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Alcohol use disorder among people diagnosed with tuberculosis in a large urban case-finding project in central Uganda: prevalence, associated factors and challenges to treatment adherence

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Abstract

Background Heavy consumption of alcohol increases the risk of developing active tuberculosis (TB), contributes to delayed diagnosis and affects adherence to treatment. Within a large urban case-finding project, we aimed to determine the prevalence of and factors associated with alcohol use disorder (AUD) and to understand the challenges that people with AUD face while seeking for TB services and adhering to TB treatment.

Methods We carried out an explanatory sequential study in two large urban districts in Uganda. We collected quantitative data on the prevalence of alcohol use disorder using the Cut, Annoyed, Guilty, Eye opener (CAGE) tool. We used a Poisson regression model with robust variance to examine factors associated with AUD. Both the crude and adjusted prevalence risk ratios with 95% confidence intervals were presented. We then conducted two focus group discussions with persons diagnosed with both TB and AUD. Focus group discussions (FGDs) were transcribed, data were analysed inductively and coded into themes using NVIVO version 12 software.

Results Out of 325 people with TB people interviewed, 62 (18.7% 95% confidence interval [CI] 18–31%) screened positive for AUD. Majority 82.3% (51/62) were male. Being male aPR 2.32 (95% CI 1.19, 4.49) and living in an urban area aOR 1.79 (95% CI: 1.10, 2.92) were significantly associated with a positive screen. Among people who screened positive for AUD, there was a tendency towards suboptimal TB treatment outcomes, although this did not reach significance aPR 1.65 (95% CI: 0.95, 2.85). Fourteen people (eight male and six female) who screened positive for AUD attended two FGDs. These respondents often did not disclose alcohol use during TB treatment and missed clinic refill appointments due to lack of transport fares to the clinic.

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Conclusion A significant proportion of people with TB screened positive for AUD but did not disclose alcohol use to their healthcare workers. These patients experienced several challenges while on TB treatment. Therefore, TB care programs need to design interventions that actively assess for AUD and in order to address related challenges.

Keywords Tuberculosis, Treatment outcomes, Alcohol use disorder, Experiences, Uganda

Introduction

Tuberculosis (TB) remains a significant global health challenge. In 2022, there were an estimated 10.6 million people who fell ill with TB and an estimated 1.3 million deaths worldwide. Low- and middle-income countries are disproportionately affected by TB morbidity and mortality. In 2022, three-quarters of active TB disease and 80% of TB deaths occurred in Sub-Saharan Africa and South East Asia, where TB morbidity and mortality is driven by co-infection with HIV and conditions resulting from social and economic deprivation [1]. In sub-Saharan Africa, 60% of all active TB disease is attributable to three risk factors: undernutrition (28%), HIV (24%), and alcohol use disorder (8%).

Uganda is among the 30 high TB burden countries and, in 2022, diagnosed more than 90,000 people with TB. Uganda also has the highest per capita consumption of alcohol in sub-Saharan Africa [2]. The country has an estimated prevalence of AUD of 9.8% in the adult population which is higher among men and among populations in urban settings [3]. Alcohol use disorder (AUD) is a known risk factor for tuberculosis infection and active disease [4]. Prolonged alcohol use weakens the immune system leading to a higher risk of progression from latent to active TB [5]. Alcohol use also results in intense mixing within social groups which leads to community transmission of TB [6]. In Uganda, where alcohol consumption often occurs in close social groups, it is estimated that 15% of the total TB burden - translating into 15,000 persons diagnosed with TB each year- is attributable to alcohol use [1]. AUD also contributes to non-adherence to TB treatment leading to suboptimal treatment outcomes and increasing the likelihood of relapse and death from TB [7]. Among persons on TB preventive therapy, alcohol consumption has been associated with sub optimal treatment completion thus decreasing the protective effect of Tuberculosis Preventive Therapy [8, 9].

Finally, AUD and TB are both characterised by social marginalization and stigma, their co-existence therefore doubly disadvantages people decreasing their ability to seek and remain in care [10]. In order to deliver TB care that is equitable and meets the needs of these persons, it is important to understand the nature and magnitude of AUD among people diagnosed with TB in routine healthcare settings in Uganda. Within a large urban TB case-finding project, we aimed to assess the prevalence of and factors associated with alcohol use disorder among persons diagnosed with TB and to understand challenges experienced by these people during TB treatment.

