



The magnitude of health care seeking delay and associated factors for tuberculosis suggestive symptoms in Sidama Region Ethiopia: Community-based cross-sectional study

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ABSTRACT

Background: Health care seeking delay for tuberculosis suggestive symptoms is a great challenge for controlling the disease. Therefore, the study aimed to determine the magnitude and identify factors associated with delayed healthcare seeking among presumptive tuberculosis cases for suggestive tuberculosis symptoms.

Methods: A community-based cross-sectional study was conducted among 476 subjects with symptoms suggestive of tuberculosis. Data were collected using a structured questionnaire, entered into Epi-data software version 3.1, and exported to SPSS software version 25.0 for analysis. The multivariable logistic regression models included variables like sex, marital status, knowledge, education level, and distance from health facility that show a significant association with health care seeking delay in the binary logistic regression at a P value 0.25. Tables, graphs, and charts were then used to display the results.

Result: The proportion of delayed health care seeking was found to be 46.7 % (95 % CI, 43.5–48.9). The study also revealed that being married, not attending formal education, having a lower monthly income, and having poor knowledge of tuberculosis were significantly associated with delayed tuberculosis-suggestive symptoms.

Conclusion: In this study, delays in health care seeking among TB-suspected patients were high compared to the Ethiopian Ministry of Health target. Different systems should be built to increase community awareness of health care.

1. Introduction

Tuberculosis (TB) is a highly communicable and curable disease that is a significant cause of illness and death worldwide [1]. According to the World Health Organization (WHO) 2022 report, globally, an estimated 10.6 million people developed TB disease in 2021. Among them, a high number of cases were reported in men and productive age groups [1].

In African countries, TB is a significant health concern [2]. Despite the fact that Sub-Saharan Africa makes up only 12 % of the entire population of the globe, it contributes 29 % of TB cases and 254,000 deaths [3]. Timely screening of presumptive tuberculosis cases in the community minimizes the spread of the disease by reducing the period between the onset of symptoms and the start of treatment [4,5]. Several factors have been suggested as the cause of health care seeking delays

[6]. Reports reflect that health care seeking delays differ from place to place due to differences in social, cultural, health system structure, and economic factors [7].

In Sub-Saharan Africa, taking appropriate action after observing signs and symptoms of TB is a key challenge in the control of tuberculosis [6]. Despite ongoing efforts to raise community awareness of tuberculosis transmission, treatment, and prevention, patients with progressive symptoms in high-TB-burdened countries like Ethiopia suggest that there is a delay in seeking health care [8–10]. Findings from different African countries indicated that in the African region, prolonged patient healthcare seeking delay was observed [11,12]. In Ethiopia, patient delays ranging from 49.1 % to 62.3 % in Hadiya and North Wollo zones, respectively, were reported [13,14]. Insufficient awareness among the community regarding the risks associated with delaying healthcare and the importance of utilizing local medical

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facilities were identified as key factors contributing to the delay in seeking care [15]. Research findings have demonstrated that community-based patient management has a positive impact on both the cure rate and sputum conversion rate in the treatment of certain diseases [16].

The burden of tuberculosis disease in Ethiopia is immense, which is among 30 countries with a high TB burden [17]. and the TB case detection rate is very low compared to the World Health Organization's (WHO) aim of discovering all infectious TB cases in order to achieve a 4.5–5 % annual reduction in TB incidence [16,17]. Moreover, according to a recent global report about 32 % of TB cases from estimated new cases may not have been diagnosed and properly treated in Ethiopia [2].

Though knowing patient delay in a community brings enormous benefits to controlling TB, most studies conducted in Ethiopia are facility-based [17]. As a result, this community-based study provides additional information about the community, the status of health care seeking delays, and associated factors. Knowing several factors that contribute to the health care delay will be important to taking different actions both at the government and community level to reduce the burden of TB in the country. Therefore, the aim of this study is to determine the magnitude and recognize factors that contribute to the delay in seeking health care for TB-suggestive symptoms.

