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HIGH LEVEL OF DELAYS IN TUBERCULOSIS DIAGNOSIS AND THE ASSOCIATED FACTORS IN A PASTORALIST COMMUNITY IN WEST POKOT COUNTY, KENYA.
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ABSTRACT

Background: **Delays in tuberculosis (TB) diagnosis and treatment increases the infectiousness of the disease thus sustaining transmission within the community. Therefore, timely diagnosis is critical in the prevention and control of TB.**
Objective: To assess the level of delay in TB diagnosis and the associated factors in West Pokot County, Kenya.
Methods: **This was a facility based cross-sectional study involving 208 pulmonary tuberculosis patients in the intensive phase of treatment. Interviewer administered questionnaire was used to collect data.**
Results: **There was a high level of delay in TB diagnosis. The median patient delay, health system delay and total delay were 66(IQR: 34-92), 31(IQR: 7-58) and 101(IQR: 68-137) days respectively. Majority 143(68.8%) of the respondents had a poor level of TB knowledge. The male gender and low level of TB knowledge were significantly associated with patient delay. The main reasons causing delays were misdiagnosis, long distance to the health facility and lack of awareness of the need for early diagnosis.**
Conclusion: **There was high level of delay in TB diagnosis and treatment in the study area. There is a need to raise TB awareness among community members on the importance of early diagnosis of TB. Innovative approaches such intensive case finding and mobile clinics are recommended to improve timely diagnosis in pastoralist communities.**

INTRODUCTION

Despite Tuberculosis(TB) being the oldest disease known to mankind, it remains the leading killer among the infectious diseases worldwide and the top cause of death due to antimicrobial drug resistance[1]. In 2015, 10.4 million new cases of TB and 1.4 million related deaths were reported worldwide[2]. The United Nations has set a target of ending the global TB epidemic by 2030, which is one of the Sustainable Development Goals (SDGs). Sub-Saharan Africa, which accounts for approximately

one-fourth of the total TB cases in the world, bears the greatest burden of TB. The situation is accentuated by the fact that more than 50% of TB patients are co-infected with Human Immunodeficiency Virus (HIV). Kenya, with 81, 518 TB cases and case notification rate of 217/100,000 in 2015, is ranked among the 30 countries with a high-burden of TB[2].

Early diagnosis of TB is one of the critical pillars of achieving the World Health Organisation (WHO) end TB strategy[3]. However, in different parts of the world, one of the major obstacles to TB control is delay in diagnosis and initiation of treatment [4-6]. Delays in TB diagnosis and treatment have been categorised into either patient delay, health care system delay or the sum of both which amounts to the total delay. Patient delay is defined as the number of days between onset of TB symptoms and the first contact with a professional health care provider, while system delay is defined as the number of days between patient visit to the health facility and initiation of anti-tuberculosis treatment [7-9, 10]. There is no universally accepted or single definition of prolonged or acceptable delay from onset of symptoms to diagnosis and initiation of anti-tuberculosis treatment. Some authors have defined prolonged delay as 1–2 months [8-10] while others have defined unacceptable delay as more than 14 weeks [11].

Prompt diagnosis and treatment of pastoralist TB patients remain a challenge in TB control programs in many countries in Africa, where pastoralism is a common means of livelihood [8]. A majority of the residents of West Pokot are nomadic pastoralists. However, in Kenya there is a dearth of documented studies on delays in TB diagnosis and treatment particularly amongst nomadic pastoralist communities. The aim of this study therefore was to investigate and document level of delay in TB diagnosis and the associated factors in West Pokot County.

METHODS

Study design and setting: This was a facility based cross-sectional study carried out at four health facilities in West Pokot County, between July and December 2015. West Pokot County is one of the administrative counties in Kenya and is located in the Rift Valley and lies within Longitudes 34 º 47′ and 35 º 49′ East and Latitude 10 º 10′ and 30º 40′ North. The County has a population of 512,690 people (2009 census) and an area of 9,169.4 km^2. It is less developed with poor infrastructure and the inhabitants are mainly Pokots. Approximately 80 % of the County is arid or semiarid and 60% of the inhabitants are nomadic pastoralists while the rest of the population are agro pastoralists [12]. The seasonal movement for search of water and pasture for the livestock makes the population to have least access to social amenities such as education and health services.