Methods

Study setting and population

This study was embedded in a large TB case finding project sponsored by the WHO STOP TB Partnership through its TBREACH initiative. The project was implemented in two metropolitan districts in central Uganda (Kampala and Wakiso) and its main objective was to improve TB case-finding within community pharmacies and private clinics in Kampala. The project trained private health providers to recognise TB signs and symptoms, collect sputum samples from presumptive TB patients, send samples for GeneXpert testing through the national specimen transportation system and refer people diagnosed with TB to public facilities for TB treatment initiation. Prior to inclusion of private providers in the project, they were assessed for suitability based on three criteria: (i) clientele received per day (ii) availability of a suitable sputum collection area and (iii) willingness to screen for TB and collect sputum [11].

From February to April 2021, we carried out an explanatory sequential mixed methods study [12] within this project. Our sample size was determined using the formula for survey sampling by Kish Leslie [13]. For our calculation, we considered the average prevalence of AUD among persons diagnosed with TB to be 30% [10]. Our estimated sample size was therefore 322.

We consecutively enrolled persons ≥ 18 years who were diagnosed with bacteriologically confirmed TB by private health providers trained by the project. Qualitative study participants were purposively selected from persons with TB who screened positive for AUD and invited to attend focus group discussions (FGDs). Participants who were available within the study area and agreed to attend the discussions were interviewed.

Data collection

We collected quantitative data using structured questionnaires, which assessed participants' socio demographic characteristics, medical history, and alcohol use. Data on alcohol use were collected using the CAGE questionnaire, a four -symptom questionnaire that asks people if they have ever (a) felt the need to *cut* down on their drinking (b) felt *annoyed* by criticism of their drinking (c) had *guilty* feelings about drinking and (d) taken a morning *eye-opener*. Male participants are classified as having

screened positive for AUD if they gave an affirmative response to ≥2 questions while female participants are classified as having screened positive for AUD if they had an affirmative response to ≥1 questions. The lower cut off score for women was chosen considering the clinical and epidemiological differences between male and female patterns of alcohol use disorder [14, 15]. The CAGE has test-retest high reliability [16] and has been validated against the Diagnostic Statistical Manual (DSM) criteria for alcohol use disorder in a variety of settings. Among primary care patients (a population similar to the one in this study), a CAGE score of ≥2 was shown to have a sensitivity of 0.71, a specificity of 0.91 and a positive predictive value of 0.74 [17] For the recognition of covert alcohol dependency, the CAGE questionnaire was shown to have a positive predictive value of 87% compared to the DSM criteria [18].

We collected additional qualitative data from a subset of persons with TB who screened positive for AUD to understand their challenges with accessing and adhering to TB treatment. We held two focus group discussions (FGDs) in the community at locations chosen by the participants. The FGDs consisted of eight male participants and six female participants. The gender segregations were intended to minimize the stigma still attached to AUD among females in Uganda and other countries in sub-Saharan Africa [19] and allow each gender to freely express themselves. This approach was also used to minimize social desirability bias [20]. The FGDs were moderated by two of the study investigators (JB and SN) who are trained in qualitative methods. The moderators used FGD guides which were designed and piloted by the study team to ensure that they addressed study objectives. The guides included questions which explored participants' experiences with TB diagnosis and treatment adherence including their knowledge on where to access TB diagnosis, their reaction to TB diagnosis, willingness to disclose their AUD to healthcare providers, and barriers to TB treatment initiation or retention in care. Projective wording was used to encourage neutral and genuine responses from participants [21]. All FGDs were conducted in the local language (Luganda) which is widely used by residents in the central region and lasted these 40–60 min.

Data analysis

Quantitative analysis

Demographic characteristics of the study population were described using frequencies and percentages. The proportion of persons diagnosed with TB who screened positive for AUD was described. Pearson's chi-square test was used to assess the associations between a positive AUD screen and the different demographic characteristics, and the corresponding p-values presented. A Poisson regression model with robust variance was used to examine factors associated with a positive AUD screen and both the crude and adjusted prevalence risk ratios with 95% confidence intervals were obtained. The model was built using a forward stepwise approach and the model with the lowest Akaike Information Criterion (AIC) was selected as the final model. Statistical analysis was carried out using STATA 15.0.

