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Exploring Clinicians' Experiences of Accessing Drug-Resistant Tuberculosis Drug Susceptibility Testing Services from Health Centers in Blantyre

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Abstract

Background. Multi Drug Resistant Tuberculosis poses a great challenge to TB control in Malawi as well as worldwide. Most cases of TB are concentrated in cities in Malawi.

Objective. To explore clinicians' experiences of accessing drug-resistant tuberculosis susceptibility testing services from health centers in Blantyre.

Methods. The study was a qualitative study using in-depth interviews of key informants. TB clinicians were interviewed using an interview guide questionnaire. This study was conducted at Zingwangwa, Gateway, and Ndirande health centers. Tuberculosis clinical officers at the health centers. Data collection took a period of six weeks.

Findings. The survey included a total of 11 participants from 5 different health centers who participated in our in-depth interviews, with a median age of 32 (IQR 22). Out of 11 participants, 3 (27.3%) were from Ndirande, 3 (27.3%) were from Zingwangwa, 3 (27.3%) were from Bangwe, 1 (9.1%) was from Limbe, and 1 (9.1%) was from Gateway. We interviewed 6 (54.5%) HSAs, 3 (27.3%) were clinical officers, and 2 (18.2%) were medical assistants.

Interpretation. Most clinicians experience delays in receiving sample results from the National Central Laboratory at CHSU. There are also frequent stockouts of consumables and congestion during the treatment of patients.

Conclusion. The study revealed that clinicians experience delays in receiving DST results from CHSU. Transportation of samples has been the major challenge in most health centers in Blantyre.

Keywords: MDR-TB, CHSU, DST, clinicians, experiences, health centers.

Introduction

Tuberculosis (TB) is caused by a bacterium called Mycobacterium tuberculosis[1]. The mode of transmission is inhalation of droplets from an infected person[2]. It affects every organ in the body except hair[3]. Tuberculosis can be categorized as pulmonary and extra-pulmonary. Pulmonary tuberculosis affects the lungs, while extra-pulmonary tuberculosis affects other organs in the body. Tuberculosis is the 13th leading cause of death and the second leading infectious killer after COVID-19 (above HIV/AIDS)[3].

According to a WHO report in 2021, an estimated 10.6 million people fell ill with tuberculosis (TB) worldwide; 6 million men, 3.4 million women, and 1.2 million children. TB is present in all countries and age groups. A total of 1.6 million people died from TB in 2021 worldwide. Child and adolescent TB is often overlooked by health care providers and can be difficult to diagnose and treat[4].

Africa also has a high number of TB cases. For instance, in 2016, 2.5 million people fell ill with TB in the African region, accounting for a quarter of new TB cases worldwide [5]. An estimated 417,000 (25%) people died from the disease in the African region (1.7 million globally) in 2016[6]. Tuberculosis is a leading cause of morbidity and mortality, especially in low-income and middle-income countries[5].

A study was conducted by Takarinda et al (2017) in Zimbabwe where they were looking at factors associated with mortality among patients on TB treatment in the Southern Region of Zimbabwe. The study found that tuberculosis remains one of the world's biggest public health threats and now ranks alongside HIV as the world's leading infectious cause of death due to treatment failure[7]. In 2021, the incidence of TB for Malawi was 132 cases per 100,000 people[8]. The incidence of TB for Malawi fell gradually from 401 cases per 100,000 people in 2002 to 132 cases per 100,000 people in 2021[9].

Tuberculosis treatment failure results in the development of multidrug-resistant (MDR) TB. Multidrug-resistant tuberculosis (MDR-TB), a form of TB infection caused by bacteria that are resistant to treatment with at least two of the most powerful first-line anti-TB drugs, isoniazid (INH) and rifampicin (RMP), globally affects an estimated 3.3% of new TB cases and 20% of previously treated cases[10]. According to the World Health Organization's 2020 annual TB report, close to half a million people developed rifampicin-resistant TB, of which 78% had MDR-TB[11].

Multidrug-resistant TB (MDR-TB) remains a public health crisis and a health security threat. MDR-TB threatens global TB control efforts, and it is one of the greatest challenges facing public health, particularly in poor resource settings where adequate diagnosis and treatment are often unavailable. The main challenge with MDR-TB is that it is expensive to treat, has increased toxicity of drugs used for treatment, and has a long duration of treatment compared to drug-susceptible TB[12].

