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Delays in Diagnosis and Treatment of Multi-Drug Resistant Tuberculosis: Magnitude and Institutional Barriers in Tanzania

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Abstract

Background: *Multi-drug-resistant tuberculosis (MDR-TB) poses significant challenges in timely diagnosis and treatment due to various institutional barriers. Effective management of MDR-TB requires addressing these barriers to improve patient outcomes. This study aimed to assess the magnitude of delays in the diagnosis and treatment of MDR-TB and identify associated institutional barriers in Tanzania.*

Methodology: *A descriptive cross-sectional survey was conducted at three major healthcare facilities: the Central Tuberculosis Reference Laboratory (CTRL), Kibong'oto National TB Hospital, and regional hospitals in Mwanza and Mbeya, from January to April 2017. A total of 200 MDR-TB patients were randomly selected from hospital records, and 12 key informants were purposively chosen. Quantitative data were collected using a modified WHO questionnaire, while qualitative data were obtained through key informant interviews. Data were analyzed using SPSS version 22 for quantitative analysis and NVivo software for qualitative analysis. Diagnostic delay was categorized based on a 21-day cutoff.*

Results: *Of the 200 approached MDR-TB patients, 192 provided complete responses (96.0% response rate). The mean age of respondents was 39.52 years (SD 12.87). Diagnostic delays were observed in 72.40% of the patients. Factors associated with delays included multiple hospital visits before diagnosis, longer consultation turnaround times, lack of health education, delayed laboratory results, payment methods (cash vs. insurance), and distance to diagnostic centers. Qualitative data revealed misdiagnosis, inadequate counseling, frequent breakdowns of diagnostic equipment, and individual-level barriers as significant contributors to delays.*

Conclusions: *The study found that a majority of MDR-TB patients experienced diagnostic delays, with multiple institutional and individual factors contributing to these delays. Addressing issues such as misdiagnosis, inadequate health education, and logistical barriers, along with improving diagnostic infrastructure and reducing financial and distance-related barriers, could enhance timely diagnosis and treatment of MDR-TB in Tanzania.*

Keywords: MDR-TB, diagnosis, treatment delay, institutional barriers, Tanzania

Introduction

Multi-drug-resistant tuberculosis (MDR-TB) is a major public health concern globally, particularly in developing countries where healthcare systems are often strained. MDR-TB is defined as tuberculosis that is resistant to at least isoniazid and rifampicin, the two most potent TB drugs (Seung et al., 2015; Xi et al., 2022). This resistance significantly complicates treatment regimens, increases treatment costs, and results in poorer patient outcomes (Salari et al., 2023). In Tanzania, as in many other low- and middle-income countries, the burden of MDR-TB is substantial, and addressing this challenge is critical to achieving national and international TB control targets (Kilale et al., 2022; Paleckyte et al., 2021).

One of the primary challenges in managing MDR-TB is the timely diagnosis and initiation of appropriate treatment (Oga-Omenka et al., 2020). Delays in diagnosis can result in prolonged periods of infectiousness, increased morbidity and mortality, and further transmission of resistant strains (Laxminarayan et al., 2006; Huemer et al., 2020). Several factors contribute to these delays, including limited access to rapid diagnostic tests, insufficient laboratory capacity, and inefficient health information systems (Mbelele et al., 2022). GeneXpert MTB/RIF, a rapid molecular test, has significantly improved the speed of MDR-TB diagnosis, but its availability and implementation remain inconsistent in many regions of Tanzania (Kilale et al., 2022; Mbelele et al., 2022; Katale et al., 2020).

Institutional barriers play a significant role in the delays observed in the diagnosis and treatment of MDR-TB. These barriers include inadequate laboratory infrastructure, shortages of trained personnel, and logistical issues related to the transportation of samples and results (Teo et al., 2021). Additionally, systemic issues such as poor coordination between different levels of the healthcare system, lack of standardized protocols, and insufficient funding further exacerbate these delays (Oga-Omenka et al., 2021; Osei et al., 2015). Understanding and addressing these institutional barriers is essential for improving the management of MDR-TB in Tanzania.

This study aims to assess the magnitude of delays in the diagnosis and treatment of MDR-TB and identify the institutional barriers associated with these delays in Tanzania. By providing a comprehensive analysis of these challenges, the study seeks to inform policymakers and healthcare providers about critical areas for intervention. Improving the timeliness and efficiency of MDR-TB diagnosis and treatment processes is vital for reducing the disease burden and achieving better health outcomes for patients in Tanzania.