Study population and sampling: The study population consisted of newly diagnosed pulmonary tuberculosis (PTB) adult patient residents in West Pokot County. A total of 635 new TB cases registered in the four hospitals during the study period. However, 208 of these cases met the inclusion criteria, and were recruited into the study using purposive sampling method. The patients were distributed equally across the four hospitals.

Inclusion Criteria: Newly diagnosed adult PTB patients in West Pokot County willing to participate in the study.

Exclusion criteria: Mentally and critically ill PTB patients. Patient who had not completed 2 weeks of treatment.

Sampling and sample size calculation: Fisher's formula was used to calculate sample size. A prevalence rate of TB diagnostic delays of 92.6 % as documented

in study done among TB patient's in western Kenya[13] was used to estimate the sample size. Using this as a reference for a single proportion calculation with type 1 error of 5% and amount of discrepancy tolerated on p of 5 % the minimum required sample was:

$$N = \frac{Z^2 p(1-p)}{d^2} = \frac{(1.96)^2\ 0.926\ (1-0.926)}{(0.05)^2}$$

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Where:

- N= sample size
  =106
- Z = standard normal score at 95% Confidence interval = 1.96
- p = Prevalence proportion = 0.926
- δ = level of discrepancy tolerated = 0.05

The study population was 208 newly diagnosed adult PTB patients sampled from a total of 635 new TB cases registered during the study period. The patients were recruited using purposive sampling where every patient seen in the TB clinic during the days of recruitment who met the inclusion criteria and was willing to take part in the study was included in the study.

The patients were distributed equally across the four hospitals.

Data collection and tools: A sample survey questionnaire was used to collection data. The interviews were conducted on patients exiting the TB clinics (an exit interview). The questionnaire which contained mainly closed ended questions was pretested before commencement of data collection. Questions addressed socio-demographic characteristics, TB knowledge, different forms of care patient sought in chronological order and date of onset of TB symptoms, date of first visit to health facility, date of diagnosis. The interview lasted between 30-60 minutes.

Data Analysis: The data was analysed using Stata version 13 computer statistical software. Univariate categorical variables were analysed in frequency and percentages. The univariate continuous variables were analysed using measures of central tendency and dispersion.

The composite measure of patients' knowledge was measured by the total number of correct answers to seven questions on knowledge of TB. These included knowledge about the cause of TB, signs and symptoms of the disease, curability, mode of transmission, risk factors for TB and preventive measures. The scale was then dichotomized into two categories (good or poor knowledge) using the median as the cut-off.

Delays in TB diagnosis and treatment was estimated in days by calculating the time between the onset of the first symptom(s) possibly related to pulmonary TB to the date when the patient first contacted qualified primary health care services as a result of the symptoms. Health Provider delay was also estimated from the time of first visit to the health worker to the time TB treatment was commenced. In the present study unacceptable delay for the three types of delays were defined as follows;

Patient delay: Having cough for more than 3 weeks prior to seeking treatment from a health care facility was considered as unacceptable delay.

Health provider/system delay*:* Starting anti-tuberculosis treatment at least one (1) week after the first visit to the health care provider was considered as prolonged delay.

Total delay*:* Total delay of more than four weeks was considered as prolonged delay.

Chi square test was used to examine patient delay differences between groups on the basis of gender, age, and marital status, level of education, religion and occupation. The relationship between patient delay (the dependent variable) and the independent variables of TB knowledge, gender, age,

marital status, level of education religion and occupation were further explored using logistic regression. Statistical significance was set at P<0.05.

Ethical considerations: The research was approved by Moi University/Moi Teaching and Referral Hospital Institutional Research and Ethics Committee (IREC) (Formal Approval Number: IREC 0001349). Participants were briefed on the study and each respondent asked to sign an informed consent form without any coercion. Participants were assured of confidentiality and anonymity for any information given.

Data collection: A sample survey questionnaire administered as an exit interview was used to collect data. The questionnaire which contained mainly closed ended questions was pretested before commencement of data collection. Questions addressed socio-demographic characteristics, TB knowledge, and date of onset of TB symptoms, date of first visit to health facility and date of diagnosis.

Data Analysis: The data was analysed using Stata version 13 computer statistical software. A composite score generated from the total number of correct answers to seven questions on knowledge of TB was used to measure patients' knowledge. The score was then dichotomized into two categories (good or poor knowledge) using the median as the cut-off.