A study done in Malawi by Mpunga et al., 2021, where they were looking at the prevalence of multidrug-resistant TB among people newly diagnosed with and those retreated for TB in Malawi, revealed that 5 (0.4%) of the 1196 new cases had MDR tuberculosis[13]. Despite the low number of cases, Malawi is facing challenges with emerging cases of multidrug-resistant TB. There are a lot of factors that contribute to the development of MDR-TB; these are as follows: poor drug compliance by patients; wrong drug prescription by TB officers; wrong dosage of medication or length of time for

taking the drugs; stockouts of TB drugs; and poor quality of medications[1].

Compliance to medications by patients diagnosed with tuberculosis is important to prevent the further spread of disease and development of drug resistance. Furthermore, early detection of disease is important because it helps in the early initiation of treatment[10]. Treatment failure can result in the death of the patients. Tuberculosis-related deaths can be minimized by proper management of cases, which includes timely diagnosis; therefore, clinicians require reliable diagnostic tools and accurate drug susceptibility testing platforms to manage drug-resistant tuberculosis patients properly.

No study has been conducted particularly in Blantyre on clinicians' experiences in accessing drug susceptibility testing platforms for drug-resistant tuberculosis. Therefore, the study aims at investigating this specifically, targeting clinicians working at health centers in Blantyre here in Malawi.

Methods

Study Design

The study was a qualitative study using in-depth interviews of key informants. TB clinicians were interviewed using an interview guide questionnaire.

Study Place

This study was conducted in Zingwangwa, Gateway, and Ndirande health centers.

Study Population

Tuberculosis clinical officers at the health centers.

Study Period

Data collection took a period of six weeks during the research rotation in MBBS4. Some of the activities during the period involved data collection, data analysis, and preparation of presentations. The sixth week was used for research dissemination.

Sampling Strategy

The study used purposive sampling, which depended more on the availability and willingness of the TB officers to participate in the study. TB clinical officers at the health centers were interviewed.

Sample Size

The number of participants (TB Clinical officers) was 11 interviews until we reached saturation. Frisch J. et al. conducted a similar study where, upon interviewing 15 participants, saturation was reached.

Inclusion and Exclusion Criteria

The inclusion criteria incorporated Tuberculosis Clinicians who were involved in the diagnosis, treatment initiation, and registration of patients in the treatment register, and the management of tuberculosis patients at the health centers as the target population. Only those who signed a consent form were interviewed. Furthermore, clinicians aged 18 years and above and those associated with the dispersing of drugs to patients were study participants.

Those who did not meet the above criteria were excluded from the study at the targeted health centers where the study was conducted.

Data Collection

Data collection for this study was aided by an interview-guided questionnaire which was developed prior to the process. The questionnaire was reviewed by our supervisor who advised on adjustments to the questions so that we could get necessary responses and achieve our objectives at the end. In-depth interviews were conducted one-on-one with the clinicians that met the inclusion criteria. The interview-guided questionnaire had two sections: the demographic section, where demographics of the participants were taken, and the Main section, where questions were tailored towards the study objectives. During the interview, one investigator interviewed the participant, the other tape recorded the interview, while the other investigator was taking down responses. The interviews were 15 to 20 minutes long and were conducted in English. Some of the responses were in Chichewa and were later translated to English. Information was summarized to the participants to ensure validity of the data. Throughout the interview, we probed more on areas which were of interest to the research study, and we ensured adequate and safe space where the clinicians could share their views without burden. The interviews were tape recorded, which was necessary for later transcription of the responses. Data saturation was reached after interviewing 9 participants from Limbe, Zingwangwa, Ndirande, and Gateway health centres, but we added three more participants from Bangwe health centre in order to ensure validity of the data.

Data Collection Tools

The study included an interview-guided questionnaire, an informed consent form, and a tape recorder, as expanded below:

Interview Guided Questionnaire

This data collection tool was developed by the investigators and had two sections. The demographics section, where the demographics of the participants (e.g., participant code number, age, gender, and qualification, etc.) were taken, was the first section. The second section was the main section and included questions that were aimed at achieving the study

objectives. The questions were open-ended; this was done purposefully to allow the participants to give as much information as they could while still being directed by the interviewer. There were two versions: Chichewa and English, but the English version was administered to the participants preferably due to easy English terminologies compared to Chichewa.

Informed Consent Form

Informed consent is crucial to participation in any research study. This form was developed by the investigators and contained key information about the study: aims, purpose, benefits, as well as possible risks from the study. This form was administered to the participants before the interview, and they were briefed on its content. The form had two sections, where the first was the information sheet that included information about the study. Following this section was the research participation declaration section, where the participant voluntarily permitted to be included as a participant in this study. This was accomplished by a signature section at the very end of the form.

Tape Recorder

This study, being a qualitative study, required the interviews to be tape recorded and later transcribed. This is because of the diversity of responses in qualitative studies. This also aided us in thematic analysis, since the analysis involves actual words said by the participant. An effort to tape high audio quality was made so as to ensure accuracy of data during transcription.