Materials and Methods

Study Design and Setting

A hospital-based descriptive cross-sectional survey research design was adopted to assess the magnitude of delays in the diagnosis and treatment of MDR-TB and identify associated institutional barriers in Tanzania. The study was conducted in three major healthcare facilities: the Central Tuberculosis Reference Laboratory (CTRL), Kibong'oto National TB Hospital, and regional hospitals in Mwanza and Mbeya.

Study Population and Sampling

The study involved 200 randomly selected MDR-TB patients and 12 purposively selected key informants. Patients were selected from the hospital records of those diagnosed with MDR-TB between January 2015 and December 2016. Key informants included healthcare providers and administrators involved in the management of TB and MDR-TB at the selected facilities.

Data Collection Tools and Procedures

A self-administered, pre-designed, and pre-tested modified WHO questionnaire was used to collect quantitative data from the patient respondents. A key informant interview guide was used to gather qualitative data from the key informants. Data collection was conducted between January and April 2017. The questionnaire captured information on patient demographics, clinical characteristics, and timelines related to TB diagnosis and treatment. The key informant interviews focused on institutional barriers and processes affecting MDR-TB management.

Data Analysis

Quantitative data were coded and analyzed using MS Excel and SPSS version 22. Descriptive statistics, including frequencies and percentages, were used to summarize patient characteristics and institutional factors. Bivariate analysis was conducted to test the strength of association between health facility factors and the duration of tuberculosis before diagnosis. Qualitative data were analyzed thematically to identify common barriers and challenges reported by key informants.

Definition of Delay

The study categorized TB diagnosis time into either delay (>21 days) or no delay (<21 days), based on a 21-day cutoff adopted from WHO guidelines.

Ethical Considerations

Institutional ethical approval was obtained from the Muhimbili University of Health and Allied Sciences Ethics and Research Committee. Permissions for data collection were sought from hospital administrators at each study site. Informed consent was obtained from all participants, and the researcher ensured all ethical considerations were observed during data collection, including confidentiality and the right to withdraw from the study at any time.

Data Collection Permissions

Permissions for data collection were sought and obtained from the relevant hospital administrators to ensure compliance with institutional protocols and to facilitate smooth data collection processes.

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Qualitative data from key informant interviews were transcribed verbatim and analyzed thematically. Themes and sub-themes were identified based on common patterns and insights related to institutional barriers. NVivo software was used to assist in the organization and coding of qualitative data.

Results

Participant Characteristics

The study approached 200 MDR-TB patient respondents, of which 8 were excluded due to inadequate filling of the research tool, resulting in 192 study respondents (96.0% response rate). The data revealed a mean age of 39.52 years (SD, 12.87), with a median of 37.0 and a mode of 41.0 years. Among the respondents, 32.29% (n=62) were aged 31-40 years. A majority of the respondents were male [n=113 (58.85%)] and married [n=107 (55.73%)]. Regarding education status, only 21.88% (n=42) had attained post-secondary education. Nearly half of the respondents were self-employed [n=89 (46.35%)] and had a household income of less than 10,000 TZS [n=106 (55.21%), (Table 1).

Table 1: Respondents' Socio-demographic Characteristics

Variable	Frequency (n)	Percentage (%)
Age (years)		
20-30	42	21.88
31-40	62	32.29
41-50	50	28.65
<50	33	17.19
Sex		
Male	113	58.85
Female	79	41.15
Marital Status		
Single	25	13.02
Married	107	55.73
Divorced	34	17.71
Widowed	26	13.54
Education Status		
Primary	59	30.73
Secondary	71	36.96
Post-Secondary	42	21.88
None	20	10.42
Occupation		
Unemployed	53	27.60
Self-employed	89	46.35
Employed	50	26.04
Household Income		
<10,000 TZS	106	55.21
10,000-20,000 TZS	28	14.58
>20,000 TZS	58	30.21

TB Diagnostic Duration

The study sought to identify the percentage of respondents experiencing delayed diagnosis. It was observed that the majority [n=139 (72.40%)] of the respondents experienced delays in TB diagnosis, while only 27.60% (n=53) were diagnosed on time (Figure 1).

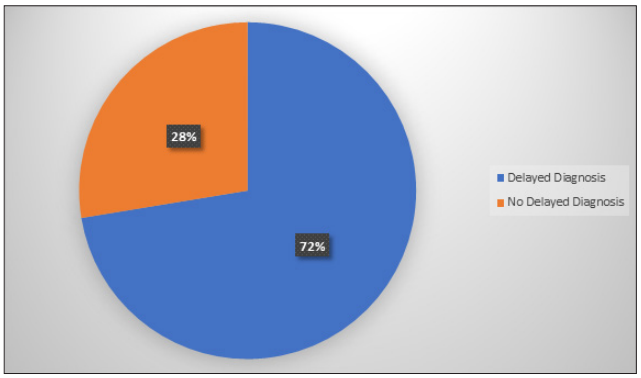

Figure 1: A Pie Chart of Uptake of Diagnostic Services.

