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Original Article

Factors Associated with Delay in Diagnosis of Tuberculosis among Newly Diagnosed Patients in Meru County

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ABSTRACT

TB remains a disease of major public health concern due to related mortality and morbidity. Kenya is a high-burden country for TB and TB/HIV, and an estimated 1330,000 people got TB in 2022, but only 90,560 were diagnosed, and over 30% were missed. Delay in TB diagnosis fuels community TB transmission and poor treatment outcomes. This study was conducted to determine the factors associated with delay in TB diagnosis among newly diagnosed TB patients in Meru County. This was a cross-sectional study involving freshly diagnosed TB patients in 7 health facilities in Meru County. A semi-structured questionnaire was used to collect data. Descriptive analysis, median time to seeking care, and median time to diagnosis were done. Chi-square and t-tests were carried out to determine the relationship between delay in diagnosis and various patients, diseases, and health system characteristics. Odd ratios were carried out for the factors found to be significant to determine the strength of the relationship. A total of 390 participants were enrolled; 299 (76.7%) males and 91 (23.3%) females. The median time to diagnosis was 40 days; 20 (3, 40) days patients delay and 20 (3, 40) days of health system delay. Of the 390 patients recruited, 359 (92.1%) delayed being diagnosed, while 31 (7.9%) did not. The factors associated with delay to diagnosis were: the Subcounty where participants sought care, having cough, weight loss, or chest pains as one of the presenting symptoms, alcohol intake, number of hospital visits before diagnosis, knowledge of TB, level, and ownership of the health facility of the initial visit. Delay in TB diagnosis is a major challenge in Meru County. There is a need for enhanced health education in the community, strengthening the capacity of private facilities, and empowering healthcare workers on the diagnosis of TB irrespective of how it presents itself.

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INTRODUCTION

Globally, tuberculosis (TB) continues to be a major public health concern due to its huge burden, high mortality, and morbidity. Over 10.6 million people got ill with TB in 2022 globally, but only 7.5 million were successfully diagnosed; over 3 million people were missed. TB is ranked among the top 10 causes of death worldwide, and the leading cause of death from a single infectious agent, causing over 1.3 million deaths in 2022. Kenya is categorized among the high-burden countries for TB and TB/HIV (1,2). The Kenya TB prevalence survey carried out in 2016 found that there were more TB cases in the country than were reported and established that 40% of people with TB had not been diagnosed (Kenya Prevalence Survey, 2016) (3). In 2022, an estimated 133,000 people got ill with drug-susceptible TB (DS-TB) and another 2500 with drug-resistant TB in the country. However, only 90,560 were diagnosed with drug-sensitive TB and 752 with drug-resistant TB, missing over 30% and 60% of people with DR-TB and DS TB, respectively (4).

Meru County is ranked among the top 10 counties with the highest TB burden in the country and reported a total of 4,333 DS-TB cases and 112 DR-TB cases in 2022 (4). Delays in TB diagnosis have far-reaching impacts on the lives of people with TB and the community, including infection transmission and poor treatment outcomes (5,6). It is estimated that one untreated smear-positive TB patient can infect an average of 10 people annually (3,7). The economic impact of delay in TB diagnosis is far-reaching and represents a significant portion of the household's monthly income (8). In Kenya, 26.5% of households of TB patients face catastrophic costs (costs more than 20% of their annual household consumption expenditure) as a result of TB, with the highest costs being faced while seeking care (3). Delay in TB diagnosis and treatment occurs at 2 main levels, which include; delay to seek care (also known as patient delay) and delay to diagnosis (health system delay), which is the time taken by the health facility to diagnose TB once the patient has sought care. Some of the factors cited for delay in diagnosis included; lack of TB diagnostic equipment, poor TB surveillance systems, poor transport network, and lack of knowledge on TB among healthcare workers and patients (9,10). Perceived stigma and multiple hospital encounters have also been associated with delays in diagnosis (11). This study was conducted to determine the factors associated with delay in TB diagnosis among newly diagnosed TB patients in Meru County.

