Alcohol use perceptions and risky behaviors—a mixed method study in Moshi,

Tanzania

by

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Thesis submitted in partial fulfillment of
the requirements for the degree of
Master of Science in the Graduate Program
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ABSTRACT

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Abstract

Background: The Kilimanjaro region has one of the highest rates of reported alcohol use per capita in Tanzania. Alcohol-related risky behaviors pose substantial threats to the health and well-being of alcohol users and people around them. This study sought to provide a better understanding of how risky behaviors are associated with alcohol use perceptions. Methods: This mixed method study took place in the Kilimanjaro Christian Medical Center. Quantitative data on alcohol use, the alcohol use disorder identification tool, alcohol-related consequences, and qualitative data on alcohol use perception and risky behaviors were collected from a hospital- and non-hospital-based sample in Moshi, Tanzania. Latent class analysis was applied to examine alcohol-related risky behaviors. Results: Three classes of risky behavior patterns were identified: "no risky behavior", "moderate risky behaviors" and "high risky behaviors". Membership of classes 3 was associated with the most alcohol use quantity and frequency. No association between classes and alcohol-stigma was found. Our qualitative results explored alcohol perceptions and risky behaviors and illustrated their possible associations. Conclusions: Although alcohol stigma may not associate the number of risky behaviors directly, our qualitative result helped us to understand how stigma associates with risky behaviors. This study may serve as a reference for designing and adjusting interventions for alcohol-related injury patients' needs; we can improve interventions by using our knowledge

about misconception and stigma and the identified risky behaviors classes as a form of

classification system.

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1. Introduction

1.1 Alcohol as a risk factor

Alcohol is one of the leading causes of death, disease, and disability globally; alcohol is associated with more than 200 types of diseases in the International Classification of Diseases-10 (ICD-10), including gastrointestinal, cancer, injury, cardiovascular, alcohol use disorder (AUD), and fetal alcohol syndrome (Rehm et al., 2010). Moreover, for the population aged 15–49 years, alcohol consumption accounts for 2·3% (95% UI 2·0–2·6) of female disability-adjusted life years (DALYs) and 8·9% male DALYs (Griswold et al., 2018). Specifically, within Africa, alcohol accounted for 6.4% of all deaths and 4.7% of all DALYs in 2012 (Ferreira-Borges, Rehm, Dias, Babor, & Parry, 2016).

In 2016, Tanzania reported average alcohol consumption of 9.4 liters per capita per year (persons 15+ years old), whereas the corresponding average for the WHO Africa Region was 6.3 liters (Organization, 2018). Prevalence of alcohol use disorders in Tanzania is 6.8% in 2016, which is 1.84 times higher than the WHO Africa Region (3.7%) (Organization, 2018). Previous studies show that alcohol use is a significant problem among young people in Tanzania: approximately 20-45% of male and 11-47% of female college students reported current alcohol use; and 11–28% of the young male are screened positive for alcohol-use disorders (AUDs) (Francis, Grosskurth, Changalucha, Kapiga, & Weiss, 2014; Francis et al., 2015).

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The Kilimanjaro region, which includes Moshi, has one of the highest reported alcohol intake per capita in Tanzania (Francis et al., 2015; Mitsunaga & Larsen, 2008). The prevalence of alcohol abuse in Moshi has been found to be 22.8% in men, 7.0% among women with partners, and 9.5% among single women (Mitsunaga & Larsen, 2008). Possible contributing factors to such high alcohol abuse rate in the Moshi region may include the Chagga culture, home-brewed alcohol tradition, and an influx of tourists (Mitsunaga & Larsen, 2008; Rodriguez-Garcia, 2001). Thus, Moshi is an ideal setting to study the perception of alcohol use and its relationship with alcohol-related risky behaviors.

The burden of alcohol use, especially among injury patients, is high in the Kilimanjaro region of Tanzania. Approximately 30% of the injury patients presented in KCMC ED consumed alcohol at the time of injury and were considered "Hazardous drinkers" (C. A. Staton et al., 2018). Injury patients who suffer an alcohol-related injury may be at high risk for drink drive, fighting, and other alcohol-related risky behaviors (Cryer, 2005; Nilsen et al., 2008). Injury patients are also a vulnerable population that suffers from both alcohol stigma and alcohol-related consequences. Due to this high chance of being involved in risky behaviors, injury patients are an important target for future hazardous alcohol use interventions.

