laid out facilities led to congestion in some areas of the health facility, particularly the waiting rooms, coupled with the fact that these facilities did not have areas designated for TB patients to be screened privately or to be separated from other patients (21,23,42,47,48,52,54).

1.3.4.2. Lack of training

Health providers also indicated the need for TB-related training and clear standard operating procedures and standard of care documents to assist with routine screening (21,42,46,54). For instance, a study conducted in Mangaung in South Africa found that some health providers reported that they had never received any formal training on TB infection control, and when they did, there were long gaps between the training and refresher training (23). A cross-sectional study conducted in Uganda among healthcare workers found that while most of them reported having positive attitudes towards TB infection control, having never attended training was significantly related to negative attitudes towards TB infection control (55).

1.3.4.3. Lack of and/ or conflicting guidelines

A study conducted in South Africa found that while some health providers knew of the existence of TB guidelines in the health facilities, they were unaware of their content (42). Health providers also felt that the conflicting guidelines posed a major barrier for them to effectively practice infection control as there was confusion between numerous guidelines and policies. In addition, health providers also perceived these guidelines as not applying to their setting (23,42).

1.3.4.4. Weak managerial support

A study conducted in Nigeria reported that weak managerial support when it came to TB infection control affected the implementation of TB infection control guidelines (47). Health providers felt that management did not care about their health, hence there was limited support which further impeded the implementation of infection control measures (29,56). However, a

South African study noted that most managers also felt ill-equipped to provide support such as training for their staff (23,47).

1.3.4.5. Attitudes of health providers

Personal factors such as feelings of powerlessness and poor staff attitudes towards TB infection control impede the implementation of good infection control (23,48,52). A study in South Africa revealed that many health providers had negative attitudes towards TB-related work and as such infection control was left to those working with TB (29). Moreover, when it comes to TB symptom screening, health providers believed that screening was not useful due to its low yield for detecting TB positive patients (23,57).

1.3.4.6. Structural inadequacies

High staff turnover and staff shortages place a great burden on the few available health providers, especially in low resource settings. This causes the limited staff to prioritize tasks other than screening for TB, which is perceived as an added responsibility that is difficult to carry out and time-consuming (21,23,29,42,46–48,54). Health providers also reported lack of funding to buy personal protective equipment and poor compliance of the IPC measures by patients including refusing to practice coughing etiquette and to be separated, as additional obstacles impeding the implementation of TB infection control measures in the health facilities (29,42,47,56).

1.3.5. Facilitators of TB infection control

Despite there being barriers to implementing infection control measures such as screening for TB in all patients entering health facilities, studies have also shown that there exist some facilitators to implementing these guidelines.

1.3.5.1.Knowledge and attitudes

Knowledge and attitudes have been reported to be some of the important facilitators of TB prevention and control practices in health facilities. A study conducted in the Free State Province in South Africa found that high attitude scores and high knowledge scores facilitated good infection control practices with every unit increase in the attitudes score increasing good infection control practices by 1.09 times (CI: 1.016 – 1.169) and those with good knowledge

being 4.03 (CI: 1.550–10.469) times more likely to practice good infection control compared to those with poor knowledge (58).

1.3.5.2. Training and availability of guidelines

Training has also been found to be a significant predictor of TB-related knowledge which in turn facilitates good infection control practices (28,59,60). This is because through educational training about infection control, health providers are able to better understand the guidelines and as such, practise good infection control (61). Similarly, knowledge of the presence of a TB infection-control plan or policy within the health facility, and being aware of the national TB infection control guidelines, have been shown to be significantly associated with good TB infection control practices (28,48). Moreover, health providers with access to the TB infection control guidelines are more likely to be knowledgeable of its content and as a result, practice good infection control measures (28).

1.3.5.3. Managerial support and experience

Having a facility manager for a role model when it pertains to infection control, getting words of encouragement from management and receiving mentorship have been reported to encourage good TB infection control practices among health providers (23,54,61). Similarly, social support and reminders from peers to adhere to the guidelines also facilitate the implementation of good infection control (50,61). Likewise, human capital and experiences with working with TB have been shown to be an important predictor of infection control practices. A study conducted in the Western Cape, South Africa revealed that increases in the number of staff members facilitated good infection control practices (35). Also managing TB cases within the facility or having experience working in a TB clinic facilitated good infection control practices (35,60).

1.3.6. Determinants of feasibility and acceptability

According to Proctor and colleagues (1), for innovations such as the TB IPC guidelines to fully serve their purpose, that is to halt TB transmission in healthcare settings and the community at large, these guidelines need to be implemented well. However, this can only be achieved when individuals implementing them commit to continue using them as part of their routine practice

(62). Durlak and Dupree (63) also noted that for innovations to be implemented consistently, they need to work as intended and implementers need to see the benefit in using them.

1.3.6.1.Factors influencing acceptability

In their Conceptual Framework of Individual Innovation Acceptance in Organizations, Frambach and Schillewaert (62) pointed out that for organizational innovations to be incorporated and used successfully, individuals within the organisation must first accept them (62). This is important as the acceptability of the innovations by individuals will determine the innovation's longevity and its utility within the organisation (62). Of note is that individuals within the organisation have the power to negatively or positively influence the process of implementation, hence it is crucial that whatever innovation is introduced into the organisation, it is acceptable to them (64).

Acceptance of innovation, according to the framework, is based on perceived beliefs and affects (i.e. feelings/emotions) held towards it (62). These beliefs and affects are reflected in an individual's attitudes towards the innovation which directly influences acceptance. Aarons (65), further notes that individual's attitudes vary by educational level, work experience and organisational-level factors, what Frambach and Schillewaert (62) call external influences. These external influences are mediated by individuals' attitudes and they include organizational facilitators, personal characteristics, personal innovativeness, and social usage (62) (see figure 2 for complete framework).

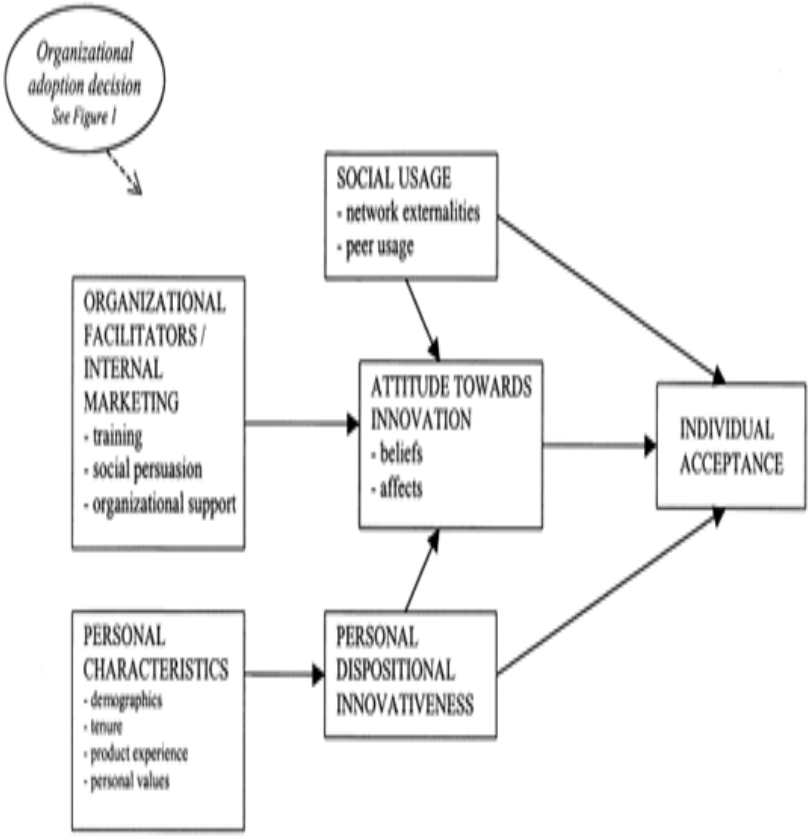


Figure 2: Conceptual Framework of Individual Innovation Acceptance in Organizations developed by Frambach and Schillewaert (2002)

Over and above the factors identified by Frambach and Schillewaert (62) acceptability can also be influenced by structural, patient and innovation level factors (66). In their Multi-level framework predicting implementation outcomes, Chaudoir et al. (66) found that these three additional factors were significant predictors of implementation outcomes which needed to be considered. On the other hand, unlike Frambach and Schillewaert, Chaudoir et al. (66) identified attitudes as being an important factor, however, this was recognised as part of the individual characteristics rather than a separate factor as in Frambach and Schillewaert's framework (62).

For Proctor et al. (1), implementation outcomes play an important role in indicating implementation successes and processes. Acceptability and feasibility are two of the eight implementation outcomes identified by Proctor and colleagues (1). For the authors [(1)p67], acceptability is defined as "the perception among implementation stakeholders that a given treatment, service, practice, or innovation is agreeable, palatable, or satisfactory".

Acceptability can be assessed either prospectively looking-forward or retrospectively looking-backwards, from the viewpoint of both the implementing stakeholders or beneficiaries of the innovation (67). Furthermore, acceptability of innovations can be assessed at three different time points with reference to when they are delivered, for instance, pre-implementation, during implementation and post-implementation (1,67).

1.3.6.2.Factors influencing Feasibility

Proctor et al. [(1)p69] also defined feasibility "as the extent to which a new treatment, or an innovation, can be successfully used or carried out within a given agency or setting". Its focus is primarily based on the practicality of the innovation given the available resources. This is important since feasible interventions are likely to promote evidence translation and sustainability of the innovation, ensuring that the benefits of the intervention are achieved. However, most studies assessing feasibility are more of feasibility/pilot studies rather than determinants studies. This is mainly because in most cases, feasibility is assessed during adoption, before scaling up of the innovation (1,68). Still, Proctor and colleagues (1) argue that feasibility as a concept can be brought up retrospectively as a potential explanation for the success or failure of the innovation (1).

Bird et al. (69) realised the importance of systematically assessing the feasibility of implementation as this was a less explored area. Moreover, they found that in developing an evidence-based measure of the feasibility of implementing complex interventions, the characteristics of that intervention could be identified as either potential barriers or facilitators through which an intervention can either fail or succeed. In addition, Chaudoir et al. (66) also identified innovation level characteristics as one of the factors with a profound impact on implementation outcomes.

1.4. Conceptual Framework

This study was grounded in the Conceptual Framework of Individual Innovation Acceptance in Organizations (62), the Structural Assessment of Feasibility (SAFE) measure (69) and the Multi-level framework predicting implementation outcomes (66) to investigate health providers' perceived feasibility and acceptability of the guidelines to screen for TB in all patients entering health facilities.

Different aspects of the three frameworks were adapted and were further complemented by the literature to guide this study. As depicted in figure 3 below, perceived feasibility and acceptability of the guidelines are directly influenced by the health providers' personal characteristics, including their attitudes towards the guidelines, organisational characteristics and guideline characteristics. The three factors directly influencing perceived feasibility and acceptability cut across at least two of the frameworks guiding this study. For instance, health providers' personal characteristics are said to be significant predictors of acceptability of interventions in both the Conceptual Framework of Individual Innovation Acceptance in Organizations (62) and the Multi-level framework predicting implementation outcomes (66). Similarly, intervention characteristics referred to as guideline characteristics in this study, have also been shown to be significant predictors of implementation outcomes which include feasibility and acceptability by Chaudoir et al. (66) and Bird et al. (69). In addition, the above literature also informed this conceptual framework.

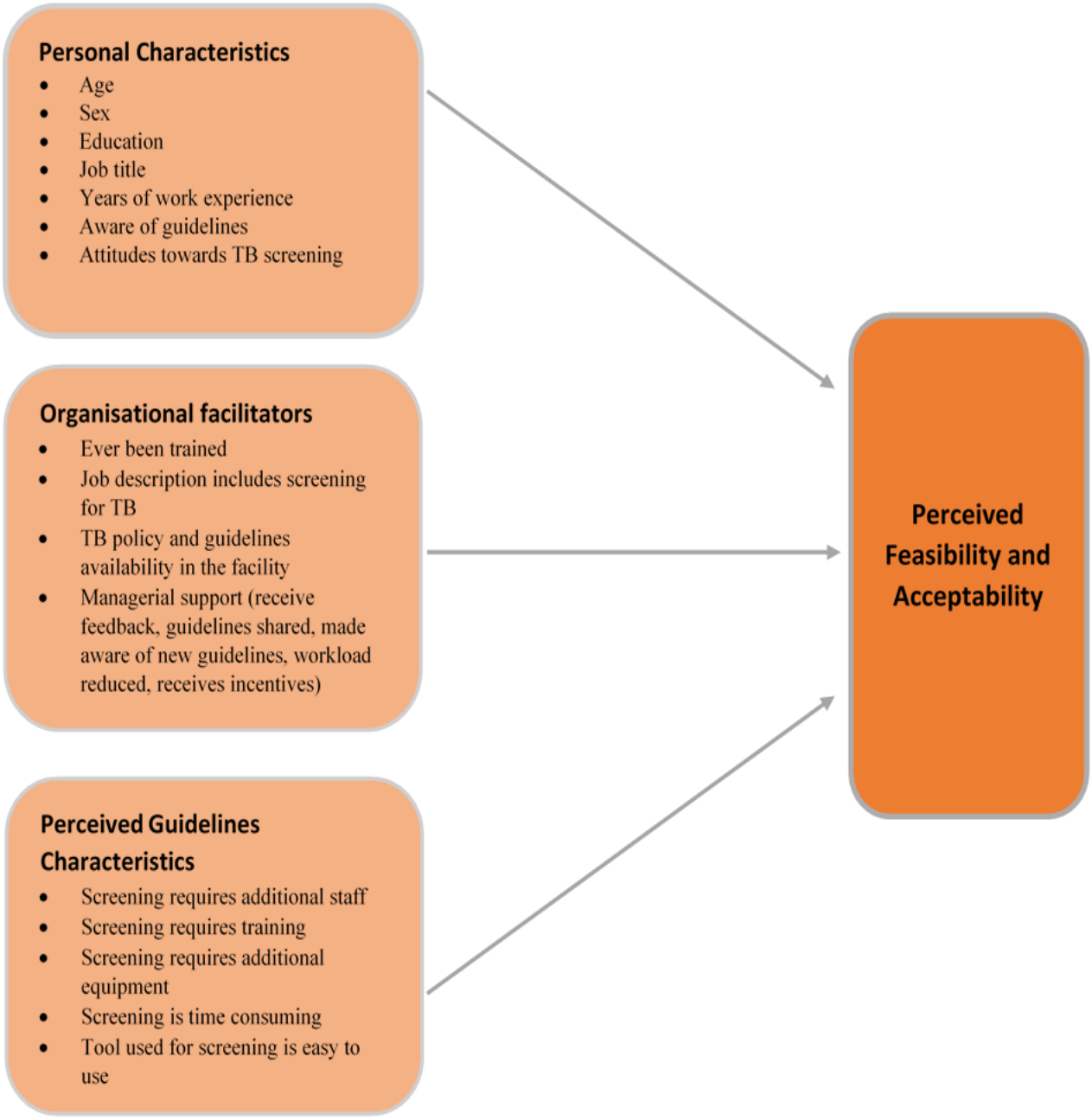


Figure 3: Conceptual Framework of Feasibility and Acceptability adapted from Frambach and Schillewaert (2002), Chaudoir et al (2013) and Bird et al. (2014).