MATERIALS AND METHODS

Settings

This study was conducted in Meru County in 7 health facilities distributed across 4 Sub-counties /TB control zones. Meru County is among the highest TB-burden counties in Kenya, reporting a total of 4,333 TB cases in 2022. The facilities were purposefully selected based on the high number of TB cases notified in these facilities. They included: Meru Teaching and Referral Hospital, Nyambene Sub-county Hospital, Mutuati Sub-county Hospital, Consolata Hospital (Nkubu), Mitunguu Dispensary, Kangeta Health Centre, and Kanyakine Sub-County Hospital.

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Study Design

This was a descriptive cross-section study involving 390 people who were in an intensive phase of TB treatment in 7 health facilities in Meru County.

Sample Size

A sample size of 369 participants was determined using Cochran's (1977) formula as below;

$$n = \frac{z^2 pq}{e^2}$$

Where;

n = Sample size

z = Critical value associated with 95 % confidence interval (1.96)

p = Proportion of Population with attribute being studied (Delayed in Diagnosis) – 0.4

q = 1- p = 1- 0.4 = 0.6

e = Margin error (0.05)

n= (1.962 × 0.4× 0.6)/ 0.052 = 369

Sampling Procedures

All newly diagnosed TB patients who were on treatment for not more than one month at the time of the study were given an opportunity to join the study. They were provided with information about the study and taken through informed consent. Those who consented were enrolled in the study.

Data Collection Procedures

Semi-structured questionnaire in electronic format (KOBO Collect) was used to collect data on bio-demographics, the time lapse between the onset of TB symptoms to seeking medical care, diagnosis and initiation of treatment, knowledge on TB, health-seeking behaviours, and access to health services. After the interview, the TB patient record card and the appointment card were marked with a blue sticker bearing the study number of the participant to ensure that the participant was not going to be interviewed again. Measures were taken to ensure the data collected was of high quality by checking through the data immediately after every interview before the study participant left the facility to ensure completeness. Any missing or unclear response to the questions was corrected by requesting the participant additional time to clarify the responses. Data was submitted to the database electronically and later downloaded in Excel format for analysis.

Data Analysis

Data was downloaded from KOBO Collect in Excel format. Data cleaning and validation were carried out. Thereafter, data analysis was carried out using SPSS Version 22. Analysis done included; descriptive analysis, measure of central tendency including means, median, mode and dispersion. The association between the dependent variable (delay in diagnosis of TB) and independent variables like age, marital status, religion, and time from onset of TB symptoms to seeking care, among others, were determined by carrying out multivariate analysis.

Ethical Considerations

Ethical clearance for this study was acquired from JKUAT's Institutional Ethics Review Committee (IERC) (Ref: JKU/2/4/896B). Further clearance was sought from the county government of Meru and the facility in charge of the specific facilities. Written informed consent was sought from the participants, and only those who gave consent were enrolled in the study. The anonymity of all respondents was ensured by the use of unique client identification numbers as opposed to patient names. Access to study data was limited to those directly involved in the study to ensure confidentiality.

RESULTS

Social Demographic Characteristics

A total of 390 participants were recruited into the study, among them 299 (76.7%) were males and 91 (23.3%) were females. Table 1 summarizes the social demographic characteristics of the participants.

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Table 1: Social Demographic Characteristics of the Participants

Characteristics	n	%
Sex		
Male	299	76.7%
Female	91	23.3%
Age in (Years)		
18 - 24	98	25%
25 - 34	137	35%
35 - 44	98	25%
45 - 54	35	9%
55 - 64	10	3%
65+	12	3%
Marital Status		
Single	159	40.8%
Married	147	37.7%
Divorced/Separated	48	12.3%
Cohabiting	22	5.6%
Widowed	14	3.6%
Education Level		
None	18	4.6%
Primary	148	37.9%
Secondary	143	36.7%
College/University	81	20.8%
Occupation		
Formal employment	37	9.5%
Casual	133	34.1%
Business	81	20.8%
Farmer	54	13.8%
Housewife	6	1.5%
Unemployed	28	7.2%
Student	51	13.1%

Duration between Onset of Tuberculosis Symptoms to Seeking Care (Patient delay)

The median time taken from the onset of TB symptoms to seeking care (patient delay) was 20 (3, 40) days. Females had a lower median patient delay of 14 (10, 30) days compared to males, 20 (10, 30) days. People aged above 55 years had the longest patient delay of 30 days. People aged between 25 to 34 years presented earliest within a median time of 12 (8, 30) days. Adolescents and young adults below the age of 24 years presented within 14 (8, 30) days.

