

# Hazardous Alcohol Drinking and Associated Factors Among Patients with Tuberculosis Attending Public Healthcare Facilities in Gedeo Zone, Southern Ethiopia

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## Research Article

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# Abstract

**Background:** Hazardous drinking is a quantity or pattern of alcohol consumption that places individuals at risk for adverse health events. Studies have shown that hazardous alcohol drinking among patients with tuberculosis has been often linked to a decrease in immune system functioning, greater rates of treatment-resistant cases, and death during treatment. However, there are rare studies that assessed the prevalence of hazardous alcohol use and associated factors among patients with tuberculosis in Ethiopia. Therefore, this study was aimed to assess the prevalence of hazardous alcohol drinking and associated factors among patients with tuberculosis attending public healthcare facilities in Gedeo Zone, Southern Ethiopia.

**Methods:** An institution-based, cross-sectional study was conducted among a randomly selected sample of 415 patients with tuberculosis. The study was conducted at the tuberculosis unit of public healthcare facilities in the Gedeo zone, Southern Ethiopia. The Alcohol Use Identification Test (AUDIT) scale was used to measure hazardous alcohol drinking. Data on social support, perceived tuberculosis stigma, and depression were collected using a standard, validated, and structured questionnaire.

**Results:** The prevalence of hazardous alcohol drinking in our study was 20 % (95% CI; 16.1% -24.2%). Medical comorbidity (AOR = 2.44, 95% CI: 1.29–4.62), length of illness ( $\geq 12$  months) (AOR = 2.88, 95% CI: 1.03–3.04), and being male (AOR = 2.10, 95% CI: 1.17–3.77) were found to be significant predictors of hazardous alcohol drinking after controlling for potential confounders.

**Conclusion:** A high prevalence of hazardous alcohol drinking was observed among patients with tuberculosis. Therefore, routine screening for alcohol use and a holistic treatment approach for patients with tuberculosis are crucial.

## Background

Alcohol is a psychoactive substance with toxic and dependence producing properties, which is widely used across the world. It is a potent drug that causes both acute and chronic changes in almost all neurochemical systems (1).

The World Health Organization (WHO) defines “hazardous drinking” as “a quantity or pattern of alcohol consumption that places individuals at risk for adverse health events” (2). Hazardous drinking was also defined as an average consumption of 21 drinks or more per week for men (or  $\geq 7$  drinks per occasion at least 3 times a week), and 14 drinks or more per week for women (or  $\geq 5$  drinks per occasion at least 3 times a week).” (3).

According to a report from the WHO, globally in 2016, alcohol is the leading cause of premature mortality and disability among those aged 15 to 49 years, accounting for 10% of all deaths in this age group (4). Worldwide in 2016, the harmful use of alcohol resulted in some 3 million deaths worldwide and 132.6 million disability-adjusted life years (DALYs). Mortality resulting from alcohol consumption is higher than

that caused by other communicable and non-communicable diseases (5). Harmful use of alcohol is responsible for 5.1% of the global burden of disease (5).

Tuberculosis (TB) is a potentially serious infectious disease that mainly affects the lungs. The bacteria that cause tuberculosis, *Mycobacterium TB* are spread from one person to another through tiny droplets released into the air via cough and sneezes (6).

Globally, the best estimate is that 10 million people (range, 9-11.2 million) equivalent to 133 cases (range, 120–148) per 100 000 population developed TB disease in 2017: 5.8 million men, 3.2 million women, and 1.0 million children (7).

Epidemiological data suggest that a significant proportion of patients with tuberculosis had a history of excess alcohol consumption and comorbid alcohol use disorders. A study from the USA revealed that that 15.1% of patients with tuberculosis had reported an excess use of alcohol, with a higher prevalence in males than females (8). Harmful use of alcohol increases the risk of TB threefold and is also a strong risk factor for poor TB treatment adherence (4).

