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Determinants And Consequences of Patient and Health System Delays in Tuberculosis Diagnosis and Treatment Among Individuals Aged ≥15 Years at Kenyatta National Hospital, Nairobi, Kenya

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Research Article

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ABSTRACT

Background: Delays in tuberculosis (TB) diagnosis and treatment remain important public health challenges, particularly in low- and middle-income countries. Delays may arise from late healthcare-seeking, barriers to accessing health services and delays in reaching a confirmed diagnosis. Understanding these factors is essential for improving early detection and timely treatment.

Objective: To assess patient and health-system delays in TB diagnosis and treatment and examine factors associated with delayed care-seeking among individuals aged 15 years and above at Kenyatta National Hospital (KNH), Nairobi, Kenya.

Methods: A facility-based observational study was conducted among 127 individuals aged 15 years and above receiving TB care at KNH. Data were obtained through structured questionnaires and review of clinical records. Descriptive statistics were used to summarize participant characteristics and reported barriers to care. Associations between selected characteristics and delay were assessed using chi-square tests, followed by binary logistic regression. Statistical significance was set at $p < 0.05$.

Results: Of the 127 participants, 65 (51.2%) were female and 62 (48.8%) were male. The largest age group was 40–49 years, comprising 41 participants (32.3%). Seventy-six participants (59.8%) reported seeking care more than two months after symptom onset, based on the delay categories supplied for this analysis. Perceived stigma was reported by 123 participants (96.9%), while 85 (66.9%) reported fear following diagnosis. Forty participants (31.5%) lived more than 10 km from a health facility. At bivariate analysis, age group ($p = 0.032$), distance to a health facility ($p = 0.015$), and education level ($p = 0.041$) were associated with delay; sex was not statistically associated with delay ($p = 0.210$). No factor was statistically significant in the reported multivariable model.

Conclusion: Delayed care-seeking was common among participants. Stigma, fear and geographical access were prominent concerns. Strengthening TB awareness, reducing stigma, improving access to diagnostic services and promoting timely referral may help reduce delays. The findings should be interpreted in light of the single-facility setting and potential recall bias.

Keywords: Tuberculosis; patient delay; health-system delay; diagnostic delay; care-seeking; Kenya.

INTRODUCTION

Tuberculosis remains a major global public health problem, despite the availability of effective diagnostic tools and treatment. Delays in diagnosis and treatment can prolong the period during which an infectious individual remains undiagnosed, contribute to disease progression and increase the risk of continued transmission. These delays remain particularly important in settings where access to healthcare is constrained by social, economic and health-system barriers.

Patient delay generally refers to the interval between the onset of symptoms and the first contact with a healthcare provider. Health-system delay refers to the interval between the first contact with a healthcare provider and confirmed diagnosis, although operational definitions vary across studies. Total delay may include both intervals and, depending on the study framework, the time between diagnosis and treatment initiation. Clearly defining each interval is therefore essential when comparing findings and identifying opportunities for intervention.

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Several factors may contribute to delayed care-seeking. Limited knowledge of TB symptoms, stigma, fear of diagnosis, financial constraints and competing responsibilities may discourage individuals from seeking care promptly. Some patients initially use self-medication, visit pharmacies or consult providers outside formal diagnostic services before reaching a facility capable of confirming TB. Each additional step may create an opportunity for delayed recognition, referral or diagnosis.

Health-system factors may also contribute to delays. These include geographical barriers, referral processes, access to diagnostic services, delays in clinical assessment and the availability of appropriate testing. Understanding the relative contribution of patient-related and health-system factors is important for designing interventions that improve timely diagnosis and treatment.

TB can also have substantial social and economic consequences, particularly among adults who contribute to household income and caregiving. Delayed diagnosis may extend illness, increase the financial burden on patients and households, and create additional demands on healthcare services.

Although previous research has examined TB diagnostic delays in different settings, local evidence remains important because healthcare-seeking pathways and access barriers vary between populations and health systems. Examining these factors at a major referral hospital can help identify barriers experienced by patients who ultimately reach specialist services.

