



Determining Patient-Related, Health Service-Related, and Socio-Cultural Factors for Non-Adherence to Tuberculosis Treatment in Namibia

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ABSTRACT

Background

Tuberculosis (TB) is a major public health issue in Namibia, and treatment adherence is crucial for effective disease management. It is essential to identify the factors that contribute to non-adherence to enhance treatment outcomes and decrease the transmission of TB. The study aims to identify patient-related, health service-related, and socio-cultural factors contributing to non-adherence to TB treatment among TB patients in Namibia.

Methods

A quantitative cross-sectional study was carried out on a sample of 43 TB patients from different regions of Namibia. Data were collected through surveys from patients undergoing TB treatment.

Results

The findings indicated that most of the participants (95%) lacked the motivation to adhere to the prescribed treatment. All individuals admitted to being negligent regarding their treatment schedule, and if they saw positive effects during the initial stage of treatment, they would discontinue their medication. Participants reported similar experiences when they had negative emotions following the initial treatment. Most participants (88%) expressed that the clinic hours were inconvenient, while all participants indicated that there was insufficient time allocated to discuss concerns of medication adherence. Most respondents (79%) reported that the healthcare professionals were unfriendly. Regarding cultural aspects, all participants expressed the idea that tuberculosis can be treated with traditional remedies, while 95% acknowledged the presence of cultural beliefs related to tuberculosis in their society. All participants held the belief that the sickness is attributed to a curse and poisoning, with 88% of participants subscribing to the notion that tuberculosis is passed down through familial inheritance. The results show that socio-cultural factors, such as stigma, and patient-related factors, such as forgetfulness, significantly contribute to non-adherence.

Conclusion

This study emphasises the complex and varied factors that contribute to the lack of adherence to TB treatment in Namibia, including important factors relating to the patients themselves, the healthcare services, and the socio-cultural context. It is crucial to implement focused interventions that specifically target these characteristics to improve adherence rates. Effective strategies should encompass thorough patient education, enhanced healthcare service delivery, and community involvement initiatives to diminish stigma and provide assistance to those with TB.

Keywords: Tuberculosis, Treatment Adherence, Quantitative Study, Patient Factors, Health Services, Socio-Cultural Factors, Namibia

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INTRODUCTION

Tuberculosis (TB) is a contagious illness caused by a type of bacteria called Mycobacterium, which is not capable of moving and is resistant to acid. TB infection and sickness occur in the body because of the pathogenesis of TB. The disease is transmitted via respiratory droplets expelled by an infected person through sneezing or coughing, or through the discharge of infectious aerosol droplets carrying the bacilli.¹ TB occurs when the immune system fails to effectively control the growth of tubercle bacilli, leading to their rapid multiplication. TB is the primary cause of mortality worldwide from infectious diseases. It is a widely recognised sickness that is caused by poverty and is frequently linked to social exclusion and lack of financial resources. It continues to be a significant worldwide public health issue, with developing nations being disproportionately affected. In the year 2016, the seriousness of the disease was observed, with around 10.4 million individuals contracting tuberculosis. Africa was responsible for 74% of these cases, resulting in 1,674,000 fatalities due to TB.² In 2019, over 10 million individuals contracted tuberculosis (TB) and 1.4 million lost their lives as a result. Since the year 2000, tuberculosis therapy has prevented more than 60 million deaths, however not everyone has been able to receive the necessary diagnosis and care, which is still not universally available.³ Namibia consistently maintains its position among the top 30 countries with a high burden of tuberculosis per capita. In 2021, the country reported a total of 6,599 cases of tuberculosis, resulting in an incidence rate of 260 cases per 100,000 inhabitants. According to the World Health Organisation (WHO), Namibia has an estimated underreporting rate of approximately 42% for tuberculosis cases, as determined by the findings of the 2017/2018 TB Disease Prevalence Survey. The anticipated incidence rate is 457 instances per 100,000 people, showing a 28% increase in the incidence rate between 2015 and 2021. This increase is more than double the average incidence rate in the African area.⁴