1.2 Alcohol stigma

Alcohol related stigma is both prevalent and pervasive among people in Moshi (El-Gabri, 2017). This stigma can influence people's alcohol use, risky behavior and help-seeking behavior (El-Gabri, 2017). Stigma is defined as the negative perception of the act of drinking, alcohol-related risky behaviors, or the person who drinks or persons that conduct alcohol-related risky behaviors. Perceived stigma is defined as one's awareness of the discrimination and devaluation, which is directed at those whose conditions are considered unfavorable (Link, 1987). The public stigma affects alcohol-dependent people from both social and societal levels (Corrigan & Watson, 2002; Rüsch, Angermeyer, & Corrigan, 2005). People with AUD may be discriminated and/or devalued due to stigma, thus the burden is also added from the individual level. Self-stigma arises when a patient internalizes a negative view of alcohol use towards him or herself. As a result, perceived stigmas are related to many negative outcomes among people with alcohol disorders, including poorer psychological functioning (Smith, Dawson, Goldstein, & Grant, 2010), poorer physical health (Ahern, Stuber, & Galea, 2007), higher depression scores (Luoma, O'Hair, Kohlenberg, Hayes, & Fletcher, 2010), lower perceived social support, and lower treatment and care seeking (Keyes et al., 2010; Parcesepe & Cabassa, 2013; Room, 2005; Vogel, Wade, & Haake, 2006).

1.3 Alcohol, stigma, and risky behaviors

Alcohol use has been associated with risky behaviors including risky sexual behaviors

and illicit drug use (Ghebremichael, Paintsil, & Larsen, 2009; Kalichman, Simbayi, Kaufman, Cain, & Jooste, 2007; Kandel, 1975; Weiser et al., 2006). Stigma may influence risky behaviors both positively and negatively. Studies have found that moderate stigma surrounding risky behaviors may reduce the spread of harmful behavior (Bayer, 2008; Livingston, Milne, Fang, & Amari, 2012; Stuber, Meyer, & Link, 2008). On the other hand, alcohol stigma is found to exacerbate negative alcohol consequences: it may delay help-seeking behaviors, because people fear being labeled as alcoholics and subsequently incur discrimination (Room, 2005). But, to our knowledge, the specific association between alcohol stigma and risky behaviors have not been studied.

1.4 Study aims

This study is the first attempt to explore the associations between perceptions and stigma of alcohol and risky behaviors in a low- and middle-income country.

General objective:

To understand the associations between alcohol use, risky behaviors, and perceptions and stigma across injury and non-injury populations in northern Tanzania.

Specific Objectives:

- Quantitative 1. Describe the alcohol use pattern, alcohol stigma, and alcohol-related risky behaviors among injury patients and the general population in Moshi.

- Quantitative 2. Identify the profiles of alcohol-related risky behavior and associate

them with alcohol use pattern and the alcohol stigma among injury patients and the general population in Moshi.

- Qualitative 3. Explore the perceptions of alcohol, stigma, risky behaviors, and alcohol use culture.

Our hypotheses were people with high alcohol-related risky behaviors tend to have higher chance of getting an alcohol use disorder and more alcohol use, as well as higher alcohol perceived stigma score measured by Alcohol-Adapted Perceived Discrimination-Devaluation scale (PDD).

2. Methods

2.1 Setting

2.1.1 Moshi, Tanzania

Moshi is the capital city of the Kilimanjaro Region of Northern Tanzania and contained a population size of over 201,150 people (51.6% female) in 2017 (Tanzania, 2012). Moshi is located near Africa's highest mountain Kilimanjaro with an altitude of 700-950 meters and coordinates 3°20's 37°20'e (Figure 1) (Moshi-Municipal-Council, 2018). The majority of people in Moshi are members of the Chagga, Pare, and Masai ethnic group (Tanzania, 2012). Language is mainly Swahili, with a small number of people who speak English.

Figure 1. Location of Moshi

Moshi and the Kilimanjaro Region are not only known for their relatively high economic development but also better health care services and low rates of mortality and low prevalence of infertility (Data-for-all, 2012; Larsen et al., 2015). In 2017, life expectancy at birth in the Kilimanjaro region is 66 years old for both male and female, which is similar to the average of Tanzania.

2.1.2 Study setting

Moshi is home to Kilimanjaro Christian Medical Center (KCMC), the third largest hospital in Tanzania. With more than 630 beds, KCMC also serves as a referral hospital for over 15 million urban and rural people in Northern Tanzania (KCMC, 2018). Therefore, KCMC was selected to assess the general perceptions of the Northern Tanzania area. This study took place in KCMC and its Emergency Department (ED).

2.2 Study Design

This mixed method study explored the associations of perceptions and stigma of alcohol use and alcohol-related risks behaviors. A mixed method approach was chosen because neither quantitative nor qualitative data only can explain how risky behaviors are linked to perceptions and other social factors. Therefore, qualitative data becomes crucial in helping us to understand what perceptions people have and their relationship to risky behaviors. The overall framework is shown in Figure 6.

Figure 2. Mixed Method Approach flow diagram

As the first step, we validated and explored the psychometric properties, validity, and reliability of the Drinker Inventory of Consequences (DrInC) in Tanzanian Swahili and Moshi population. Although DrInC is a commonly administered harm assessment questionnaire, the Swahili version has not been fully explored in sub-Saharan Africa and cross-culturally validated in local Tanzanian Swahili culture. The validation details can be found in Zhao (2018). We used quantitative survey data from two surveys administered in Moshi to describe alcohol use, perceived stigma, and risky behaviors. Participants were then grouped into profiles based on their risky behavior patterns and we associated these profiles with perceived stigma and alcohol use based on our quantitative data.