2. Material and methods

2.1. Study setting and period

This study was done from July 1–November 1, 2022, in Hawassa Zuria District, Sidama Regional State, Ethiopia. Hawassa Zuria district is located 273 km south of both Addis Ababa, the capital of Ethiopia, and Hawassa City, the capital of Sidama Regional State. According to the region report, in the district, there are 23 kebele, with a total population of 175,890. A kebele is the smallest administrative unit in Ethiopia. There is one general hospital serving the catchment population and five health centers in the district. The health center provides diagnosis and treatment services. In each kebele, health posts are allocated for serving 250–5000 people. Health Extension workers provide health education to the community during their respective visits.

2.2. Study design

A community-based cross-sectional study was conducted from July 1–November 1, 2022.

2.3. Study subject

The study population for this study was all study site residents aged 15 and older who were identified for TB-suggestive symptoms by home visits.

2.4. Eligibility criteria

All presumptive TB cases aged ≥ 15 years were screened for TB-suggestive symptoms. Severely ill individuals who could not answer the questions and unwilling participants were excluded from the study.

2.5. Sample size determination

The sample size for the first objective was decided using the single population proportion formula by taking p , the proportion of patients delayed for more than or equal to 30 days in the Hadiya zone of the SNNP region ($P = 49.1\%$) [13]. The sample size calculated based on the following assumptions was a 5 % margin of error (d) and a 95 % confidence interval, so the required sample size is 384. The expected total number of presumptive TB cases in the study area within one month from the previous month's report of the district health office is 1030,

which is less than 10,000, or $n/N > 0.05$. So it is possible to use a correction formula. The calculated sample size was 288.

The design effect was used since our sampling involves clusters (Kebeles).

$$288 * 1.5 = 432$$

$$\text{Final } n = 432 + 10\%(432) = 476$$

2.6. Sampling procedures

Among the 23 kebele in the district, 8 kebeles were randomly selected for the survey. The sampling frame was separately prepared for each kebele. The sample size was allocated proportionally to each kebeles. Consecutive sampling methods were used until the required sample size was attained.

2.7. Variable of the study

The dependent variable is health care seeking delay (delay for more than 30 days) for tuberculosis-suggestive symptoms. The independent variables are socio-demographic and socio-economic variables, health-seeking behavior, and clinical factors, knowledge related to TB disease factors, stigma related to TB disease factors, health service-related factors, and distance to a health facility.

2.8. Data collection and data quality control procedure

Data on demographic and clinical information was collected using pre-tested and structured questionnaires. The interview questionnaires were translated into the Sidamic language (Sidaamu Afoo). The interview questionnaire was adapted from similar studies in Ethiopia and Kenya [18] and was pretested in the Tula district, which is one of the neighboring Sidama zone districts, before the actual data collection. The data collection was conducted by trained health professionals. After the pre-test, a discussion was held with supervisors and data collectors. The corrective measure was taken to address the problems seen. The actual data collection process was strictly supervised. The supervisors monitored the activities of each data collection process concurrently with the data collectors to increase trustworthiness. Data collectors visited house to house to gather data. When participants were not found during the first visit, two more subsequent visits were made before excluding them from the study. Major symptoms that are used for screening TB patients were used as a starting point for symptom onset. The duration of the delay was calculated afterward.

2.9. Data processing and analysis

Data were coded and entered in Epi Data version 3.1 statistical software and exported into Statistical Package for Social Science (SPSS) version 25. Frequencies and percentages were calculated for all variables. To identify independent variables and adjust their association with health care-seeking delay, we used the Likelihood ratio and Wald's tests. Model fitness was checked by Hosmer Lemeshow goodness-of-fit test and multicollinearity were checked using the variance inflation factor (VIF), considering < 10 for all variables. Based on Hosmer and Leme's applied logistic regression model, variables that show a significant association with health care seeking delay for TB in the binary logistic regression at a P value ≤ 0.25 were included in the multivariable logistic regression models. We reported crude and adjusted odds ratios. The level of statistical significance was set at a 95 % confidence interval. A p -value of less than 0.05 was considered to be statistically significant. Finally, the result was presented using tables, figures, and statements.