Hospital-based Barriers to Timely Diagnosis

From Table 2, respondents who visited the hospital more than three times prior to diagnosis were 3.26 times (95% CI=1.58-6.80; p=0.001) more likely to experience diagnostic delays compared to those who visited less than three times. A turnaround time of more than three hours increased diagnostic delay by 2.4 times (95% CI=1.07-5.36; p=0.034) compared to a turnaround time of less than three hours. Similarly, respondents whose laboratory investigation results took more than two days were 2.5 times (95% CI=1.20-5.29; p=0.015) more likely to experience diagnostic delays compared to respondents whose results took less than two days. Respondents who did not receive health education on TB were 2.8 times (95% CI=1.30-5.67; p=0.007) more likely to experience diagnostic delays than those who received health education before diagnosis. Regarding payment methods, cash-paying respondents were 4.6 times (95% CI=1.83-11.27; p=0.0001) more likely to experience diagnostic delays compared to those with insurance. Respondents living more than five kilometers from TB diagnostic centers were 3.9 times (95% CI=1.72-8.80; p=0.0001) more likely to experience diagnostic delays than those living less than five kilometers from diagnostic centers.

Table 2: Association between Hospital Factors and TB Diagnostic Duration

Diagnostic Duration	No Delay (%)	Delay (%)	OR (95% CI)	P-value
Prior Visits with TB Suggestive Symptoms Before Diagnosis				
<3 times	24 (12.5)	29 (15.1)	*	*
>3 times	29 (15.1)	110 (57.3)	3.26 (1.58-6.80)	0.001
Consultation Turnaround Time				
<3 hours	35 (18.2)	66 (34.4)	*	*
>3 hours	18 (9.4)	73 (38.0)	2.40 (1.07-5.36)	0.034
Health Education on TB Before Diagnosis				
Yes	24 (12.5)	29 (15.1)	*	*
No	29 (15.1)	110 (57.3)	2.80 (1.30-5.67)	0.007
Laboratory Tests Turnaround Time				
>2 days	26 (13.5)	89 (46.4)	2.50 (1.20-5.29)	0.015
<2 days	24 (12.5)	50 (26.0)	*	*
Service Payment Methods				
Cash	32 (16.7)	107 (55.7)	4.60 (1.83-11.27)	0.0001
Insurance	18 (9.4)	7 (3.6)	*	*
Distance to Diagnostic Centers				
<5 KM	19 (9.9)	16 (8.3)	*	*
>5 KM	29 (15.1)	98 (51.0)	3.90 (1.72-8.80)	0.0001

* =the value is not reported due to lack of statistical significance or calculation.

Qualitative Findings on Health Factors Associated with Delay in Diagnosis of TB

Theme 1: Misdiagnosis

Healthcare providers reported that misdiagnosis among TB symptomatic patients contributed to diagnostic delay. Many TB patients were initially diagnosed with lower respiratory tract infections, particularly pneumonia. The prescribed medication resulted in subsiding TB symptoms temporarily, only for them to recur after the medication period was over.

Theme 2: Inadequate Counselling

Inadequate counselling or health education was identified as a significant barrier to timely TB diagnosis. Issues such as lack of privacy, poor doctor-patient relationships, high workload, and communication barriers hindered proper health education.

Theme 3: GeneXpert Machine

Breakdown Laboratory technologists highlighted frequent breakdowns of GeneXpert machines, causing significant delays in TB diagnosis. Limited availability and functionality of these machines resulted in increased turnaround times and delays in initiating treatment.

Theme 4: Distance to Facility

Delays in sputum results were reported as a crucial barrier, exacerbated by individual-level barriers such as lack of transportation fare and long distances to health facilities. Patients were often discouraged from returning to the hospital multiple times for their results, leading to further delays in diagnosis and treatment initiation.

Discussion

In this study, a majority (72.40%) of MDR-TB patients experienced diagnostic delays, a rate somewhat lower compared to diagnostic delays reported in India (87.4%) but higher than findings from Ethiopia (50.9%) (Arja et al., 2021; Noman et al., 2024). These differences may stem from variations in diagnostic criteria and sample sizes between studies.