Data Management and Analysis

The tape-recorded data were transcribed into English, but before transcribing, we listened to our tape-recorded data several times to make sure that we were familiar with the data. The researcher reviewed each transcript by comparing it with the tape-recorded information more than once to make sure that we did not miss any information. In addition to that, an independent person listened to the recorded interviews and verified the translation to ensure accuracy. Data analysis was conducted using Excel concurrently with data collection, questionnaire, and transcript in order to detect and correct errors during data entry. Thematic analysis was used to analyze the data [3]. The process of data analysis involved the transcription of information to paper (written words) and then reading over the written transcripts, then translation of information followed by structural coding, which involved responses to specific interview questions or general analytic themes of the study. The next phase was selective coding, whereby hypotheses-related codes were created, then axial coding was done that involved disaggregation of core themes followed by hypothesis testing.

The final report of our study findings will be shared with the course coordinator, DHO, COMREC, KUHES library, and our research supervisor. Thereafter, the results will be published.

Ethical Considerations

Privacy and confidentiality were observed during the interview, and information was only used for academic purposes and was not shared with non-concerned parties in one way or another. Identification codes were used rather than participants' names.

Clinicians participating in the research consented before the interview started. They were allowed to withdraw at any time they wished. Permission to conduct the study at the health centers in Blantyre was obtained from The District Health Office for Blantyre City. There was no anticipated harm, whether physical or mental, to the research participants regarding the research study.

Results

Social Demographic Characteriscs of Participants

A total of 11 participants from 5 different health centers participated in our in-depth interviews with a median age of 32 (IQR 22). Out of 11 participants, 3 (27.3%) were from Ndirande, 3 (27.3%) were from Zingwangwa, 3 (27.3%) were from Bangwe, 1 (9.1%) was from Limbe, and 1 (9.1%) was from Gateway. The majority of the participants are married, representing 8 (72.7%); only 2 (18.2%) were single, and 1 (9.1%) was divorced. We interviewed 6 (54.5%) HSAs, 3 (27.3%) were clinical officers, and 2 (18.2%) were medical assistants. Most of the participants have MSCE as their highest qualification, representing 6 (54.5%) participants; 2 (18.2%) have certificates, 2 have diplomas, and only one has a degree as their highest qualification. The median work experience is 4 (IQR 5). The table below summarizes the demographic characteristics of our participants:

Table 1. Social demographic characteristics of the participants

CHARACTERISTICS	OVERALL N=11	PERCENTAGE (100%)
Median age (years)		32 (IQR 22)
Sex		
Males	3	27.30%
Females	8	72.70%
Marital status		
Married	8	72.70%
Single	2	18.20%
Divorced	1	9.10%
Occupation		
HSA	6	54.50%
Clinical officer	3	27.30%
Medical assistant	2	18.20%
Qualification		
Degree	1	9.10%
Diploma	2	18.20%
Certificate	2	18.20%
MSCE	6	54.50%
Health Facility		
Zingwangwa	3	27.30%
Ndirande	3	27.30%
Limbe	1	9.10%
Bangwe	3	27.30%
Gateway	1	9.10%
Median Work Experience (years)		4 (IQR 5)

Thematic Analysis Results

From the analysis of the data, four major themes emerged: 1) Experiences when sending and receiving samples, 2) Challenges faced by clinicians, and 3) Methods of improving DST services. Each theme had sub-categories.

Theme 1: Access to DST services at the health centres

Participants expressed similar perspectives on their access to DST services in general. Three sub-themes emerged from the main theme of experiences when sending and receiving results: laboratory for DST sample submission, availability of diagnostic tools for DST, and time taken to receive results from CHSU.

1.1. Laboratory for DST sample submission

Most of the participants submitted their samples to their local laboratories, and if the sample had rifampicin detected using

GeneXpert, then they sent their sample to CHSU for culture. This was depicted in the following quotes;

> *"For resistant TB, we send our samples to CHISU for culture, but for normal TB, we do it here, but because you have mentioned resistant, if we are suspecting TB resistant, we send our samples to CHISU in Lilongwe for culture, but for normal TB, we do it here."*

1.2. Availability of diagnostic tools

Most of the participants only know diagnostic tools that are available at their local laboratory, but they really do not know what they use at CHSU for DST. This was depicted in the following quotes;