Inadequate patient compliance with TB therapy is seen as a significant obstacle to achieving successful treatment outcomes and is a contributing factor to the development of multidrug-resistant TB (MDR-TB), worsening of illness severity, continued transmission of TB, and potential mortality. Furthermore, writers concur that failure to comply with TB therapy jeopardises treatment effectiveness, heightens the

likelihood of TB transmission, and fosters the emergence of drug resistance.⁶ The authors also mention that non-adherence to TB treatment hinders treatment success and increases the risk of TB replication.⁶ Hence, the main obstacle in treating tuberculosis is the inadequate compliance of patients, leading to the development of MDR-TB, exacerbation of the illness, continuous transmission of tuberculosis, and potential mortality.⁵ Non-compliance with TB treatment has been demonstrated to frequently result in avoidable hospitalisations and preventable mortality, as evidenced by a recent prospective cohort research.⁷

TB continues to pose a substantial public health problem in Namibia, despite major endeavours to manage and eradicate the illness. A significant obstacle to successful TB management is the lack of patient compliance with treatment regimens. Failure to comply with treatment not only extends the period of being infectious, which increases the likelihood of spreading the disease, but also leads to the emergence of drug-resistant strains of tuberculosis, making treatment more complex and worsening health consequences. Although there have been many studies conducted on the factors that affect adherence to TB treatment worldwide, there is a significant lack of research specifically focused on the setting of Namibia. Gaining a comprehensive understanding of how these factors interact in the specific context of Namibia is essential for developing precise interventions aimed at enhancing adherence rates. The aim of this study was to examine the factors that contribute to non-adherence to TB treatment in Namibia, specifically focusing on patient-related, health service-related, and socio-cultural aspects. Specific research objectives for the study are as follows:

- Understanding patient-related barriers in relation to non-adherence to TB treatment in Namibia.
- Assessing health service-related issues related to non-adherence to TB treatment in Namibia, and
- Evaluating socio-cultural influences non-adherence to TB treatment in Namibia.

METHODS

This study employed a cross-sectional design and utilised quantitative methods. The research was



carried out in the Tsumkwe constituency, located in the Otjozondjupa area of Namibia, with a population of 9907. The target population consisted of all tuberculosis patients who were attending the clinics in Tsumkwe constituency and were not following their tuberculosis treatment regimen. During the study, it was discovered that a total of 43 individuals were not adhering to their tuberculosis therapy. Since the population size was relatively small, the study used census sampling technique where population and sample size for the study was same. The data were gathered by a questionnaire that participants completed on their own. The instrument was comprised of the following sections: Section 1 comprised demographic data, encompassing five categories pertaining to participants' gender, age group, employment position, marital status, and education status. Section 2 addressed the factors contributing to the lack of adherence to anti-TB medication. The part regarding patient-related issues consisted of seventeen items that required a binary response of either 'yes' or 'no'. The questions asked for responses regarding the factors influencing compliance with treatment, such as motivation, depression related to the disease, limitations in daily activities, lifestyle changes, persistent coughing despite TB treatment, previous treatment failures, adherence to the treatment diet, emotional support from family, forgetfulness in taking TB medication, negligence in following the schedule, discontinuing medication when feeling well or unwell, reasons for stopping medication, concerns about the quantity of TB drugs, side effects of TB therapy, issues with drug shortages, awareness of the treatment duration, and running out of medication at home. The part on health-service related factors consisted of twelve items that required a binary response of either 'yes' or 'no'. The inquiries sought responses regarding the availability of clinic hours that are convenient for consulting health professionals, the opportunity to discuss medication adherence, the flexibility of clinic hours, the friendliness of healthcare workers, the