People who had bacteriologically confirmed pulmonary tuberculosis (PTB +ve) had a median patient delay of 15 (10, 30) days, while those with clinically diagnosed TB had 30 (20, 30) days, and those with Extrapulmonary TB (EPTB) had 30 (20, 68) days. People who were HIV positive had a median patient delay of 30 (10, 30) days, while those who were HIV negative had 20 (10, 30) days. Table 2 below shows the median patient delay stratified by various social demographics and disease factors.

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Table 2: Median Patient Delay to Stratified by Various Factors

Characteristic	n	%	Median patient delay (In days)
Sex			
Female	91	23%	14 (10, 30)
Male	299	77%	20 (10, 30)
Age Group			
18 – 24	98	25%	14 (8, 30)
25 – 34	137	35%	12 (8, 30)
35 – 44	98	25%	24 (14, 30)
45 – 54	35	9%	20 (15, 60)
55 – 64	10	3%	30 (22, 30)
65+	12	3%	30 (9, 30)
Marital Status			
Married	147	38%	20 (11, 30)
Single	159	41%	14 (8, 30)
Separated	48	12%	20 (12, 30)
Widowed	14	4%	30 (12, 30)
Cohabitating	22	6%	20 (10, 30)
Education Level			
None	18	5%	30 (12, 30)
Primary	148	38%	23 (10, 30)
Secondary	143	37%	14 (9, 30)
Tertiary	81	21%	20 (10, 30)
Occupation			
Business	81	21%	15 (10, 30)
Casual employment	133	34%	20 (10, 30)
Farmer	54	14%	30 (14, 52)
Formal employment	37	9%	15 (10, 21)
Student	51	13%	14 (10, 30)
Unemployed	34	9%	14 (10, 21)
Income Levels			
Below 5000	123	32%	14 (10, 30)
5001 – 10,000	107	27%	16 (10, 30)
10,001 - 20,000	85	22%	20 (10, 30)
20, 001 – 30,000	39	10%	20 (12, 30)
Above 30,000	36	9%	20 (15, 20)
HIV Status			
HIV Negative	342	89%	20 (10, 30)
HIV Positive	43	11%	30 (10, 30)
Type of TB			
PTB+	341	87%	15 (10, 30)
PTB-	25	6%	30 (20, 30)
EPTB	24	6%	30 (20, 68)
Knowledge on TB			
Good Knowledge on TB	330	85%	15 (10, 30)
Minimal Knowledge of TB	60	15%	24 (14, 30)
Facility Ownership where first sought care			
FBO	40	10%	24 (12, 30)
GOK	158	41%	14 (10, 30)
NGO	1	0%	6 (6, 6)
Private	191	49%	20 (10, 30)

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Duration between Seeking Care to Diagnosis (Health System/ Diagnostic Delay)

The median time between presenting to a health facility to diagnosis was 20 (3, 40) days. Females had a lower median health facility/diagnostic delay of 16 (3, 31) days while males had 20 (3, 40) days. Elderly people above the age of 55 years had a median delay of 9 (2, 24) days. Patients with EPTB had a median health system delay of 55 (30, 120), those with PTB +ve 17 (3, 32) days and those with PTB -ve 21 (3, 60) days. HIV-negative participants had a health system delay of 20 (3, 40) while those who were HIV-positive had 6 (2, 30) days. Health system delay was different depending on the level and ownership of the health facility where they sought care first. Participants who sought care in dispensaries (Level 2 hospital) as their first point of service and sub-county hospitals (Level 4 hospitals) had the shortest health system delay of 3 (2, 16) days and 4 (2, 30) days respectively. Those who sought care in Health centres (Level 3 hospitals) had a health system delay of 90 (17, 104) days while those in Level 5 hospitals had 27 (16, 48) days. Participants who sought TB care first in GOK facilities had a health system delay of 5 (2, 26) days, while those who went to Faith-Based Organization hospitals (FBOs) had 2 (2, 22) and those who went to private hospitals took 30 (16, 60) days. Table 3 summarizes the median health system delay/Diagnostic delay stratified by various patient and disease and health system factors