This study assessed patient and health-system delays in TB diagnosis and treatment among individuals aged 15 years and above receiving care at Kenyatta National Hospital in Nairobi, Kenya. It also examined selected socio-demographic and access-related factors associated with delayed care-seeking.

2. METHODS

2.1 Study design

A facility-based observational study was conducted using structured participant interviews and review of clinical records. The study reconstructed reported care-seeking pathways and relevant clinical events retrospectively.

Patient delay was defined as the interval between the onset of TB-related symptoms and first contact with a healthcare provider. Health-system delay was defined as the interval between first healthcare contact and confirmed TB diagnosis. Where treatment-initiation dates were available, these were used to describe the subsequent interval between diagnosis and initiation of treatment.

The final designation of the study design should be consistent with the approved protocol and the actual sampling and data-collection procedures.

2.2 Study setting

The study was conducted at Kenyatta National Hospital, Nairobi, Kenya. KNH is a national referral and teaching hospital that provides specialized diagnostic and treatment services and receives patients referred from different parts of the country. Its TB services provide a setting in which patient care-seeking pathways and barriers encountered before diagnosis can be examined.

The study relates to the approved data-collection period in 2022. The findings describe participants and circumstances during that study period and should not be interpreted as a direct assessment of TB delays in 2026.

2.3 Study population

The study population comprised individuals aged 15 years and above with a confirmed diagnosis of pulmonary TB who were receiving treatment at KNH during the study period.

The eligibility criteria reported for the study included age 15 years and above, confirmed pulmonary TB, current receipt of treatment at the study site and provision of informed consent. Individuals with extrapulmonary TB, a history of previous TB treatment, or an inability to participate at the time of data collection were excluded according to the supplied study description. These criteria should be retained only insofar as they match the approved protocol and recruitment records.

2.4 Sample size and sampling procedure

The final analytical sample comprised 127 participants. The original sample-size calculation used the single-population proportion formula:

$$n = Z^2pq/d^2$$

where (Z) represents the standard normal value for the selected confidence level, (p) is the assumed proportion, (q=1-p), and (d) is the margin of error.

The calculation used a 95% confidence level, an assumed proportion of 0.5 and a margin of error of 0.05. The supplied study description states that a finite-population correction was applied and that the adjusted target was 96 participants. The final sample of 127 exceeded that target.

Systematic sampling was reportedly used to select eligible participants from the sampling frame. The procedure involved identifying the sampling frame, calculating the sampling interval, selecting a random starting point and selecting every subsequent eligible participant according to that interval. The sampling interval and recruitment numbers should be confirmed from the original field records before submission.

2.5 Data collection

Data were collected using a structured questionnaire and clinical-record review. The questionnaire captured socio-demographic characteristics, symptom history, care-seeking behaviour, reported barriers to seeking care and the sequence of healthcare contacts before diagnosis. Clinical records were reviewed for available diagnostic and treatment information.

Using participant interviews alongside clinical records allowed reported care-seeking histories to be considered alongside available documented clinical events. However, symptom onset and some early care-seeking events relied on retrospective recall and may therefore be subject to recall error.

2.6 Study variables and operational definitions

The main outcome was delayed care-seeking. The supplied results classify delay using categories of less than one month, one to two months, two to three months and more than five months. These categories do not fully cover all possible durations and must be checked against the original questionnaire and dataset before the final analysis is reported.

The manuscript's primary delay threshold must be consistent throughout the methods, tables and regression analysis. Because the supplied results discuss delays exceeding two months, this threshold is used descriptively in the current draft. It should not be presented as the model outcome unless that is the outcome actually used in the original statistical analysis.

Independent variables included sex, age group, education, distance to a health facility, perceived stigma and fear following diagnosis. The original analysis should be consulted to confirm which variables were included in the regression model and how each variable was categorized.

2.7 Data management and statistical analysis

Quantitative data were analyzed using IBM SPSS Statistics version 25. Descriptive statistics were used to summarize participant characteristics and reported barriers. Categorical variables were summarized using frequencies and percentages.