proximity of the health facility, financial difficulties related to transportation, the adequacy of healthcare personnel, the respect for privacy, the addressing of emotional and spiritual distress, the willingness of healthcare workers to add. The part on socio-cultural aspects consisted of nine items that required respondents to provide 'yes' or 'no' answers. Seven of the questions had open-ended prompts that prompted participants to provide more information to justify their selections. The survey questions inquired about individuals' inclination to seek advice from a traditional healer, their financial well-being, the possibility of moving to a different location, and whether TB is hereditary. The data gathering instrument was offered in English. The research assistants were fluent in the local languages and, where needed, provided accurate translations of the instrument to ensure precise responses. A pilot study was carried out at the medical facilities in Okurungava, Otjimuse, Hakahana, and the Katutura Healthcare Centre in the Khomas region, which had a significant number of tuberculosis patients who failed to complete their treatment. The purpose of the pilot study was to assess the time required for respondents to complete the questionnaire and comprehend the questions. No revisions were proposed. The collected data were gathered, coded, and analysed using the SPSS software application. Frequency distribution of remarks pertaining to patient variables, health service factors, and socio-cultural factors. The study received ethical approval from the Ethics committee of the University of South Africa. Enrollment in the study was voluntary. Strict adherence to anonymity and secrecy was consistently upheld.

RESULTS

A total of 43 participants were recruited and all participated in the study. More than half (60%) of the participants were female. Majority (75%) were below the age of 40 years, and unemployed (77%). About half (46%) were single, and most of them (83%) had primary education.

Table 1: Summary of participants' demographic data (n= 43)

VARIABLES		n	%
Participants' gender	Male	26	60
	Female	17	40
Age group	19-29	21	49
	30-39	12	28
	40-49	8	18
	50 and above	2	5
Employment status	Employed	10	23
	Unemployed	33	77
Marital status	Single	17	46
	Married	6	16
	Co-habiting	14	38
	Missing	6	14
Education status	Primary	35	83
	Secondary	7	17

Patient-related factors

The results showed that most of the participants (95%) were not motivated to comply with treatment. All participants indicated that TB-disease limited their daily activities. Almost all the participants (93%) noticed changes in their lifestyle, and another 98% participants failed to complete a previous treatment. It was found that 93% participants knew that they had to comply with diets. All participants reported that

they were careless about their treatment schedule, and if they felt good during the initial phase of treatment, they would stop taking treatment. The same was reported by participants when they felt bad after initial treatment. When asked about too many drugs, most of them answered positively (93%). Almost all of them (95%) were aware of the length of their treatment, and 91% reported that they had ran out of drugs at home (Table 2).

Table 2: Participants' responses on patient-related factors (n=43)

VARIABLE		n	%
Do you feel motivated to comply with treatment?	Yes	2	5
	No	41	95
Do you feel depressed for having this disease?	Yes	43	100
Did you think this disease has limited you from your daily activities?	Yes	43	100
Have you noticed changes in your lifestyle due to this disease?	Yes	40	93
	No	3	7
Have you failed in the previous treatment?	Yes	42	98
	No	1	2
Do you know the diet to comply with the treatment?	Yes	40	93
	No	3	7
Do you ever forget to take your TB drugs?	Yes	34	79
	No	9	21
Are you careless about the schedule?	Yes	43	100
If you feel good (initial phase), do you stop taking TB drugs?	Yes	43	100
If you feel bad, do you stop taking TB drugs?	Yes	43	100
Do you consider that the number of TB drugs you are taking is too much?	Yes	40	93
	No	3	7
Are you aware of any TB therapy side effect?	Yes	3	7
	No	40	93

Have you stopped taking TB drugs due to shortages?	Yes	40	93
	No	3	7
Are you aware of the length of treatment?	Yes	41	95
	No	2	5
Have you ever run out of drugs at home?	Yes	39	91
	No	4	9

Health-service related factors

Most of the participants reported that the clinic hours were inconvenient (88%), and all mentioned that there was not sufficient time allotted to discuss aspects of medication adherence. Majority (79%) indicated that the healthcare workers were not friendly, All of them had to travel far to get to the health facility to get the treatment. When asked about privacy, 77% indicated that their privacy was not respected when interacted with the health services. All the participants received treatment recommendations from the healthcare worker (Table 3).