Delays in TB diagnosis and treatment was estimated in days by calculating the time between the onset of the first symptom(s) possibly related to pulmonary TB to the date when the patient first contacted a qualified healthcare provider. Health Provider delay was also estimated from the time of first visit to the health worker to the time TB treatment was commenced. In the present study unacceptable delay for the three types of delays were defined as follows;

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Total delay: Total delay of more than four weeks.

Chi square test was used to examine patient delay differences between groups. The relationship between patient delay (the dependent variable) and the independent variables of TB knowledge, and social-demographic characteristics were further explored using logistic regression. Statistical significance was set at P<0.05.

Ethical considerations: The research was approved by Moi University/Moi Teaching and Referral Hospital Institutional Research and Ethics Committee (IREC) (Formal Approval Number: IREC 0001349). Participants were briefed on the study and each respondent asked to sign an informed consent form without any coercion. Participants were assured of confidentiality and anonymity for any information given.

RESULTS

Socio-demographic characteristics of the respondents: Out of the 208 respondents the majority (63.5%) were male. The respondent's age ranged from 18-78 years with mean age of 38.8(SD+ 16.1years). The median age was 36 (IQR 27-50). Other characteristics of the respondents are shown in Table 1.

Table 1
Socio-demographic characteristics of 208 TB patients in West Pokot County

Variables	Male n=132 n (%)	Female n=76 n (%)	Total n=208 n (%)
Age group			
18-20	17(12.9)	13(17.1)	30(14.4)
21-30	29(22)	21(27.6)	50(24)
31-40	29(22)	16(21.1)	45(21.6)
41-50	23(17.4)	14(18.4)	37(17.9)
>50	34(26.7)	12(15.8)	46(22.1)
Religion			
Christianity	103(78)	66(86.8)	169(81.3)
Muslim	8(6)	4(5.3)	12(5.7)
No religion	21(16)	6(7.9)	27(13)
Level of education			
No formal education	60(45.5)	25(32.9)	85(40.9)
Primary	44(33.3)	30(39.5)	74(35.6)
Secondary	28(21.2)	21(27.6)	49(23.5)
Marital status			
Married	85(64.4)	40(52.6)	125(60.1)
Single	32(24.2)	24(31.6)	56(26.9)
Divorced/windowed	15(11.4)	12(15.8)	27(13)
Occupation			
Pastoralists	69(52.3)	35(46.1)	104 (50)
Self-employed	25(18.9)	15(19.7)	40(19.2)
Employed	23(17.4)	14(18.4)	37(17.8)
Others	15(11.4)	12(15.8)	27(13)

Level of knowledge on tuberculosis: Responses to questions on cause, symptoms, curability, transmission, prevention and risk factors of tuberculosis were used to calculate a composite score of level of knowledge. The score was calculated by allocating one point to every correct response. The total score was 17 points. The knowledge score ranged from 1-15 with a mean of 7.3(SD 2.8). Scores above 8 were considered good level of knowledge and those with a score below 8 were considered to have poor knowledge. Slightly less than a third of the respondents 65(31.2%) had a good level of knowledge while 143(68.8%) had a poor level of knowledge.

Only 50(24%) of the respondents attributed germ/bacteria as the causative agent of TB. The majority of the respondents 73(35%) thought that TB was caused by smoking and drinking. Other causes of TB identified by the respondents were dust 43(21%), cold air 34(16%), curse 8(4%), and food shortage 5(2.4%). A minority of the respondents 10(5%) thought that TB was inherited. Hard labour, trauma, sharing a room with goats, dirty environment were also identified by respondent as possible causes of TB.

When asked about the symptoms of TB a majority of the respondents, mentioned chest pain 87(42%), weight loss 65(31%), cough 60(29%), bloody sputum 40(19%), fever and night sweat 31(15%). A small

percentage 10(5%) were unfamiliar with any of the TB symptoms.

The majority of the respondents 158(76%) were aware that TB is transmissible while 28(13%) indicated that TB could not be transmitted and 22(11%) were not sure. The majority of the respondents 91(44%) indicated that TB is transmitted through coughing sneezing and breathing, while 72(35) indicated that TB is spread through sharing of utensils and sexual contact with patients 19(9%).