Chi-square tests were used to assess bivariate associations between selected characteristics and delay. Binary logistic regression was reported as the multivariable method for assessing factors associated with delay. Adjusted odds ratios (AORs), 95% confidence intervals and p-values were used to summarize the reported model results. Statistical significance was set at $p < 0.05$.

The final manuscript must identify the precise dependent variable and reference categories used in the logistic regression. The regression estimates and confidence intervals must be verified against the original SPSS output.

2.8 Ethical considerations

The study received ethical approval from the University of Nairobi/Kenyatta National Hospital ethics review process (approval number: UoN/KNH-P187/03/2022) and Mount Kenya University (approval number: MKU/ERC/2079), as recorded in the study information available for this revision. Research authorization and participant consent procedures should be reported in accordance with the original approvals and study records.

Participation was voluntary, and informed consent was obtained as reported in the study documentation. Participant confidentiality was maintained during data handling and reporting. No directly identifying participant information is included in this manuscript.

3. RESULTS

3.1 Socio-demographic characteristics

A total of 127 participants were included in the analysis. Females accounted for 65 participants (51.2%), while males accounted for 62 (48.8%). The largest age group was 40–49 years, comprising 41 participants (32.3%), followed by participants aged 30–39 years, comprising 34 (26.8%).

Primary education was reported for 40 participants (31.5%) and secondary education for 35 (27.6%). Fifty-five participants (43.3%) were self-employed, 30 (23.6%) were unemployed and 42 (33.1%) were in formal employment.

Table 1. Socio-demographic characteristics of participants (n = 127)

Characteristic	Category	n	%
Sex	Male	62	48.8
	Female	65	51.2
Age group (years)	15–29	25	19.7
	30–39	34	26.8
	40–49	41	32.3
	≥50	27	21.2
Education	No formal education	18	14.2
	Primary	40	31.5
	Secondary	35	27.6
	Tertiary	34	26.8
Occupation	Unemployed	30	23.6
	Self-employed	55	43.3
	Formal employment	42	33.1

3.2 Patient delay and reported barriers

The supplied dataset summary indicates that 22 participants (17.3%) sought care within one month of symptom onset, 29 (22.8%) sought care after one to two months, 38 (29.9%) after two to three months and 38 (29.9%) after more than five months. The last two categories together account for 76 participants (59.8%). Perceived stigma was reported by 123 participants (96.9%), while 4 (3.1%) did not report stigma. Fear following diagnosis was reported by 85 participants (66.9%) and not reported by 42 (33.1%). Forty-six participants (36.2%) lived less than 5 km from a health facility, 41 (32.3%) lived 5–10 km away, and 40 (31.5%) lived more than 10 km away.

Table 2. Reported delay and barriers to care (n = 127)

Variable	Category	n	%
Time to first care	Less than 1 month	22	17.3
	1–2 months	29	22.8
	2–3 months	38	29.9
	More than 5 months	38	29.9
Perceived stigma	Yes	123	96.9
	No	4	3.1
Fear following diagnosis	Yes	85	66.9
	No	42	33.1
Distance to health facility	Less than 5 km	46	36.2
	5–10 km	41	32.3
	More than 10 km	40	31.5

Note: The time-to-first-care categories are reproduced from the supplied manuscript data. The original questionnaire and dataset must be checked to establish whether the category "more than 5 months" is correct and to determine how durations between 3 and 5 months were classified.

Participants also reported care-seeking pathways involving self-medication, pharmacies and informal providers before presentation to formal healthcare services. The frequencies for these pathways were not included in the supplied results and are therefore not quantified here.

3.3 Bivariate analysis

The supplied analysis reported statistically significant associations between delay and age group ($p = 0.032$), distance to a health facility ($p = 0.015$) and education level ($p = 0.041$). Sex was not statistically associated with delay ($p = 0.210$).

Table 3. Bivariate associations between selected participant characteristics and delay

Variable	Reported p-value	Interpretation at $p < 0.05$
Sex	0.210	Not statistically significant
Age group	0.032	Statistically significant
Distance to health facility	0.015	Statistically significant
Education level	0.041	Statistically significant

Note: The original category-specific counts, denominators and percentages must be reinstated from the original output if the journal requires the full contingency table. The category definitions used in this analysis must be consistent with those in Table 1 and the regression model.