Qualitative analysis

Audio files from the FGDs were transcribed verbatim. Coding was done by two trained qualitative researchers to minimise bias. Discrepancies were settled by concurrence. An inductive analysis approach was employed. Manual coding on one transcript was done to develop a coding framework. Segments of responses in each transcript were summarised into codes that were grouped to develop themes. NVivo version 12 software was used to manage data and conduct open coding on all the transcripts. The approach adopted for analysis makes our findings reliable and credible. Our findings are presented with illustrative quotes for each emergent theme.

Ethics Statement

We adhered to the Declaration of Helsinki and the Guidelines for Good Clinical Practice (GCP). Every member of the research team held certification in Good Clinical Practice and the protection of human subjects. The study was reviewed by the Infectious Diseases Institute (IDI) scientific committee to assess for compliance with GCP. Institutional review and approval were obtained from the School of biomedical sciences research ethics committee and the Uganda National Council of Science and Technology (UNCST) Ref (HS1106ES) respectively.

Obtaining informed consent

All participants involved in the study provided written informed consent before participating in the study including permission to audio record the interview. They also consented to sharing data without disclosing their identity. All data collected was kept in lockable cabins and audio files were password protected.

Results

Overall, 325 persons diagnosed with TB were enrolled into the study. Majority, 212 (65.2%) were male with a median age of 33 years (IQR 26 to 42). Two hundred ninety-two (89.8%) had attained at least a primary education and 65(20%) were living with HIV (Table 1).

Sixty-two (19.0%) of study participants screened positive for AUD. In the unadjusted analysis, sex PR 2.47 (95% CI 1.34, 4.55), age of residence PR 2.08 (95% CI 1.30, 3.32); being over 35 years (PR 3.19 (95% CI 1.31, 7.77), being divorced or widowed PR 1.88 (95% CI 1.06,

Table 1 Characteristics of participants interviewed

Characteristic	Positive AUD screen (*N* = 62) *n* (%)	No AUD (*N* = 263) *n* (%)	Chi-square pvalue[1]
Sex			
Male	51 (82.3)	161 (61.2)	
Female	11 (17.7)	102 (38.8)	**< 0.01**
Area of Residence			
Urban	39 (62.9)	107 (40.7)	
Peri-urban	23 (37.1)	156 (59.3)	**< 0.01**
Age			
15–24	5 (8.1)	61 (23.2)	
25–34	21 (33.9)	89 (33.8)	
35–44	20 (32.2)	64 (24.3)	
45+	16 (25.8)	49 (18.6)	**0.04**
Type of person with TB			
Newly diagnosed	54 (87.1)	242 (92.0)	
Previously treated	8 (12.9)	21 (8.0)	0.22
HIV Status			
PLHIV	12 (19.4)	53 (20.1)	
HIV-	49 (79.0)	205 (78.0)	
HIV unknown	1 (1.6)	5 (1.9)	0.98
Highest Education Level Attained			
None	6 (9.7)	27 (10.3)	
Primary	28 (45.1)	106 (40.3)	
Secondary	22 (35.5)	103 (39.1)	
Tertiary	6 (9.7)	27 (10.3)	0.92
Marital Status			
Single	17 (27.4)	111 (42.2)	
Married	24 (38.7)	89 (33.8)	
Divorced/Separated/Widowed	21 (33.9)	63 (24.0)	**0.08**
Primary Employment			
None	14 (22.6)	75 (28.5)	
Self-Employment	38 (61.3)	133 (50.6)	
Salaried Employment	10 (16.1)	55 (20.9)	0.31
Daily Income (rate 1$=UGX 3586)[2]			
<$2	31 (50.0)	123 (46.8)	
$2–5	18 (29.0)	87 (33.1)	
$>5	13 (21.0)	53 (20.1)	0.83
Socioeconomic status			
Low	24(38.7)	89 (33.8)	
Middle	18(29.0)	87 (33.1)	
High	20 (32.3)	87 (33.1)	0.74