Studies have also shown that alcohol consumption among tuberculosis patients has been often linked to a decrease in immune system functioning, which increases the risk for active tuberculosis (9-11), death during treatment (8) positive smear results (8), higher rates of homelessness (12), and greater rates of treatment resistant cases (13). Thus, early identification and management of alcohol use problems among patients with tuberculosis are vital to reduce and possibly prevent the associated negative consequences.

However, there are limited studies that assessed the prevalence of hazardous alcohol drinking and the associated factors among patients with tuberculosis. To the best of our knowledge, there are no previous studies on the prevalence of hazardous alcohol drinking and its associated factors among patients with tuberculosis in Ethiopia. Therefore, this is the first study to determine the prevalence and associated factors of hazardous alcohol drinking among patients with tuberculosis in Ethiopia.

## **Methods**

### **Study Design and period**

Institution-based, cross-sectional study design was used in this study. It was conducted from November 1 to December 30, 2018.

### **Study setting**

The study was conducted among adult patients with tuberculosis attending TB clinics in the public health facilities of Yirgacheffe, Wonago, and Dilla Zuriya districts, Gedeo zone, Southern Ethiopia. Gedeo zone is found in South Nation, Nationalities and Peoples' Regional State of Ethiopia, 359 km southeast of Addis

Ababa (the capital city of Ethiopia). In the zone, there are about 42 public healthcare facilities (1 referral hospital, two primary hospitals, and 39 health centers).

### **Sample size determination and sampling procedure**

Since this study was the part of the study on '*Prevalence of depressive symptoms and associated factors among patients with tuberculosis attending public health institutions in Gede'o zone, South Ethiopia*' the sample size calculated for depression was used for the current study, with the following assumptions of 95% confidence level, a 5% margin of error and 43.3% prevalence of depression in Ethiopia (14) and a non-response rate of 10% was taken to determine a final sample size of 415. Study participants were proportionally allocated for each health institution, according to patient flow by referring to the previous year annual reports. A systematic sampling technique was used to select the study participants.

### **Study participants**

All patients with TB attending TB clinic were taken as a source population, while those patients with TB who were available during the data collection period were considered as a study population. Patients aged 18 and above years old and patients who were on anti-TB medicine for at least 2 weeks were included in the study. Those patients who were severely ill during the study period were excluded.

### **Data sources and measurement**

Data were collected using a structured, pretested, and standard questionnaires by face-to-face interview technique. Trained nurses and public health professionals working at the TB clinic were collected the data. The questionnaires included socio-demographic data, Patient Health Questionnaire-9 (PHQ-9), Oslo social support Scale-3, and structured questions for assessment of the associated factors.

The dependent variable hazardous alcohol drinking was measured as a dichotomous variable (Yes/No) on 10 items of the AUDIT, with the cutoff point set at greater than or equal to 8, that is, patients with tuberculosis who scored greater than 8 had hazardous alcohol drinking.

The 10-item Alcohol Disorder Identification Test (AUDIT) assesses alcohol consumption level, symptoms of alcohol dependence, and problems associated with alcohol use. Responses to items on the AUDIT are rated on a 4-point Likert scale from 0 to 4, with a maximum score of 40 points. Higher AUDIT scores indicate more severe levels of risk; a score of 8 and above indicates a tendency toward problematic drinking or hazardous or harmful drinking. The AUDIT was translated into Amharic and back to English by two different language expertise and mental health professionals for checking its consistency (15-17).

### **Data quality management**

The questionnaire was designed in English and was translated to Amharic and back to English, that is, forward and backward translation. The questionnaire was designed and modified appropriately to control the quality of the data. The questionnaire was pretested on 5% of the sample. The data collection process

was supervised daily by the supervisors and the principal investigator, and the completed questionnaires were checked for completeness and coded.

## **Statistical Analysis**

Data was entered using Epi Data version 3.1 and analyzed using SPSS-20. Means, frequencies, and percentages were used to summarize the data, which was then presented in the form of figures, tables, and text. The strength of the association was presented by crude odds and adjusted odds ratio with their corresponding 95% CI. Statistical significance was set at  $p < 0.05$ .