3.4 Multivariable logistic regression

The supplied manuscript reported the following adjusted estimates. None of the associations reached statistical significance at the 0.05 level.

Table 4. Multivariable logistic regression analysis of factors associated with delay

Variable and comparison	AOR	95% CI	p-value
Female versus male	1.21	0.65–2.25	0.540
Age 40–49 years versus other ages	1.48	0.78–2.81	0.210
Distance >5 km versus <5 km	1.72	0.89–3.31	0.103
Lower versus higher education	1.36	0.72–2.56	0.330

The adjusted odds ratios were above 1 for the listed comparisons, but the 95% confidence intervals included 1 and the p-values exceeded 0.05. Consequently, the supplied model did not identify statistically significant independent associations. These estimates should be checked against the original SPSS output, including the reference categories and exact outcome definition, before publication.

4. DISCUSSION

This study examined reported delays in care-seeking among individuals aged 15 years and above receiving TB care at Kenyatta National Hospital. The supplied findings indicate that delayed care-seeking was common, with 59.8% of participants falling into the two reported duration categories extending beyond two months. Stigma, fear following diagnosis and distance to health facilities were also frequently reported.
The high proportion reporting delayed care-seeking is important for TB control because timely identification and treatment are central to reducing the period during which individuals remain undiagnosed. However, the observed duration categories and delay threshold must be interpreted cautiously until their definitions are reconciled with the original study instrument and analysis.

4.1 Participant characteristics

The largest participant age group was 40–49 years, representing 32.3% of the sample. This describes the age distribution of the participants recruited at a national referral hospital; it should not be interpreted as evidence that this age group has the highest population-level TB risk in Kenya. The facility-based sample does not provide a population denominator with which to estimate age-specific TB incidence or prevalence.
The sample included slightly more females than males. The observed distribution is descriptive and does not establish a sex difference in TB risk. In the supplied bivariate analysis, sex was not significantly associated with delay.

4.2 Patient delay and care-seeking

More than half of participants were reported to have sought care after two months or longer, based on the categories supplied for this manuscript. Such delays may reflect a combination of symptom interpretation, perceived severity, access constraints and decisions about where to seek initial care. Because the study relied partly on retrospective reporting, recall error may have influenced the reported timing of symptom onset and first healthcare contact.

The study also describes pathways involving self-medication, pharmacies and informal providers before contact with formal health services. These pathways may offer opportunities for earlier recognition and referral, but the current results do not quantify how much time was attributable to each step. Any recommendations about particular provider groups should therefore be framed as potential intervention opportunities rather than proven causal effects from this analysis.

4.3 Stigma and fear

Perceived stigma was reported by 96.9% of participants, while 66.9% reported fear following diagnosis. These results indicate that stigma and fear were common experiences or concerns within this sample. Stigma can discourage disclosure of symptoms and engagement with health services, while fear of a diagnosis or its social consequences may affect willingness to seek testing.

Because stigma was reported by nearly all participants, the study has limited ability to distinguish the effect of stigma between those with and without the reported outcome unless the original analysis provides sufficient variation and a clearly defined measure. The high proportion should be interpreted as a descriptive finding, not as proof that stigma independently caused delay.

Interventions that communicate accurate information about TB, protect patient confidentiality and support non-discriminatory care may help reduce social barriers

to accessing services. The effectiveness of specific interventions was not evaluated by this study.

4.4 Geographical access

Approximately one-third of participants reported living more than 10 km from a health facility. Distance may impose transport costs and time burdens, particularly for individuals with limited financial resources or competing work and family responsibilities. The bivariate analysis reported an association between distance and delay, but the association was not statistically significant in the supplied adjusted model. This difference between bivariate and multivariable results may reflect confounding, limited statistical precision or the categorization of variables. The current findings do not establish that distance independently predicts delay. Further investigation across multiple facilities and communities could help assess how distance, transport costs, service availability and referral practices interact.