1: **Bold**: p-value < 0.2

2: international poverty line is estimated at 1.90 by the world bank [22]

3.36) and having a poor treatment outcome (defined as death, loss to follow up) PR 1.77 (95% CI 1.00, 3.93) were significantly associated a positive AUD screen. However, in the adjusted analysis, only male sex aPR 2.32 (95% CI 1.19, 4.49) and living in urban areas aPR 1.79 (95% CI 1.10, 2.92) were significantly associated with a positive AUD screen. There was a tendency towards poor treatment outcomes among people who screened positive for AUD but this did not reach statistical significance aPR 1.65 (95% CI: 0.95, 2.85). *(*Table 2*)*

Qualitative analysis

Two focus group discussions were attended by 14 respondents (8 men and 6 women). All respondents were persons diagnosed with both TB who screened positive for AUD. The median age of the respondents was 38(IQR 29–47) years. Majority 10/14 of the respondents were living with HIV, 13/14 had newly diagnosed TB and 12/14 had successfully completed treatment. Almost half (6/14) of the respondents were living below the international poverty line (earned less than two dollars a day).

Table 2 Factors associated with a positive AUD screen among persons diagnosed with TB

Characteristic	Overall Sample *N* = 325	AUD *N* = 62	No AUD *N* = 263	Unadjusted PR 95% CI	Adjusted PR 95% CI
Sex					
Male	212 (65.2)	51 (82.3)	161 (61.2)	**2.47(1.34, 4.55**)	**2.32 (1.19, 4.49**)
Female	113 (34.8)	11 (17.7)	102 (38.8)		
Area of Residence					
Urban	146 (44.9)	39 (62.9)	107 (40.7)	**2.08(1.30, 3.32)**	**1.79 (1.10, 2.92)**
Peri-urban	179 (55.1)	23 (37.1)	156 (59.3)		
Age					
15–24	66 (20.3)	5 (8.1)	61 (23.2)		
25–34	110 (33.9)	21 (33.9)	89 (33.8)	2.52(1.00,6.37)	1.90 (0.72, 5.02)
35+	149 (45.8)	36 (58.0)	113 (43.0)	**3.19(1.31, 7.77)**	1.92 (0.71, 5.22)
Type of TB					
Newly diagnosed TB	296 (91.1)	54 (87.1)	242 (92.0)	0.66(0.35, 1.25)	0.73 (0.38, 1.41)
Previously treated TB	29 (8.9)	8 (12.9)	21 (8.0)		
HIV Status					
PLHIV	64 (19.7)	11 (17.7)	53 (20.1)	0.88(0.49, 1.59)	0.95(0.49, 1.85)
No HIV	261 (80.3)	51 (82.3)	210 (79.9)		
Highest Education Level Attained					
None	134 (41.2)	6 (9.7)	27 (10.3)		
Primary	125 (38.5)	28 (45.1)	106 (40.3)	1.15 (0.52, 2.55)	1.23 (0.55, 2.72)
Secondary	33 (10.1)	22 (35.5)	103 (39.1)	0.97 (0.43, 2.19)	1.32 (0.59, 2.97)
Tertiary	33 (10.1)	6 (9.7)	27 (10.3)	1 (0.36, 2.79)	1.38 (0.52, 3.69)
Marital Status					
Single	128 (39.4)	17 (27.4)	111 (42.2)		
Married	113 (34.8)	24 (38.7)	89 (33.8)	1.60 (0.37, 2.82)	1.39 (0.73, 2.64)
Divorced/Separated/Widowed	84 (25.8)	21 (33.9)	63 (24.0)	**1.88 (1.06, 3.36)**	1.66 (0.86, 3.23)
Primary Employment					
None	89 (27.4)	14 (22.6)	75 (28.5)		
Self-Employment	171 (52.6)	38 (61.3)	133 (50.6)	1.41 (0.81, 2.47)	1.30 (0.73, 2.32)
Salaried Employment	65 (20.0)	10 (16.1)	55 (20.9)	0.98 (0.46, 2.06)	0.93 (0.44, 1.94)
Daily Income(rate 1$=UGX 3586)[1]					
<$2	154 (47.4)	31 (50.0)	123 (46.8)		
$2–5	105 (32.3)	18 (29.0)	87 (33.1)	0.85 (0.50, 1.44)	0.66 (0.37, 1.16)
$>5	66 (20.3)	13 (21.0)	53 (20.1)	0.98 (0.55, 1.75)	0.69 (0.39, 1.21)
Socioeconomic status					
Low	113 (34.8)	24(38.7)	89 (33.8)		
Middle	105 (32.3)	18(29.0)	87 (33.1)	0.81 (0.46, 1.40)	0.95 (0.56, 1.63)
High	107 (32.9)	20 (32.3)	87 (33.1	0.88 (0.52, 1.50)	1.23 (0.69, 2.20)
Treatment Outcomes					
Treatment success	285 (87.7)	50 (80.7)	235 (89.4)		
Death[2] /Unknown[3]/LTFU[4]	40 (12.3)	12 (19.3)	28 (10.6)	**1.71 (1.00, 2.93)**	1.65 (0.95, 2.85)