1.5. Problem Statement

Screening patients for TB as they enter health facilities or soon after arrival, to prevent and control the spread of TB infections to other attendees, should be part of routine practice, however, this is not the case. Failure to identify, diagnose and treat TB in patients, not only has severe consequences for the individual but entire communities, including health providers. The fact that health providers are at more than twice the risk of TB, MDR-TB and XDR-TB infections compared to the general population, should be a motivating factor for good infection control practices. However, the persistent burden of infections among these individuals is evidence that this is not regarded as a priority and is, therefore, a critical area that needs to be addressed. As such, this study assessed the perceived feasibility and acceptability among health providers of these guidelines, as the implementation of TB infection prevention and control measures greatly depends on them, especially at the PHC level (23). Beyond that, feasibility and acceptability of interventions are two of the determinants of implementation success (1) thus their investigation is of great value to the field of Implementation Science.

1.6. Justification

This study has identified several gaps in the literature with regards to the perceived feasibility and acceptability among health providers of the guidelines to screen for TB symptoms as soon as patients arrive at the health facility. Firstly, while much work has been done to understand barriers to implementing infection prevention and control measures, little effort has been put into studying TB symptom screening, and even less into looking at health providers' perceived feasibility and acceptability of these guidelines as two probable explanatory factors for the poor adherence to implementing these guidelines.

Furthermore, although many feasibility studies have frequently been conducted in preparation for randomised control trials and for scaling up new interventions, few studies have been conducted to assess feasibility, retrospectively, as a potential explanation for the success or failure of interventions. Additionally, in most of these studies feasibility has been measured using a checklist approach, giving consent rates, completion rates, linkage rates (70), rather than as a construct. This is understandable, as the purpose of a feasibility study is to assess the performance of the programme and whether that programme will work in the real world or not (68,70), however, this also limits other ways in which feasibility can be measured.

Likewise, studies that have assessed acceptability, most being qualitative studies, have not been able to measure the construct of acceptability, rather they have reported perceived barriers and or facilitators to implementation as a proxy of acceptability. Similarly, in quantitative studies, acceptability has been measured using indicators of acceptability such as "number of participants who agreed to be in the study", or "completion rates" for example, rather than looking at the acceptability of the innovation as a construct derived from direct self-reported measures (70–73).

This study, therefore, contributes to the Implementation Science literature by looking at feasibility retrospectively and quantifying both feasibility and acceptability as a concept rather than a proxy of these constructs. Furthermore, by using newly developed and sparsely used psychometric measures of implementation outcomes, the Acceptability of Implementation Measure (AIM) and the Feasibility of Implementation Measure (FIM), this study has been able to shed light on the reliability of these measures, while also demonstrating that they can be effectively used even when the study sample size is small.

1.7. Research Question, Aim and Objectives

1.7.1. Research Question

What factors influence the feasibility and acceptability among health providers, of implementing the guidelines to screen for TB symptoms in everyone presenting at non-TB specializing clinics in Johannesburg?

1.7.2. Research Aim

To investigate factors influencing the feasibility and acceptability among health providers, of the guidelines to screen for TB symptoms in everyone presenting at non-TB specializing clinics in Johannesburg in 2019.

1.7.3. Objectives

- Objective 1: To estimate the average feasibility and acceptability scores of screening for TB symptoms in everyone presenting at non-TB specializing clinics.
- Objective 2: To examine factors associated with the feasibility score of screening for TB symptoms in everyone presenting at non-TB specializing clinics.
- Objective 3: To examine factors associated with the acceptability score of screening for TB symptoms in everyone presenting at non-TB specializing clinics.

CHAPTER TWO: METHODS

2.1. Introduction

This chapter describes the methods that were used to answer the study question. It begins by reporting on the study design that was used, which is followed by a description of the study setting. The study's population of interest, sampling approach and sample size are also specified. A detailed description of the instrument development, data management, including how the outcome variables were generated, and the data analysis plan are provided. This chapter ends by discussing ethical issues related to the conduct of the study.

2.2. Study Design

This study used a cross-sectional study design to collect primary data using standardized survey questionnaires. This design was chosen because of its feasibility and affordability considering the time and financial constraints (74,75).

2.3. Study Setting

This study was conducted in government primary healthcare clinics in the City of Johannesburg Metropolitan Municipality (CoJ) located in Gauteng Province, South Africa. The CoJ covers a total area of 1 645 km² and has an estimated population of about 5 007 000. It is one of the largest metros in Gauteng Province and the most densely populated city in South Africa, with a population density of 3 044 persons per km^2 (31). The CoJ is further divided into seven health sub-districts (sub-district A-G) (31) and has a total of 108 clinics. The CoJ is a major economic hub in South Africa, characterised by high levels of migration, overcrowding, poor health status and poverty (76), all factors associated with the risk of TB exposure (4). HIV and TB remain a challenge in the CoJ with more than 600 000 people estimated to be living with HIV and it has the highest absolute burden of diagnosed pulmonary TB cases (17 361) and RR-TB (7.7 cases per 100 TB cases) in the entire province (30,77).

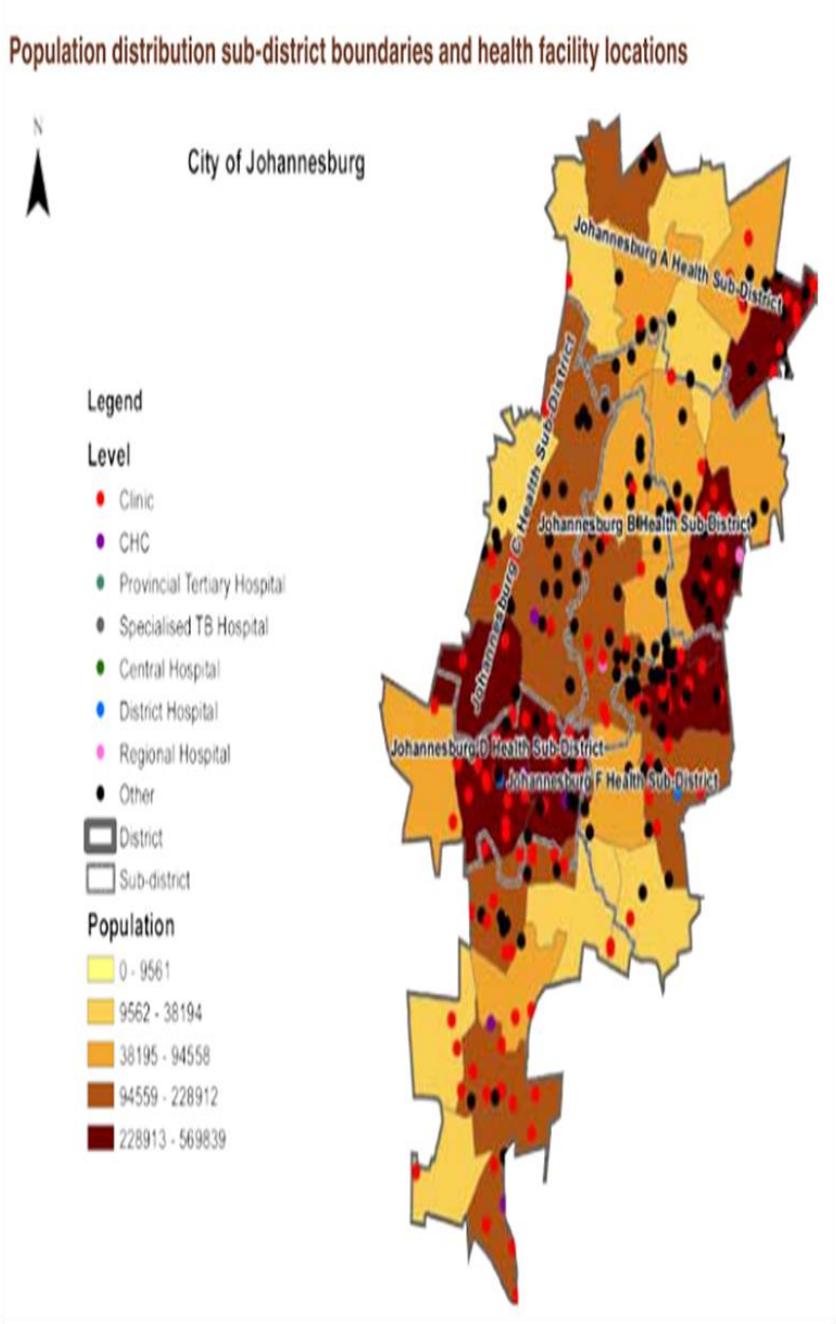


Figure 4: Map of the City of Johannesburg District (image from the District Health Barometer 2016/2017)

2.4. Study Population

Healthcare providers (including doctors, professional nurses, nursing assistants, nursing students, health promoters/community health workers and counsellors) working in non-TB specializing government primary healthcare (PHC) clinics who have ever screened patients for TB were the population of interest. These healthcare providers were selected to participate in the study, as they were viewed as having the relevant experiences of screening patients for TB and assumed knowledge of the guidelines.

2.4.1. Exclusion Criteria

Healthcare providers who had never screened patients for TB, those who were just visiting from other clinics or departments and those who had worked in the selected clinic for less than one month.

2.5. Sampling Approach

This study used a two-stage sampling approach. At the first stage, government non-TB specialising PHC clinics were randomly selected from a list of PHC facilities in the City of Johannesburg obtained from the Gauteng Province website (http://www.gauteng.gov.za/government/departments/health/services/clinics). This list of facilities had PHC facilities, satellite clinics and community health centres, however, for this study, only PHC facilities were included in the sampling frame. Thereafter, this list was imported into STATA and a random selection of 16 facilities was computed. Following the random selection, within each selected clinic all the healthcare providers involved in screening patients for TB were approached and invited to participate in the study.

2.6. Sample Size

The sample size was calculated as follows: We wanted a sample size that would allow us to detect as statistically significant at the 5% level a difference of 1 standard deviation in the mean acceptability (or feasibility) score between two equally sized groups, with 90% power. A sample of 23 per group (or a total of 46) would achieve this. However, this calculation does not take into account the effect of clustering within clinics. One simple way of taking account of such clustering effects is to inflate the sample size by the assumed design effect. Assuming a moderate design effect of 1.5 would inflate the required sample size to 1.5 X 46 or 69 in total. If we assume that each clinic has a minimum of 5 eligible staff members, then we would require

14 clinics to achieve this sample size. We sampled 16 clinics in case there was a problem of facility-level non-response, and in fact two of the clinics were being refurbished and could not participate.

2.7. Participant recruitments

The study team went to the facilities to present the study to the facility managers and requested permission to conduct the study in their respective facilities. Once permission was granted by the facility manager, we requested them to point us to all the available health providers that screened for TB. We then approached all the identified health providers and explained the study.

2.8. Instrument development and data collection

The conceptual framework and literature review informed the development of the structured survey questionnaire used. The survey questionnaire comprised of 67 questions assessing feasibility, acceptability, health provider's attitudes towards the guideline, perceptions of the guideline's characteristics, organisational facilitators and health provider's characteristics. Research electronic data capture (REDCap), which is a secure web platform for developing and managing online databases and surveys, was used to develop the study's survey questionnaire (78).

2.8.1. Quality Control

During the development of the questionnaire on REDCap, quality control measures such as consistency checks, skip patterns, and range checks were incorporated into the application to improve the accuracy and completeness of the collected data. Furthermore, to ensure that key questions related to the outcome variables were answered, these questions were made compulsory on REDCap, and if not answered an error message was displayed on the screen. Before data collection commenced, the questionnaire was pretested for content relevance and ease of application and revised accordingly.

2.8.2. Data Collection

Data for this study were collected between March and May 2019. The researcher and two research assistants visited all 16 randomly sampled clinics and found that two of the clinics were still under construction. Consequently, data were only collected in 14 of the 16 clinics. Data were collected electronically using the REDCap application which was downloaded on to mobile tablets. The survey questionnaire was designed in English, however, where necessary translations were provided by the research assistants during data collection. Experienced research assistants who all had at least a bachelor's degree were trained on the aims of the study, ethics of conducting research and how to use the REDCap application and administer the survey. To reduce social desirability bias, the survey was self-administered, however, the research assistants or the researcher were always available to assist the participants if such assistance was requested. No personal identifiers were collected except for the clinics' names which were assigned numeric codes during analysis. To minimize the number of questions skipped and to ensure good quality data, the research assistants or the researcher skimmed through the survey after the participant was finished and then saved the data.

2.9. Data Management

Data were entered straight into the REDCap app during data collection and thereafter imported into STATA version 15 software for analysis. Before analysis on STATA, data were cleaned and where applicable variables were recoded for ease of interpretation. To ensure confidentiality, individual facility names were removed, instead, numeric codes were used in their place.

2.9.1. Study Variables

Data were collected on socio-demographic characteristics of healthcare providers, organisational facilitators which are the clinic characteristics facilitating the implementation of the guidelines, perceived characteristics of the guidelines based on the experiences of the healthcare providers, healthcare provider's attitudes towards the guidelines, perceived feasibility of the guidelines and the acceptability of implementing the universal TB screening guidelines in the clinic.