## **Results**

### **Socio-demographic and economic characteristics**

A total of 409 participants were interviewed, of whom 252 (61.6%) were males. More than fifty percent of the participants resided in rural areas. Of the participants, 66.5 % were engaged in government work and private business. One-third of the participants were aged below

24 years and more than 50 % were married. Regarding literacy, 22.5% had not attended formal education, 40.3 % had primary education, and more than one-third, 37.2 % had secondary and above education. The majority of the participants had a monthly income of <1539 and 21.8 % had  $\geq 1539$  ETB per month **(Table 1)**.

Table 1- Distribution of patients with tuberculosis attending the tuberculosis unit of public healthcare facilities, Gedeo zone, South Ethiopia, 2018 (n = 409)

Variables	Categories	Frequency	Percent (%)
Sex	Male	252	61.6
	Female	157	38.4
Age in years	18-24	135	33
	29-34	122	29.8
	35-44	85	20.8
	45 and above	67	16.4
Marital status	Married	217	53.1
	Single	157	38.3
	Divorced/Single/divorced	35	8.6
Level of education	No formal education	92	22.5
	Primary education	165	40.3
	Secondary education	152	37.2
Occupational status	Employed	272	66.5
	Unemployed	137	33.5
Place of residence	Rural	217	53.1
	Urban	192	46.9

### Psychosocial and clinical characteristics of the respondents

One-third of the participants with harmful alcohol use 139 (34 %) had poor social support, 177 (43.1%) had intermediate social support. Regarding perceived TB stigma, more than one-third of the participants (159 (38.9%) had perceived TB stigma, and a greater proportion (61.6 %, n = 250) of participants had not perceived TB related stigma.

A greater proportion (73.8 %, n = 302) of participants were pulmonary TB patients, and (61.6 %, n = 250) of the participants were in the intensive phase of treatment (the first two months of treatment).

A large proportion of the participants (77 %, n = 315) were medium adherent to TB treatment. Majority of the participants were new TB patients and 15.2 % were retreatment cases.

In addition to TB, 71 (17.4%) had HIV, and 22 participants reported having other comorbid chronic illnesses: hypertension (n = 6), cardiac illness (n = 10), diabetes mellitus (n = 2), and kidney disease (n = 4). Only 5.1% had a family history of mental illness. Two hundred thirty-six (57.7 %) were interviewed within 6–12 months of their illness. Nearly half of the participants had depressive symptoms (**Table 2**).

Table 2- Description of psychosocial and clinical characteristics of patients with tuberculosis attending the tuberculosis unit of public healthcare facilities, Gedeo zone, South Ethiopia, 2018 (n = 409)

Variables	Categories	Number (%)
Perceived TB stigma	No	132 (32.3)
	Yes	277 (67.7)
Adherence to TB medication	High adherence	41 (10.0)
	Medium adherence	315 (77.0)
	Low adherence	53 (13.0)
Perceived social support	Poor social support	139 (34.0)
	Intermediate social support	177 (43.1)
	Strong social support	93 (22.9)
Classification of TB	Pulmonary	302 (73.8)
	Extra-pulmonary	107 (26.2)
Phase of treatment	Intensive phase	250 (61.1)
	Continuation phase	159 (38.9)
Treatment category	New case	347 (84.8)
	Re-treatment case	62 (15.2)
Comorbidity	TB/HIV comorbidity	71 (17.4)
	Other comorbid condition	22 (5.4)
	No comorbidity	316 (77.2)
Depressive symptoms	No	223 (54.5)
	Yes	186 (45.5)

### Prevalence of hazardous alcohol drinking

The 10-items of the Alcohol Disorder Identification Test (AUDIT) were summed and a single variable was generated (18). A score of 8 and above indicates a tendency to hazardous alcohol drinking. A total of 82 (20%) patients with tuberculosis were hazardous alcohol drinkers.

### Factors associated with hazardous alcohol drinking

Socio-demographic factors, clinical factors, and psychosocial factors were used to identify statistically significant factors. Among all covariates, age, gender, marital status, depression, medical comorbidity, duration of illness, social support, and category of TB treatment were found to have p-value less than 0.2 in invariable logistic regression and considered for the multiple logistic regression model. The model goodness of fit was tested using Hosmer and Lemeshow test and the p-value was found to be 0.64, which revealed as the model is good.