In the qualitative phase, we conducted 7 focus group discussions with injury patients, family members, and medical and research personnel to explore perceptions of

alcohol use and risky behaviors in KCMC. Focus group topics corresponded to qualitative research objectives, which explored the alcohol-related risky behaviors and their relation to perceptions and stigma of alcohol use. Focus group topics were divided into two sets: 1) alcohol stigma and risky behaviors conducted by the research team, and 2) alcohol use knowledge and culture conducted by the PI. Focus groups were conducted between June 2018 and August 2018.

Injury patients were chosen as both parts of the quantitative and qualitative population of interest because they are vulnerable in the face of both alcohol stigma and related consequences. Compared with patients present at a primary health care facility, those presenting to the ED are more likely to report higher problem drinking rates and alcohol dependence (Cherpitel, 1999). Therefore, injury patients presenting in an emergency care setting will be the ideal population to study alcohol perceptions and selecting them may increase the sensitivity of this study as they are more likely to suffer from alcohol-related consequences than other populations (Cryer, 2005; Nilsen et al., 2008). The qualitative part of this study also included injury patients' family members and medical and research personnel. Many cultures are family centered in Africa, family members may know the habit of the injury patient and would be more willing to provide related information than the injury patient themselves. Medical personnel were included because they contact injury patients every day and witnessed the burden of alcohol-related consequences. Research personnel were included because they have conducted

extensive alcohol-related research and they have a deep understanding of alcohol use and its place in Tanzanian culture. Together with injury patients' family members, medical and research personnel, and the general population, this study can better explore the community and social relationships with and perceptions of alcohol use and risky behaviors and eventually pave the way for future risky-behavior interventions in the Moshi area.

2.3 Quantitative Methods

2.3.1 Participant selection and criteria

Participants were made up of two population: 341 injury patients identified on arrival in the Emergency Department of KCMC who suffered an injury and random sample of 500 adults selected in Moshi, Tanzania. The general validation population was recruited with informed consent around the hospital and downtown Moshi. Injury participants were included if they are ≥18 years old, seeking care at KCMC Emergency Department for an injury of any severity, clinically sober, medically stable, able to communicate in fluent Swahili, and consented to participate before discharge from the hospital. In effect, we over-sampled injury patients (40% of total sample) because they generally have more alcohol-related consequences than the normal population. The selection of this mixed population will increase the sensitivity of our analyses and allows

us to focus on our planned future intervention population. This study only included those who consumed alcohol at least once in their lifetime (n=242+380) (Figure 5).

| Injury patients enrolled: n=341 | → | Excluded: n=99
• Never consumed alcohol | → | Total included: n=242
• At least consumed once in their lifetime |
| General population enrolled: n=500 | → | Excluded: n=120
• Never consumed alcohol | → | Total included: n=380
• At least consumed once in their lifetime |

Figure 3. STROBE-Type Flow Diagram for the Retrospective Cross-Sectional Study

2.3.2 Data collection

Injury patients presenting to the KCMC Emergency Department for an acute injury were screened for participation in our project. After informed consent, they were surveyed prior to discharge from the hospital. Questions were administered at the bedside as a part of the 45 minutes baseline survey. The general sample was collected by recruiting and consented random people (not patients but potentially family members) around the hospital and different random public locations downtown. Data were collected by hand and entered into an Internet-based dataset (REDcap) with a quality control process conducted by the principal investigator (CAS).

2.3.3 Measures

We collected basic demographic information, alcohol use, alcohol use disorder and consequences, and alcohol stigma variables. Variables including types of injuries, whether it is alcohol-related, and characteristics such as education, income, employment are not included in this dataset.

2.3.3.1 Alcohol Use Disorders Identification Test (AUDIT)

Alcohol use disorders were measured by the AUDIT. AUDIT is an instrument used to identify people with problem drinking patterns (T. F. Babor, Higgins-Biddle, Saunders, & Monteiro, 2001). The 10-item AUDIT assesses alcohol intake (question 1-3), alcohol dependence (question 4-6), and alcohol-related problems (question 7-10). A World Health Organization collaborative study showed AUDIT has 92% sensitivity and 94% specificity in 6 countries (Saunders, Aasland, Babor, De la Fuente, & Grant, 1993).

AUDIT score was analyzed both as a continuous variable and a dichotomous variable in this study. AUDIT's score ranges from 0-40. A score of 8 or more indicates harmful drinking globally and in our population. (Conigrave, Hall, & Saunders, 1995; Saunders et al., 1993).

2.3.3.2 The Drinker Inventory of Consequences (DrInC)

The DrInC is a 50-item (score range from 0-50) harm assessment questionnaire, which is used specifically for assessing adverse consequences of alcohol abuse. Forty-five items are scored in a positive direction to measure the severity of alcohol problems, and 5 reverse-scaled control items are included (Miller, Tonigan, & Longabaugh, 1995). DrInC measures five categories: Interpersonal, Physical, Social, Impulsive and Intrapersonal aspects, as indicated in Appendix A (Miller et al., 1995). Each category employs a time-frame focusing on the past 3 months, as well as a lifetime measure of alcohol consequences.