Table 3: Median Health System Delay/Diagnostic Delay Stratified by Various Patient and Disease and Health System Factors

Characteristic	n	%	Median Health System Delay
Sex			
Female	91	23%	16 (3, 31)
Male	299	77%	20 (3, 40)
Age Group			
18 – 24	98	25%	16 (3, 40)
25 – 34	137	35%	20 (4, 40)
35 – 44	98	25%	20 (3, 30)
45 – 54	35	9%	30 (4, 55)
55 – 64	10	3%	9 (2, 24)
65+	12	3%	8 (3, 22)
Marital Status			
Married	147	38%	15 (3, 32)
Single	159	41%	8 (2, 32)
Separated	48	12%	20 (4, 40)
Widowed	14	4%	20 (3, 39)
Cohabitating	22	6%	18 (3, 55)
Education Level			
None	18	5%	25 (10, 40)
Primary	148	38%	4 (2, 38)
Secondary	143	37%	15 (3, 53)
Tertiary	81	21%	20 (3, 30)
Occupation			
Business	81	21%	19 (4, 30)
Casual employment	133	34%	23 (3, 60)
Farmer	54	14%	16 (2, 38)
Formal employment	37	9%	15 (3, 30)
Student	51	13%	20 (3, 36)

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Characteristic	n	%	Median Health System Delay
Unemployed	34	9%	6 (2, 30)
Income Levels			
Below 5000	123	32%	18 (4, 40)
5001 – 10,000	107	27%	15 (2, 30)
10,001 - 20,000	85	22%	14 (3, 40)
20, 001 – 30,000	39	10%	26 (20, 30)
Above 30,000	36	9%	16 (3, 58)
HIV Status			
HIV Negative	342	89%	20 (3, 40)
HIV Positive	43	11%	6 (2, 30)
Type of TB			
PTB+	341	87%	55 (30, 120)
PTB-	25	6%	21 (3, 60)
EPTB	24	6%	17 (3, 32)
Knowledge on TB			
Good Knowledge on TB	330	85%	15 (3, 40)
Minimal Knowledge of TB	60	15%	30 (16, 53)
Facility Level where participants sought care first			
Level 2-Dispensary	11	3%	3 (2, 16)
Level 3-Health Centre	5	1%	90 (17, 104)
Level 4-SCH	166	43%	27 (16, 48)
Level 5-County referral	208	53%	4 (2, 30)
Facility Ownership where first care was sought			
FBO	40	10%	2 (2, 22)
GOK	158	41%	5 (2, 26)
NGO	1	0%	12 (12, 12)
Private	191	49%	30 (16, 60)

Factors Associated with Delay of TB Diagnosis

A delay in TB diagnosis was considered to be the overall delay (both patient delay and health system delay). The acceptable duration from the onset of TB symptoms to diagnosis was considered to be 21 days. Participants who took more than 21 days to be diagnosed with TB were considered to have delayed, while those who took 21 or fewer days were considered not to have delayed. Of the 390 participants recruited in the study, 359 (92.1%) delayed being diagnosed, while 31 (7.9%) did not delay. Sub-county, where participants sought care, was found to be strongly significant (P<0.001); 83.2% of people who sought care in Igembe South were delayed as compared to 97.4%, 96%, and 94.6% in Imenti South, Imenti North, and Igembe North, respectively. Presenting with a cough as one of the symptoms was significant (P=0.032); 100% of those with no cough were delayed in being diagnosed with TB, while 91% of those without a cough were delayed. Facility ownership where patients sought care was strongly significant (P<0.001); 85% of those who sought care in public (GOK) facilities were delayed as compared to 97.5% and 96.9% of those who sought care in private and Faith-Based Organizations (FBOs) facilities, respectively. Other factors found to be significant included; knowledge of TB transmission (p<0.001), number of visits to a health facility before a TB diagnosis was made (p<0.001), income levels (P=0.038), alcohol intake (p=0.011) and facility level where participants sought care first (p=0.008) (Table 4)