The odds of hazardous alcohol drinking increased by 2.10 times (95% CI: 1.17, 3.77) for males than females. Not having medical comorbidities has reduced the risk of hazardous alcohol drinking. Those TB patients who had comorbid medical conditions were about more than two times (AOR = 2.44, 95 % CI: 1.29–4.62) more at risk of hazardous alcohol drinking than patients who had no medical comorbidity.

The duration of illness was associated with hazardous alcohol drinking among TB patients. The odds of hazardous alcohol drinking increased by 2.88 times (95 % CI: 1.03–3.04) for patients who had a longer duration of illness compared to patients who had a shorter period of illness (<6 months) (Table 3).

**Table 3 Bivariate and multivariable analysis of factors associated with hazardous alcohol drinking among patients with tuberculosis attending the tuberculosis unit of healthcare facilities, Gedeo Zone, South Ethiopia, 2018 (n = 409)**

VARIABLES	CATEGORIES	Hazardous alcohol drinking		COR (95 % CI)		AOR (95 % CI)	
		Yes	No				
Sex of the participants	Male	57	195	1.54	(0.91, 2.59)	<b>2.10</b>	<b>(1.17, 3.77) *</b>
	Female	25	132	1		1	
Marital status	Married	46	171	1		1	
	Single	24	133	0.67	(0.39, 1.15)	1.04	(0.54, 2.03)
	Widow/ Divorced/ Separated	12	23	1.94	(0.89, 4.18)	0.87	(0.34, 2.21)
Age of participants	18- 24 years	13	122	0.34	(0.15, 0.75)	0.38	(0.14, 1.01)
	25-34 years	27	95	0.90	(0.44, 1.83)	0.83	(0.37, 1.88)
	35-44 years	26	59	1.40	(0.67, 2.90)	1.17	(0.52, 2.64)
	45 years and above	16	51	1		1	
Depression	Yes	55	131	3.04	(1.82, 5.08)	1.54	(0.84, 2.83)
	No	27	196	1		1	
Medical Comorbidity	Yes	34	59	3.21	(1.90, 5.42)	<b>2.44</b>	<b>(1.29, 4.62) **</b>
	No	48	268	1		1	
Duration of illness	< 6 months	6	72	1		1	
	6 -12 months	47	189	2.98	(1.22, 7.29)	2.47	(0.96, 6.35)
	>=12 months	29	66	5.27	(2.05, 13.5)	<b>2.88</b>	<b>(1.03, 8.04) *</b>
Social support	Poor social support	42	97	2.49	(1.52, 4.07)	1.36	(0.75, 2.48)
	Good social support	40	230	1		1	
Category of TB treatment	New case	58	289	1		1	
	Re-treatment case	24	38	3.14	(1.75, 5.64)	1.66	(0.80, 3.43)

Key: \* = p-value less than 0.05; COR crude odds ratio, AOR adjusted odds ratio, CI confidence interval

## Discussion

The prevalence of hazardous alcohol drinking among patients with tuberculosis in the current study was found to be 20% (95 % CI = 16.1–24.2). The current estimate is lower than the studies conducted in Botswana, Lesotho, India, and Thailand (24.7%, 35.1%, 29%, 32%, and 24.4% (10, 19-22). This might be because of the difference in study setting, study design, study year, socio-demographic, and type of screening tools used.

Even though all studies from Botswana, South India, and Lesotho used AUDIT that might make it similar to the current study, the population, year of study and the socio-demographic difference might account for the difference. The estimate of the current study is consistent with studies reported from South Africa, Scotland, and USA (23.3%, 23.2%, 18%, and 17.9%, respectively (23-26).

On the other hand, the estimate of the current study is by far higher than the one study conducted in USA (15.1%) (27). The tool used for measuring hazardous alcohol drinking, and the cutoff point used to categorize the patients' alcohol use behavior is completely different from the current study. On top of that, the study design, study time, and the setting at which the current data was collected could be considered as a source of variation in estimation between the current and compared studies.