2.10. Operational definition of terms

Presumptive TB case is an individual who responds yes to at least one of the symptoms listed in the WHO standard TB screening tool [19],

TB suggestive symptoms - The following symptoms were considered TB suggestive symptoms: Cough lasting longer than 2 weeks, fever and night sweat, loss of weight, chest pain, shortness of breath, coughing sputum that is blood stained (hemoptysis) any one of these symptoms was considered when estimating the length of health care-seeking delay [19].

Health care seeking delay Is the time interval from the appearance of the first symptoms of tuberculosis until the first visit to any formal health care facility that provides diagnosis and treatment services (health centers and hospitals). Most of the study has been dichotomized as >30 days as a prolonged delay [10].

3. Result

3.1. Socio-demographic characteristics of the participants

From 476 health care-seeking delay cases, data from 469 were analyzed. Seven presumptive TB cases were excluded due to the incompleteness of the data. Around 255 (54.4 %) of the participants were males. The median age of the respondents was 27 years. Among the study participants, the majority, 197 (42 %), were within the age range of 15–24 years. Around two hundred eleven (45 %) of the participants were followers of protestant Christians. Regarding income and occupation, 274 (58.4 %) earn <2000 ETB, and 86 (18.3 %) participants were employed, respectively (Table 1). The majority of participants lived in rural areas. The median travel time from their living place to the health facility was 30 min on a one-way trip.

Table 1
Socio-demographic characteristics of the study participants in Hawassa zuria district, Sidama region. (n = 469).

Variable	Category	Frequency	Percentage
Age	15–24	197	42.0
	25–44	178	38
	>44	94	20.0
Sex	Male	255	54.4
	Female	214	45.6
Religion	Orthodox	191	40.7
	Protestant	211	45.0
	Muslim	44	9.4
	Other	23	4.9
Educational status	Not educated	107	22.8
	Primary	185	39.4
	Secondary and above	177	37.7
Marital status	Single	161	34.4
	Married	274	58.4
Residence	Widowed/Divorced	34	7.2
	Urban	156	33.3
	Rural	313	66.7
Occupation	Employed	86	18.3
	Unemployed	129	27.5
	Daily laborer	43	9.2
	Student	85	18.1
	Farmer	42	9.0
	Merchant	84	17.9
Income	<2000 ETB	287	61.2
	2000-4000 ETB	107	22.8
	>4000ETB	16	3.4
Family size	≤3	117	24.9
	3–5	235	50.1
	>5	117	24.9
Distance to HF	<30 min	274	58.4
	30–60 min	117	24.9
	>60 min	78	16.6
	>60 min	78	16.6
Means of transportation to HF	Bicycle	62	13.2
	Walk	242	51.6
	other Vehicle	165	35.2

3.2. Health care seeking for TB symptoms

Among all study participants, 219 (46.7 %) perceived they were late for health care services. Among them, 156 (33.3 %) and 55 (11.7 %), respectively, suggest the reason for their delaying by thinking that the illness is self-limited and lack of money. Two or more symptoms were observed at the start of the illness. Weight loss in 102 (21.7) and coughing in 90 (19.2 %) were commonly reported symptoms (Table 2). About 219 (46.7 %) of the respondents delayed treatment for more than 30 days and sought treatment after they manifested signs and symptoms of tuberculosis. While the remaining 53.3 % visited health facilities within 30 days of developing the symptoms (Fig. 1).