The negative consequences identified using DrInC have been shown to correlate with other outcome measures, such as psychosocial functioning and psychiatric dysfunctions (Cisler & Zweben, 1999). DrInC has been validated in the developed countries but not in Tanzanian culture or injury population (Forcehimes, Tonigan, Miller, Kenna, & Baer, 2007; Read, Kahler, Strong, & Colder, 2006).

When identifying latent classes of risky behaviors, we excluded 2 questions from the original 12 questions impulse control subscale due to their similarities to other questions, indicated by the face validation and strong Phi-coefficients (r>0.5): "I have broken things or damaged property while drinking or intoxicated" and "while drinking or intoxicated, I have injured someone else." The first removed question is very similar to the *Foolish risk* question and *Impulsive things that regret* question. The second removed question is similar to the *Physical fight* question. Questions and variables used are summarized in Appendix B.

2.3.3.3 Alcohol-Adapted Perceived Devaluation-Discrimination Scale

Alcohol stigma was assessed with the Alcohol-Adapted Perceived Discrimination-Devaluation scale (PDD). The alcohol-adapted PDD is an instrument to assess an individual's perceived alcohol stigma (PAS) towards drinkers (Glass, Kristjansson, & Bucholz, 2013). The PDD contains 12 six-point Likert scale question and has shown good psychometric properties in various settings (Luoma et al., 2013; Luoma et al., 2010; Ruan et al., 2008). Seven PDD questions assessed perceived discrimination of heavy drinkers

and five questions assessed perceived devaluation (Glass et al., 2013). The maximum score is 84 (6 points * 12 questions). High PAS score is associated with poorer mental health and a lower chance of alcohol treatment in high-income settings (Glass et al., 2013; Keyes et al., 2010; Smith et al., 2010).

2.3.4 Quantitative Analysis

Data analysis and the generation of figures were performed with R software (v.3.3.3) and a significance level was set at the 0.05 level of significance. All variables were first assessed with basic descriptive statistics. The missing data for the AUDIT and DrInC scales were imputed by using the multiple imputation method provided by the mice package (Buuren & Groothuis-Oudshoorn, 2010). Multiple imputation was selected to avoid uncertainty brought by single imputation which could lead to errors in any conclusions drawn (Graham, 2009). A sensitivity analysis showed there are no significant differences to the models with and without the imputed data.

We applied latent class analysis (LCA) to examine alcohol-related risky behaviors. First, the optimal latent classes number of the model was confirmed by using model fit indices. The global fit indices were informed by the Bayesian Information Criterion (BIC) and Akaike Information Criterion (AIC), taking into account the goodness of fit and parsimony. The lower values of BIC and AIC indict better fit (Muthén, 2004). Likelihood ratio tests were used to examine whether a model with multiple profile groups fit the data

better than a model with one profile group. Entropy is a measure of aggregated classification uncertainty (Celeux & Soromenho, 1996). A higher entropy value represents a better fit. The normalized entropy value is range from 0 to 1, a value larger than 0.8 indicates the latent classes are highly discriminating (Tein, Coxe, & Cham, 2013). Model fitness was assessed based on the model fit indices as well as the research purpose and model interpretability as recommended in the literature (Jung & Wickrama, 2008; Kriston et al., 2011). Models with profile group 1-6 were tested by poLCA package in R software (Linzer & Lewis, 2011). Negative binomial models were used to test latent classes and their association with the AUDIT score and PDD score.

2.4 Qualitative Methods

2.4.1 Participant selection and criteria

Participants were a convenience sample of Kilimanjaro Christian Medical Center (KCMC) Emergency Department (ED) injury patients and their family members, as well as medical and research personnel.

<u>Injury patients</u>

Injury patients were identified in the emergency department treatment area and the wards with the assistance of the hospital's patient record about patient's diagnosis, ability to move, location, age, and gender. After consultation and agreement of the

appropriateness of patients with his/her care nurses, the research nurses then approached eligible injury patients.

We did not screen for alcohol use disorders (AUDs) or asked if the injury is alcohol-related because patients were often unwilling to disclose their alcohol use, especially when related to their injury. Besides, injury patients were hard to recruit in the hospital because many of them either had injuries prohibiting their movement to the focus group locations or were too ill to participate.

Injury patients were included if they were ≥18 years old, clinically sober, seeking care at KCMC Emergency Department, medically stable, able to provide a full informed consent, and able to communicate in fluent Swahili. Patients were excluded from the study if they had leg injuries or were too ill to participate.

Family members

Family members were identified and randomly selected in ED and wards' waiting areas by asking their purpose of visiting. Family members of injury patients were recruited if they were ≥18 years old, agreed to participate, and spoke fluent Swahili.