The current study also identified different factors that had an association with hazardous alcohol drinking among patients with TB. Sex of the participant was one of the factors that had a significant association with hazardous alcohol drinking. The risk of hazardous alcohol drinking for men participants was higher compared to women. This might be due to the biological differences in reactions to alcohol use, and that gender differences in alcohol use behavior may be modified by psychosocial and cultural factors (5, 28-30). The study result is consistent with institution-based cross-sectional studies from Namibia, Lesotho, India, and Scotland (19, 22, 25, 31).

The other factor that had a significant association with hazardous alcohol drinking was the duration of illness. The odds value of hazardous alcohol drinking was 2.88 times higher among those who had longer duration of illness compared to those who had less than 6 months of illness duration. A systematic review conducted on the association between alcohol use, alcohol use disorders, and tuberculosis reported a risk of alcohol use for TB treatment outcome and vice versa (32).

Alcohol use has a negative impact on the clinical course of TB (33, 34). People drinking alcohol show higher relapse rates, a higher probability of poor clinical outcome, and a higher probability of experiencing Multi-Drug Resistant-TB (35-37).

The other factor, which increased the odds range of hazardous alcohol drinking was medical comorbidity, HIV/AIDS, and other chronic diseases. Those who had comorbid medical conditions were 2.44 times at

higher risk of being a hazardous alcohol user compared to patients without medical comorbidities (30). Thus, the current finding is supported by WHO Global Status Report on Alcohol and Health 2018 (5). This might be because of the fact that having medical comorbidities will increase stress and other psychological problems.

Unlike other studies, the current study did not find any association between hazardous alcohol drinking and; age of the participant, marital status, depressive symptoms, social support, and category of TB treatment.

### **The strengths and limitations of the study**

Our study has two major strengths. First, the study assessed hazardous alcohol drinking, which was not previously studied. Second, validated and standardized tools were used to assess hazardous alcohol drinking and independent variables.

Since the cross-sectional study design could not establish clear risks of hazardous alcohol drinking among patients with tuberculosis, it was difficult to imply the temporal relationship between significantly associated factors and hazardous alcohol drinking. In addition to this, the authors did not consider other mental health issues that can confound the study outcomes. For instance, the presence of severe mental illness and tobacco use, which are commonly associated with alcohol use. Therefore, we recommend further studies to focus on tobacco use and comorbid severe mental health disorders.

## **Conclusion And Recommendation**

In this study, we found that a substantial percentage of patients with tuberculosis were hazardous alcohol drinkers (20%). Having medical comorbidity, a longer duration of illness (12 months and above), being male were found to be significant predictors of hazardous alcohol drinking. Therefore, routine screening and a holistic treatment approach of alcohol use among patients with tuberculosis are crucial.

## **Abbreviations And Acronyms**

AUDIT: Alcohol Use Disorders Identification Test

DALYs: Disability Adjusted Life Years

PHQ-9: nine-item Patient Health Questionnaire

TB: Tuberculosis

## **Declarations**

**Competing interests:** The authors declare that they have no competing interests.

**Authors' contributions:** KY conceived the topic, wrote the proposal, involved in study design, participated in data collection process, analyzed the data, and drafted the manuscript. HML participated in the data analysis and writing of the paper. GA, HM, KK and HMT were involved in designing of the study and drafted the manuscript. All authors read and approved the final manuscript.

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### **Availability of data and materials**

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

### **Consent for publication**

Not applicable.

### **Ethics approval and consent to participate**

Ethical approval was obtained from Institutional Review Board (IRB) of Dilla University, College of Health Science and Medicine. Permission letter from zonal health department was also secured before data collection. Necessary permission was obtained from the health offices of the respective districts (i.e., Yirgacheffe district, Wonago district, and Dilla Zuriya district), and the health centers. The patients' confidentiality was respected, where only codes were used instead of the patients' names.