3.3. Knowledge of TB disease, services in public health facilities

In this study, different variables measuring the knowledge of the respondents were assessed. People were considered to have good knowledge if their knowledge score was higher than the mean value. If the respondents' scores fell below the mean level of knowledge, they were considered to have poor knowledge. 258 (55 %) of the total participants had little awareness about TB illnesses and the services offered for TB at the hospital. The remaining 211 (45 %) of the respondents showed above-average knowledge scores about TB diseases and the services provided for TB in health facilities.

3.4. Perceptions of TB disease

Regarding the perception of respondents about TB, more than one-third (176, or 37.5 %) of the respondents perceived that TB cannot be transmitted from one person to another. One hundred forty-seven (31.3

Table 2
Health care seeking behavior of respondents for the first TB symptoms, Hawassa, Zuria Woreda, 2022.

Variable	Category	Frequency	Percentage
Major symptoms manifested before seeking care at health facility	Cough	90	19.2
	Haemoptysis/coughing blood	53	11.3
	Fever	50	10.7
	night sweats	45	9.6
	Chest pains	48	10.2
	Weakness/fatigue	39	8.3
Did you suspect that you had TB?	Weight loss	102	21.7
	Shortness of breath	42	9
	Yes	188	40.1
Length of stay with symptoms before seeking care at health facility	No	281	59.9
	</ = 30 days	250	53.3
Reasons for delay in seeking care/treatment at the health facility	>30 days	219	46.7
	Symptoms would improve	156	33.3
What are your reasons for the consultation of HCW?	Was on medication from Pharmacist	54	11.5
	Was taking herbs prescribed by herbalist	55	11.7
	Was on medication from a private clinic	47	10.0
illnesses other than TB (comorbidities)	Did not have money to go to the health center/hospital	55	11.7
	Was working/did not have time to go to a health facility	102	21.7
What are your reasons for the consultation of HCW?	Yes	59	12.6
	No	410	87.4
What are your reasons for the consultation of HCW?	Illness got worst	308	65.7
	Advised by family members	103	22.0
What are your reasons for the consultation of HCW?	Enlightened through community awareness	58	12.4

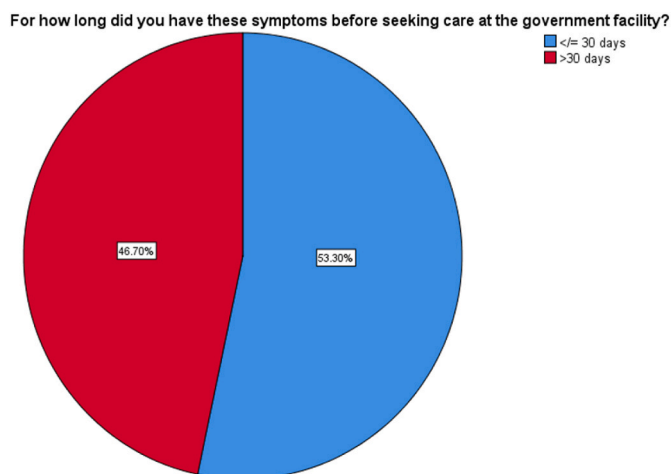


Fig. 1. Length of time (days) before seeking care at health facilities by respondents suggestive of TB, Hawassa Zuria district, 2022. (n = 469).

% of respondents perceived that TB is not a dangerous disease, while 175 (37.3 %) perceived that TB is a dangerous disease. More than half (53.1 %) of the respondents perceived that proper TB treatment could be obtained from a health center or hospital. About 206 (43.9 %) of the respondents perceived that there is a complete cure for TB (Table 3).

3.5. Stigma towards TB patient

We used seven items to assess stigma related to TB patients. The result was computed to get the overall level of stigma. The mean score of the seven items was calculated, and respondents who scored below the mean were considered not subject to stigma, while those who scored above the mean were considered stigmatized due to their positive status with TB. According to this study, about 43.9 % of the respondents were stigmatized due to their TB status.