The finding that multiple visits to healthcare providers before a diagnosis was associated with prolonged diagnostic duration aligns with established literature, which frequently identifies repeated consultations as a risk factor for delayed diagnosis. This pattern may result from dissatisfaction with initial care, suboptimal quality of service, or the need for multiple evaluations before a conclusive diagnosis is made. Similar observations have been noted in other studies where multiple visits contributed to extended diagnostic times due to factors such as patient dissatisfaction, inadequate care quality, or attitudes of healthcare providers (Noman et al., 2024; Cazabon et al., 2020; Tegegn et al., 2020).

Our study also identified that longer consultation turnaround times were associated with delays in diagnosis. This corroborates findings from a systematic review of high-burden nations, which highlighted turnaround time as a critical barrier to timely TB diagnosis (Wakjira et al., 2023). The delay in diagnosis may be compounded by patients seeking care from alternative facilities or private clinics due to extended waiting times, thus prolonging the overall diagnostic process (Wakjira et al., 2023; Storla et al., 2008).

Additionally, delays in obtaining laboratory results were found to be a significant factor in diagnostic delays. This finding is consistent with studies conducted in Uganda, which also identified delays in laboratory processing as a major barrier to timely diagnosis (Andom et al., 2023).

A notable finding from this study was the association between lack of health education and diagnostic delay. Respondents who did not receive health education on TB were significantly more likely to experience delays. This reflects issues noted in Tanzania, where there is a greater focus on non-communicable diseases, often neglecting communicable diseases such as TB (Andom et al., 2023). The lack of targeted health education on TB may contribute to delays in recognizing symptoms and seeking timely care.

The study also found that patients who paid out-of-pocket in cash were more likely to experience diagnostic delays compared to those with insurance. This finding is in line with studies from Nigeria, Indonesia, and Ethiopia, which identified cash payments as a barrier to timely diagnosis (Buregyeya et al., 2014; Ndumwa et al., 2023). The financial burden associated with cash payments may delay diagnosis due to patients' inability to afford necessary diagnostic tests promptly (Abubakar et al., 2022). Conversely, insurance coverage often facilitates quicker access to diagnosis and treatment (Ndumwa et al., 2023; Abubakar et al., 2022).

Distance to diagnostic centers was another significant factor associated with delays. Patients residing more than five kilometers from diagnostic centers were nearly four times more likely to experience diagnostic delays. This finding aligns with other research indicating that longer distances to healthcare facilities are associated with delays in diagnosis (Alemayehu et al., 2023). However, this finding contrasts with a study from Mombasa County, Kenya, which reported different results. This discrepancy may be due to varying local contexts or healthcare infrastructure differences.

Qualitative findings revealed that misdiagnosis, inadequate counseling, and frequent breakdowns of GeneXpert machines were significant barriers to timely TB diagnosis. Misdiagnosis often led to temporary symptom relief but did not address the underlying TB infection, causing delays in effective treatment. Inadequate counseling, attributed to factors such as lack of privacy and poor communication, hindered proper patient education and engagement in their care. Frequent breakdowns of GeneXpert machines exacerbated delays in diagnosis due to increased turnaround times and limited availability of diagnostic tools.

Furthermore, individual-level barriers, including lack of transportation fare and long distances to health facilities, discouraged patients from returning for follow-up visits, contributing to further delays in diagnosis and treatment initiation

Conclusions

This study underscores the multifaceted nature of diagnostic delays in MDR-TB patients, highlighting the importance of addressing hospital-based barriers, enhancing health education, improving laboratory efficiency, and reducing financial and logistical obstacles to timely diagnosis.

Declaration

Ethical Approval and Consent to Participate

Ethical approval was granted by the Muhimbili University of Health and Allied Sciences (MUHAS) Ethical Committee. Additionally, permission to collect data was obtained from the relevant institutions involved in the study.

Consent to Participate

Informed consent was secured from all participants prior to their involvement in the study. Each respondent received a detailed explanation of the study's purpose, procedures, potential risks, and benefits. Participants were assured that their participation was entirely voluntary and that they could withdraw from the study at any time without facing any negative consequences.

Participants provided written consent by signing a consent form, which confirmed their understanding and agreement to participate. The consent form guaranteed confidentiality, the right to withdraw, and provided information on how their data would be used and protected. Participants were given the opportunity to ask questions and seek clarification before consenting to the study.

Consent for Publication

Not applicable

Availability of Data and Material

All data generated for this study, figures and tables are included in this manuscript.

Conflicts of Interest

The authors declare that they have no conflict of interest

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Authors' Contributions

JS designed the study, developed methodology and participated in data collection. BK and BM participated in data analysis and interpretation. JS and PK drafted the manuscript. All authors critically reviewed the manuscript and approved the final version.

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