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## **References**

1. Kaplan BJ. Kaplan and sadock's synopsis of psychiatry. Behavioral sciences/clinical psychiatry. Tijdschrift voor Psychiatrie. 2016;58(1):78-9.
2. Saunders JB, Aasland OG, Babor TF, De La Fuente JR, Grant M. Development of the alcohol use disorders identification test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption-II. Addiction. 1993;88(6):791-804.
3. Piccinelli M, Tessari E, Bortolomasi M, Piasere O, Semenzin M, Garzotto N, et al. Efficacy of the alcohol use disorders identification test as a screening tool for hazardous alcohol intake and related disorders in primary care: a validity study. Bmj. 1997;314(7078):420.
4. Organization WH. Global status report on alcohol and health 2018: World Health Organization; 2019.

5. Organization WH. Global status report on alcohol and health 2018: Executive summary. World Health Organization; 2018.
6. Fauci AS, Kasper DL. Harrison's infectious diseases: McGraw-Hill; 2013.
7. Glaziou P, Floyd K, Raviglione MC, editors. Global epidemiology of tuberculosis. Seminars in respiratory and critical care medicine; 2018: Thieme Medical Publishers.
8. Volkmann T, Moonan P, Miramontes R, Oeltmann J. Tuberculosis and excess alcohol use in the United States, 1997–2012. *The International Journal of Tuberculosis and Lung Disease*. 2015;19(1):111-9.
9. Zhang P, Bagby GJ, Happel KI, Summer WR, Nelson S. Pulmonary host defenses and alcohol. *Front Biosci*. 2002;7(1).
10. Laprawat S, Peltzer K, Pansila W, Tansakul C. Alcohol use disorder and tuberculosis treatment: A longitudinal mixed method study in Thailand. *South African Journal of Psychiatry*. 2017;23.
11. Imtiaz S, Shield KD, Roerecke M, Samokhvalov AV, Lönnroth K, Rehm J. Alcohol consumption as a risk factor for tuberculosis: meta-analyses and burden of disease. *European Respiratory Journal*. 2017;50(1).
12. Lönnroth K, Jaramillo E, Williams BG, Dye C, Raviglione M. Drivers of tuberculosis epidemics: the role of risk factors and social determinants. *Social science & medicine*. 2009;68(12):2240-6.
13. Udwadia ZF, Amale RA, Ajbani KK, Rodrigues C. Totally drug-resistant tuberculosis in India. *Clinical Infectious Diseases*. 2012;54(4):579-81.
14. Duko B, Gebeyehu A, Ayano G. Prevalence and correlates of depression and anxiety among patients with tuberculosis at Wolaita Sodo University Hospital and Sodo Health Center, Wolaita Sodo, South Ethiopia, Cross sectional study. *BMC psychiatry*. 2015;15(1):1-7.
15. Gelaye B, Williams MA, Lemma S, Deyessa N, Bahretibeb Y, Shibre T, et al. Validity of the patient health questionnaire-9 for depression screening and diagnosis in East Africa. *Psychiatry research*. 2013;210(2):653-61.
16. Organization WH. Brief intervention for hazardous and harmful drinking: a manual for use in primary care. World Health Organization; 2001.
17. Abiola T, Udofia O, Zakari M. Psychometric properties of the 3-item oslo social support scale among clinical students of Bayero University Kano, Nigeria. *Malaysian Journal of Psychiatry*. 2013;22(2):32-41.
18. Organization WH. Brief intervention for hazardous and harmful drinking: a manual for use in primary care/Thomas F. Babor, John C. Higgins-Biddle. Brief intervention for hazardous and harmful drinking: a manual for use in primary care/Thomas F Babor, John C Higgins-Biddle2001.
19. Hayes-Larson E, Hirsch-Moverman Y, Saito S, Frederix K, Pitt B, Maama-Maime L, et al. Depressive symptoms and hazardous/harmful alcohol use are prevalent and correlate with stigma among TB-HIV patients in Lesotho. *The International Journal of Tuberculosis and Lung Disease*. 2017;21(11):S34-S41.