3.6. Factors associated with delayed health care seeking of TB patients

We performed a multivariable analysis using variables that exhibit a strong correlation with the delay in seeking health care in binary logistic regression. Men, no schooling, being unmarried, a monthly salary of at least 4000 Ethiopian Birr, and a high level of knowledge were the reference variables. From the multivariable logistic regression analysis, female sex, lower average monthly income, lower educational level, marital status, being married, and poor knowledge about TB showed a significant association with delayed health care seeking for suggestive TB. The odds of delayed health seeking were 2.74 times more likely among female patients than male patients [AOR: 2.74, 95%CI

Table 3
Perceptions of respondents about TB disease, Hawassa zuria district, Sidama region. (n = 469).

Variable	Category	Frequency	Percentage
TB can transmit from one person to another	Yes	322	68.7
	No	147	31.3
TB is considered very dangerous	Not dangerous	147	31.3
	Dangerous	175	37.3
	Slightly dangerous	147	31.3
Tb can be completely cured	Yes	263	56.1
	No	206	43.9
Proper TB treatment are obtained at	Drugstores	59	12.6
	Private Clinic	59	12.6
	Health Centre/ Hospital	249	53.1
	Traditional Healer	58	12.4
	Herbalist	44	9.4

(1.80–4.17)]. Married participants were 4.15 times more likely to delay seeking treatment than patients who were unmarried or single [AOR: 4.15, 95%CI (3.39–6.32)]. Participants who did not have formal education were 6.63 times more likely to be delayed than those who had attended secondary and beyond [AOR: 6.63, 95%CI (4.15–7.79)]. The participants who had a monthly income below 2000 ETB were 2.07 times more likely to be delayed in seeking health care for suggestive TB than those who had a monthly income greater than 4000 ETB [AOR: 2.07, 95%CI (1.19–3.59)]. Participants with poor knowledge regarding TB were 1.85 times more likely to be delayed in seeking health care for suggestive TB than those with good knowledge about TB [AOR: 1.85, 95%CI (1.24–2.75)] (Table 4).

3.7. Discussion

This study assessed the magnitude of delay in seeking health care among patients who showed signs and symptoms of tuberculosis. The result shows that 46.7 % (95 % CI: 43.5–48.9) of respondents sought delayed health care. Different socio-demographic and economic characteristics and knowledge levels of the respondents were identified as independent predictors of delayed health care-seeking among patients manifesting signs and symptoms of TB. The prevalence of delayed healthcare seeking observed in the current study is similar to the study findings of the Tigray Region, Ethiopia, and Tanzania [12,20]. Though the prevalence of this study is lower than the study from the Bale and Wollo Zones of Ethiopia, which is 96 % and 62.3 % [12,21]. This disparity might be due to socioeconomic and demographic differences, like cultural background, religion, and education status. Differences in the living standards of the participants, study time, and design differences.

In this study, a high proportion of delays were observed among female participants. The study findings were similar to those of the study conducted in Tanzania [11]. This could be due to males' high decision-making power in the study area and less awareness of the disease by women due to a lack of enough knowledge. However, in contrast to this study, the findings of a study conducted in India showed female participants visited health facilities in a shorter time than male participants [6]. This difference might be due to differences in the level of awareness and knowledge about TB disease [14].

Our study findings revealed that married participants were delayed more than single participants. This may be due to most married people spending most of their time at work to get money to support their family while ignoring their illness. The report from Cameron also showed that the person who is responsible for taking care of the family showed a higher delay in seeking health care than others [22]. The findings of this study also contradict those of a study in Tanzania, in which the healthcare-seeking behavior of married couples was similar to that of divorced and single people [11].

The findings of this study revealed that individuals with low monthly incomes showed high delays in seeking health care. Our study findings are in line with those of Nepa [23] and Laos [24] This may be due to low-monthly income participants being involved in different activities for a long time; they might not get enough time to visit health facilities. Most of the time, they go to health facilities when the disease gets worse.