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Table 4: Factors Associated with Delay in Diagnosis of TB

Characteristics	Total (n (%))	Delay in diagnosis of TB		Test	p-value
		No (n (%))	Yes (n (%))		
Sex					
Male	299(76.7)	23(7.7)	276(92.3)	χ^2 (df=1, value=0.12)	0.734
Female	91(23.3)	8(8.8)	83(91.2)		
Age (Mean (SD))	32.9(12.0)	29.7(13.2)	33.3(11.9)	t (df=388, value=-1.59)	0.112
Marital status (Living with partner)					
No	19(8.6)	202(91.4)	221(56.7)	χ^2 (df=1, value=0.29)	0.588
Yes	12(7.1)	157(92.9)	169(43.3)		
Level of Education					
None	18(4.6)	2(11.1)	16(88.9)	χ^2 (df=3, value=1.51)	0.68
Primary	148(37.9)	12(8.1)	136(91.9)		
Secondary	143(36.)	13(9.1)	130(90.9)		
College/University	81(20.8)	4(4.9)	77(95.1)		
Employment status					
Formal Employment	37(9.5)	2(5.4)	35(94.6)	χ^2 (df=2, value=1.22)	0.543
Informal employment	268(68.7)	20(7.5)	248(92.5)		
Unemployed	85(21.8)	9(10.6)	76(89.4)		
Average Monthly Income					
Below 5000	123(31.5)	16(13.0)	107(87.0)	χ^2 (df=3, value=8.42)	0.038*
5001-10000	107(27.4)	9(8.4)	98(91.6)		
10001-20000	85(21.8)	4(4.7)	81(95.3)		
Above 20000	75(19.2)	2(2.7)	73(97.3)		
HIV Test Results					
Negative	342(88.8)	27(7.9)	315(92.1)	χ^2 (df=1, value=0.10)	0.749
Positive	43(11.2)	4(9.3)	39(90.7)		
Type Of TB					
PTB+	341(87.4)	30(8.8)	311(91.2)	χ^2 (df=2, value=2.96)	0.227
PTB-	25(6.4)	0	25(100)		
EPTB	24(6.2)	1(4.2)	23(95.8)		
Smokes					
No	282(72.3)	26(9.2)	256(90.8)	χ^2 (df=1, value=2.25)	0.134
Yes	108(27.7)	5(4.6)	103(95.4)		
Alcohol Intake					
No	245(62.8)	26(10.6)	219(89.4)	χ^2 (df=1, value=6.39)	0.011*
Yes	145(3.2)	5(3.4)	140(96.6)		
Had Cough					
No	47(12.1)	0	47(100)	χ^2 (df=1, value=4.62)	0.032*
Yes	343(8.9)	31(9.0)	312(91.0)		
Had Blood Stained Sputum					
No	362(92.8)	31(8.6)	331(91.4)	χ^2 (df=1, value=2.61)	0.107
Yes	28(7.2)	0	28(100)		