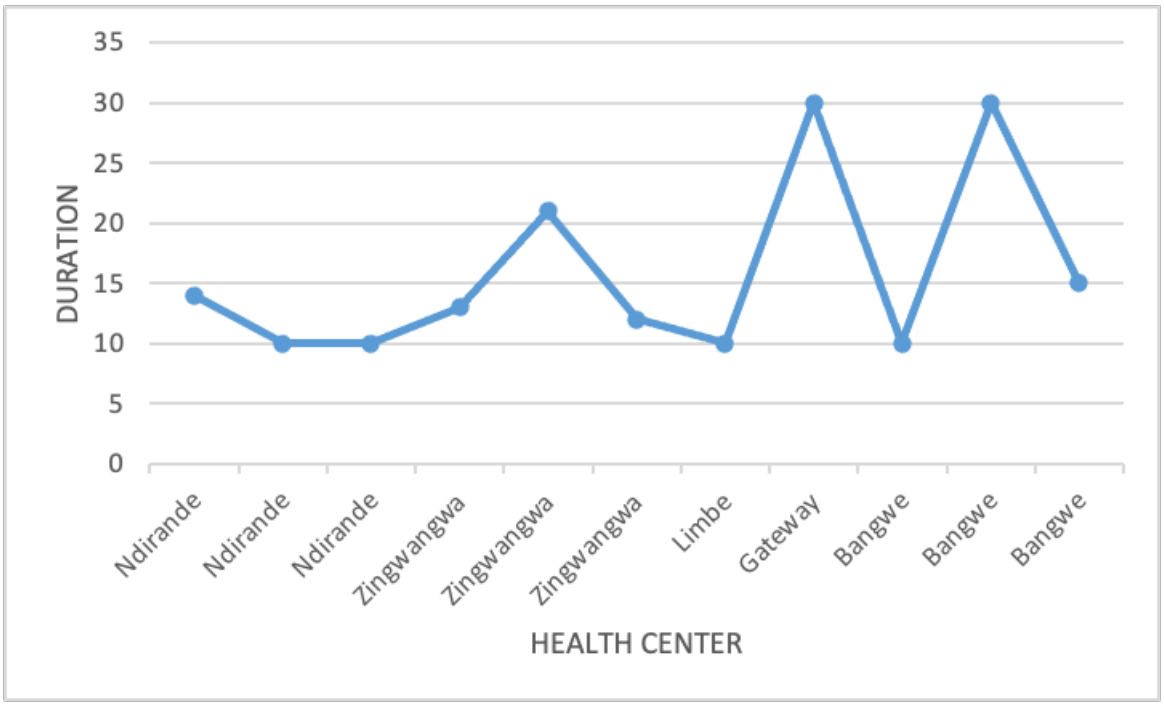
> *"At our lab, they use GeneXpert, microscopy, and I don't know what they use for culture at CHSU"*

1.3. Time taken to receive from CHSU

Most participants receive results from their local laboratories within 24 hours or 48 hours, but it takes a lot of days for them to receive results from CHISU, with the highest number of days being 30 days. This was depicted in the following quotes;

> *"From our lab, it depends, sometimes within 24 hours, sometimes within 48 hours."*

The figure below shows the time taken for them to receive results from CHSU:



Theme 2: Experiences when accessing DST services at CHSU

Participants from all health centres generally stressed challenges faced when accessing DST services at CHSU, which mostly included challenges when accessing the DST service at CHSU, challenges when receiving results from CHSU, and lack of resources for DST at the health centres.

2.1. Challenges when accessing DST services

Poor quality samples

One participant at Zingwangwa Health Center commented on the poor quality of samples submitted by patients when requested to submit sputum samples

> *"Mmmh, it has been good, though we have some challenges, aaaah, especially for those patients who are told to bring sputum, they bring us saliva, which is difficult to detect"(P003ZHC)*

Runout of vouchers necessary for sample submission from CHSU

One participant from Gateway Health Centre said that one of the challenges they face in terms of accessing DST services from CHSU is that of the runout of vouchers necessary for sending samples to CHSU. The participant is quoted as follows:

> *"At times we have challenges because when the CHSU does not send us the voucher for sending the specimen itself, we wait for the CHSU to send us the voucher. We collect the sample and send it by courier or AXA. I think they have negotiated with the AXA bus so that we can collect the sample and send it to them with the AXA bus; they collect the samples to CHSU"(P001GHC)*

2.2. Challenges when receiving DST results from CHSU

Delay in receiving results from CHSU due to congestion of samples at CHSU

A number of 6 participants from Bangwe, Zingwangwa, and Gateway health centres expressed concerns over a common challenge they face, which is the delay in receiving results from CHSU. Expressions of at least one participant from these health centres have been quoted below:

> *"At times it takes, mmmh, I can say 30 days, 15 days, mmmh, it depends because the whole Malawi, we are depending on CHSU for culture, so each and every district, they send their samples to CHSU."(P001GHC)*
>
> *"Mmmm, it takes a lot of time for results to come, but we can say in a month or from two weeks to a month, it's*

> *when we can receive the results because most of the health centres send their samples to Queens, and maybe there might be a lot of work for them to do, but in a month, someone can receive their results."(P003ZHC)*
>
> *"Mostly the problem we face is that because CHSU is far, it takes long for us to get the results; the end result is that treatment is started late because of this, there are chances of spreading the disease further."(P001ZHC)*
>
> *"Delay in receiving results from CHSU and congestion"(P003BHC)*

Missing results due to mixing up of samples

One participant from Zingwangwa Health Centre also expressed that they face challenges like missing results due to the mixing up of results from one health centre to the other due to congestion. The participant's statement has been quoted as follows:

> *"Yes, the answer they give us is that there is always congestion at Queens, like at Queens, there are so many facilities that send their samples there, and one of the challenges is that they can mix up results from one health centre to another health centre because it is always congested, so they always give us the same answers that they overwork what what"(P003ZHC)*

Lengthening of the process

Two of the participants in the study from Limbe and Ndirande health centres expressed concerns over the lengthening of the process of results reception as the results get to them through the DHO. The participants have been quoted as follows:

> *"Aah, I cannot say there are challenges because when we send our samples to CHSU, there are people who come from Queens to collect them, when they collect the samples, they send the samples. Then the results come back through the DHO office, and then we get informed"(P001LHC)*
>
> *"The first challenge is that we do not receive feedback from CHSU; maybe they send feedback to the DHO, but for us, normally we do not receive any feedback from CHSU for MDR culture."(P002NHC)*

2.3. *Lack of resources for DST at the health centres*

Stockouts of resources and electricity problems

A total of three participants from Ndirande and Gateway health centres stressed that the most prominent challenge they face is when there are stockouts of resources as well as electricity problems in the absence of power backup. Their statements have been quoted as follows:

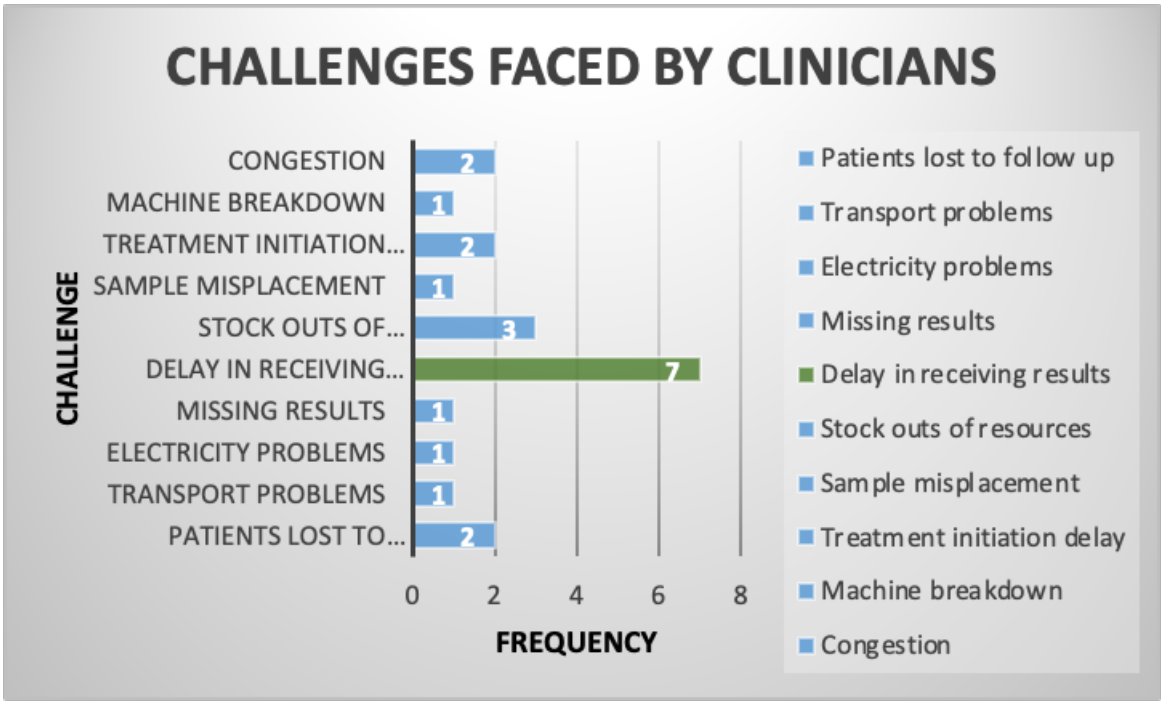
> *"At this facility, we do not have any problem; here at Ndirande, we do not have any problem, we have, but they are rare problems, maybe alcohol can be out of stock since we use alcohol when doing the tests, sometimes it can happen that alcohol is out of stock, maybe there is no cartilage, maybe there is no electricity, and some samples can get damaged and we can throw them away."(P002NHC)*
>
> *"Breakdown of machines, run out of cartridges, no power backup."(P001NHC)*
>
> *"Mmmmh, at times when we don't have cartridges is when the results are delayed, but if we have enough cartridges, there is no problem"(P001GHC)*