The study findings also indicated poor knowledge about TB disease risk factors for healthcare delay. Participants with good Tb knowledge are less likely to delay after observing signs and symptoms of TB disease since they know the means of Tb transmission and the consequences of untreated TB cases. The findings of this study are similar to those from North Wollo, Ethiopia [14].

The limitation of this study is the failure to use qualitative data collection methods like focus group discussion to deeply understand the community's perception. In addition to that laboratory diagnosis of suspected cases was not done. The study was conducted in one region which was difficult to make a firm conclusion.

Table 4

Factors associated with delayed health care seeking of TB patients, Hawassa zuria district, Sidama region. (n = 469).

Variable	Category	Health care seeking status		COR (95%CI)	AOR (95%CI)	P-value
		Not delayed	Delayed			
Sex	Male	152	103	1	1	
	Female	98	116	1.74 (1.2–2.5)	2.74 (1.80–4.17)	0.000
Level of Education	None	25	82	6.08 (3.5–10.48)	6.63 (4.15–7.79)	0.000
	Primary	110	75	1.26 (0.82–1.93)	0.90 (0.59–1.39)	0.646
	secondary and above	115	62	1	1	0.000
Marital status	Single	115	46	1	1	0.002
	Married	110	164	3.72 (2.45–5.66)	4.15 (3.39–6.32)	0.001
	Widowed/Divorced	25	9	1.79 (0.92–2.08)	1.85 (0.70–4.86)	0.215
monthly income	<2000 ETB	124	153	2.46 (1.41–4.15)	2.07 (1.19–3.59)	0.010
	2000-4000 ETB	42	42	1.37 (0.73–2.55)	2.16 (0.81–3.97)	0.115
	>4000ETB	24	24	1	1	0.023
Travel time from home to the health facilities	<30 min	149	125	1	1	0.535
	30–60 min	55	62	1.34 (0.87–2.07)	1.12 (0.70–1.81)	0.632
	>60 min	46	32	0.83 (0.50–1.38)	0.79 (0.45–1.38)	0.398
Knowledge	Poor knowledge	104	154	0.3 (0.20–0.44)	1.85 (1.24–2.75)	0.002
	Good knowledge	1466	65	1	1	

4. Conclusion and recommendation

According to this study, a significant delay in seeking healthcare was observed among individuals suspected of having tuberculosis (TB). Approximately half of the individuals with suspected pulmonary TB exhibited a delay in seeking healthcare at public health facilities. Several factors were found to be significantly associated with this delay, including being female, having lower educational attainment, having lower income levels, being married, and having poor knowledge about TB. The community should be sensitized to seeking appropriate health care as early as possible. The sensitization programs should take into consideration different groups in a society, such as women, the illiterate, and the economically poor, by using culturally convenient media of communication to ensure that the whole community is reached. Health education sessions should be designed and provided to enhance accurate awareness dissemination on symptoms, medication options, and the curability of TB in the community.

Authors' contributions

Conceptualization: BJ, GD, DH Data curation: BJ Formal analysis and methodology: BJ, GD, DH.

Investigation: BJ, Supervision: DH.

Writing, review & editing: BJ, GD, DH.

BJ- Prepared the manuscript.

Ethical approval

Ethical clearance was obtained from the Ethical Review Committee of Pharma College Hawassa Campus. Permission letters were also obtained from the Sidama regional status, Hawassa zuria district health office, and the respective health facilities. Informed verbal consent was obtained from each participant.

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Declaration of competing interest

The authors declare that there is no competing interest. Women and children empowerment organization only supported the data collection. The funder has no role in methodology, writing and publication.