20. Zetola N, Modongo C, Kip E, Gross R, Bisson G, Collman R. Alcohol use and abuse among patients with multidrug-resistant tuberculosis in Botswana. *The International journal of tuberculosis and lung disease*. 2012;16(11):1529-34.
21. Suhadev M, Thomas BE, Murugesan P, Chandrasekaran V, Charles N, Durga R, et al. Alcohol use disorders (AUD) among tuberculosis patients: a study from Chennai, South India. *PloS one*. 2011;6(5):e19485.
22. Thapa P, Kamath R, Shetty B, Monteiro A, Sekaran V. Prevalence and associated factors of alcoholism among tuberculosis patients in Udipi Taluk, Karnataka, India: a cross sectional study. *Journal of Nepal Health Research Council*. 2014.
23. Peltzer K, Naidoo P, Matseke G, Louw J, Mchunu G, Tutshana B. Prevalence of psychological distress and associated factors in tuberculosis patients in public primary care clinics in South Africa. *BMC psychiatry*. 2012;12(1):1-9.
24. Peltzer K, Louw J, Mchunu G, Naidoo P, Matseke G, Tutshana B. Hazardous and harmful alcohol use and associated factors in tuberculosis public primary care patients in South Africa. *International journal of environmental research and public health*. 2012;9(9):3245-57.
25. de la Haye B, Wild S, Stevenson J, Johnston F, Blatchford O, Laurenson I. Tuberculosis and alcohol misuse in Scotland: a population-based study using enhanced surveillance data. *The International journal of tuberculosis and lung disease*. 2012;16(7):886-90.
26. Fiske CT, Hamilton CD, Stout JE. Alcohol use and clinical manifestations of tuberculosis. *Journal of Infection*. 2009;58(5):395-401.
27. Oeltmann JE, Kammerer JS, Pevzner ES, Moonan PK. Tuberculosis and substance abuse in the United States, 1997-2006. *Archives of Internal Medicine*. 2009;169(2):189-97.
28. Wilsnack RW, Vogeltanz ND, Wilsnack SC, Harris TR. Gender differences in alcohol consumption and adverse drinking consequences: cross-cultural patterns. *Addiction*. 2000;95(2):251-65.
29. Nolen-Hoeksema S, Hilt L. Possible contributors to the gender differences in alcohol use and problems. *The Journal of general psychology*. 2006;133(4):357-74.
30. Macintyre K, Bloss E. Alcohol brewing and the African tuberculosis epidemic. *Medical anthropology*. 2011;30(2):126-35.
31. O'Connell R, Chishinga N, Kinyanda E, Patel V, Ayles H, Weiss HA, et al. Prevalence and correlates of alcohol dependence disorder among TB and HIV infected patients in Zambia. *PloS one*. 2013;8(9):e74406.
32. Rehm J, Samokhvalov AV, Neuman MG, Room R, Parry C, Lönnroth K, et al. The association between alcohol use, alcohol use disorders and tuberculosis (TB). A systematic review. *BMC public health*. 2009;9(1):1-12.
33. Moran A, Harbour DV, Teeter LD, Musser JM, Graviss EA. Is alcohol use associated with cavitary disease in tuberculosis? *Alcoholism: Clinical and Experimental Research*. 2007;31(1):33-8.
34. Jakubowiak W, Bogorodskaya E, Borisov E, Danilova D, Kourbatova E. Risk factors associated with default among new pulmonary TB patients and social support in six Russian regions. *The*

international journal of tuberculosis and lung disease. 2007;11(1):46-53.

35. Khudzik L, Pankratova D, Riabov B, IuV V. Social and clinical characteristics of progressive forms of pulmonary tuberculosis in Saratov and Saratov region. Problemy tuberkuleza. 2001(6):24-7.
36. Shevchenko A. Tuberculosis of the respiratory tract and chronic alcoholism. Problemy tuberkuleza. 2001(8):6-8.
37. Di Gennaro F, Pizzol D, Cebola B, Stubbs B, Monno L, Saracino A, et al. Social determinants of therapy failure and multi drug resistance among people with tuberculosis: A review. Tuberculosis. 2017;103:44-51.