Medical personnel

Medical personnel including nurses and doctors were identified in the emergency department and wards by direct inquiry of their interest and availability. Medical personnel were recruited if he/she were ≥18 years old, doctors, nurses or research personnel, agree to participate, and speak fluent Swahili.

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<u>Research personnel</u>

Research personnel including research nurses and assistants were directly asked their willingness and availability to participate in the last focus group. Research personnel were recruited with the same standards as medical personnel except they were required to be fluent in English so that the researcher could conduct the focus group in English.

All participants offered invitations to the focus group were informed about the goals of this study. They were also informed they would be compensated 5000 TSH ($2.20) for their transportation and would be interviewed by qualified research personnel and assured their personal information would be kept secret. Finally, they were asked if they agreed to provide informed consent.

2.4.2 Research team and reflexivity

Focus groups were conducted by three trained female research nurses, three trained research assistants at KCMC and the student researcher (PI) from Duke Kunshan University. The research nurses all have over a decade of experience conducting focus groups among similar populations. We chose research assistants to conduct the focus groups for two reasons. First, to help them practice focus group skills after the proper training and second, young assistants are generally more flexible than older nurses in terms of exploring answers about alcohol. Research assistants were accompanied by at least one research nurse to ensure the focus group process was correct and smooth. The

PI chose to be the moderator of the last focus group with research personnel for three reasons: first, there is no language barrier because research personnel spoke fluent English; second, to be personally involved in the FGD process; and finally, to attempt a deeper exploration of the subject. The PI was unable to directly engage in earlier focus groups because they were all administered in Swahili due to limited participant comfort in English.

Figure 4. Our research team in KCMC

2.4.3 Focus group guideline

DZ drafted the first version of focus group guideline and reviewed by CAS. The guideline was then reviewed by the research team and went through the translation and back-translation process multiple times to avoid misunderstanding and explore the most appropriate translation. During the translating meeting, each team member was required to translate one question and answer the question in turn. Other members were asked to critically check the translation. As a result, we simplified and separated many questions, as well as deleted some questions that are irrelevant. Focus group questions are open and they are listed in Appendix C.

2.4.4 Focus group procedures

Focus groups were scheduled the same or next day when 5-10 eligible participants were recruited. We planned to conduct two focus groups among each population with the consideration of time, resources, and saturation of information. On average, we conducted one to two focus groups per week depending on the workload on research nurses and assistants. For facilitating an environment to foster an open discussion, we separated focus groups among injury patients, family members, and medical and research personnel. In total, we conducted 7 focus groups, including 6 focus groups about alcohol stigma and risky behaviors among injury patients (2), family members (2), and medical personnel (2)

in Swahili and one additional focus group about the alcohol knowledge and education among research personnel (1) in English.

Focus group participants were first given numbers on a piece of paper to avoid referring to any private identifications such as names when identifying participant's basic demographic information. Focus group participants were informed of the aims of the study as well as the qualifications of the research team and focus group facilitators. We also stated the rules of a focus group discussion at the beginning of each focus group, such as state their numbers prior to answering any questions. At the end of the focus group, we provided beverages and refreshments and 5000 TSHs compensation for their travel costs.

Focus groups typically lasted for 60-90 minutes and took place in a small quiet room in the hospital. Figure 5 demonstrates the environment of our focus group venue. Focus group discussions were led by trained research nurses, assistants, and the researcher. The discussion processes were audio-recorded via tablet computers.

Three research assistants translated and transcribed the first six focus group scripts from Swahili to English after each of the focus groups. The last English focus group script was transcribed by the PI. The transcription and translation of all records happened within two weeks after the focus groups had been conducted so that we could do inductive thematic content analysis and adjust questions for further probing. During the translation, debriefing sessions with research assistants and the researcher were held to

assess potential latent cultural misunderstandings and potential issues with the translation process. All recordings, scripts and other types of data were saved in Duke Box without any identifying information.

Figure 5. One focus group discussion among injury patients (two in white coats are facilitators)

2.4.5 Qualitative data analysis

The analysis was iterative and occurred after each focus group so that emerging themes would be explored in later focus groups. For example, we found some participants had a hard time understanding the question of *how drinkers' risky behaviors influence the way people view them?* Then we separated the questions into two questions to help participants to understand.

The qualitative data from six focus groups about risky behaviors and alcohol stigma were coded together and analyzed. This process helped the research team to compare across scripts to highlight emerging themes and perspectives. When no new themes emerged, thematic saturation was reached and the qualitative study for the first set of focus groups was considered complete (Guest, Bunce, & Johnson, 2006). A codebook was created by reading through all focus group transcripts thoroughly to identify structural themes and three levels of codes. This was done with the process of creating 7 focus group memos. The process of generating a codebook helped to organize and merge themes and codes. We used Microsoft Excel to code data initially because its ease to share and compare themes and codes. The last focus group about alcohol culture and education was coded separately and analyzed in NVivo.