1: international poverty line is estimated at 1.90 by the world bank [22] 2: Death from any cause while on TB treatment 3. Unknown: person whose treatment outcome is not recorded 4: LTFU- loss to follow-up: a person who missed two or more consecutive months of TB treatment. 5. **Bold**: significant associations

Our qualitative analysis yielded themes about respondents' experiences along the TB cascade of care. Respondents reported delayed TB diagnosis because healthcare workers thought their chronic ill health was due to their alcohol use. They also noted significant stigma and discrimination from community members. Respondents did not disclose alcohol use to their healthcare workers due to fear of retribution and additional stigmatization. Consequently, they did not receive any interventions to stop or reduce alcohol use while on TB treatment. Concurrent use of alcohol during TB treatment was reported to increase drug adverse reactions. Finally, the lack of food and transport fares to return to the health facility for clinic refill visits caused difficulties with TB treatment adherence.

Delayed access to TB diagnosis

Persons diagnosed with both TB who screened positive for AUD reported delayed diagnosis due to lack of

knowledge about TB and low self-risk perception which hindered them from seeking TB testing services.

"…You have lost weight, what is the problem these days?" [They asked] I responded that, "I do not know" so they told me, "Go test for TB" I asked, "where would I get TB from?" they told me that, "Anyone can get infected with TB". (23-year-old female)

"I had refused, if it was not for my sister there, [points at a community health worker at a distance] I had refused. She insisted and said, "You have a bad cough, let us go to the health facility". I said, "No" but she kept insisting until she brought me. It was a Saturday approaching 5:00pm. I was tested and I got treatment immediately." (59-year-old Male).

However, at other times, the delayed diagnosis of TB among persons who screened positive for AUD was because their frequent ill health was sometimes mistaken as arising from excessive alcohol use. This resulted in several misdiagnoses and large medical bills accumulating from repeated visits to healthcare facilities which in turn caused social disharmony.

"Every time they took me to the health centre they would say I am sick and put cannulas [for IV medicines] on me. I would not spend a week without falling sick." (24-year-old female).

TB stigma and discrimination

Among people who screened positive for AUD, a TB diagnosis was received with anxiety due to stigma towards people with TB within their families and in the larger community. Family members isolated them and mistook them for HIV positive individuals while community members did not want to share workspaces with them.

"Only people who have ever experienced that situation would understand but I was given my own plate and cup and asked not mix my utensils with other people's utensils". They would say, "this one who has TB cannot fail to have HIV, she has two problems." (24-year-old female).

"I feared being discriminated by people, everyone who looks at you asks you to leave". (40-year-old male).

Some of the people interviewed were afraid of losing their jobs particularly if they worked in large public spaces or in close proximity with others.

"You know I work in a very public place, since I work in a bar selling beer. You know these customers. If they buy, they want you to drink some". (39-year-old female bartender).

"TB medicine is strong medicine. You need to work [so that you can get food to eat] but my colleagues at the construction site, they did not want me to get close to them. Where would I work then?" (42-year-old male).