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Characteristics	Total (n (%))	Delay in diagnosis of TB		Test	p-value
		No (n (%))	Yes (n (%))		
Had Night Sweats					
No	170(43.6)	15(8.8)	155(91.2)	χ^2 (df=1, value=0.32)	0.575
Yes	220(56.4)	16(7.3)	204(92.7)		
Had Weight Loss					
No	172(44.1)	19(11.0)	153(89.0)	χ^2 (df=1, value=4.04)	0.045*
Yes	218(55.9)	12(5.5)	206(94.5)		
Had Chest Pains					
No	241(61.8)	28(11.6)	213(88.4)	χ^2 (df=1, value=11.61)	0.001*
Yes	149(38.2)	3(2.0)	146(98.0)		
Sub-county					
Igembe North	37(9.5)	2(5.4)	35(94.6)	χ^2 (df=3, value=19.99)	<0.001**
Igembe South	125(32.1)	21(16.8)	104(83.2)		
Imenti North	151(38.7)	6(4.0)	145(96.0)		
Imenti South	77(19.7)	2(2.6)	75(97.4)		
Level of facility first sought care.					
Level 2-Dispensary	45(11.5)	4(8.9)	41(91.1)	χ^2 (df=5, value=15.51)	0.008*
Level 3-Health Centre	27(6.9)	3(11.1)	24(88.9)		
Level 4-SCH	109(27.9)	17(15.6)	92(84.4)		
Level 5-County referral	16(4.1)	1(6.3)	15(93.8)		
Private Medical Clinic	86(21.1)	2(2.3)	84(97.7)		
Pharmacy/Chemist/Other	107(27.4)	4(3.7)	103(96.3)		
HF Ownership					
GOK	158(40.6)	23(14.6)	135(85.4)	χ^2 (df=2, value=17.53)	<0.001**
FBO	40(10.3)	1(2.5)	39(97.5)		
Private	191(49.1)	6(3.1)	185(96.9)		
Number of Visits Before Treatment					
1	28(7.2)	3(10.7)	25(89.3)	χ^2 (df=2, value=19.92)	<0.001**
2—3	189(48.5)	26(13.8)	163(86.2)		
More than 3	173(44.4)	2(1.2)	171(98.8)		
Knowledge of TB Causes					
No	214(54.9)	9(4.2)	205(95.8)	χ^2 (df=1, value=9.08)	0.003*
Yes	176(45.1)	22(12.5)	154(87.5)		
Knowledge TB transmission					
No	186(47.7)	4(2.2)	182(97.8)	χ^2 (df=1, value=16.34)	<0.001**
Yes	204(52.3)	27(13.2)	177(86.8)		

*p-value < 0.05

**p-value < 0.001

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Odds Ratios of Delaying to Diagnosis of TB

The factors found to be associated with the delay in diagnosis of TB were further analyzed to investigate the odds of delay in TB diagnosis. Patients treated in Imenti North Sub-county were 7.6 times more likely to delay compared to those in Igembe South (OR=7.572, 95% CI (1.723, 33.28)). People who took alcohol were 3.3 times more likely to delay than those who did not (OR=3.324, 95% CI (1.247, 8.86)). People who sought care in faith-based health facilities were 6.6 times likely to delay compared to those who sought care in public health facilities (OR=6.644, 95% CI (0.87, 50.773)), and those who sought care in private facilities were 5.3 times likely to delay (OR=5.253, 95% CI (2.082, 13.254)). Patients without knowledge of how TB is transmitted were almost 6.9 times more likely to delay in diagnosis compared to those with knowledge (OR=6.9, 95% CI (2.38, 20.24)) (Table 5).