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References

- [1] Organization WH. Global Tuberculosis Report 2022. Geneva: World Health Organization.
- [2] O. Uwishema, R. Badri, H. Onyeaka, M. Okereke, S. Akhtar, M. Mhanna, B. Zafar, A. Zahabioun, K.A. Said, M.R. Tovani-Palone, Fighting Tuberculosis in Africa: the Current Situation amidst the COVID-19 Pandemic, 2022, <https://doi.org/10.1017/dmp.2022.142>.
- [3] A. Zumla, M. Rao, E. Dodoo, M. Maeurer, Potential of immunomodulatory agents as adjunct host-directed therapies for multidrug-resistant tuberculosis, *BMC Med.* 14 (1) (2016) 1–12, [https://doi.org/10.1016/s1473-3099\(16\)00086-4](https://doi.org/10.1016/s1473-3099(16)00086-4).
- [4] A.K.J. Teo, S.R. Singh, K. Prem, et al., Duration and determinants of delayed tuberculosis diagnosis and treatment in high-burden countries: a mixed-methods systematic review and meta-analysis, *Respir. Res.* 22 (2021) 251, <https://doi.org/10.1186/s12931-021-01841-6>.
- [5] K.S. Veesa, K.R. John, P.K. Moonan, S.P. Kaliappan, K. Manjunath, K.D. Sagili, et al., Diagnostic pathways and direct medical costs incurred by new adult pulmonary tuberculosis patients prior to anti-tuberculosis treatment—Tamil Nadu, India, *PLoS One* 13 (2) (2018), e0191591, <https://doi.org/10.1371/journal.pone.0191591>.
- [6] S. Makgopa, S. Madiba, Tuberculosis Knowledge and Delayed Health Care Seeking Among New Diagnosed Tuberculosis Patients in Primary Health Facilities in an Urban District, South Africa, 2021, <https://doi.org/10.1177/117863292111054035>. Health Services Insights.
- [7] F. Getnet, M. Demissie, A. Worku, T. Gobena, B. Seyoum, R. Tschopp, C. T. Andersen, Determinants of patient delay in diagnosis of pulmonary tuberculosis in Somali pastoralist setting of Ethiopia: a matched case-control study, *Int. J. Environ. Res. Publ. Health* 16 (18) (2019 Sep 12) 3391, <https://doi.org/10.3390/ijerph16183391>. PMID: 31547479; PMCID: PMC6765848.
- [8] W. Laohasiriwong, R.K. Mahato, R. Koju, K. Vaeteewootacharn, Delay for first consultation and its associated factors among new pulmonary tuberculosis patients of central Nepal, *Tubercul. Res. Treat.* (2016) 2016, <https://doi.org/10.1155/2016/4583871>.
- [9] D.A. Rodríguez, K. Verdonck, K. Bissell, J.J. Victoria, M. Khogali, D. Marín, et al., Monitoring delays in diagnosis of pulmonary tuberculosis in eight cities in Colombia, *Rev. Panam. Salud Pública* 39 (2016) 12–18.
- [10] S.B. Gebreegziabher, G.A. Bjune, S.A. Yimer, Patients' and health system's delays in the diagnosis and treatment of new pulmonary tuberculosis patients in West Gojjam Zone, Northwest Ethiopia: a cross-sectional study, *BMC Infect. Dis.* 16 (1) (2016) 1–13, <https://doi.org/10.1186/s12879-016-1995-z>.
- [11] G.B. Tarimo, Delay in Seeking Care Among Tuberculosis Patients Attending Tuberculosis Clinics in Rungwe District, Tanzania, Muhimbili University of Health and Allied Sciences, 2012.
- [12] K.C. Takarinda, A.D. Harries, B. Nyathi, M. Ngwenya, T. Mutasa-Apollo, C. Sandy, Tuberculosis treatment delays and associated factors within the Zimbabwe national tuberculosis programme, *BMC Publ. Health* 15 (1) (2015) 1–12, <https://doi.org/10.1186/s12889-015-1437-7>.