The majority of respondents 202(97%) were aware that TB is curable. On preventive measures, the majority of the respondents 40.7(81) said they should avoid sharing cups with a TB patient. Other preventive measures suggested were avoiding spitting carelessly 31(15%), having a separate room for a patient 34(16%) and early treatment for affected patients 40(19%).

Length of delay in TB diagnosis

The three types of delay in TB diagnosis and treatment were estimated in days (Table 2)

Table 2

Delay in TB diagnosis among 208 new cases of pulmonary tuberculosis in West Pokot County in Kenya

Type of delay	All patients N=208	Male n=136	Female n=76	p value
Patient delay in days				
Mean (95% CI)	72(64-80)	79(71-88)	60(44-75)	*0.01
Median	66	77	48	**0.002
IQR	34-92	45-102	15-75	
System delay in days				
Mean (95% CI)	38(32-43)	31(25-37)	49(40-59)	*0.001
Median	31	26	40	**0.02
IQR	7-58.5	6-43	26-67	
Total delay in days				
Mean (95% CI)	110(101-119)	111(100-121)	109(92-127)	*0.89
Median	101	103	96	**0.54
IQR	68-137	74-138	59-136	

**P value based on t test for mean comparison.*

***P value based on Bootstrap test for median comparison*

IQR -Interquartile range.

Patient delay: The majority of patients 140(81.7%) experienced patient delay. The study revealed a mean patient delay of 72 days with a median of 66(IQR: 34-92). The delay was significantly higher among males, with male patient delay being 79 days compared to 60 days for females.

System delay: The mean health system delay was 38 days with a median of 31 (IQR: 7-58). In the majority 156 (75%) of the respondents there was unacceptable health provider delay. The system delay was significantly

higher among females (49 days) compared to males (31 days).

Total delay: The mean total delay was 110 days with a median of 101(IQR: 68-137) days. There was no significant difference in the total delay among male and females, however the majority of the patients 192(92.3%) had an overall unacceptable total delay of more than one month.

Factors associated with patient delay: Sociodemographic characteristics associated with patient delay were determined using chi square test. Both the gender χ^2 =14.2; p= <0.001 and level of TB knowledge χ^2 =5.6; p= 0.01 of the respondent were significantly associated with patient delay. The age, marital status, religion and the occupation of the patient had no association with the patient delay.

After adjusting for confounding factors, poor tuberculosis knowledge (AOR=2.27; p=0.04) and the being male (AOR=3.96; p=0.001), were associated with patient delay (Table 3).

Table 3

Adjusted Multivariate Logistic Regression model for factors associated patient delay

	Patient delay			
Variables	AOR	SE	95%CI	P-value
Level of TB knowledge				
Good	Ref			
Poor	2.27	1.0	1.1-0.5.48	**0.04**
Sex				
Female	Ref			
Male	3.96	1.63	1.76-8.90	**0.001**
Age				
18-20	Ref			
21-30	1.19	0.84	0.30-4.73	0.79
31-40	2.75	2.29	0.54-14.1	0.22
41-50	1.28	1.15	0.22-7.44	0.78
>50	1.16	1.02	0.21-6.56	0.86
Religion				
Christian	Ref			
Muslim/No religion	0.72	0.24	0.24-2.14	0.55
Level of education				
No education	Ref			
Primary	1.15	0.66	0.37-3.55	0.81
Secondary and college	1.88	1.29	0.48-7.27	0.36
Marital status				
Currently married	Ref			
Single	0.57	0.32	0.19-1.73	0.32
Windowed/divorced	0.73	0.47	0.20-2.62	0.63
Occupation				
Pastoralists	Ref			

Businessman	0.57	0.33	0.17-1.83	0.34
Formal employment	1.26	0.92	0.29-5.32	0.75
Others	**0.88**	**0.67**	**0.19-3.92**	**0.86**

DISCUSSION

To the best of our knowledge this is the first study to document TB delays among pastoralist's communities in Kenya. The study revealed a median total delay of 101 days (IQR: 68-137). The WHO treatment guidelines recommend that anyone with a cough lasting more than two weeks should have their sputum tested for TB [14] and therefore, the observed delay is unacceptably high. The findings are of great public health concern due to the risk of TB transmission in the community.