Table 5: Odds of Delaying in Diagnosis of TB

Characteristics	Total (n (%))	Patient Delay			95%CI for OR	
		No (n (%))	Yes (n (%))	OR	Lower	Upper
Alcohol Intake						
No **(ref)**	245(62.8)	26(10.6)	219(89.4)	1		
Yes	145(3.2)	5(3.4)	140(96.6)	3.324	1.247	8.86
Average Monthly Income						
Below 5000 **(ref)**	123(31.5)	16(13.0)	107(8.0)	1		
5000-10000	107(27.4)	9(8.4)	98(91.6)	0.183	0.041	0.821
10000-20000	85(21.8)	4(4.7)	81(95.3)	0.298	0.063	1.422
Above 20000	75(19.2)	2(2.7)	73(97.3)	0.555	0.099	3.119
Weight Loss						
No **(ref)**	172(44.1)	19(11.0)	153(89.0)	1		
Yes	218(55.9)	12(5.5)	206(94.5)	2.132	1.005	4.524
Level of facility first sough care						
Level2-Dispensary	45(11.5)	4(8.9)	41(91.1)	0.398	0.095	1.667
Level 3-Health Centre	27(6.9)	3(11.1)	24(88.9)	0.311	0.065	1.481
Level 4-SCH	109(27.9)	17(15.6)	92(84.4)	0.21	0.068	0.647
Level 5-County referral	16(4.1)	1(6.3)	15(93.8)	0.583	0.061	5.567
Private Medical Clinic	86(21.1)	2(2.3)	84(97.7)	1.631	0.292	9.124
Pharmacy/Chemist/Other**(ref)**	107(27.4)	4(3.7)	103(96.3)	1		
Sub-county		No	Yes			
Igembe South **(ref)**	125(32.1)	21(16.8)	104(83.2)	1		
Igembe North	37(9.5)	2(5.4)	35(94.6)	3.534	0.788	15.839
Imenti South	77(19.7)	2(2.6)	75(97.4)	4.88	1.903	12.512
Imenti North	151(38.7)	6(4.0)	145(96.0)	7.572	1.723	33.28
HF Ownership						
GOK **(ref)**	158(40.6)	23(14.6)	135(85.4)	1		
FBO	40(10.3)	1(2.5)	39(97.5)	6.644	0.87	50.773

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Characteristics	Total (n (%))	Patient Delay			95%CI for OR	
		No (n (%))	Yes (n (%))	OR	Lower	Upper
Private	191(49.1)	6(3.1)	185(96.9)	5.253	2.082	13.254
Number of Visits Before Treatment						
1	28(7.2)	3(10.7)	25(89.3)	0.097	0.016	0.612
2—3	189(48.5)	26(13.8)	163(86.2)	0.073	0.017	0.314
More than 3 **(ref)**	173(44.4)	2(1.2)	171(98.8)	1		
Knowledge of causes of TB						
No	214(54.9)	9(4.2)	205(95.8)	3.254	1.457	7.265
Yes **(ref)**	176(45.1)	22(12.5)	154(87.5)	1		
Knowledge of how TB is transmitted						
No	186(47.7)	4(2.2)	182(97.8)	6.941	2.38	20.24
Yes **(ref)**	204(52.3)	27(13.2)	177(86.8)	1		

DISCUSSION

This study investigated the factors associated with delay in TB diagnosis and initiation of treatment among newly diagnosed TB patients in Meru County, Kenya. Patient delay was described as the number of days between the onset of TB symptoms to presentation in a health facility, and health system delay/diagnostic delay was described as the number of days between presentation in a health facility to diagnosis. Delay to diagnosis (Overall delay) was described as the number of days between the onset of TB symptoms to diagnosis. The median time to diagnosis was 40 days, with 20 (3, 40) days of patient delay and 20 (3, 40) days of health system delay. The following factors were found to be associated with the delay in diagnosis;

Sub-county/TB Control Zone where Participants Sought Care

This study was conducted in 5 out of 10 TB control zones in Meru County. There was a significant difference in the delay to diagnosis across the TB control zones. People who sought care from Igembe South were more likely to be diagnosed earlier as compared to the other TB control zones where the study was conducted. People who sought care from Imenti North were 7.52. times likely to delay being diagnosed with TB compared to those who sought care in Igembe South. Those who sought care from Imenti South and Igembe North were 4.88 and 3.53 times more likely to delay being diagnosed with TB than those in Igembe South.

Knowledge on TB

Knowledge of TB was found to be associated with delay in TB diagnosis; Knowledge of causes of TB (P=0.003) and knowledge of TB transmission (P<0.001). Participants who knew TB (Knew the causes of TB and how TB is transmitted) sought care earlier and were diagnosed earlier than those who did not. Awareness is key in advising health-seeking behaviours. Lack of awareness of TB has been linked to a delay in TB diagnosis in many studies (10,12,13).