- [13] G. Getahun, B. Erchafo, L.A. Gebretsadik, M. Chaka, Patient delay and associated factors among pulmonary tuberculosis patients at Hadiya zone public health facilities in south Ethiopia, 2017, *Eur. J. Clin. Biomed. Sci.* 4 (4) (2018) 55–62.
- [14] D. Tsegaye, E. Abiy, T. Mesele, T. Tadesse, Delay in seeking health care and associated factors among pulmonary tuberculosis patients in north Wollo zone, Northeast Ethiopia: institution Based Cross-sectional Study, *Arch. Clin. Microbiol.* 7 (3) (2016) 17, <https://doi.org/10.1371/journal.pone.0255327>.
- [15] R. Yirgu, F. Lemessa, S. Hirpa, A. Alemayehu, E. Klinkenberg, Determinants of delayed care seeking for TB suggestive symptoms in Seru district, Oromiya region, Ethiopia: a community based unmatched case-control study, *BMC Infect. Dis.* 17 (1) (2017 Apr 20) 292, <https://doi.org/10.1186/s12879-017-2407-8>. PMID: 28427367; PMCID: PMC5397811.
- [16] B.M. Ereso, M. Sagbakken, C. Gradmann, S.A. Yimer, Treatment outcomes of patients with drug-sensitive tuberculosis under community-based versus facility-based directly observed treatment, short course strategy in Southwest Ethiopia: a prospective cohort study, *BMJ Open* 11 (7) (2021 Jul 21), e048369, <https://doi.org/10.1136/bmjopen-2020-048369>.
- [17] A. Haileamlak, Ethiopia is on track of achieving the WHO end Tuberculosis Milestone, *Ethiopian J. Health Sci.* 31 (1) (2021) 1–2, <https://doi.org/10.4314/ejhs.v31i1.1>.
- [18] X. Lin, V. Chongsuvivatwong, L. Lin, A. Geater, R. Lijuan, Dose–response relationship between treatment delay of smear-positive tuberculosis patients and intra-household transmission: a cross-sectional study, *Trans. R. Soc. Trop. Med. Hyg.* 102 (8) (2008) 797–804, <https://doi.org/10.1016/j.trstmh.2008.04.027>.
- [19] Ethiopia FMOHo, First Ethiopian National Population Based Tuberculosis Prevalence Survey, 2011.
- [20] M.M. Mesfin, T.W. Tasew, I.G. Tareke, Y.T. Kifle, W.H. Karen, M.J. Richard, Delays and care seeking behavior among tuberculosis patients in Tigray of northern Ethiopia, *Ethiop. J. Health Dev.* 19 (2005) 7–12.
- [21] A. Asres, D. Jerene, W. Deressa, Delays to treatment initiation is associated with tuberculosis treatment outcomes among patients on directly observed treatment short course in Southwest Ethiopia: a follow-up study, *BMC Pulm. Med.* 18 (1) (2018) 1–11, <https://doi.org/10.1186/s12890-018-0628-2>.
- [22] A.K.J. Teo, C. Ork, S. Eng, N. Sok, S. Tuot, L.Y. Hsu, et al., Determinants of delayed diagnosis and treatment of tuberculosis in Cambodia: a mixed-methods study, *Infect. dis. poverty* 9 (1) (2020) 1–12, <https://doi.org/10.1186/s40249-020-00665-8>.
- [23] J. Cai, X. Wang, A. Ma, Q. Wang, X. Han, Y. Li, Factors associated with patient and provider delays for tuberculosis diagnosis and treatment in Asia: a systematic review and meta-analysis, *PLoS One* 10 (3) (2015), e0120088, <https://doi.org/10.1371/journal.pone.0120088>.
- [24] S. Banu, M.T. Rahman, M.K.M. Uddin, R. Khatun, T. Ahmed, M.M. Rahman, et al., Epidemiology of tuberculosis in an urban slum of Dhaka City, Bangladesh, *PLoS One* 8 (10) (2013), e77721, <https://doi.org/10.1371/journal.pone.0077721>.