2.9.1.1.Outcome Variable

This study focused on two outcome variables. The first outcome of interest was self-reported perceived acceptability of the guidelines to screen for TB symptoms in everyone presenting at the clinic. With the guidance from Proctor and colleagues'(1) definition of acceptability, we defined acceptability as the extent to which screening for TB symptoms in everyone presenting at a health facility is well-received by health providers, this essentially means that health providers approve and welcome the universal TB symptom screening guidelines. Acceptability was measured using the Acceptability of Intervention Measure scale (AIM) developed by Weiner and colleagues (79). The AIM has four-items and each item is measured on a five-point Likert scale. The AIM as a measure of acceptability has been validated and is deemed reliable for measuring providers' acceptance of evidence-based practice (EBP) (79). The questions used to measure acceptability in the AIM were adapted and are presented in table 1 below. The values of each item of the AIM ranged from 1 "strongly disagree" to 5 "strongly agree" with possible total scores per individual provider ranging between 4 (indicating low acceptability) to 20 (indicating high acceptability) (79). The acceptability score was generated by adding all the items for each participant, and this score was treated as a quantitative variable. To measure the internal consistency of the scale, a Cronbach's Alpha was computed. This is because internal consistency is used to describe the extent to which items of a scale are closely related and measure the same concept, in our case, acceptability and feasibility (80). A Cronbach's alpha ranging from 0.70 to 0.95 is deemed acceptable (80).

Table 1: Acceptability of Intervention Measure (AIM)

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1. Screening for TB in everyone who enters the clinic meets my approval.	①	②	③	④	⑤
2. Screening for TB in everyone who enters the clinic is appealing to me.	①	②	③	④	⑤
3. I like screening for TB in everyone who enters the clinic.	①	②	③	④	⑤
4. I welcome screening for TB in everyone who enters the clinic.	①	②	③	④	⑤

The second outcome of interest was the perceived feasibility of screening for TB in every patient entering the health facility. Adapting the definition of feasibility by Proctor and

colleagues (1), we defined feasibility as the extent to which screening for TB in everyone presenting at a health facility is perceived as being practical for routine practice and can be successfully carried out given the limited resources within government PHC clinics in the City of Johannesburg. Likewise, feasibility was measured using the Feasibility of Intervention Measure scale (FIM) developed by Weiner and colleagues (79). Similar to the AIM, the FIM is a four-item, five-point Likert scale measure of feasibility which has been validated and deemed reliable (79). The questions used to measure feasibility in the FIM were adapted and are presented in table 2 below. The scale values of the FIM also ranged from 1 "strongly disagree" to 5 "strongly agree". The feasibility score was generated by adding all the items per individual participant to create a composite score. A Cronbach's Alpha was computed to determine whether the items measured the same concept. The feasibility score was treated as a quantitative variable with a lower limit of 4 and an upper limit of 20, whereby 4 indicated poor perceived feasibility and 20 indicated that the guidelines were perceived to be feasible.

Table 2: Feasibility of Intervention Measure (FIM)

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1. Screening for TB in everyone who enters the clinic is implementable.	①	②	③	④	⑤
2. Screening for TB in everyone who enters the clinic is possible.	①	②	③	④	⑤
3. Screening for TB in everyone who enters the clinic is doable.	①	②	③	④	⑤
4. Screening for TB in everyone who enters the clinic is easy.	①	②	③	④	⑤

2.9.2. Explanatory Variables

This study collected data on several factors that have been shown to be important determinants of the provider's perceived feasibility and acceptance of EPB. These included factors related to health providers' characteristics, organisational facilitators, guidelines characteristics and attitudes towards using the guidelines.

2.9.2.1.Health Providers' Characteristics

Health provider's characteristics included socio-demographic factors such as sex, age, education, occupation, their work experiences and personal attributes such as attitudes. Health providers' age, years of work experience and years working in the current clinic were self-reported in years. Sex was reported as male coded "1" and female coded "2". In the survey, health providers' highest level of education was categorised into five categories, which included high school incomplete coded as 0, high school complete coded as 1, diploma coded as 2, degree coded as 3 and postgraduate degree coded as 4.

Job title included three categories namely professional nurse coded as 0, mid-level healthcare workers coded as 1 and community health workers coded as 2. For the mid-level health workers' category, multiple job titles which included nursing assistants, enrolled nurses, auxiliary nurses and nursing students were combined due to the small number of observations in individual categories e.g. nursing assistants. Mid-level health workers are defined as health professionals that have been trained for shorter periods as compared to nurses and doctors, and they have a restricted scope of practice and work under the supervision of professional nurses or other professionals (80). The questionnaire also asked about the term of employment, but due to the small number of observations in the categories "temporary" and "contract employment", these two categories were combined, leading to a binary variable coded as 0 permanent and 1 not permanent.

Being aware of the IPC guidelines and the TB management guidelines were asked as separate questions in the questionnaire, however, these were combined in the analysis as one variable that illustrated whether the provider is aware of either the IPC guidelines or the TB management guidelines. This was done because both the guidelines address screening everyone entering the facility, therefore, if the providers were not aware of the IPC guidelines but were aware of the TB management guidelines, this would not have disadvantaged them in any manner since the same information is included in both the guidelines. This resulted in three categories, namely not aware of any of the guidelines (0), aware of one of the guidelines (1) and aware of both the guidelines (2).

To measure attitudes towards the guidelines to screen for TB in everyone presenting at a health facility, the Evidence-Based Practice Attitude Scale-36 (EBPAS-36) adapted by Rye and colleagues (81) from the longer version EBPAS-50 developed by Aarons and colleagues (82) was used. This scale was deemed psychometrically strong and cross-culturally valid (81). The EBPAS-36 is a valid and reliable measure of health providers' attitudes towards EBP (81). It

has 12 domains or subscales and 36 items measured on a five-point Likert scale that range from 0 to 4. For this study, only five suitable subscales each comprising of three items were used. These included subscales on the requirement, appeal, openness, fit and burden scales. Overall, the adapted subscales resulted in a 15-item measurement of attitudes which was used in this study. Items measuring the burden subscale were reverse coded and a Cronbach alpha statistic was calculated in STATA. Attitude scores were generated by summing all the items for each health provider. Higher total scores indicated positive attitudes while lower scores indicated negative attitudes towards the guidelines to screen for TB in everyone entering the facility (81).

2.9.2.2.Organisational Facilitators

Eleven variables that are grouped as "organisational facilitators" were included in the analysis. The clinic names, which were assigned unique numerical codes, were used to adjust for clustering. The questions about ever been trained in IPC and/or TB management were asked separately but were grouped in the analysis with possible responses for these two questions coded as 0 never been trained in either of the guidelines and 1 trained in at least one of the guidelines. Furthermore, because one's job description is provided by management upon signing an employment contract, the question that asked whether screening for TB symptoms was part of the health provider's job description was included as an organisational facilitator factor, rather than personal characteristics and this was coded as 0 no and 1 yes. In addition, the question on when patients are screened was coded as 0 "immediately as they enter" 1" within 30 minutes of arrival" and 2 "1 hour or more after arrival". The question of whether the provider knew if the clinic had a TB policy was coded as 0 "no" and 1" yes". The questions on whether the IPC and TB management guidelines were available at the clinic were asked separately in the survey, however, these were combined in the analysis and coded as (0) none of the guidelines are available, (1) one of these guidelines is available and (2) both of these guidelines are available. Questions on whether the guidelines were shared with the health providers, whether they were made aware of new guidelines, and whether they received regular feedback on the performance of their work, had their workloads reduced when feeling overwhelmed and whether they received incentives apart from their salaries were categorised as "0" no/never, "1" sometimes and "2" yes/always (where applicable).

2.9.2.3.Characteristics of the Guidelines

To measure characteristics of the guidelines, the Structural Assessment of FEasibility (SAFE) measure was adapted to formulate questions related to this construct. The SAFE scale is a psychometrically reliable and flexible 16-item scale of the assessment of the feasibility of complex interventions developed by Bird and colleagues in 2014 (69). The development of the SAFE scale was based on a focused literature review of Implementation Science that identified implementation barriers and facilitators related to the characteristics of an intervention (69). The SAFE scale comprises of eight facilitators and eight barriers of implementation, and due to the unequal weight placed on the importance of each barrier and facilitator, the authors recommend against using composite scores and suggest using ratings for individual items (69). For this study, only five relevant individual items were adapted and used to measure the guidelines characteristics. These included, whether health providers thought that screening everyone for TB required additional staff members, required additional training, required additional equipment to be available at the clinic, was time-consuming and whether the screening tool was easy to use. In the survey, these were rated on a five-point Likert scale, ranging from strongly agree (4) to strongly disagree (0).

2.10. Data Analysis Plan

To address the study question, the results were analysed according to the study objectives after computing summary statistics to describe the socio-demographic characteristics. The summary statistics were presented in a table, where continuous variables were summarised using medians with the interquartile range, while categorical variables were expressed as frequency distributions with percentages.

Objective 1: To estimate the average feasibility and acceptability score of screening for TB in everyone presenting at non-TB specializing clinics.

Composite scores of feasibility and acceptability were estimated by summing up the four items used to measure the constructs for each provider. A Cronbach's Alpha was measured and for both feasibility and acceptability, the composite scores were graphically displayed in a histogram and boxplots to illustrate their distribution and this is presented in the appendices. In addition, the median feasibility and acceptability scores and their interquartile range (IQR) were presented.

Objective 2: To examine factors associated with the feasibility score of screening for TB in everyone presenting at non-TB specializing clinics.

To examine factors influencing health provider's perceived feasibility of the guidelines to screen for TB in everyone entering the health facility, univariable and multivariable Tobit regression models were fitted. This regression model was chosen due to its ability to estimate linear regression between variables when a continuous outcome variable is either left or right-censored. Tobit regression models are also an appropriate statistical method to use when the outcome variable is a latent variable, meaning that it is not directly observed but derived from other observed variables (83). Specific to this study, this regression model was selected because the feasibility score can be viewed as censored data with a lower limit of 4 and an upper limit of 20. This means that an individual health provider can have the lowest possible score of 4 on the feasibility measure, but nothing below that and a high score of 20 and nothing above that. Furthermore, the feasibility score was not directly observed, rather the FIM scale was used to derive the outcome. Moreover, dependent on whether the guidelines are perceived as feasible or not, the feasibility score was likely to be skewed and as such, a Tobit regression model was an appropriate model as it adjusts for this skewness through censoring. These models were fitted in STATA, with the clustering effect adjusted for. To avoid overfitting the model, we employed a forward and backward elimination approach which removed the least significant variables one at a time until all the remaining factors were significant at the 25% level or lower. Furthermore, because of the effect of clustering on the models, only 13 terms (number of variables including their categories) could be fitted. As such, level indicators were not used on some of the ordinal scale variables with multiple categories, however, this was determined by how the model reacted to such variable. Potential confounders such as age, sex and education were forced into the models and the 25% level of significance did not apply to them. The results were interpreted using coefficients as a measure of association with a 95% confidence interval (CI) and the estimates were considered statistically significant at $p<0.05$.

Objective 3: To examine factors associated with the acceptability score of screening for TB in everyone presenting at non-TB specializing clinics.

Similar to what has been described in the statistical analysis plan for objective 2, univariable and multivariable Tobit regression models were also used to examine factors associated with health provider's acceptance of the guidelines to screen for TB in everyone presenting at the health facility. This regression model was selected because acceptability score can also be viewed as censored data with a lower limit of 4 and an upper limit of 20. Acceptability is also a latent variable derived from the AIM scale. All the detailed information presented in the statistical analysis plan for objective 2 also apply for objective 3 analysis plan.

2.11. Ethics

This study was approved by the University of the Witwatersrand Human Research Ethics Committee (ref. M181159). Furthermore, permission to conduct the study was obtained from the National Department of Health and the Health District of Johannesburg. Regional and operations managers from the selected clinics were also contacted and informed of the study and they permitted us to conduct the study at their respective facilities. Information sheets detailing the study purpose and informed consents were given to health providers participating in the study to sign. Participation in the study was not expected to elicit traumatic experiences or cause harm. Furthermore, participation was voluntary, and the interviews were conducted at the selected clinics, therefore, no expenses were incurred from participating and as a result, no incentives or reimbursements were provided. For ethical purposes, health providers only took the survey during their tea and lunch breaks (free time), and in rare circumstances where they did not have any patients.

CHAPTER THREE: RESULTS

3.1. Chapter Introduction

The main purpose of this study was to investigate factors associated with the feasibility and acceptability scores of screening for TB in everyone presenting in primary healthcare facilities in the City of Johannesburg. This chapter, therefore, presents the findings of this study and begins by providing descriptive statistics of health providers' personal characteristics, organisational characteristics and guideline characteristics. This is followed by an estimation of the feasibility and acceptability scores and lastly, an investigation of the factors associated with the feasibility and acceptability scores to the guidelines is presented.

3.2. Description of the study participants

This study was carried out in six of the seven health sub-districts in the City of Johannesburg. Sixteen government PHC clinics were randomly selected, however, two were excluded without replacement due to them being out of operation during data collection. Within the 14 participating clinics, a total of 69 health providers were identified and all consented to participate in this study and completed the questionnaire. The minimum number of health providers that participated per facility was three, this was mainly in smaller and poorly staffed health facilities, while the maximum number was eight health providers.

Health Facility	Number of participants
Health Facility 1	3
Health Facility 2	5
Health Facility 3	5
Health Facility 4	4
Health Facility 5	5
Health Facility 6	4
Health Facility 7	5
Health Facility 8	5
Health Facility 9	5
Health Facility 10	5
Health Facility 11	5
Health Facility 12	8
Health Facility 13	5
Health Facility 14	5
Total	**69**

3.2.1. Personal characteristics

Table 3 below presents the participants' characteristics. Of those who participated, the majority (83%) were females; the median age was 40 years (IQR 34 - 47) with the youngest participant being 22 years and the oldest being 66 years old. Among the 69 health providers, most (62%) were professional nurses. Furthermore, 44% of the health providers had a diploma and 13% had a postgraduate degree. The overall median years of work experience in the field of health was 10 years (IQR 6-19) with most (59%) having worked in the current clinic for 1 to 5 years, and the majority (75%) holding permanent positions. Most (62%) of the health providers indicated that they were aware of both the IPC guidelines and the TB management guidelines.