In addition to TB stigma, respondents were afraid of additional discrimination towards them due to their alcohol use. As a result, they often did not disclose this to healthcare workers

"The healthcare workers taught us to adhere to TB treatment. They instructed us to first eat and then swallow medicine"… "However, we hid the fact that we were taking alcohol from them". (39-year-old female)

Experiences with TB Treatment.

Persons with screened positive for AUD experienced several challenges during TB treatment including the side effects of TB medicines, which were sometimes exacerbated by concurrent alcohol use and lack of adequate food and/or transport fares to visit the health facilities.

"However, when I took alcohol soon after the medicine, it would affect me badly…. I would get burning in the stomach and I would get 'really drunk'. I could not sleep well". (39-year-old female).

"There is a time I did not swallow the TB medicine because I had no food yet the healthcare workers had told me that I should first eat then swallow [medicine] when I am satisfied". (28-year-old female).

"There is a time I spent about two days without returning to the clinic because I had no money for [the] transport [fare]". (24-year-old female).

However, due to lack of disclosure about alcohol use to the healthcare workers, people did not receive any help dealing this problem. As a result, many of them continued taking alcohol, while they were on TB treatment.

> *"Of course, alcohol is not something easy to quit. You sometimes choose not to drink but later in the evening or night-time, after you have finished doing your work, you find yourself taking some [alcohol]". (24-year-old female).*

> *"Of course, healthcare workers told us not to take alcohol or cigarettes with our TB medicines. I stopped smoking but I must take some alcohol, I cannot stay without taking alcohol". (59-year-old male).*

> *"Not being able to take alcohol while on TB treatment was difficult because if you do not drink, you do not get sleep". (40-year-old male).*

Notably, some people with AUD noted receiving some interventions which enabled them to improve their adherence to TB medicines. These included digital adherence interventions and community-based support from community healthcare workers.

> *"The phone reminds you that you need to swallow your medicine. They would also call me and ask, Have you swallowed? and I talk with them". (36-year-old male).*

Discussion

In this study, we explored prevalence of and factors associated with alcohol use disorder among people diagnosed with TB in a large urban case-finding project. In addition, we documented the challenges faced by persons who screened positive for AUD while on TB treatment. We found that almost one in five people diagnosed with TB screened positive for AUD. Being male and residing in an urban setting were significantly associated with a positive AUD screen. The proportion of persons who screened positive for AUD in our study was higher than that reported in the general population in Uganda but comparable to that in other populations of persons diagnosed with TB and people living with HIV [10, 23]. This is because AUD results in impaired immunity which increases the likelihood of progression from latent TB infection to active TB disease [24]. In addition, AUD is associated with social marginalization and conditions such as crowding, malnutrition, and poverty which predispose these persons to TB.

The proportion of men who screened positive for AUD was five times higher than that of women, a finding consistent with that from other studies both globally and in sub-Saharan Africa [10, 21, 25, 26]. Higher prevalence of alcohol use disorder among men is attributed to higher disposable income, greater social acceptance for drinking among men and lack of alcohol control policies that result in under-age drinking particularly among young boys [23, 27, 28]. Our study found an association between living in urban areas and higher rates of screened positive for AUD. This may be due to greater availability of alcohol and closer proximity of alcohol distribution outlets to their potential consumers in urban than in rural areas. Studies from both Uganda and other developed countries have found that living in urban cities with higher numbers of alcohol outlets was independently associated with increased alcohol use [3, 29]. These findings imply that screening for AUD should be integrated into routine healthcare delivery particularly in urban and peri-urban settings in Uganda.

Our study found that a tendency towards suboptimal treatment outcomes (death, treatment failure and loss to follow-up) among people with screened positive for AUD although this association did not reach significance. Suboptimal treatment outcomes caused by non-adherence to TB treatment or altered absorption and metabolism of TB medicines have been reported in other studies. In these studies, people with both TB and AUD were twice as likely to experience treatment failure or death while on TB as people with only TB [7, 30–32]. However, in our study, non adherence to TB treatment could have been mitigated by the available adherence support systems e.g., digital adherence interventions mentioned by some of the participants. These findings show that in order to further improve TB treatment outcomes in Uganda, the national TB and Leprosy program must prioritise the management of comorbidities including AUD among patients diagnosed with TB.