Lack of supplies

One participant from Limbe health centre pointed out that sometimes they do not have enough supply of equipment for DST at the health centre. The participant's statement has been quoted as below:

> *"The challenges that are usually there maybe when sometimes the laboratory does not have enough equipment, it means the samples can get destroyed, then another sample will be required to be taken again from the patient; now when the patient comes to get their results, they should be told that samples were lost, which becomes a challenge." (P001LHC)*

Note: The figure below summarizes the challenges faced by clinicians when accessing the DST platform at CHSU.

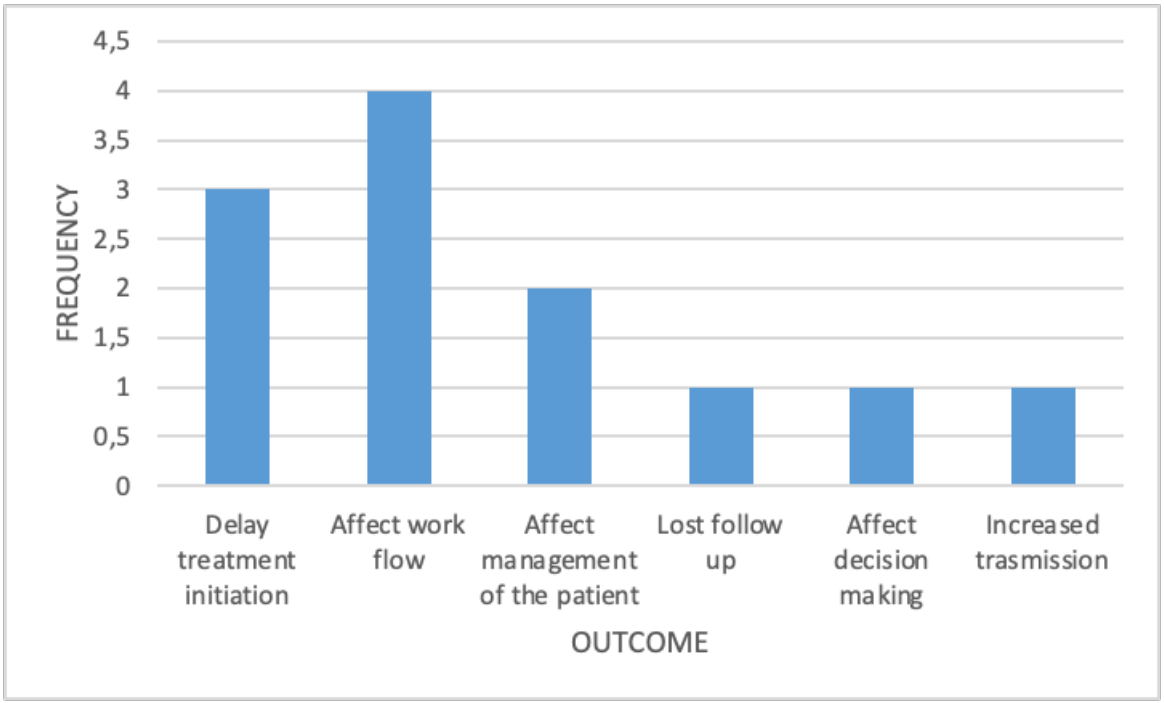


Theme 3: Impact of challenges on patients' management and outcome

The majority of the participants said most of the challenges affect their workflow. Some said they make them delay in treatment initiation as they are supposed to wait for the results, which they say takes a lot of time. This also affects the management of their patients as they face dilemmas on what to do with these patients. These have been depicted from the following quotes:

> *"Eeeee h - Patients are lost to follow-up and also delay in initiation of treatment" [P001NHC]*
>
> *"Affect patient management and delay in initiation of treatment" [P002BHC]*
>
> *"Mostly patients are lost to follow-up and delay in initiation of treatment" [P001BHC]*