Table 3: Summary of participants' responses on health-service related factors (n=43)

VARIABLE		n	%
Are the clinic hours to see health personnel convenient?	Yes	6	14
	No	37	88
Is there sufficient time allotted to discuss aspects of medication adherence?	No	43	100
Are the working hours at the health facility flexible?	Yes	3	7
	No	40	93
Is the healthcare worker friendly?	Yes	9	21
	No	34	79
Do you travel far to get to the health facility for your treatment?	Yes	43	100
Do you have financial challenges to support means of transport to access health facility?	No	43	100
Does the health facility have sufficient health workers to attend to patients?	Yes	4	9
	No	39	91
Do you feel that your privacy was respected when you interreacted with the health service?	Yes	10	23
	No	33	77
Do you feel that health services satisfactorily addressed the emotional and spiritual suffering that results from the disease and the treatment?	No	43	100
Do you think that the healthcare worker was receptive to your questions and concerns?	Yes	6	14
	No	37	86
Have you received treatment recommendations from the healthcare worker?	Yes	43	100

Socio-cultural related factors

Regarding cultural factors, all participants believed that TB can be cured using traditional medicines while 95% mentioned that cultural beliefs in their community associated with TB. All participants agreed that they have been exposed to stigma and

discrimination. Another 95% participants indicated that TB is witchcraft compared. All participants believed that the illness is due to a curse and poisoning, with 88% participants believed that the TB is inherited within the family (Table 4).

Table 4: Summary of participants' responses on socio-cultural related factors (n=43)

VARIABLE		n	%
Do you believe in curing of TB using traditional medicines?	Yes	43	100
Do you have cultural beliefs in your community associated with TB treatment?	Yes	41	95
	No	2	5
Did you feel stigmatised or discriminated because of your disease?	Yes	43	100
Do you think that TB is witchcraft?	Yes	41	95
	No	2	5
Are you financially stable?	Yes	4	9
	No	39	91
Have you intended to consult a traditional healer?	Yes	41	95
	No	2	5
Do you believe that the illness is due to a curse?	Yes	43	100
Do you believe that the illness is due to poisoning?	Yes	43	100
Have you ever believed that TB is inherited in some family?	Yes	38	88
	No	5	12

DISCUSSION

The objective of this study was to examine the factors that contribute to non-adherence to TB treatment in Namibia, including patient-related, health service-related, and socio-cultural aspects. Multiple factors, including patient-related, health service-related, and socio-cultural factors, were shown to contribute to non-adherence among TB patients in Namibia.

Non-adherence can be attributed to patient-related causes. These encompass cognitive qualities that facilitate comprehension of the treatment and its intricacies, as well as the ability to create and commit to memory a treatment plan and its procedures. The overall psychological and social well-being significantly affects adherence. Participants had feelings of depression because of their illness. Depression arises from the fact that the effects of the TB disease go beyond the patient's mental and social well-being. Individuals with diminished ability to carry out their everyday activities are prone to experiencing depression. Furthermore, it should be noted that all the participants in the study had a restricted capacity to participate in their regular daily activities. TB also has long-term repercussions on the patient's physical capacity, which might lead to unemployment for some individuals. Research has shown that a lack of understanding of treatment can cause many patients to discontinue their treatment. This can happen either because they experience discomfort from side effects of the medication or because they start to feel better and don't realise the potential negative effects of ceasing treatment.⁸⁻¹¹ An Indian study revealed that

most of the patients who were lost to follow up managed to complete at least the initial two months of treatment.⁸ Conversely, a South African study discovered that the average time from the start of treatment to loss to follow up was 101 days, which was associated with the alleviation of TB symptoms.¹²