Persons who screened positive for AUD experienced stigma related to both TB and alcohol use. TB stigma resulted in physical isolation and loss of work while AUD stigma prevented disclosure of alcohol use to healthcare providers. TB Stigma is common in high TB burden countries [33] and contributes to delayed diagnosis, delayed initiation of treatment and non-adherence to TB treatment [34]. Non-disclosure of alcohol use is also common among people with AUD and results disease progression and poor outcomes for co-morbidities [35–37]. However, currently treatment for alcohol use disorders is not integrated into primary care settings in Uganda. It is therefore important that healthcare workers are provided with the training and tools to routinely screen people diagnosed with TB for AUD and deliver interventions to reduce alcohol use e.g., counselling or behavioural interventions in order to improve treatment outcomes in this population [37, 38].

For many people with AUD, lack of food and transport fares to health facilities were a barrier to TB treatment adherence. Adequate nutrition is important in ensuring optimal adherence to TB treatment and improving treatment outcomes [39, 40]. In high TB burden, low income settings, food and monetary support have been shown to improve TB treatment completion. In Uganda, the national TB and Leprosy program has provided food and cash supplements to people with multi-drug resistant TB over the past five years, which has contributed to significant improvements in treatment completion in this group [41]. Similar interventions should be considered for vulnerable people with drug susceptible TB e.g. people with AUD.

Limitations of the study

We used both quantitative and qualitative data collection methods and so we were able to triangulate our study results. During the focus group discussions, we interviewed males separately from females to minimize stigma and encourage unhindered sharing of experiences with alcohol use disorder. However, our study had some weaknesses. We did not further validate a positive CAGE screen with a definitive diagnostic tool for alcohol use disorder e.g., the Diagnostic and Statistical Manual. Therefore, we could have overstated the prevalence of alcohol use disorder in this study. We only used only self-reported measures of alcohol use disorder which likely resulted in under-reporting of the condition due to social desirability bias as has been reported in other studies [42]. To limit this, we trained our research staff to probe for detailed responses from participants. We also encourage our research staff to use projective wording during focus group discussions to elicit neutral and genuine responses [43]. Participants in our focus group discussions were predominantly persons living with HIV. So, the qualitative findings may be more representative of the HIV positive population. Finally, our study excluded people below 18 years who may have added valuable insights on AUD in this population, this will be considered for future studies.

Conclusion

Our study showed that a high proportion of persons diagnosed with TB in central Uganda screened positive for AUD. This is likely to adversely affect TB treatment outcomes among these people. Interventions to address AUD should be integrated into primary care settings in order to address this problem.

Abbreviations

AIDS	Acquired Immune Deficiency Syndrome
AUD	Alcohol Use Disorder
CAGE	Cut, Annoyed, Guilty, Eye opener
COVID-19	Coronavirus Disease
FGDs	Focus Group Discussions
GCP	Good Clinical Practice
HIV	Human Immune Virus
IDI	Infectious Diseases Institute
PLHA	People Living With HIV/AIDS
TB	Tuberculosis
TPT	Tuberculosis Preventive Therapy
UNCST	The Uganda National Council of Science and Technology

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Author contributions

CS, SZM, ELO, and AD conceptualized the project. SZM, CSW, AD, ELO, JB, LS, and TS finalized the protocol and prepared data collection instruments. SZM, CSW, AD, ELO, JB, LS, and MN printed the tools and trained data collectors. JB, SZ, and IK analyzed the data. All authors contributed to interpreting the results and writing and revising the manuscript. SZM authorized the final manuscript version.

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Data availability

Electronic copies of study CRFs, research quantitative data set, the corresponding transcripts and code book, and generated queries from NVivo analysis are backed up on the IDI one drive share point with restricted access. However, they are available upon request to the corresponding author.

Declarations

Ethics approval and consent to participate

The study obtained ethical approval from the Makerere University College of Health Sciences School of Biomedical Sciences Research and Ethics Committee (SBS-REC) and the Uganda National Council for Science and Technology (Approval reference number HS1106ES). All study participants provided written informed consent before enrolment. The study was conducted in compliance with Good Clinical practice guidelines.

Consent for publication

This declaration is not applicable as no individual data has been published in this manuscript.

Competing interests

The authors declare no competing interests.

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