All transcripts were coded by DZ and three research assistants using a thematic narrative approach, reflecting on the research questions and themes raised by the participants. For each transcript, DZ and the research assistant who transcribed and translated the script completed coding separately with primary, secondary, and tertiary level coding classifications. DZ then checked codes with advisors, specializing in qualitative research. Our research team reviewed the evolving thematic codes and gave input based on their knowledge with their cultural background and the focus group populations. Representative quotes for each theme were selected based on the comparative analysis of DZ and the research assistant's coding.

2.5 Research ethics

This study has IRB approval from the Duke Institutional Review Board and Kilimanjaro Christian Medical Center Ethics Committee. This study contains a minimal level of risk. Informed consents were obtained from all participants before each focus group. All participants were then introduced to the study and its purpose, benefits and potential risks of participation and assured that all personal information collected would remain confidential. All participants were told that they were free to drop out of the study at any time without repercussions. Confidentiality of the focus group participants was addressed by using unique identification rather than names. For participants who were illiterate, inform consent was verbally delivered in Swahili by the study staff.

3. Results

Alcohol use includes alcohol use quantity, frequency, and age at first use

Figure 6. Analysis framework

3.1 Quantitative results: Latent class analysis

3.1.1 *Demographics*

Table 1 provides an overview of the sample characteristics. Of the total 841 patients surveyed, this study included only those who consumed alcohol at least once in their lifetime: 246 injury patients and 379 general population (n=626). Of the total 626 participants, most were male (60%) and has an average age of 41.73 (SD = 23.86). Of the participants, 72.2% (n=452) reported consumed alcohol in the past 12 months. Among them, 53.10% consumed alcohol at least two times a week and the majority (85.62%) reported consuming no more than four drinks per drinking day, as shown in Table 1.

Table 1. Sociodemographic profile of the validation sample

Variables	
Age (years), mean (SD)	41.73 (23.86)
Male, N (%)	375 (60%)
Consumed alcohol in the last year, N (%)	452 (72.20%)
Drinking frequency, N (%)	
Monthly or less	107 (23.67%)
2 to 4 times a month	105 (23.23%)
2 to 3 times a week	139 (30.75%)
4 or more times a week	101 (22.34%)
Drinking quantity (per drinking day), N (%)	
1 or 2	214 (47.35%)
3 or 4	173 (38.27%)
5 or 6	36 (7.96%)
7 8 or 9	16 (3.54%)
10 or more	13 (2.88%)

3.1.2 *Number of latent classes*

We explored different models to classify risky behaviors. Three different models were suggested by the fit indices (Table 2). 3-class model and 4-class model were suggested by consistent cAIC. 4-class model and 5-class model were suggested by BIC. Since different

statistical fit indices suggested different models, we decided to give research objective and

practical interpretability more weight as suggested by the literature (Jung & Wickrama, 2008;

Kriston et al., 2011). The 3-class model was chosen because the sample distribution in the 3-

class model is relatively even (59.67%, 25.57%, and 14.76%) and it is the only class that meets

the standard that all subgroups' size is over 5% of the whole cohort (Nielsen, Vach, Kent,

Hestbaek, & Kongsted, 2016). Also, the highly contrasted risky behavior patterns in class 3 are

easy to interpret in this study setting and 4-class and 5-class model did not meet our research

objective of designing an easy-to-use classification system for admitted injury patients.

Table 2. Fit indices for the models of latent class analysis

Model	log-likelihood	resid. df	BIC	aBIC	cAIC	likelihood-ratio	Entropy
1 class solution	11192.4	582	22668.1	22528.4	22712.1	17149.1	-
2 class solution	-7464.5	537	15502.1	15219.5	15591.1	9693.3	0.975
3 class solution	-6799.7	492	14462.4	14036.9	14596.4	8363.8	0.956
4 class solution	-6599.6	447	14351.7	13783.4	14530.7	7963.4	0.874
5 class solution	-6470.5	402	14383.4	13672.3	14607.4	7705.3	NaN
6 class solution	-6385.2	357	14502.6	13648.6	14771.6	7534.7	NaN

Note: BIC = Bayesian Information Criterion; aBIC = Adjusted BIC; cAIC = consistent Aikaike Information
Criterion;

3.1.3 *Latent class characteristics*

The 3 class profile groups comprise sufficient numbers of participants in each class. The "No

risky behavior" class has 374 (59.67%) participants; the "Moderate risky behavior" class has

160 (25.57%) participants; the "High risky behaviors" class has 92 (14.76%) participants. Risky

behavior patterns are shown in Fig. 1 and Table 3.

Figure 7. Class characteristics regarding different risky behaviors

Table 3. Characteristics of the identified classes

Class	Drink drive	Use other drugs	Foolish risk	Impulsive things that regret	Physic al fight	Smoke more	Over weig ht	DUI	Legal trouble	Had accid ent
1. No risky behavior (n=374)	3.7%	0.8%	2.7%	0.1%	0.6%	2.9%	1.4%	0.0%	0.0%	1.4%
2. Moderate risky behaviors (n=160)	15.2%	3.1%	41.4%	27.1%	11.7%	17.6%	8.0%	4.0%	2.5%	10.5%
3. High risky behaviors (n=82)	30.3%	16.2%	91.7%	85.8%	58.7%	46.5%	18.4%	22.3%	31.4%	42.4%

Participants in the "No risky behavior" class exhibited low alcohol-related risky

behaviors. Only 3.7% of the participants in this class had reported drink driving behaviors;

2.9% had smoked more because of drinking; 2.7 % had taken foolish risks after drinking. Less

than 2% of the participants in this class participated in other risky behaviors.