The clinic's operation hours, during which patients could consult with a healthcare provider, were inconvenient for the patients. The inconveniences and bad sensations reported by patients regarding the health service system have a detrimental impact on their decision to comply with medicines. Patients would desire reduced waiting times and queues, as well as flexible operating hours that are synchronised with their other requirements. Patients expressed dissatisfaction with the rigid operation hours of the clinic and believe that greater flexibility will enhance their ability to make decisions regarding their treatment and the type of support they require. Several studies have documented a substantial correlation between the availability of healthcare facilities and the failure to adhere to TB treatment.¹³

Healthcare personnel who are responsive play a significant role in providing health services and ensuring adherence to tuberculosis treatment. These healthcare staff demonstrate kindness towards the patients. This is beneficial for instructing and assisting patients in reestablishing a feeling of authority over their sickness. Additionally, it fosters patient confidence in the healthcare system, hence



facilitating the attainment of favourable health results. Nevertheless, this study revealed that healthcare workers were perceived as lacking friendliness. Patients expressed dissatisfaction with the limited time dedicated to discussing their medication and adherence, resulting in inadequate provision of adherence counselling. Consequently, patients were unable to raise any grievances or instances of insensitive treatment from healthcare workers. Consequently, it is likely that patients were not given the chance to fully comprehend the comprehensive nature of their treatment, resulting in elevated rates of non-adherence.

Patients undertook extensive journeys to reach a healthcare institution for medical treatment. The challenges of remoteness, harsh settings, inadequate transit systems, and defective communication infrastructure have hindered the recruitment of skilled healthcare workers, creating a barrier for patients seeking access to care. Non-adherence was also identified as a risk factor for long distance. A study conducted in Uganda revealed that being two kilometres distant from the treatment site, as opposed to being in closer proximity, led to improved treatment adherence.¹⁴

The identification of system impediments included the failure of healthcare workers to comply with suggested norms and procedures. Healthcare workers failed to uphold patient privacy. The counselling sessions lacked privacy due to healthcare workers being occupied with various responsibilities, and the clinic premises were cramped and overcrowded. The health services given were inadequate in addressing the patients' emotional and spiritual needs associated with the TB disease and its treatment. Counselling is a crucial component of complete treatment education since it facilitates adherence by allowing patients to discuss and clarify their experiences. Nevertheless, patients perceived healthcare workers as unresponsive. Several patients who did not adhere to their treatment claimed a lack of sufficient care or support, which subsequently resulted in their non-adherence. Patients in impoverished nations often cite inconvenient clinic hours, lengthy waiting times, and unsatisfactory patient-provider relationships as factors contributing to their non-compliance with TB treatment.^{10, 13, 15, 16} In addition, many patients reported a lack of adequate education and counselling regarding TB therapy and

expressed that they were not provided with a clear explanation for the six-month treatment programme.^{16, 17}

Patients' adherence to TB therapy can be influenced by socio-cultural views. Patients in this study reported experiencing discrimination due to their TB diagnosis. The presence of stigma has a negative impact on a patient's overall well-being and hinders attempts to manage the TB disease. Furthermore, TB is often associated with a negative social perception, leading to the marginalisation and isolation of individuals affected by the disease. This, in turn, gives rise to heightened levels of dread among patients, as the community may harbour misconceptions regarding the transmission of the disease. Communities have various historical and contextual elements that contribute to a negative perception of the TB condition, hence impeding adherence. Authors in West Africa have documented a stigma associating TB with an ethnic or familial curse. It is believed that patients are perceived as being excessively unclean, and the disease is highly transmissible. This perception is so strong that even healthcare professionals avoid interacting with TB patients.¹⁸ Consequently, individuals are more prone to conceal their illness and less motivated to seek medical treatment.¹⁸ Moreover, there are reports indicating that the general population in East Africa holds the belief that individuals who test positive for TB are also infected with HIV, which worsens the unfavourable attitudes towards TB patients and has a detrimental effect on their adherence to treatment.¹⁸ Multiple studies have highlighted the stigmatisation of TB as a significant risk factor for patients discontinuing their treatment.^{19, 20}