To measure the reliability of the adapted items for attitudes, we used a Cronbach's alpha which resulted in an alpha of $\alpha = 0.79$, signifying that the items were interrelated. Furthermore, we computed a Cronbach's alpha for each of the subscales as recommended by Tavakol and colleagues (80) and we found that while the alpha from all 15 items was acceptable ($\alpha = 0.79$), two of the subscales, appeal and fit, had poor alphas of $\alpha = 0.37$ and $\alpha = 0.38$ respectively. We thus removed both these subscales from the attitude scale measure, and this resulted in an overall Cronbach's alpha of $\alpha = 0.76$. The decision to exclude the appeal and fit subscales from the measure of attitudes was further validated by carrying out a principal component factor analysis, which showed that one component (with an eigenvalue of 3.66) was sufficient as a measure of attitudes. Stata outputs for the attitude scales are presented in Appendix I below. Overall, the participants had positive attitudes towards the guidelines to screen for TB in everyone presenting in healthcare facilities with the median attitude score being 16 (IQR 13 – 20).

Table 3: Personal Characteristics of Health Providers Participating in the study

Variables	Frequency (n)	Percentage (%)
Health Provider's Characteristics		
Age (years)	**Median (IQR) 40** (34 - 47)	
Sex		
Male	12	17
Female	57	83
Highest Level of Education		
High School Incomplete	4	6
High School Complete	16	23
Diploma	30	44
Degree	10	14
Postgraduate Degree	9	13
Job title		
Professional Nurse	43	62
Mid-level Health Worker	14	20
Community Health Worker	12	18
Years of work experience	**Median (IQR)** 10 (6 - 19)	
Years working in the current clinic	**Median (IQR)** 3 (1 – 5)	
Term of Employment		
Permanent	52	75
Contact / Temporary	17	25
Aware of IPC or TB management guidelines[1]		
Not aware of any of the guidelines	6	9
Aware of one of the guidelines	20	29
Aware of both of the guidelines	43	62
Attitudes towards screening everyone	**Median (IQR)** 16 (13 – 20)	

[1] Of the 69 participants, 53 were aware of the IPC guidelines. Similarly, 53 were also aware of the TB management guidelines

3.2.2. Organisational Characteristics

Among all the health providers who have ever screened patients for TB, almost all (68 out of 69) reported screening patients for TB as part of their job description, with 71% having been trained in at least one of the guidelines. However, only 20% reported to screening patients immediately as they entered health facilities. When asked whether they knew if the clinic had a TB policy, the majority (85%) confirmed that the clinic had a TB policy. Likewise, 88% of the health providers reported that both the IPC and the TB management guidelines were available at the clinic. Most (83%) of the health providers reported that these guidelines have been previously shared with them, and 67% reported that when new guidelines are published, management makes them aware of these guidelines. While 82% of the health providers received regular feedback on the performance of their work, most (52%) reported never receiving any help when they became overwhelmed by the workload, and the majority (97%) reported that they did not receive any incentives, apart from their salaries, for screening patients for TB.

Table 4: Descriptive statistics of the organisational facilitators

Variables		Frequency (n)	Percentage (%)
Organisational Characteristics			
Job description includes screening for TB	No	1	2
	Yes	68	98
Ever trained in IPC / TB management	Never been trained on either	18	29
	Been trained on at least one of the guidelines	45	71
Time taken to screen patients	Immediately when they enter	14	20
	Within 30 minutes after arrival	26	38
	1 hour or more after arrival	29	42
Clinic has a TB policy	No	10	15
	Yes	59	85
IPC or TB management guidelines available	None of the guidelines are available	2	3
	One of these guidelines is available	6	9
	Both guidelines are available	61	88
Guidelines shared with the health provider	No	12	17
	Yes	57	83
Health provider made aware of new guidelines	Never	3	4
	Sometimes	20	29
	Always	46	67
Workload reduced when overwhelmed	Always	13	19
	Sometimes	20	29
	Never	36	52
Receives training on request	No	13	19
	Sometimes	15	22
	Yes	41	59
Receives regular feedback on work performance	No	12	18
	Yes	45	82
Receives incentives for screening patients	No	67	97
	Yes	2	3

3.2.3. Guidelines Characteristics

Using the SAFE measure, we identified five important guideline characteristics related to this study. Overall, most of the health providers agreed that screening every patient for TB required additional staff members. Similarly, most of the health providers either agreed or strongly agreed that screening everyone for TB required additional training. On the other hand, health providers either disagreed or strongly disagreed that screening everyone required additional equipment. Likewise, most disagreed or strongly disagreed that screening every patient presenting at the health facility was time-consuming. Finally, health providers either agreed or strongly agreed that the tool used to screen for TB symptoms was easy to use.

Table 5: Descriptive statistics of the guideline characteristics

Variables	Frequency (n)	Percentage (%)
Guidelines Characteristics		
Screening all for TB requires additional staff members		
Strongly disagree	9	13
Disagree	13	19
Neutral	4	6
Agree	21	30
Strongly agree	22	32
Screening all for TB requires additional training		
Strongly disagree	3	4
Disagree	15	22
Neutral	1	1
Agree	28	41
Strongly agree	22	32
Screening all for TB requires additional equipment		
Strongly disagree	18	26
Disagree	21	31
Neutral	5	7
Agree	14	20
Strongly agree	11	16
Screening all for TB is time-consuming		
Strongly disagree	19	27
Disagree	23	33
Neutral	4	6
Agree	15	22
Strongly agree	8	12
The tool used for TB screening is easy to use		
Strongly disagree	1	1
Disagree	2	3
Neutral	0	0
Agree	33	48
Strongly agree	33	48

3.3. Objective 1: To estimate the average feasibility and acceptability scores of screening for TB in everyone presenting at non-TB specializing clinics.

To estimate the average feasibility and acceptability scores of screening for TB in everyone presenting at health facilities, two four-item scales adapted from the FIM and AIM, respectively, were used. The overall estimated Cronbach's Alpha for feasibility score was α=0.88, indicating good internal consistency, while the overall Cronbach's alpha for acceptability score was α=0.70, indicating an acceptable internal reliability scale. The feasibility and acceptability scores were estimated by summing the items for each health provider and the summary statistics are presented below in table 6.

Table 6: Average Feasibility and Acceptability Scores

	α	Median	IQR
Feasibility Score	0.88	16	16 - 20
Acceptability Score	0.70	16	14 - 17

Overall, table 6 shows that the median feasibility score is 16. The feasibility score distribution depicted in the histogram in appendix K reveals that the feasibility score is highly skewed to the left, with outliers at two points depicted in the boxplot in appendix K. Moreover, these two figures demonstrate the censoring in the data, with more health providers scoring between 16 to 20. More specifically, 36% of the health providers scored 16 or 80% while 29% scored 20 or 100% on perceived feasibility. These findings imply that health providers perceive the guidelines to screen for TB in everyone presenting at the health facility as being feasible.

Similarly, table 6 shows that the median acceptability score is 16. On the other hand, the histogram depicted in appendix K shows that the acceptability score, while not normally distributed, is not as skewed as the feasibility score, however, it does have an outlier depicted in the boxplot in appendix K. Similar to feasibility, 32% of the health providers scored 16 or 80%. This also implies that the guidelines to screen for TB in everyone presenting at the health facility is acceptable to health providers.

3.4.Objective 2: To examine factors associated with the feasibility score of the guidelines to screen for TB symptoms in everyone presenting at non-TB specializing clinics.

Unadjusted and adjusted Tobit regression models were fitted to investigate factors associated with health providers' perceived feasibility score of screening for TB symptoms in everyone presenting in health facilities in the CoJ district. Considering that health providers in the same facility tend to behave in a similar manner, clustering was taken into account which meant that only 13 factors could be fitted in a model. In an attempt to avoid overfitting the model, some of the variables with an ordinal scale, such as all the guideline characteristics, were fitted as ordinal rather than categorical variables. As such, table 7 below presents these findings. In the adjusted model, all 69 observations were included.

The adjusted model shows that when taking other variables into account, only two factors were significantly associated with the predicted perceived feasibility score. In particular, health provider's attitudes towards the guidelines to screening for TB in everyone presenting in health facilities was significantly associated with perceived feasibility scores, with a unit increase in attitude score associated with a 0.34 unit increase in the predicted feasibility score.

Similarly, receiving little to no help in terms of management reducing workload when one is overwhelmed was significantly associated, although with a reduction in the perceived feasibility score of the guidelines. Specifically, the predicted perceived feasibility score was 1.82 points lower for health providers who sometimes had their workload reduced and 1.54 points lower for health providers who never had their workload reduced, compared to those who always had their workload reduced when feeling overwhelmed.

In addition, one guideline characteristic and two organisational facilitators were marginally significant ($0.05<P<0.10$). In particular, a unit increase in the level of agreement that screening everyone for TB symptoms required additional staff members, decreased health providers' predicted feasibility scores by 0.59 points. Similarly, health providers whose job description included screening patients for TB symptoms had a predicted feasibility score of 3 points lower compared to those who did not have TB screening as part of their job description. On the other hand, as the number of guidelines available at the health facility increased, the predicted feasibility score also increased by 5.74 for those working in health facilities with one of the guidelines available and by 6.09 points for those working in facilities in which both guidelines were available. Although marginally significant, the results also show that having TB management guidelines available increases the predicted feasibility scores by 5.6 points.

Table 7: Fitted Tobit Regression Models of Health Provider's Perceived Feasibility of the Universal TB Screening Guidelines and Associated Factors

VARIABLES	Unadjusted			Adjusted		
	Coef	p-value	(95% CI)	Coef	p-value	(95% CI)
Personal Characteristics						
Age	0.003	0.962	(-0.115 – 0.121)	-0.02	0.617	(-0.096 – 0.057)
Sex						
Male	Ref			Ref		
Female	-0.65	0.802	(-5.791 – 4.496)	-1.89	0.293	(-5.449 - 1.671)
Postgraduate Education						
No	Ref			Ref		
Yes	2.48	0.096	(-0.450 – 5.406)	1.48	0.230	(-0.958 - 3.910)
Job title						
Professional Nurse	Ref					
Mid-level Health Worker	-0.22	0.885	(-3.265 – 2.822)			
Community Health Worker	-3.15	0.084	(-6.736 – 0.439)			
Attitudes	0.41	0.000*	(0.201 – 0.614)	0.34	0.001*	(0.144 - 0.534)
Organisational Characteristics						
Job description includes TB screening						
No	Ref			Ref		
Yes	1.48	0.053	(-0.21 – 2.986)	-3.00	0.058	(-6.108 - 0.099)
IPC or TB management guidelines available						
None of the guidelines are available	Ref			Ref		
One of these guidelines is available	4.75	0.212	(-2.767 - 12.264)	5.74	0.084	(-0.798 - 12.269)
Both of these guidelines are available	5.68	0.058	(-0.209 - 11.566)	6.09	0.064	(-0.366 - 12.553)
IPC guidelines available						
No	Ref					
Yes	2.18	0.211	(-1.266 – 5.634)			
TB management guidelines available						
No	Ref					
Yes	5.60	0.064	(-0.332 – 11.531)			
Workload reduced when overwhelmed						
Always	Ref			Ref		
Sometimes	-2.18	0.069	(-4.535 - 0.174)	-1.82	0.022*	(-3.370 - -0.274)
Never	-2.32	0.085	(-4.976 - 0.329)	-1.54	0.011*	(-2.715 - -0.364)

Guideline Characteristics						
Screening all for TB requires additional staff members	-0.71	0.034*	(-1.373 - -0.056)	-0.59	0.086	(-1.261 - 0.086)
Tool used for TB screening is easy to use	2.97	0.032*	(0.270 - 5.674)	1.91	0.166	(-0.812 - 4.629)

*****p-value level of significance at <0.05

3.5. Objective 3: To examine factors associated with the acceptability score of screening for TB symptoms in everyone presenting at non-TB specializing clinics.

Unadjusted and adjusted Tobit regression models were fitted to investigate factors associated with health providers' acceptability score of screening for TB symptoms in everyone presenting in health facilities in the CoJ district. Similar to objective two, this analysis took into account clustering to allow for similar responses from health providers in the same facility. Clinics were given numeric codes to maintain confidentiality, and these codes were used as the unique cluster identifiers. Given that health providers from 14 clinics participated in this study, this meant that only 13 factors can be fitted in a model. Furthermore, to avoid overfitting the model, some of the variables with an ordinal scale were fitted as ordinal rather than categorical variables. As such, table 8 below presents these findings. In the adjusted model, only 63 observations were included, meaning that some of the factors had missing values.

The adjusted model shows that when taking other factors into account, a one unit increase in age is significantly associated with a 0.05 unit decrease in the predicted acceptability score of screening for TB symptoms in everyone presenting in health facilities. Similarly, the predicted acceptability score for women was 2.31 points lower than for males. On the other hand, those with a postgraduate education had a predicted acceptability score of 1.89 points higher than those without a postgraduate education.

When taking other factors into account, health providers' attitudes towards the guidelines to screen for TB symptoms in everyone entering health facilities was significantly associated with an increase in the acceptability score, with a unit increase in attitude score associated with a 0.38 unit increase in the predicted acceptability score. Similarly, having previously been trained on at least one of the guidelines was significantly associated with an increase in the predicted acceptability score.

Furthermore, a unit increase in the number of available guidelines at the health facility increased health providers' predicted acceptability score by 1.37 units. In particular, having the IPC guidelines available at the health facility significantly increased the predicted acceptability score by 2.62 points. On the other hand, receiving little to no help when relating to the workload was significantly associated with a decrease in the predicted acceptability of the guidelines. In particular, those who sometimes had their workload reduced when they felt overwhelmed had a predicted acceptability score of 1.76 points lower compared to those who always had their

workload reduced. Similarly, those who never had their workload reduced had a significantly lower predicted acceptability score of 1.70 points compared to those who always received help.