Participants in "Moderate risky behaviors" class showed a moderate amount of alcohol-related risky behaviors. 41.4% and 27.1% of the participants in this class had taken foolish risks and done impulsive things that they regretted later after drinking. Less than 20% of the participants in this class participated in other risky behaviors.

As expected, participants in the "High risky behaviors" class showed very high numbers of alcohol-related risky behaviors. 91.7% and 85.5% of the participants in this class had done foolish risks and impulsive things that they regretted later after drinking; 58.7% of the participants had engaged in an alcohol-related physical fight with others; 46.4% had smoked more because of alcohol use. All risky behaviors in class 3 occur at least two times more frequent than in the "Moderate risky behavior" class.

3.1.4 *Cross-class comparisons*

In the third step, we compared classes on 1) sociodemographic variables, 2) alcohol use, 3) alcohol stigma. Table 4 shows the detailed results of the analysis. In order to better understand the associations between the risky behavior profiles and drink patterns and alcohol stigma, we converted the coefficients derived from models to the odds ratio.

3.1.5 *Sociodemographics*

Gender proportion differed significantly between risky behavior classes. Female

counted 51.3% of class 1 but only 30.2% of class 2 and 10.9% of class 3. The age distribution is

significantly different between class 1 and 3 but not between 1 and 2. The average age of class

3 is 6 years younger than it is in class 1 and 2.

3.1.6 *Alcohol use*

Significant cross-class differences were observed for all alcohol use items after

controlling for age and gender (Table 4). Class 2 and 3 are 2.47 and 5.36 times more likely to

be classified AUDIT above 8 than class 1, respectively. The box plot between AUDIT score and

profile groups also suggested this association (Figure 2). Alcohol use quantity, frequency, and

binge drinking frequency all showed similar patterns across the profile groups (Table 4, figure

3).

3.1.7 *Perceived alcohol-related stigma*

The Alcohol adaptive PDD revealed no significant differences between profile groups

(Table 4, figure 4). The average PDD scores range between 38.3-39.1 among different classes.

Table 4 Cross-class comparisons on demographics, alcohol use, and alcohol stigma

Class	Gender (% female)	Age (SD)	AUDIT >8 (%)	Alcohol use quantity (SD) [1]	Alcohol use frequency (SD) [2]	Binge drinking frequency (SD) [3]	Alcohol Stigma, PDD, (SD)
1. No risky behavior (n=374)	51.3%	42.7 (16.1)	36.4%	0.52 (0.75)	2.31 (1.09)	0.41 (0.94)	38.8 (8.7)
2. Moderate risky	30.2%	42.4	59.4%	0.91	2.58	0.86	39.1

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behaviors (n=160)		(39.0)		(0.94)	(1.06)	(1.23)	(8.3)
3. High risky behaviors(n=92)	10.9%	36.7	76.1%	1.37	3.07	1.52	38.3
		(12.7)		(1.11)	(1.03)	(1.41)	(7.4)
Odds ratio							
Class 2 compared with class 1	0.29 ***	0.90	2.47 ***	2.31 ***	1.42 *	2.45 ***	1.01
Class 3 compared with class 1	0.07 ***	0.23 ***	5.36 ***	5.24 ***	3.53 ***	6.37 ***	0.997

Note: With the exception of gender (% female) and AUDIT >8, data report means (standard deviations).

[1] 0) Never; 1) Monthly or less; 2) 2 to 4 times a month; 3) 2 to 3 times a week; 4) 4 or more times a week

[2] 0) 1 or 2; 1) 3 or 4; 2) 5 or 6; 3) 7 8 or 9; 4) 10 or more

[3] 0) Never; 1) Less than monthly; 2) Monthly; 3) Weekly; 4) Daily or almost daily