The patients faced significant obstacles in achieving financial security. Insufficient financial resources lead to a state of overall financial uncertainty and stress, which hinders efforts to comply with obligations. Financial insecurity has a detrimental effect on patients' capacity to attend clinic appointments and afford food, both of which have a poor impact on adherence. Financial stress undermines individuals' ability to cope with health challenges and perpetuates practices that contribute to non-adherence. Several studies have found that characteristics associated with a low socio-economic status are determinants of TB treatment. These factors encompassed insufficient monthly earnings, residing in either rural



or urban areas, being unemployed, and having a poor degree of education.^{8,10,21,22}

The patients belonged to a nomadic society that relocated for various reasons. The movement of individuals carrying diseases, such as tuberculosis (TB), facilitates the spread of these illnesses. The

patients relocated due to socio-cultural factors influenced by certain cultural and traditional beliefs. Several investigations corroborate the conclusions of this study, which revealed a correlation between relocation and non-adherence to TB treatment.^{9,20}

REFERENCES

1. Eribo, OA, Du Plessis, N, Ozturk, M, Guler, R, Walzl, G, Chegou, NN. The gut microbiome in tuberculosis susceptibility and treatment response: guilty or not guilty? *Cell Molecular Life Sciences*, 2020;77:1497-1509.
2. Tola, A, Minshore, KM, Ayele, Y, Mekuria, AN. Tuberculosis treatment outcomes and associated factors among TB patients attending public hospitals in Harar Town, Eastern Ethiopia: A five-year retrospective study. *Tuberculosis Research and Treatment*, 2019. Available from: <https://doi.org/10.1155/2019/1503219> (accessed on 08 February 2023).
3. World Health Organization. (2018). *Global Tuberculosis Report*. Geneva, Switzerland: World Health Organization.
4. Ministry of Health and Social Services (MoHSS). *Treatment Outcomes for EPTB cases. National tuberculosis and leprosy programme. Annual report, 2021*.
5. Krasniqi, S, Jakupi, A, Daci, A, Tigani, B, Jupoli-Krasniqi, Pira, M, Zhjeqi, V, Neziri, B. Tuberculosis treatment adherence of patients in Kosovo, 2017. Available from: <https://www.hindawi.com/journals/trt/2017/4850324> (accessed on 05 April 2023).
6. Tang, Y, Zhao, M, Wang, Y, Gong, Y, Yin, X, Zhao, A, Zheng, J, Liu, Z, Jian, X, Wang, W, Wu, C, Lu, Z. Non-adherence to anti-tuberculosis treatment among internal migrants with pulmonary tuberculosis in Shenzhen, China: a cross-sectional study. *BMC Public Health*, 2015;15:474.
7. Sustersic, M, Gauchet, A, Duvert, A, Gonnet, L, Foote, A, Vermorel, C, Allenet, B, Bosson J-L. Proposal for a global adherence scale for acute conditions (GASAC): A prospective cohort study in two emergency departments. *PLoS ONE*, 2019;14(12):1.
8. Ahmed, M, Mohan, R. A comparative study of factors for interruption of antitubercular treatment among defaulters in urban and rural areas of Kamrup District, Assam. *Journal of Family Medicine and Primary Care*, 2021;10:127.
9. Kimani, E, Muhula, S, Kiptai, T, Orwa, J, Odero, T, Gachuno, O. Factors influencing TB treatment interruption and treatment outcomes among patients in Kiambu County, 2016-2019. *PloS One*, 2021;16:e0248820.