The belief that screening for TB symptoms in everyone entering health facilities required additional equipment and having a TB policy in the facility were marginally significant. In particular, as the level of agreement increased that screening required additional equipment, the predicted acceptability score decreased by 0.32 units. On the other hand, having a TB policy in the facility increased the predicted acceptability score by 1.23 points compared to when the clinic doesn't have a TB policy.

Table 8: Fitted Tobit Regression Models of Health Provider's Acceptability of the Universal TB Screening Guideline and Associated Factors

VARIABLES	Unadjusted			Adjusted		
	Coef	p-value	(95% CI)	Coef	p-value	(95% CI)
Personal Characteristics						
Age	-0.02	0.673	(-0.089 – 0.058)	-0.05	0.042*	(-0.104 - -0.002)
Sex						
Male	Ref			Ref		
Female	-1.89	0.212	(-4.880 - 1.104)	-2.31	0.000*	(-3.476 - -1.152)
Postgraduate Education						
No	Ref			Ref		
Yes	2.01	0.102	(-0.411 - 4.423)	1.89	0.001*	(0.806 - 2.978)
Job title						
Professional Nurse	Ref					
Mid-level Health Worker	0.41	0.721	(-1.861 – 2.678)			
Community Health Worker	-1.53	0.096	(-3.339 – 0.277)			
Attitudes	0.34	0.000*	(0.225 - 0.462)	0.38	0.000*	(0. 299 – 0.463)
Organisational Characteristics						
Ever trained in IPC / TB management						
Never been trained on either	Ref			Ref		
Been trained on at least one of the guidelines	1.04	0.246	(-0.736 - 2.821)	1.32	0.023*	(0.193 - 2.447)
Clinic has a TB policy						
No	Ref			Ref		
Yes	1.93	0.028*	(0.217 - 3.646)	1.23	0.054	(-0.024 - 2.479)
IPC or TB management guidelines available	1.63	0.056	(-0.039 - 3.306)	1.37	0.000*	(0.701 - 2.037)
IPC guidelines available						
No	Ref					
Yes	2.63	0.017	(0.494 – 4.759)			
TB management guidelines available						
No	Ref					
Yes	0.98	0.259	(-0.740 – 2.702)			
Workload reduced when overwhelmed						
Always	Ref			Ref		
Sometimes	-1.69	0.134	(-3.907 - 0 .532)	-1.76	0.006*	(-2.991 - -0.533)
Never	-2.07	0.009*	(-3.622 - -0.524)	-1.70	0.008*	(-2.944 - -0.463)

Guideline Characteristics						
Screening all for TB requires additional equipment	-0.57	0.054	(-1.147 – 0.010)	-0.32	0.080	(-0.679 - 0.040)
Tool used for TB screening is easy to use	0.98	0.086	(-0.141 - 2.097)	-0.34	0.184	(-0.818 - 0.165)

*****p-value level of significance at <0.05

CHAPTER FOUR: DISCUSSION AND CONCLUSION

4.1. Introduction

A person with undiagnosed TB can infect an average of 5 -15 people per year through close contact if not identified and treated (5). Screening for TB symptoms in all who visit health facilities immediately after arrival is meant to reduce the risk of transmission to others in crowded settings, yet studies show that this is seldomly practised. Given that this TB infection prevention measure is important, as it is the first line of defence against the spread of TB, this study investigated the perceived feasibility and acceptability among health providers of the guidelines to screen for TB symptoms in all who enter health facilities as probable explanations for poor adherence to the IPC guidelines. This chapter, therefore, aims to present a summary of key results, and draw conclusions from the study.

4.2. Perceived feasibility and acceptability of the guidelines among health providers

On average, health providers in this study scored 80% on the feasibility and acceptability scores. This means that generally, health providers perceived screening for TB symptoms in all who enter health facilities as soon as they arrive as feasible and acceptable.

On the other hand, this study found that while health providers perceive these guidelines as feasible and acceptable, most (80%) still report not screening patients immediately after arriving at the facility. Rather, patients are screened an hour or more after arriving at the clinic. This may be due to a lack of an implementation plan of the guidelines, which may also be the reason why these guidelines are not well implemented. For instance, while the guidelines recommend that a staff member should be designated for screening all the patients that enter health facilities, it does not clearly define the specific person that should be designated for the task. Furthermore, there are no monitoring and evaluation structures to govern this. As such, having clearly defined tasks for each health provider could improve both acceptability and feasibility as this would make them aware of their specific role.

These findings are similar to those of a study conducted in South Africa (29) which found that screening was conducted in consultation rooms with most patients waiting in the queue for at least two hours before consulting, even though the guidelines state that patients should be

screened for TB immediately or soon after arrival (14). This further reveals the challenges faced by the health system with regards to the shortage of health providers. There are just not enough health providers to have them stationed at the door to conduct TB screening, thus most patients are screened once in the consultation room. This is further influenced by the fact that health providers perceive TB screening as part of history taking, hence the belief that it needs to be done in a private consultation room and not in public spaces such as the waiting area (29).

Although this is understandable from a human resource shortage standpoint, it is also concerning and reveals that while the guidelines are perceived to be feasible and acceptable, they are not being implemented with fidelity, which is the degree to which implementers are implementing a particular intervention as prescribed in the original guidelines (1). This further explains the slower than desired decline of TB infections globally (5) as close contact with TB suspects is not reduced through triaging those suspected of being infected and ensuring that they do not remain in the health facilities for prolonged hours.

4.3. The influence of characteristics of health providers on perceived feasibility and acceptability

To investigate factors influencing the perceived feasibility and acceptability among health providers, of the guidelines to screen for TB symptoms in everyone as they arrive at the health facility, this study assessed their personal characteristics. After controlling for all other factors, the results show that attitudes, age, sex, and education are the most important personal characteristics associated with the acceptability of the guidelines. On the other hand, attitudes towards the guidelines are the only significant personal characteristic associated with health providers' perceived feasibility of the guidelines.

In particular, health providers in this study demonstrated positive attitudes towards the guidelines to screen for TB symptoms in everyone as they enter health facilities. This is consistent with other studies that have also found that health providers generally have positive attitudes towards infection prevention and control measures (23,29,52,56,58). Furthermore, attitude scores in this study were measured using a psychometrically valid and reliable instrument (81), and as such, provided valuable insight, as the results show that an increase in attitude score also significantly increased health providers' perceived feasibility and acceptability scores. Engelbrecht and colleagues also noted that positive attitudes were a significant predictor of good TB infection control practices (58), while negative attitudes

reduced the likelihood of adhering to clinical guidelines (84). This is because attitudes are an important precursor which can either facilitate or impede the implementation of interventions (65,85,86). On the other hand, a study investigating barriers and facilitators among community nurses of the implementation of Evidence-Based Practice (EBP) found that having positive attitudes did not guarantee the implementation of these EBP (87). This further indicates that more factors may be at play which influences health providers' decision to adhere to guidelines or not.

Furthermore, this study found that as age increased, health providers were significantly less likely to accept these guidelines. This is consistent with findings from a meta-review which found that while the younger health professions with less experience were more likely to adhere to guidelines, older health professionals with more experience were significantly less likely to adhere to clinical guidelines (84). The reason for this observed difference in the acceptance and adherence to guidelines is that older health providers remain stuck in old ways of doing things due to their many years of experience, thus introducing new guidelines challenges their knowledge, as a result, they are resistant and find it difficult to accept changes brought about by new guidelines (88). This indicates the lack of continuing education and training among health workers which results in poor health practices. It is, therefore, important that health providers are provided with opportunities to expand their knowledge through health education and training to keep up with the evolving health practices and guidelines.

This is further supported by this study which found that having a postgraduate degree was significantly associated with the acceptability of the guidelines. Similar to these findings, a worldwide survey on the acceptability of novel diagnostic tests for active tuberculosis also found that levels of acceptance were significantly associated with higher levels of health provider's education (89). This was also the case from a study looking at the determinants of guideline use among health providers which found that those with a postgraduate degree were significantly more likely to use guidelines (90). On the other hand, this study found no significant difference between Professional nurses versus mid-level workers and CHWs and their perceived feasibility and/ or acceptability towards the guidelines to screen for TB in all who enter health facilities.

This study found that females compared to males were significantly less likely to accept the guidelines to screen for TB symptoms in all who visit health facilities as soon as they arrive. This is concerning since 70% of the health workforce is made up of women (91). Similarly, a

cross-sectional study investigating the determinants of guideline use in primary care physical therapy found that males, compared to females, were twice as likely to perceive EBP as useful for decision making (90). Further studies are needed to explore this stark difference between females and male's acceptance of guidelines and adherence to these guidelines. Moreover, this will inform gender-specific strategies that aim to encourage female health providers to increase their level of acceptance and adherence to guidelines.

4.4. Organisational facilitators and their influence on perceived feasibility and acceptability

This study assessed organisational facilitators to determine which of these were significantly associated with the perceived feasibility and acceptability of the guidelines. After controlling for all other factors, having ever been trained in at least one of the guidelines and having either of the guidelines available at the clinic were the two important organisational facilitators significantly associated with an increase in the acceptability score. On the other hand, receiving little to no help when one is overwhelmed by the workload was a significant barrier to the perceived feasibility and acceptability of the guidelines.

Over 80% of the participants in this study were aware of the presence of a TB policy or the TB infection prevention and control guideline within the clinic. Furthermore, the multivariable analysis showed that having TB IPC or the TB management guidelines available at the clinic was significantly associated with health providers' acceptance of the guidelines. Similarly, an Ethiopian study found that health providers who reported being aware of the presence of a TB infection control plan or the national guidelines for TB infection control, were 4 and 9 times more likely, respectively, to practice TB infection control measures (48). This is because having guidelines easily available at the health facility gives health providers straight-forward and practical content to refer to when needed (92). On the other hand, not having the guidelines available at the health facility reduced adherence to these guidelines as health providers may not be aware of their existence and content (84,93) and as such, they may believe that they are not important (56). What literature has further highlighted as an important factor influencing health providers' acceptance of guidelines is that they need to be clear (94). Not only this but in a case where there are multiple guidelines, the information needs to be consistent, because having multiple guidelines with conflicting information may lead health providers not to adhere to the recommendations in these guidelines (23).

On the other hand, it is not sufficient to only share and make available the guidelines to health providers, however, training should also be part and parcel of this dissemination. In this study, most of the participants (71%) reported to ever being trained in at least one of the guidelines i.e. the IPC or TB management guidelines. Furthermore, the results showed that having ever received training in either of these guidelines was significantly associated with a 1.32 point increase in the predicted acceptability score. This is because training not only creates awareness of the existence of the guidelines but it also ensures that those who are trained are knowledgeable and have an understanding of the significance of the guidelines for preventing the spread of TB (59,95). A qualitative study investigating barriers and facilitators of implementing clinical guidelines also noted that one of the main barriers to implementing the guidelines was not having the time to read guidelines (95), therefore, providing regular and mandatory training forces all the health providers to make time and it ensures that they are aware not only of the existence of the guidelines but also of its content.

When relating to leadership, it has been shown that effective leadership can modify the impact that may result from resource limitation in health facilities (96). A supportive manager can counteract demotivating factors, and as a result, promote health provider's acceptance and adherence to guidelines. In this study, receiving little to no help when one is overwhelmed by the workload significantly reduced health providers' perceived feasibility and acceptability of the guidelines to screen all patients for TB as soon as they arrive at the health facility. Lack of motivation resulting from the heavy workload and low appreciation of health providers reduces their willingness to accept and adhere to guidelines (87,88,96) and make them think that screening patients as they arrive at the facility is time-consuming and less of a priority(21,23,29,42,46–48,54). Studies have also noted the importance of supporting health providers to help them adhere to clinical guidelines (84,93,96). Furthermore, strong and active organisational leadership is important for encouraging guideline adherence as it increases awareness of guidelines (95) and also identify areas that need improvement and creates strategic plans to increase acceptability and adherence to guidelines. Additionally, the ability to have consistent communication with or knowledge transfer from a leader also promotes acceptability of the guidelines, not only of individuals but the entire team (95). It is therefore important for those in leadership positions to receive training on effective leadership to motivate health providers as this may increase their acceptability and adherence of these guidelines.

4.5. Guideline characteristics and their influence on perceived feasibility and acceptability

The descriptive results revealed that most of the health providers agreed or strongly agreed that screening everyone for TB required additional training, however, this was not significant in the adjusted model, implying that training to screen for TB symptoms may not be essential given that the health providers are already conducting this. This study found that when controlling for other factors in the model, only two of the guideline characteristics were marginally significant. In particular, this study found that when health providers perceived the guidelines to screen all who enter health facilities for TB as requiring additional staff members, they were less likely to perceive these guidelines as being feasible. Similarly, when health providers perceived these guidelines as requiring additional equipment, they were also less likely to accept them. In contrast, when health providers perceived the screening tool as easy to use, they were significantly more likely to perceive these guidelines as feasible, however, when controlling for other factors this became insignificant. A meta-review of factors influencing the implementation of clinical guidelines found that guidelines that are easy to understand and do not require specific resources have a greater likelihood of being used (84). This speaks to the complexity of the guidelines which has been cited as the most influential factor affecting the implementation of guidelines (84,93). It is, therefore, crucial for guideline developers to take the complexity of these guidelines and tools into consideration (84), especially if they are to be used by people of varying educational levels and backgrounds i.e. doctors, professional nurses, mid-level health workers and community health workers.

4.6. Limitations of the study

A major methodological challenge of this study was the small sample size, made more acute by the need to take clustering into account. This meant that because we had 14 clusters, only 13 terms could be included in the model to avoid overfitting the model. As a result, some of the variables included in the models were used as ordinal variable, even though they had been presented as categorical in the descriptive statistics. It is also noteworthy that the results of this study may not be generalisable as a result of the small sample size, therefore, caution should be taken when interpreting the results. The study collected data at the individual level and not at a facility-level (e.g. number of staff, daily headcount, TB caseload per month), and as such we could not provide a background to the study setting nor were we able to untangle participant's roles and responsibilities vs. what is happening at the facility-level. Furthermore, while we tried to reduce social desirability bias by making the survey self-administered, this might not have been prevented for participants who needed the assistance of the researcher during data collection. Likewise, despite being assured that the survey was not in any form an assessment of performance, some participants may have been hesitant to respond honestly, as such, may have provided desirable responses. Although the researcher and research assistants were always present to assist, information bias due to the survey being in English may have resulted in misclassification, therefore, affecting the results. Finally, this study only examined one component of infection prevention and control (screening for TB in everyone entering the health facility as soon as they arrive) rather than the entire infection control guidelines, even though in the literature review we made a lot of reference to the entire IPC guidelines.