The figure below shows the impact of challenges on patients' management and outcome:



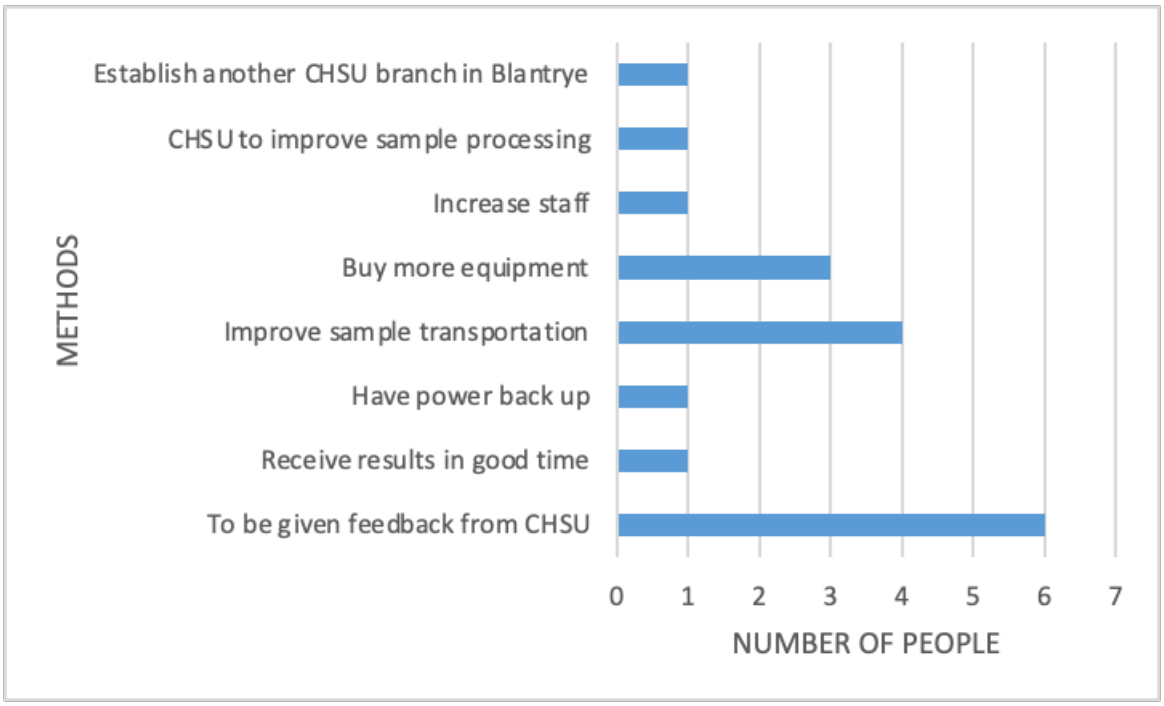
Theme 4: Methods of improving DST services

The majority of the participants said that if feedback has to be given to them, DST services can be improved. Some said another branch has to be established so that they can reduce the time taken to receive results. Others suggested that sample transportation has to be improved in order to improve these services. These have been depicted from the following quotes:

> *"We should have power back up" [P001NHC]*
>
> *"Maybe if there was direct transport so that when we have a sample to be sent to CHSU, somebody should just come and collect it; then the same day it should be sent to Lilongwe. Also, if the results could be coming in early*

> *so that it should not be up to a week before results come in, but the problem is that they have a lot of samples to process. So it would have been better if there was another lab like CHSU." [P001ZHC]*
>
> *"Improve sample processing time and buy more equipment" [P003BHC]*
>
> *"Speed up sample processing time, recruit more staff" [P002BHC]*

The figure below shows some suggestions that were given by different participants:



Discussion

This qualitative study adds to the literature about exploring clinicians' experiences of accessing drug-resistant tuberculosis drug susceptibility testing services. We discuss the findings in the context of the themes that were identified from the information gathered. Clinicians work effectively when they have access to diagnostic tools that guide them in coming up with a proper diagnosis. Like any other disease, clinicians working in TB clinics need to access drug-resistant TB testing tools. For instance, having access to culture and sensitivity helps to choose the right anti-TB drug. Patients start TB treatment at the right time, which prevents further spread of the disease. Effective treatment outcomes depend on early diagnosis of TB and adherence to treatment[14].

During the study, we discovered that the majority of participants have problems receiving results from CHSU. The maximum number of days to receive samples was 30 days. A similar study conducted by Charlie et al., 2022, in Malawi revealed that one of the major challenges of managing multidrug-resistant tuberculosis in Malawi was the long turnaround time of culture results[9]. These findings are slightly lower than those in the Kyrgyzstan National Report on TB in 2017, in

which the turnaround time for DST TB was 90 days, which resulted in further spread of the disease[14]. They managed to reduce the turnaround time by buying more laboratory DST testing equipment. The difference could be due to the organization of the health system.