Level of Facility where Participants Sought Fare First

The level of the health facility where participants sought care first was found to be statistically significant (P=0.008). People who sought care in Level 4 (Sub-County Hospital) had a shorter diagnostic delay than those diagnosed in Level 3 (health centres) and Level 5 hospitals (County Teaching & Referral Hospital). This can be explained by the fact that level 4 hospitals are the workstations for the sub-county TB coordinators who coordinate TB activities in the facility as well

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as the sub-county. Most of these hospitals are also well equipped with molecular TB diagnostic equipment, unlike the lower-level facilities. This finding is in line with a study conducted in Zimbabwe and another one conducted in China (14,15).

Ownership of the Facility where Participants Sought Care First

Facility ownership was strongly significant (P <0.001). People seeking care in private hospitals and FBOs are delayed more in being diagnosed with TB than those seeking care in public facilities. The Kenya National Strategic Plan for TB 2024 - 2028 identifies some of the challenges in the private sector that affect the provision of TB services including; suboptimal engagement and support of the private facilities by the National Tuberculosis, Leprosy and Lung Disease Program (NTLD-P), lack of diagnostic capacity and health care worker knowledge and capacity challenges to strengthen provision of TB services (16). This finding is in line with a study conducted in India (Konda S, Melo) and another one conducted in South Africa (17). However, the finding is contrary to a study conducted in Ethiopia that showed that visiting a private practitioner reduced the time to diagnosis (18).

Number of Hospital Visits before a diagnosis

This study found that the number of hospital visits before a TB diagnosis was made was strongly significant (P<0.001). Among the study participants, 28 (7.2%) of the participants were diagnosed after only 1 hospital visit, while 189 (48.5%) had 2 - 3 visits, and 173 (44.4%) had more than 3 visits. Participants who had more than 3 hospital visits before TB diagnosis was made were more likely to delay being diagnosed. This finding is similar to a study carried out in Indonesia involving 414 participants with TB. Multiple pre-diagnosis visit was found to be associated with a delay in TB diagnosis (19). Another study conducted in rural areas in Nigeria found that the average number of hospital visits before a TB diagnosis was made was 3 and that multiple hospital visits led to a delay in TB diagnosis (20).

Presenting TB Symptoms

The presenting TB symptoms were found to be associated with a delay in diagnosis. Participants presenting with a cough as one of the symptoms were more likely to be diagnosed early than those who did not (P=0.032). All (100%) patients with no cough were delayed in being diagnosed with TB. Among patients who were presented with chest pain and weight loss, 94.5% and 94% were diagnosed with TB, respectively. These findings are in line with other studies (21,22) but contrary to the findings of this study (23).

Alcohol Intake

Alcohol intake was associated with a delay in TB diagnosis. 96.6% of those who took alcohol were delayed as compared to 89.4% of those who did not. People who took alcohol were 3.3.24 times more likely to delay compared to those who did not. This finding is in agreement with other studies (24–26)

STUDY LIMITATIONS

The data collected did not have the exact dates for various important variables, including the onset of TB symptoms, the first visit to a health facility, and the TB diagnosis date, among others, since it was largely based on patients' reported information. This study faced a degree of recall bias as a result of participants' inability to recollect all the past events regarding the current illness. The effort to minimize the recall bias was made by recruiting patients who were diagnosed with TB in the past 1 month, whose recollection was likely to be more accurate. Further, this study was not able to address all the health system causes of delay, like shortage of human resources, capacity of the human resources, and staff attitude, among others. The study was conducted during the COVID-19 pandemic, and the effects of the pandemic might have impacted some healthcare-seeking behaviours and TB diagnoses.

CONCLUSIONS

Delay in TB diagnosis is a major challenge in Meru County. Lack of knowledge of TB, health facility capacity to diagnose TB, and the clinical

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presentation of the patient seem to be the key factors attributed to this delay. There is a need for enhanced health education in the community, strengthening the capacity of private facilities to diagnose TB and empowering the HCWs to diagnose TB irrespective of how it presents.

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Conflict of Interest Statement

The authors declare no conflict of interest

Availability of Data Statement

All data sets for this study are available from the corresponding author on request.

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