4.5 Education and age

Age group and education level were associated with delay at bivariate analysis but were not statistically significant in the supplied multivariable model. These findings should be interpreted as evidence that unadjusted associations were observed, but independent associations were not demonstrated by the reported adjusted analysis.

The interpretation also depends on how age and education were categorized. The bivariate table and regression model must use clearly defined and consistent categories. Where categories are combined, the rationale should be explained and the results should be reported without implying that one group has greater risk unless supported by the estimates.

4.6 Implications for TB services

The findings support continued attention to early recognition of TB symptoms, community awareness, stigma reduction and access to timely diagnostic services. Strengthening referral pathways and engaging relevant first-contact providers may help reduce missed opportunities for diagnosis. These implications are consistent with the broad public health importance of reducing diagnostic delay, although this study did not evaluate the effectiveness of specific interventions.

The supplied results do not provide a complete quantitative estimate of health-system delay or the interval from diagnosis to treatment initiation. Accordingly, conclusions about the relative contribution of patient and health-system delays should not be drawn until the corresponding results are confirmed and reported.

4.7 Study limitations

Several limitations should be considered. First, the study was conducted at a single tertiary referral hospital, limiting generalizability to community settings and other healthcare facilities. Second, retrospective reporting of symptom onset and early care-seeking may be affected by recall error. Third, incomplete clinical records may affect the accuracy of reconstructed timelines. Fourth, the supplied analysis does not establish causality between reported factors and delayed care-seeking.

The sample size may also limit statistical precision, particularly for multivariable comparisons. The absence of statistically significant adjusted associations should not be interpreted as proof that the factors have no relationship with delay. Finally, the delay categories and operational definitions require reconciliation with the original data before the estimates can be interpreted definitively.

5. CONCLUSION

Delayed care-seeking was common among the participants included in this facility-based study. Perceived stigma, fear following diagnosis and geographical distance were frequently reported, while age group, distance and education level were associated with delay in the supplied bivariate analysis. None of the factors in the supplied multivariable model was statistically significant after adjustment.

The findings highlight the importance of public health strategies that promote early recognition of TB symptoms, reduce stigma, improve access to diagnostic services and support timely referral. The results should be interpreted cautiously because of the single-facility design, possible recall error and the need to verify the delay definitions and statistical output. Complete conclusions about health-system delay and treatment initiation require the corresponding verified results.

6. RECOMMENDATIONS

1. Strengthen community and facility-based education on TB symptoms and the importance of seeking care promptly.
2. Incorporate stigma reduction and confidentiality protections into TB communication and patient-support activities.
3. Review referral pathways and opportunities for early recognition among providers patients

commonly contact first.
4. Consider access barriers, including travel distance and indirect costs, when planning diagnostic services.
5. Ensure that programme monitoring distinguishes symptom onset, first healthcare contact, confirmed diagnosis and treatment initiation as separate events.
6. Conduct further research across multiple facilities and community settings to assess whether the observed associations apply more broadly.

These recommendations are potential public health responses to the observed patterns; their effectiveness was not evaluated directly in this study.

7. ETHICS, DATA AVAILABILITY AND DECLARATIONS

Ethics approval: Ethical approval numbers recorded for this study are UoN/KNH-P187/03/2022 and MKU/ERC/2079. The final submission should use the exact committee names and approval details appearing on the original letters.

Informed consent: The study documentation indicates that informed consent was obtained from participants. The final statement should reflect the actual consent procedures and any approved provisions for participants aged 15–17 years.

Data availability: The data underlying this study are not reproduced in the manuscript. A data-availability statement should be completed according to the actual consent, ethics approval, institutional requirements and the journal's policy. Do not state that the dataset is publicly available unless it has been deposited in a public repository.

Funding: State the actual funding status documented for this study. Do not name a funder unless funding was received.

Conflicts of interest: The corresponding author should disclose any actual competing interests in accordance with the journal's policy.

Author contributions: Insert the accurate contribution statement for each listed author, based on the work actually performed.

Acknowledgements:

Include only individuals or institutions that provided a genuine contribution and whose acknowledgement is appropriate.

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