4.7. Strengths of the study

To our knowledge, this is the first study to quantify perceived feasibility and acceptability of the guidelines to screen for TB symptoms in all who visit health facilities as soon as they arrive using the FIM and AIM in the South African context. Furthermore, the credibility of this study's findings lay in the fact that feasibility and acceptability scores were measured using the FIM and AIM. These are two psychometrically and practically strong measures of feasibility and acceptability, which have been deemed valid and reliable (79). As such, this study contributes to the field of Implementation Science, as there has previously been a lack of information on the validity and reliability of measures used to assess implementation outcomes and this has threatened the strength of knowledge development in the field (97,98). Moreover, the conceptual framework used was able to correctly predict the effect of personal

characteristics, organisational characteristics and guideline characteristics, on the perceived feasibility and acceptability of the guidelines to screen for TB symptoms in all who enter health facilities, although not all the variables were significant. This may also have been influenced by the small sample size discussed above.

4.8. Implications of the findings and opportunity for future studies

Relevance to future studies: These findings have an important implication for further studies, in that it has demonstrated that health providers perceive these guidelines as feasible and acceptable, thus allowing future research to develop strategies that leverage on this fact, as the perceived feasibility and acceptability of innovations can either hinder or facilitate the adoption of these innovations, especially in resource-constrained settings. Future studies also need to explore in-depth explanations of how feasibility and acceptability relate to routine practice and how these can be used to develop strategies that ensure that the gap between perceived feasibility and acceptability and routine practice is reduced.

Relevance to public health: This study provides facility managers with the opportunity to use the finding to restructure patient registration/admission into the clinic to include TB symptoms screening which will ensure that guidelines are followed with fidelity. Specifically, training should be provided to those working at the patient file station or reception on TB infection prevention and control so that they can screen patients for TB symptoms as soon as they arrive at the facilities, because they are the first point of contact with all patients entering health facilities. This will further minimize the time TB suspect spend at the health facility and risk transmitting the infection to other patients and health providers. Moreover, not only is screening all patients for TB symptoms feasible and acceptable, but it is also simple (58), meaning that with proper training even those who are not clinically trained can screen patients. Furthermore, it is also important for facility managers to continue to give health providers the support they need and making guidelines available and accessible to all (99), as this increases health providers' acceptance of these guidelines. In addition, with the increasing number of healthcare professionals using social media platforms such as WhatsApp in their daily work to share information with peers and patients (100), facility managers should exploit and use these platforms for disseminating guidelines to ensure that health providers always have these at hand (93).

Relevance to policy: South Africa adopted the TB 90/90/90 targets in 2016 which were later modified to be 90/100/90 in the National Strategic Plan for HIV, TB and Sexually Transmitted Infection 2017 - 2022 (101). These targets aim to screen 90% of high-risk individuals, diagnose and treat 100% of those with TB and successfully treat 90% of those with drug-susceptible TB by 2020. Screening for TB symptoms in everyone entering health facilities is one of the indicators measured in the District Health Barometer and is one of the indicators used to track the country's progress towards providing universal health coverage (32). While this has been showing a positive increase in the number of people being screened for TB, the limitation of this indicator is that it does not assess the quality or duration it takes before patients are screened. This study, therefore, provides policymakers with the opportunity to modify such indicators and emphasise the importance of the timing of screening patients, especially in health facilities as the rate of transmission might be increased by the fact that most of those attending health facilities have weak immune systems. Moreover, this will motivate health facilities to ensure that these guidelines are followed, especially if screening for TB symptoms in all who enter health facilities soon after arrival is part of health provider's Key Performance Indicators.

4.9. Conclusion

South Africa's high HIV prevalence in the general population and the large number of crowded health facilities with suboptimal resources creates a favourable environment for TB to spread. Screening all patients as they enter health facilities is the first line of defence against TB which helps with early identification of those with the disease and stops it from spreading to others with compromised immune systems, especially in health facilities. Hence, routinely screening all patients as the guidelines stipulate is critical to efforts to control and eliminate TB. In this study, we found that while health providers demonstrated positive attitudes towards screening all patients and these guidelines were perceived as feasible and acceptable, most health providers still reported to screening patients an hour or more after arrival and not immediately as recommended in the guidelines. Furthermore, this study highlighted the importance of management support, as those who received little to no help when they became overwhelmed by the workload were less likely to perceive these guidelines as feasible and acceptable. On the other hand, receiving training and making the guidelines accessible and available at the clinic were two of the important facilitators of health providers' acceptance of these guidelines. In

conclusion, having ruled out health providers' perceived feasibility and acceptability of the guidelines as probable barriers to implementing the guidelines with fidelity, further studies are needed to investigate strategies that facilitate the implementation of these guidelines to ensure that TB suspects are identified and placed on treatment to assist in the control and elimination of the spread of the disease.

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APPENDICES

Appendix A: Plagiarism Declaration



PLAGIARISM DECLARATION TO BE SIGNED BY ALL HIGHER DEGREE STUDENTS

SENATE PLAGIARISM POLICY: APPENDIX ONE

I Tetelo Maakamedi (Student number: 603667) am a student registered for the degree of MSc Epidemiology (Implementation Science) in the academic year 2018.

I hereby declare the following:

- I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong.
- I confirm that the work submitted for assessment for the above degree is my own unaided work except where I have explicitly indicated otherwise.
- I have followed the required conventions in referencing the thoughts and ideas of others.
- I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.
- I have included as an appendix a report from "Turnitin" (or other approved plagiarism detection) software indicating the level of plagiarism in my research document.

Signature: _____ Date: 29 May 2020

Appendix B: Turnitin Report

Turnitin Originality Report

603667:Maakamedi_Tetelo_603667.pdf by Tetelo Maakamedi

From Research Report (COMH7175_2014)

Processed on 30-Jun-2020 11:04 AM SAST
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   https://hdl.handle.net/10539/24605
3. < 1% match (Internet from 06-Sep-2017)
   http://www.canberra.edu.au/researchrepository/file/242c62c1-dfe6-4041-ae43-adcfd3c80c7e/1/full_text.pdf
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6. < 1% match ()
   http://hdl.handle.net/10539/21261
7. < 1% match ()
   http://livrepository.liverpool.ac.uk/3061802/1/200929420_Jun2019.pdf
8. < 1% match ()
   https://researchonline.lshtm.ac.uk/id/eprint/4653948/1/s12913-019-4324-6.pdf
9. < 1% match (publications)
   Jabulani R. Ncayiyana, Jean Bassett, Nora West, Daniel Westreich et al. "Prevalence of latent tuberculosis infection and predictive factors in an urban informal settlement in Johannesburg, South Africa: a cross-sectional study", BMC Infectious Diseases, 2016
10. < 1% match ()
    http://hdl.handle.net/10539/1863
11. < 1% match (Internet from 04-Feb-2020)
    https://bmcinfectdis.biomedcentral.com/articles/10.1186/s12879-016-1984-2
12. < 1% match (Internet from 03-Nov-2019)
    https://onlinelibrary.wiley.com/doi/pdf/10.1111/ecot.12056
13. < 1% match ()
    http://stacks.cdc.gov/view/cdc/43101/

Appendix C: Wits HREC (Medical) Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

R14/49 Ms T Maakamedi

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M181159

NAME: (Principal Investigator)	Ms T Maakamedi
DEPARTMENT:	School of Public Health Medical School University
PROJECT TITLE:	Factors associated with the feasibility and acceptability of universal TB screening in primary healthcare clinics in Johannesburg
DATE CONSIDERED:	30/11/2018
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Professor J Levin
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	14/03/2019

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary on 3rd floor, Phillip V Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.
I/We fully understand the conditions under which I am/we are authorised to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated from the research protocol as approved, I/we undertake to resubmit to the Committee. **I agree to submit a yearly progress report**. When a funder requires annual re-certification, the application date will be one year after the date of the meeting when the study was initially reviewed. In this case, the study was initially reviewed in **November** and will therefore reports and re-certification will be due early in the month of **November** each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature

15/03/2019
Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix D: Johannesburg Health District Approval Letter

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

Joburg
a world class African city

JOHANNESBURG HEALTH DISTRICT

Wits - Human Research Ethics Committee(Medical)
University of The Witwatersrand,
Johannesburg, South Africa
maakamedit@gmail.com

Enquiries: Dr EM Ohaju
Tel: 011 694 3888 Cell: 076 8831659
Email: Elizabeth.Ohaju@gauteng.gov.za

Hillbrow CHC: Administration Building
Cr Smith Str. & Klein Street
Private Bag X21, Johannesburg
South Africa, 2017

DRC Ref: 2019-01-015

NHRD Ref no: GP_201901_035

Dear: Ms Tetelo Maakamedi

TITLE: ***Factors Associated with the Feasibility and Acceptability of Universal TB Screening in Primary Healthcare Clinics in Johannesburg***

Your application for research approval refers.

The District Research Committee has reviewed your application. This letter serves as an in-principle approval to access the Districts Health facilities (mentioned below) for the above project subject to following conditions:

- The facility to be visited: SEE ATTACHED LIST
- This facility will be visited from **22/02/2019 to 29/02/2020**
- The research can only commence after you submit an ethics clearance certificate from a recognized institution.
- You will report to the Facility Manager before initiating the study.

Region	Regional Health Manager	Contact No.	Cell phone
G	Ms. T Cebekhulu	011 213 9708	071 678 7561
ABCEF	Ms Matlala	011 440 1259	082 307 0267
D (L A)	Mabel Ngcobo	011 986 - 0164	082 467 9316

The following conditions must be observed:

- Participants' rights and confidentiality will be maintained all the time.
- No resources (Financial, material and human resources) from the above facilities will be used for the study. Neither the District nor the facility will incur any additional cost for this study.
- The study will comply with **Publicly Financed Research and Development Act, 2008 (Act 51 of 2008) and its related Regulations**.

- You will submit a copy (electronic and hard copy) of your final report. In addition, you will submit a six-monthly progress report to the District Research Committee.
- Your supervisor and University of The Witwatersrand will ensure that these reports are being submitted timeously to the District Research Committee.
- The District must be acknowledged in all the reports/publications generated from the research and a copy of these reports/publications must be submitted to the District Research Committee.

We reserve our right to withdraw our approval, if you breach any of the conditions mentioned above.

Please feel free to contact us, if you have any further queries. On behalf of the District Research Committee, we would like to thank you for choosing our District to conduct such an important study.

Regards,

Dr E.M Ohaju
Chairperson: District Research Committee
Johannesburg Health District
Date 26/02/2019

Mrs M.L Morewane
Chief Director
Johannesburg Health District
Date: 26/02/2019

Appendix E: Information Sheet

STUDY INFORMATION SHEET



Study title: ***Factors Associated with the Feasibility and Acceptability of Universal TB Screening in Primary Healthcare Clinics in Johannesburg.***

Good Day

Introduction and Purpose

My name is Tetelo Maakamedi, a student at the University of the Witwatersrand, Johannesburg South Africa. I am currently studying towards my MSc Epidemiology in the field of Implementation Science at the School of Public Health. I am conducting a research to study factors associated with the feasibility and health providers' acceptability of universal TB screening in primary healthcare clinics in the City of Johannesburg district as recommended in the National Infection Prevention and Control guidelines for TB, MDR-TB and XDR-TB 2015.

This study is conducted for the purpose of fulfilling the partial requirement for the degree in MSc Epidemiology (Implementation Science). In this study, we want to learn about your views of the guidelines so that we can be able to measure whether they are feasible and acceptable to you. With this being said, please kindly note that this study is **NOT** an assessment of your performance as a health provider or facility, rather this study seeks to gain new knowledge from your experiences.

Invitation to Participate

We would appreciate your voluntary participation in this study. We value your view and experiences and would like to invite you to share them with us through completing a digitized survey questionnaire that will not take more than 20 minutes of your precious time. By choosing to participate in this study we do not anticipate any risk of harm to you, however, should you experience distress please feel free to inform the researcher and you can also contact the resources provided at the end of this information sheet. Furthermore, while there is no direct benefit to participating in the study, your participation will contribute to knowledge gaps and inform policy that may benefit the health system and health providers in South Africa in the future.

Voluntary Participation

Please note that **participation is voluntary**, and you have a right to refuse to participate or withdraw at any time during the process of collecting the information. Refusing or withdrawing from the study will not involve any penalty or loss of benefits to you.

Confidentiality and Anonymity

All the information obtained during this study, including your personal information will be treated in the strictest confidential manner and will only be used by the researcher and supervisor and no one else, unless the Human Research Ethics Committees of the University require personal data to respond to a formal complaint, or for a compliance audit, or if required by law. If the results of this study are published, rest assured that none of your information will be identifiable or traced back to you. The data collected during the study will be securely retained for two (2) years if a scientific publication arises from the study and six (6) years if there is no publication. Thereafter it will be destroyed accordingly.

Reimbursements

There will be **no** payment or cost associated with participating in the study.

Contact details of the researcher

Should you have any concerns or questions regarding the process of the study, please feel free to contact me or my supervisor on:

Tetelo Maakamedi
Cell No. 078 407 9467
Email: maakamedit@gmail.com

Prof. Jonathan Levin (supervisor)
Tel. 011 717 2554
Email: jonathan.levin@wits.ac.za

In case of complains / problems with regards to how this study has been conducted you can also contact the Chairperson of this Committee who is Professor Clement Penny, who may be contacted on telephone number 011 717 2301, or by e-mail on Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretariat are 011 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za

Thank you for reading this Study Information Sheet.

Date: March 2019

Appendix F: Informed Consent Form

INFORMED CONSENT FORM



I hereby confirm that I have read through the study information sheet and understood what my participation in the study will involve.