The study also found that most clinicians in Blantyre have challenges in accessing laboratory services for tuberculosis drug susceptibility testing at their respective health facilities. One of the major challenges revealed in the study was stockout of resources**.** These findings correlated with the study done by Charlie et al., 2022, in Malawi, which found that one of the major challenges of managing MDR TB was lack of resources such as GeneXpert[9].

Furthermore, the study has found that these challenges affect patient management and outcomes in different ways. For example, the majority of the participants said these challenges affect their workflow and also cause delays in treatment initiation for their patients. In addition to that, they also lose patients to follow-up, and they affect their decisions on whether they should be on treatment or not; this leads to an increase in transmission.

On sample submission from health centers, the study revealed that most of the participants submit their samples to their local laboratories, which are within the compound of the facility, and if there was a need for confirmation of rifampicin resistance and MDR, the sample was sent to CHSU. The use of local laboratories appears to be cost-effective in terms of transportation. In addition, for diagnostic tools for TB in health centers, the study found that most health centers use GeneXpert, including the detection of rifampicin-resistant TB; however, the WHO Report for 2018 revealed that sputum smear microscopy, with its low detection rate, remains the most commonly used diagnostic test for pulmonary TB in low-resource health facilities[15].

A study done by Zhang A et al, where they were looking at low-cost diagnostic tests for susceptible and drug-resistant tuberculosis in rural Malawi, highlighted that in Malawi, there are approximately two smear and microscopy facilities per 100,000 people and one laboratory capable of performing tuberculosis drug susceptibility tests per 10 million people. In this study, it was also highlighted that, though in 2010 the WHO recommended GeneXpert MTB/RIF as an initial tuberculosis diagnostic test despite its sensitivity and utility, the GeneXpert MTB/RIF implementation in high tuberculosis burden areas is cost-prohibitive (approximately $18 per sample in Malawi), requires expensive instrumentation with weekly maintenance and monthly calibration, a sustained power source, and laboratory technicians with specialized training. This has been reflected in the responses of the participants as challenges they face at the health centres, specifically to mention lack of supplies, stockouts of resources for DST, as well as lack of power backup and machine breakdowns.

According to a study done by Charlie L et al in Malawi, where they were looking at Programmatic Challenges in Managing Multidrug-Resistant Tuberculosis in Malawi, they found a lot of challenges affecting PMDT, among which one was a decrease in the turnaround time of culture results. This was evident in the responses of the participants, where it takes an average of 21 days for them to receive results from CHSU for MDR-TB, and some of the health centres were not receiving results at all.

During the study, the impact of these challenges on patient management and outcomes was also uncovered in different

ways. For example, the majority of the participants said these challenges affect their workflow and also cause delays in treatment initiation for their patients. In addition to that, they also lose patients to follow-up, and they affect their decisions on whether patients should be on treatment or not; this leads to an increase in transmission.

On the other hand, these studies above lack information on ways in which DST services can be improved. Our study has found different suggestions reported by participants on how DST services can be improved. Some of the suggestions on how DST services can be improved are as follows: feedback has to be given to them as most of the clinicians do not receive feedback from CHSU, another branch has to be established so that they can reduce the time taken to receive results, sample transportation has to be improved in order to improve these services, increasing staff members, having power backups, receiving results in good time, buying more equipment, and improving sample transportation.

Limitations of the Study and Recommendations

The major limitation of our study is that our sample size was very small due to the limited number of health centers we visited and also the few number of TB officers we found per health center, but we tried to get as much information as we could so as to add more validation to the study findings. Future studies should consider a large sample size in order to reach better conclusions. We were also requested by participants to give them money before interviews since they say our fellow undergraduate students always give them money before collecting data in their facilities. Lastly, the clinicians were interviewed during working hours, which made it hard to have adequate interview length.

Conclusions

Despite the National TB Control Program and the availability of TB offices in various health facilities, clinicians have challenges in accessing drug susceptibility testing services.

The study revealed that clinicians experience delays in receiving DST results from CHSU. Transportation of samples has been a major challenge in most health centers in Blantyre.

The study has recommended the following ways of improving access to DST services: feedback has to be given to clinicians on DST from CHSU, another branch has to be established so that they can reduce the time taken to receive results, sample transportation has to be improved in order to improve these services, increasing staff members, having power backups to receive results in good time, buying more equipment, and improving sample transportation.

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Statements and Declarations

Conflict Of Interests

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