The median delay in the present study compares to that of studies done in Mozambique(150 days)[15],Tanzania(136 days)[16], Uganda(112 days) [17], Ghana(104 days)[18]. However, this median delay was much higher than the delay observed in Kenya in a referral hospital setting (44 days) [13]. The difference may be attributed to the fact that the diagnosis of TB may be faster in a referral hospital setting owing to high expertise and better diagnostic facilities compared to the County and Sub-Counties hospitals used in the current study. The delay in the present study was also higher compared to studies in other African countries such as Ethiopia(45 days)[19],South Africa(60 days)[20] and Malawi(80 days)[21]. This may be due to the fact that the present study was done in a pastoralist community who are marginalized with poor access to TB services.

In the present study, mean patient delay of 72 days was almost 2-fold of the system delay of 38 days. This is in agreement with other studies done in Kenya [13], Ethiopia [19],Tanzania [16] that showed longer patient delay compared to system delay. Having health providers who are well equipped with appropriate knowledge, skills and availability of suitable diagnostic facilities is likely to shorten provider delays and vice versa. However, it is important to note that where a TB patient presents early for diagnosis (short patient delay), the patient may only have vague symptoms [16] and therefore sputum smear microscopy may not be requested. Similarly, in early stages of the disease, smear microscopy may not yield positive results leading to misdiagnosis thus longer provider delay. However, longer patient delays lead to patients presenting themselves with advanced stages of the disease and diagnosis is unlikely to be missed [8] hence short provider delay. Hence, longer provider delay may not always reflect the inefficiency of the health system.

This study asserts that being knowledgeable about TB was associated with shorter patient delay. The results affirm other studies that showed that gaps in knowledge on transmission, treatment, and prevention leads to diagnostic and treatment delays among people living with TB [8, 15, 22]. Similarly a study done in Ethiopia, found that lack of awareness of TB contributed to late presentation of suspected TB patients in the health facility [23]. The current study reveals that the majority (68.8%) of the patients had poor level of TB Knowledge and only 19% of the respondents thought that early treatment was important in the control of TB. This is despite the fact that these were patients who were already receiving treatment and should have received TB education at the health facility. This implies that TB knowledge at the community level is even poorer. The

respondents had misconceptions on the cause and prevention of TB. They attributed the cause of TB to factors such as smoking, drinking alcohol, exposure to cold air, dust, hard labour and sharing utensils with TB patients. Similarly, a sizeable number (5%) of respondents thought that TB was hereditary. This may be due to the fact that TB is an airborne illness, which often spreads amongst people living in close proximity and therefore may seem to affect people from the same families. The misconceptions about the cause of TB may affect the kind of preventive methods adopted by the community members. Improving community's knowledge on TB is therefore an essential component in the TB Control strategy as it shapes their health seeking behaviour thus reducing delays in diagnosis and treatment [24].

In the present study, total delay was not significantly different between males and females. This is consistent with other studies done in Tanzania[16] and Ghana[18].

Concerning patient and health system delays the current study found a significant difference between men and women where men experienced longer patient delays compared to women. This is consistent with other studies done in Uganda [17] and South Africa [20]. The longer patient delay among men may be a contributing factor to the higher burden of TB among men compared to women. Conversely, the mean system delay was significantly higher for women compared to that of men. Thorson argued that longer diagnostic delays among women may be attributed to biological differences in symptom presentation between male and female making a suspected female TB patients at risk of not getting suitable diagnostic investigations, on the basis of being a woman[25].

The current study had some limitations, one of them being dependence on patients' self-report on delays in seeking treatment. Self-report may not be correct as it is impacted by social desirability bias. The study also depended on the ability of individuals to recall past events. To reduce the recall bias only newly diagnosed patients were included in the study.

In conclusion delays in TB diagnosis was high in the study area. Innovative approaches such as intensive case finding are recommended to improve timely diagnosis. In addition, there is clearly a need to raise TB awareness in the community to expel the misconceptions held about TB by community members. Innovative approaches such as intensive case finding and mobile clinics are recommended to improve timely TB diagnosis in pastoralist communities.

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AUTHORS' CONTRIBUTIONS

GM: The article being part of her PhD work, was responsible for the conceptualization, design, data collection and analysis, drafting of the manuscript and revising the final version of the manuscript.

CO, TO: Being PhD supervisors provided guidance in every stage of the study design to implementation, revised the draft and approved the final version of the manuscript.

HDN: Provided guidance in the design of the study, revised the draft and approved the final version of the manuscript.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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