- All the information I required to make an informed decision to participate in the study have been provided in the information sheet.
- I agree to have my information digitally collected by the study team.
- I confirm that I have not been forced to participate and I am willingly doing so.
- I understand that I will not directly benefit from the study and I am still choosing to participate.
- I acknowledge that I will not be paid for participating in the study.
- I understand that I can withdraw from the study at any point without consequences.
- I am aware that the information I provide will be strictly treated with confidentiality and none of my responses can be traced back to me.

PARTICIPANT

Name of Participant (print) _____
Signature of Participant _____
Date _____

FIELDWORKER

Name of Fieldworker (print) _____
Date _____

Appendix G: Survey Questionnaire

7	age Show the field ONLY if: [consent] = '1'	Section Header: *Section 1: Sociodemographic Characteristics* How old are you?	text (integer, Min: 18), Required Custom alignment: RH Question number: 1 Field Annotation: @PLACEHOLDER='years'
8	sex Show the field ONLY if: [consent]=1	Sex	radio, Required 1 Male 2 Female Question number: 2
9	education Show the field ONLY if: [consent]=1	Highest Level of Education	radio, Required 1 High School Incomplete 2 High School Completed 3 Diploma 4 Degree 5 Postgraduate Degree
10	occupation Show the field ONLY if: [consent]=1	What is your occupation / profession?	radio, Required 1 Doctor 2 Professional nurse 3 Nursing assistant 4 Enrolled nurse 5 Auxiliary nurse 6 Community health worker 7 Other
11	other_occupation Show the field ONLY if: [occupation] = '7' and [consent]=1	If other, please specify	text, Required Question number: 3.1 Field Annotation: @PLACEHOLDER='text'
12	years_work_experience Show the field ONLY if: [consent]=1	In total, how many years of work experience do you have?	text (number), Required Question number: 4 Field Annotation: @PLACEHOLDER='numbers'
13	clinic_work_experience Show the field ONLY if: [consent]=1	How many years have you worked in the current clinic?	text (number), Required Question number: 5 Field Annotation: @PLACEHOLDER='numbers'
14	permanent Show the field ONLY if: [consent]=1	Which position do you hold at this clinic?	radio, Required 1 Permanent 2 Temporary 3 Contract
15	aware_of_ipc Show the field ONLY if: [consent]=1	Section Header: *Section 2: Awareness of Guidelines* Before this interview, were you aware of the 2015 National Infection Prevention and Control Guidelines for TB, MDR-TB and XDR-TB (IPC guidelines)?	yesno, Required 1 Yes 0 No Question number: 6
16	ever_trained_ipc Show the field ONLY if: [aware_of_ipc] = '1' and [consent]=1	Have you ever received training on the IPC guidelines?	yesno, Required 1 Yes 0 No
17	last_training_ipc Show the field ONLY if: [ever_trained_ipc] = '1' and [consent]=1	When was your last IPC training?	radio, Required 1 1-3 months ago 2 4-6 months ago 3 7-11 months ago 4 1 year ago 5 more than a year ago

18	aware_of_screening_all Show the field ONLY if: [aware_of_ipc] = '1' and [consent]=1	Before this interview, were you aware of the recommendation in the IPC guidelines to screen for TB in everyone entering the clinic?	yesno, Required 1 Yes 0 No
19	aware_tb_man_guide Show the field ONLY if: [consent]=1	Are you aware of the National Tuberculosis Management Guidelines 2014 published by the National Department of Health (NDoH)?	yesno, Required 1 Yes 0 No
20	ever_trained_tb Show the field ONLY if: [aware_tb_man_guide]=1 and [consent]=1	Have you ever received training on TB management?	yesno, Required 1 Yes 0 No
21	last_tb_training Show the field ONLY if: [ever_trained_tb] = '1' and [consent]=1	When was your last TB management training?	radio, Required 1 1-3 months ago 2 4-6 months ago 3 7-11 months ago 4 1 year ago 5 more than a year ago
22	tb_manag_recom Show the field ONLY if: [consent]=1 and [aware_tb_man_guide]=1	Are you aware of the recommendation in the TB management guidelines 2014, to screen for TB in everyone presenting at the clinic?	yesno, Required 1 Yes 0 No
23	job_description Show the field ONLY if: [consent]=1	Section Header: *Section 3: Practice / Behaviour* Does your job description include screening patients for TB?	yesno, Required 1 Yes 0 No Question number: 9
24	do_you_screen Show the field ONLY if: [consent]=1	Do you currently screen patients for TB?	yesno, Required 1 Yes 0 No
25	ever_screened Show the field ONLY if: [do_you_screen] = '0' and [consent]=1	Have you ever screened patients for TB?	yesno, Required 1 Yes 0 No
26	end_dont_screen Show the field ONLY if: [ever_screened] = '0' and [consent]=1	Thank you very much for your participation. We are only looking for healthcare providers who screen patients for TB. Have a great day.	descriptive
27	do_you_screen_all Show the field ONLY if: [do_you_screen] = '1' and [consent]=1	Do you screen for TB in EVERY patient consulting with you? *the emphasis is on EVERY patient*	radio, Required 1 Yes 2 No 3 Sometimes
28	those_screened Show the field ONLY if: [do_you_screen_all] = '2' and [do_you_screen] = '1' and [consent]=1	If no, then who gets screened for TB? *you can select more than one option*	checkbox, Required 1 those_screened___1 Patients living with HIV 2 those_screened___2 Patients who suspect that they may have TB 3 those_screened___3 Patients reporting a prolonged cough 4 those_screened___4 Household contacts of TB patients 5 those_screened___5 Children under 5 years 6 those_screened___6 Other

29	other_patients_scree Show the field ONLY if: [those_screened(6)] = '1' and [consent]=1	If other, please specify	text, Required
30	where_screening_patients Show the field ONLY if: [do_you_screen] = '1' or [ever_screened] = '1' and [consent]=1	Where in the clinic do you conduct TB symptom screening? *you can select more than one option*	checkbox, Required 1 where_screening_patients___1 Reception 2 where_screening_patients___2 Waiting room 3 where_screening_patients___3 Consulting room 4 where_screening_patients___4 Other
31	other_where_screen Show the field ONLY if: [where_screening_patients(4)] = '1' and [do_you_screen]=1 or [ever_screened]=1 and [consent]=1	If other, please specify	text, Required
32	time_to_screen Show the field ONLY if: [do_you_screen] = '1' or [ever_screened] = '1' and [consent]=1	Of those you screen, on average, how long after arriving at the clinic do they get screened for TB?	radio, Required 1 As soon as they enter the clinic 2 Within 10 minutes after arrival 3 Within 30 minutes after arrival 4 Within 1 hour after arrival 5 Within 2 hours after arrival 6 After 2 hours Field Annotation: @PLACEHOLDER="in minutes"
33	wear_mask Show the field ONLY if: [do_you_screen] = '1' or [ever_screened] = '1' and [consent]=1	When screening patients for TB, do you wear an N95 protective mask?	radio, Required 1 Always 2 Most times 3 Sometimes 4 Never
34	tb_policy Show the field ONLY if: [do_you_screen] = '1' or [ever_screened] = '1' and [consent]=1	Section Header: *Section 4: Organisational Facilitators* Does the clinic have a TB policy that you know of?	yesno, Required 1 Yes 0 No
35	ipc_available Show the field ONLY if: [do_you_screen] = '1' or [ever_screened] = '1' and [consent]=1	Are the IPC guidelines available at the clinic?	radio, Required 1 Yes 0 No 2 I don't know
36	tb_manag_avail Show the field ONLY if: [do_you_screen]='1' or [ever_screened]='1' and [consent]=1	Are the TB management guidelines available at the clinic?	radio, Required 1 Yes 0 No 2 I don't know
37	ipc_guidelines_shared Show the field ONLY if: [do_you_screen] = '1' or [ever_screened] = '1' and [consent]=1 and [ipc_available]=1 or [tb_manag_avail]=1	Have these guidelines been shared with you?	yesno, Required 1 Yes 0 No
38	new_guide_aware Show the field ONLY if: [do_you_screen]='1' or [ever_screened]='1' and [consent]=1	When new guidelines are published does management make you aware of them?	radio, Required 1 Always 2 Sometimes 3 Never

39	reg_tb_training Show the field ONLY if: [do_you_screen] = '1' or [ever_screened] = '1' and [consent] =1	Does the clinic provide you with TB training upon request?	radio, Required 1 Yes 0 No 2 Sometimes
40	workload_reduce Show the field ONLY if: [do_you_screen] = '1' or [ever_screened] = '1' and [consent] =1	When you get overwhelmed by the workload does management help to make your work easy by reducing the amount of work you need to do?	radio, Required 1 Always 2 Sometimes 3 Never
41	monitoring Show the field ONLY if: [do_you_screen] = '1' or [ever_screened] = '1' and [consent] =1	Does your supervisor monitor your work?	radio, Required 1 Yes 0 No 2 Sometimes
42	feedback Show the field ONLY if: [do_you_screen] = '1' or [ever_screened] = '1' and [consent] =1	Do you receive regular feedback from your supervisor on the performance of your work?	yesno, Required 1 Yes 0 No
43	incentives Show the field ONLY if: [do_you_screen] = '1' or [ever_screened] = '1' and [consent] =1	Other than your salary, do you receive any incentives for screening and diagnosing TB in patients?	yesno, Required 1 Yes 0 No
44	additional_staff Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	Section Header: *Section 5: IPC Guidelines Characteristics The following statements are trying to assess the characteristics of the guidelines based on your experience. Please indicate to what extent you agree or disagree with these statements.* Screening for TB in everyone presenting at the clinic requires additional staff members?	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
45	addition_training Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	Screening for TB in everyone presenting at the clinic requires training in addition to my professional experience and education?	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
46	screening_time_consum Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	Screening for TB in everyone presenting at the clinic is time-consuming?	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
47	additional_equipment Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	Screening for TB in everyone presenting at the clinic requires additional equipment than those available at the clinic?	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree

48	screening_harm_patients Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	Screening for TB in everyone presenting at the clinic can cause harm to patients?	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
49	screening_harm_provider Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	Screening for TB in everyone presenting at the clinic can cause harm to health care workers?	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
50	tool_easy2_use Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	The TB symptoms screening checklist used to screen everyone presenting at the clinic is easy to use?	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
51	screening_implementable Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	Section Header: *Section 6: Feasibility of the Universal Screening Guidelines The following statements are trying to assess the feasibility of the guidelines based on your experience. Please indicate to what extent you agree or disagree with these statements.* Screening for TB in everyone presenting at the clinic is implementable.	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
52	screening_is_possible Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	Screening for TB in everyone presenting at the clinic is possible.	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
53	screening_is_doable Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	Screening for TB in everyone presenting at the clinic is doable.	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
54	screening_is_easy Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	Screening for TB in everyone presenting at the clinic is easy to do.	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
55	meet_approval Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	Section Header: *Section 7: Health Provider's Acceptance of the IPC Guidelines The following statements are trying to assess your acceptance of the guidelines . Please indicate to what extent you agree or disagree with these statements.* Screening for TB in everyone presenting at the clinic meets my approval.	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree

56	screening_appealing Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	Screening for TB in everyone presenting at the clinic is attractive to me.	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
57	like_screening Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	I like screening for TB in everyone presenting at the clinic.	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
58	welcome_screening Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	I welcome screening for TB in everyone who enters the clinic.	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
59	required_supervisor_screen Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	Section Header: *Section 8: Attitudes Towards Screening Patients for TB The following statements are trying to assess your attitudes towards the guidelines. Please indicate to what extent you agree or disagree with these statements.* I am required by my supervisor to screen for TB in everyone that enters the clinic.	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
60	required_facility_screen Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	I am required by the clinic policy to screen for TB in everyone that enters the clinic.	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
61	required_ndoh_screen Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	I am required by the NDoH to screen for TB in everyone that enters the clinic.	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
62	colleagues_happy_screen Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	Other colleagues who follow the guideline to screen for TB in everyone that enters the clinic are happy to do it.	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
63	had_enough_training Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	I had enough training to screen for TB in everyone that enters the clinic to do it correctly	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree

64	screening_makes_sense Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	Screening for TB in everyone that enters the clinic makes sense to me	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
65	willing_try_intervention Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	I am willing to try new types of interventions even if I have to follow a treatment manual/guideline	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
66	wiling_interven_researcher Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	I am willing to use new and different types of interventions developed by researchers	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
67	willing_interven_patients Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	I like to use new types of interventions to help my patients	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
68	say_use_guidelines Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	I had a say in how I would use the guidelines to screen for TB in everyone who enters the clinic	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
69	screening_right_patients Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	I know that screening for TB in everyone who enters the clinic is right for my patients	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
70	screening_fits_approach Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	Screening for TB in everyone who enters the clinic fits with the approach I use to treat my patients	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
71	cant_meet_obligations Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	When I screen for TB in all the patients who enter the clinic I can't meet my other obligations	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree

72	cant_fit_daily_routine Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	I don't know how to fit screening for TB in everyone who enters the clinic into my daily work routine	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
73	dont_have_time Show the field ONLY if: [ever_screened] = '1' or [do_you_screen] = '1' and [consent] =1	I don't have time to screen all the patients for TB when they enter the clinic	radio (Matrix), Required 1 Strongly Disagree 2 Disagree 3 Neither agree nor disagree 4 Agree 5 Strongly Agree
74	health_provider_questionnaire_complete	Section Header: *Form Status* Complete?	dropdown 0 Incomplete 1 Unverified 2 Complete

Appendix H: STATA Sample Size Calculation

```
. power twomeans 70 80 , sd(10)  power(0.9)

Performing iteration ...

Estimated sample sizes for a two-sample means test
t test assuming sd1 = sd2 = sd
Ho: m2 = m1  versus  Ha: m2 != m1

Study parameters:

        alpha =    0.0500
        power =    0.9000
        delta =   10.0000
           m1 =   70.0000
           m2 =   80.0000
           sd =   10.0000

Estimated sample sizes:

            N =        46
  N per group =        23

.
```

Appendix I: Cronbach's Alpha for the Attitude scale

Appendix i_1: Overall Cronbach's Alpha of the Attitude scale

```
Test scale = mean(unstandardized items)
```