10. Gube, A.A, Debalkie, M, Seid, K, Bisete, K, Mengesha, A, Zeynu, A, Shimelis, F., Gebremeskel, F. Assessment of Anti-TB Drug Nonadherence and Associated Factors among TB Patients Attending TB Clinics in Arba Minch Governmental Health Institutions, Southern Ethiopia. *Tuberculosis Research and Treatment*, 2018;3705812.
11. Iweama, C.N, Agbaje, O.S, Umoke, P.C.I, Igboke, C.C, Ozoemena, E.L, Omaka-Amari, N.L, Idache, B.M. Nonadherence to tuberculosis treatment and associated factors among patients using directly observed treatment short-course in north-west Nigeria: A cross-sectional study. *SAGE Open Medicine*, 2021;9:2050312121989497.
12. Kigozi, G, Heunis, C, Chikobvu, P, Botha, S, Van Rensburg, D. Factors influencing treatment default among tuberculosis patients in a high burden province of South Africa. *International Journal of Infectious Diseases*, 2017;54:95-102.
13. Mekonnen, H.S, Azagew, A.W. Non-adherence to anti-tuberculosis treatment, reasons and associated factors among TB patients attending at Gondar town health centers, Northwest Ethiopia. *BMC Research Notes*, 2018;11.
14. Robsky, K.O, Hughes, S, Kityamuwesi, A, Kendall, E. A, Kitonsa, P. J, Dowdy, D.W, Katamba, A. Is distance associated with tuberculosis treatment outcomes? A retrospective cohort study in Kampala, Uganda. *BMC Infectious Diseases*, 2020;20:406.
15. Workie, M.G, Aycheh, M.W, Birhanu, M.Y, Tsegaye, T.B. Treatment interruption among drug-susceptible pulmonary tuberculosis patients in Southern Ethiopia. *Patient Preference and Adherence*, 2021;15:1143-1151.
16. Woimo, T.T, Yimer, W.K, Bati, T, Gesesew, H.A. The prevalence and factors associated for anti-tuberculosis treatment non-adherence among pulmonary tuberculosis patients in public health care facilities in South Ethiopia: a cross-sectional study. *BMC Public Health*, 2017;17:269.
17. Lei, X, Huang, K, Liu, Q, Jie, Y.F, Tang, S.L. Are tuberculosis patients adherent to prescribed treatments in China? Results of a prospective cohort study. *Infectious Diseases of Poverty*, 2016;5:38.
18. Msoka, E.F, Orina, F, Sanga, E.S, Miheso, B, Mwanyonga, S, Meme, H, Kiula, K, Liyoyo, A, Mwebaza, I, Aturinde, A, Joloba, M, Mmbaga, B, Amukoye, E, Ntinginya, N.E, Gillespie, S.H, Sabiiti, W. Qualitative assessment of the impact of socioeconomic and cultural barriers on uptake and utilisation of tuberculosis diagnostic and treatment tools in East Africa: a cross-sectional study. *BMJ Open*, 2021;11:e050911.
19. Putera, I, Pakasi, T.A, Karyadi, E. Knowledge and perception of tuberculosis and the risk to become treatment default among newly diagnosed pulmonary tuberculosis patients treated in primary health care, East Nusa Tenggara: a retrospective study. *BMC Research Notes*, 2015;8, 238.
20. Wohlleben, J, Makhmudova, M, Saidova, F, Azamova, S, Mergenthaler, C, Verver, S. Risk factors associated with loss to follow-up from tuberculosis treatment in Tajikistan: a case-control study. *BMC Infectious Diseases*, 2017;17:543.
21. Mukhtar, F, Butt, Z.A. Establishing a cohort in a developing country: Experiences of the diabetes-tuberculosis treatment outcome cohort study. *Journal of Epidemiology and Global Health*, 2017;7:249.
22. Ambaw, F, Mayston, R, Hanlon, C, Medhin, G, Alem, A. Untreated depression and tuberculosis treatment outcomes, quality of life and disability, Ethiopia. *Bulletin of the World Health Organization*, 2018;96:243-255.