Item	Obs	Sign	item-test correlation	item-rest correlation	average interitem covariance	alpha
newrequire~r	69	+	0.6416	0.5418	.1932539	0.7665
newrequire~y	69	+	0.6889	0.6257	.199978	0.7649
newrequire~h	69	+	0.7132	0.6568	.1998164	0.7639
newcolleag~y	69	+	0.3981	0.2873	.2186677	0.7874
newenough_~g	69	+	0.4272	0.2543	.2113534	0.7987
newmakes_s~e	69	+	0.6157	0.5496	.2078333	0.7716
newwil_try~n	69	+	0.5617	0.4839	.2096601	0.7747
newwil_int~r	69	+	0.6871	0.6362	.2063016	0.7685
newwil_int~s	69	+	0.6967	0.6534	.2094493	0.7703
newsay_on_~e	69	+	0.3293	0.1589	.2231505	0.8058
newscreen_~s	69	+	0.6871	0.6299	.203121	0.7667
newscreen_~h	69	+	0.5491	0.4820	.2139391	0.7766
newcant_me~a	69	-	0.3944	0.2245	.2155059	0.8004
newcant_fi~e	69	-	0.4179	0.2789	.2142131	0.7906
newdont_ha~e	69	-	0.5158	0.3803	.2031562	0.7820
Test scale					.2086266	0.7910

Appendix i_2: Cronbach's Alpha of the requirement subscale

```
. alpha newrequired_supervisor newrequired_facility newrequired_ndoh, asis item

Test scale = mean(unstandardized items)
```

Item	Obs	Sign	item-test correlation	item-rest correlation	average interitem covariance	alpha
newrequire~r	69	+	0.8397	0.5622	.5971867	0.9531
newrequire~y	69	+	0.8992	0.7858	.4974425	0.6843
newrequire~h	69	+	0.9019	0.7989	.5121483	0.6837
Test scale					.5355925	0.8294

Appendix i3: Cronbach's Alpha of the appeal subscale

```
. alpha newcolleagues_happy newenough_training newmakes_sense, asis item

Test scale = mean(unstandardized items)
```

Item	Obs	Sign	item-test correlation	item-rest correlation	average interitem covariance	alpha
newcolleag~y	69	+	0.6020	0.2065	.2440324	0.3070
newenough_~g	69	+	0.8064	0.2279	.1513214	0.3437
newmakes_s~e	69	+	0.5845	0.2852	.1973572	0.2308
Test scale					.1975703	0.3725

Appendix i4: Cronbach's Alpha of the openness subscale

```
. alpha newwil_try_intervention newwil_interven_researcher newwil_interven_patients, item asis

Test scale = mean(unstandardized items)
```

Item	Obs	Sign	item-test correlation	item-rest correlation	average interitem covariance	alpha
newwil_try~n	69	+	0.8622	0.6374	.2990196	0.8454
newwil_int~r	69	+	0.9059	0.7818	.2551151	0.6761
newwil_int~s	69	+	0.8430	0.6904	.3529412	0.7800
Test scale					.3023586	0.8311

Appendix i5: Cronbach's Alpha of the fit subscale

```
. alpha newsay_on_guideline newscreen_right_patients newscreen_fits_approach, item asis

Test scale = mean(unstandardized items)
```

Item	Obs	Sign	item-test correlation	item-rest correlation	average interitem covariance	alpha
newsay_on_~e	69	+	0.7734	0.1293	.2777067	0.6955
newscreen_~s	69	+	0.6279	0.3020	.1334186	0.2048
newscreen_~h	69	+	0.6503	0.3696	.0897272	0.1374
Test scale					.1669508	0.3844

Appendix i_6: Cronbach's Alpha of the burden subscale

Test scale = mean(unstandardized items)

Item	Obs	Sign	item-test correlation	item-rest correlation	average interitem covariance	alpha
newcant_me~a	69	-	0.7876	0.4498	.5718244	0.5526
newcant_fi~e	69	-	0.7187	0.4141	.7527707	0.5936
newdont_ha~e	69	-	0.7838	0.4979	.5349531	0.4800
Test scale					.6198494	0.6416

Appendix i_7: Cronbach's Alpha of the acceptable subscale (i.e. requirement, openness, burden)

Test scale = mean(unstandardized items)

Item	Obs	Sign	item-test correlation	item-rest correlation	average interitem covariance	alpha
newrequire~r	69	+	0.6422	0.4871	.2458059	0.7313
newrequire~y	69	+	0.6888	0.5917	.2541865	0.7204
newrequire~h	69	+	0.7485	0.6702	.2478839	0.7118
newwil_try~n	69	+	0.5297	0.4070	.2801273	0.7446
newwil_int~r	69	+	0.6682	0.5873	.2681768	0.7275
newwil_int~s	69	+	0.6397	0.5653	.2780188	0.7338
newcant_me~a	69	-	0.5573	0.3308	.2600475	0.7699
newcant_fi~e	69	-	0.5225	0.3299	.2705974	0.7603
newdont_ha~e	69	-	0.5785	0.3848	.2564624	0.7526
Test scale					.2623674	0.7610

Appendix i₈: Principle Component Analysis

```
. pca newrequired_supervisor newrequired_facility newrequired_ndoh newwil_try_intervention newwil_interven_resear
> cher newwil_interven_patients newcant_meet_obliga newcant_fit_routine newdont_have_time, mineigen(3)

Principal components/correlation                Number of obs    =         69
                                                Number of comp.  =          1
                                                Trace            =          9
    Rotation: (unrotated = principal)           Rho              =     0.4262
```

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	3.83538	2.22895	0.4262	0.4262
Comp2	1.60643	.569879	0.1785	0.6046
Comp3	1.03655	.348424	0.1152	0.7198
Comp4	.688128	.054231	0.0765	0.7963
Comp5	.633897	.168498	0.0704	0.8667
Comp6	.465399	.0473454	0.0517	0.9184
Comp7	.418053	.181048	0.0465	0.9649
Comp8	.237005	.157849	0.0263	0.9912
Comp9	.0791562	.	0.0088	1.0000

Principal components (eigenvectors)

Variable	Comp1	Unexplained
newrequire~r	0.3596	.5041
newrequire~y	0.4142	.3421
newrequire~h	0.4263	.303
newwil_try~n	0.3308	.5802
newwil_int~r	0.4131	.3455
newwil_int~s	0.3991	.3891
newcant_me~a	-0.1586	.9036
newcant_fi~e	-0.1542	.9088
newdont_ha~e	-0.1707	.8882

Appendix J: Cronbach's Alpha for Outcome Variables

Appendix j_1: Cronbach's Alpha for feasibility

```
Test scale = mean(unstandardized items)
```

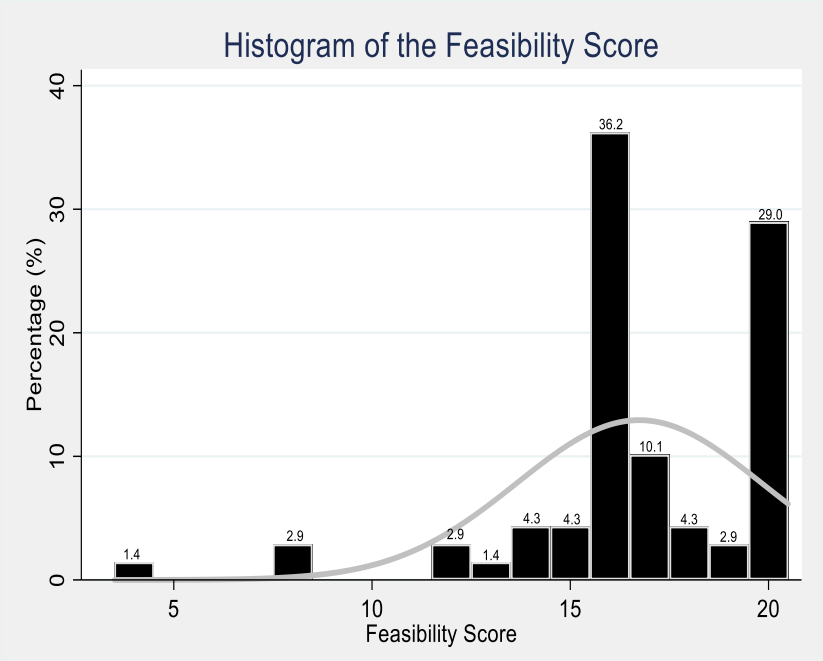
Item	Obs	Sign	item-test correlation	item-rest correlation	average interitem covariance	alpha
screen~table	69	+	0.8987	0.8206	.5125746	0.8228
screeni~ible	69	+	0.9003	0.8150	.4902671	0.8215
screen~oable	69	+	0.8238	0.6817	.554561	0.8733
screening_~y	69	+	0.8265	0.6768	.5424837	0.8773
Test scale					.5249716	0.8824

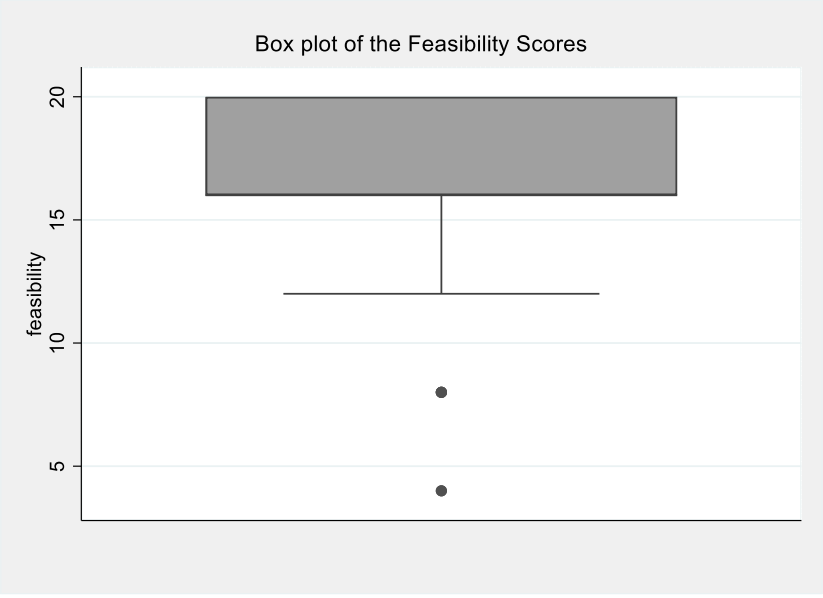
Appendix j_2: Cronbach's Alpha for acceptability

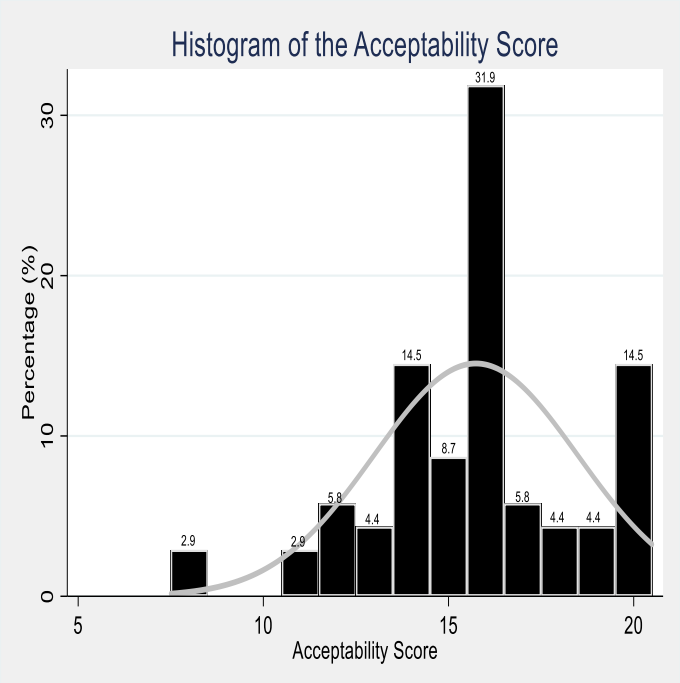
```
Test scale = mean(unstandardized items)
```

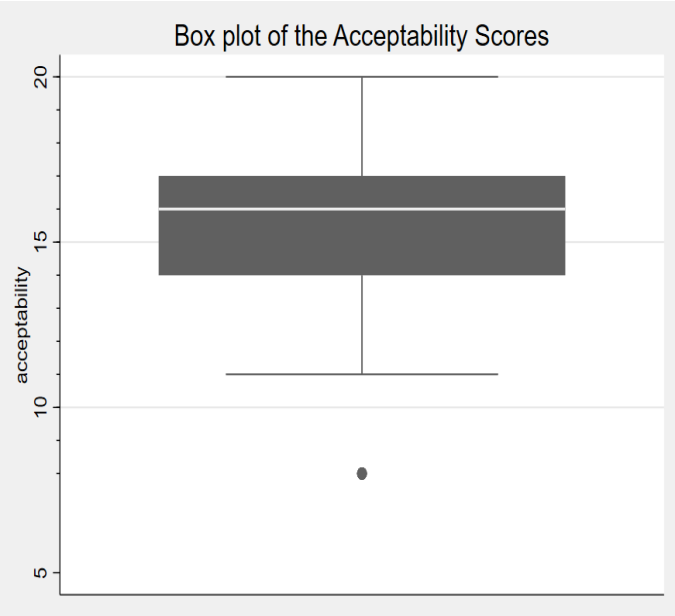
Item	Obs	Sign	item-test correlation	item-rest correlation	average interitem covariance	alpha
meet_appro~l	69	+	0.7153	0.4171	.3442739	0.6943
screening_~g	69	+	0.7629	0.5015	.2966752	0.6334
like_scree~g	69	+	0.7402	0.5373	.3265132	0.6126
welcome_sc~g	69	+	0.7229	0.5534	.3579142	0.6201
Test scale					.3313441	0.7023

Appendix K: Distribution of feasibility and acceptability






Histogram of the Acceptability Score
Percentage (%)
0
10
20
30
2.9
2.9
5.8
4.4
14.5
8.7
31.9
5.8
4.4
4.4
14.5
5
10
15
20
Acceptability Score


Box plot of the Acceptability Scores
acceptability
5
10
15
20