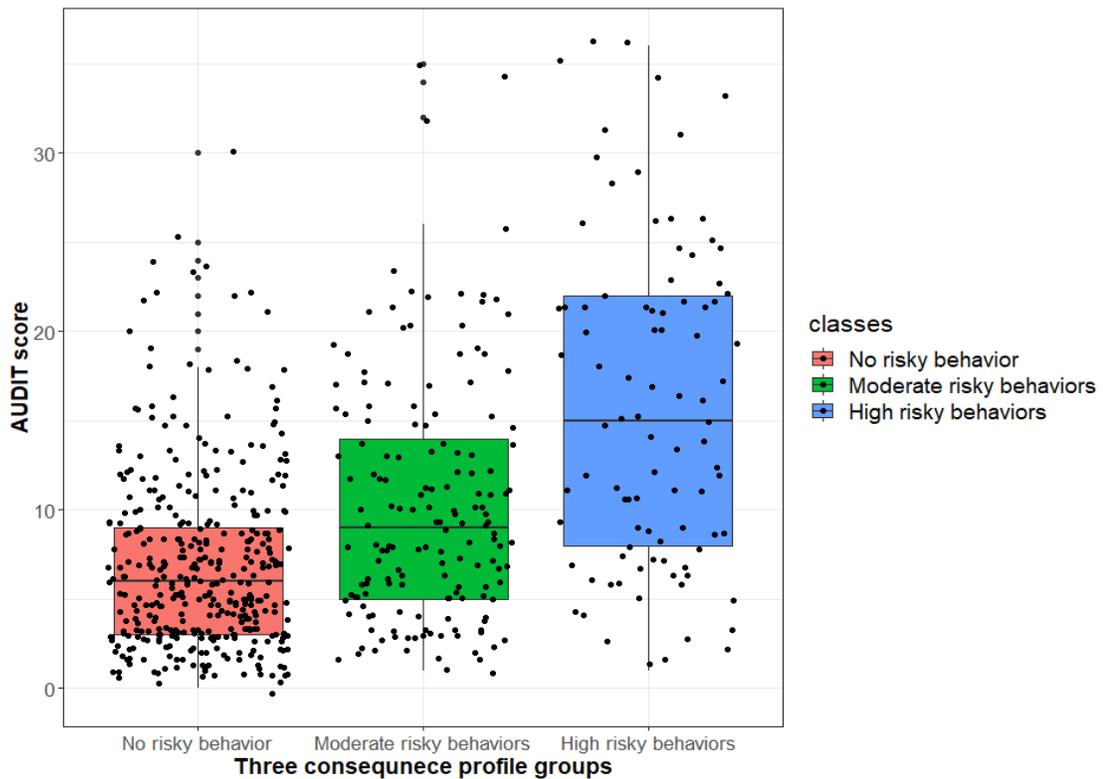* p-value < .05; ** p-value < .01; *** p-value < .001

Figure 8. Box plot of AUDIT score and profile groups with superimposed data points

Figure 9. Box plot of alcohol use quantity, frequency, and binge drinking frequency and profile groups with superimposed data points

Figure 10. Box plots of PDD score and profile groups with superimposed data points

3.2 Qualitative results

Table 5. Qualitative data themes

Themes	Subthemes
Perception of alcohol use	Perception of moderate alcohol use
	The stigma of excessive alcohol use
	Alcohol harm awareness
	Different perceptions by genders
	Impact of negative perceptions on drinkers
Risky behaviors associated with alcohol use	Alcohol's contribution to risky behaviors
	Contributors to risky behaviors other than alcohol
	Risky behaviors' impact on community and perceptions
Macro-level factors that influence perceptions	Alcohol culture
	Alcohol education
	Alcohol advertisements
	Alcohol policy and regulation

3.2.1 *Demographics*

In total, we conducted 7 focus groups with 48 participants. Participants' mean age is around 40. Most of them are from the Chagga ethnic group. Because medical personnel recruited in this study were mostly nurses so the medical personnel focus group participants are mainly female. Because of the relatively sensitive topics of this study, we might run into social desirability bias which participants might hide their alcohol use status. This might explain why there are so many abstainers in family members and injury patients. Medical and research personnel tended to drink less or not drink at all might resulted from their high educational status and a disproportionately high proportion of females.

Table 6. Demographic and adherence characteristics of study participants

	Family members	Injury patients	Medical personnel	Research personnel
No. Groups	2	2	2	1
No. Participants	16	13	13	6
No. Female (%)	9 (56.3%)	6 (46.15)	12 (92.31%)	4 (66.67%)
Mean Age (SD)	40.25 (10.03)	42.31 (12.57)	44.23 (10.08)	40.05 (15.63)
Ethnic group				
Chagga	62.5%	69.2%	61.5%	83.3%
Pare	12.5%	15.4%	0.0%	0.0%
Other	25.0%	15.4%	38.5%	16.7%
Income source *				
No income	18.8%	23.1%	0.0%	0.0%
Farming	25.0%	23.1%	0.0%	0.0%
Employment	50.0%	53.8%	84.6%	100.0%
Family	6.3%	0.0%	0.0%	16.7%
Other	0.0%	7.7%	15.4%	0.0%
Drink frequency				
Never	68.8%	84.6%	84.6%	83.3%
Monthly or less	6.3%	0.0%	15.4%	16.7%
2 to 4 times a month	18.8%	7.7%	0.0%	0.0%
2 to 3 times a week	6.3%	7.7%	0.0%	0.0%
4 + times a week	0.0%	0.0%	0.0%	0.0%

Some participants have income from two sources

3.2.2 *Perception of alcohol use*

<u>*Perception of moderate alcohol use*</u>

Most of our participants accept the culture of daily moderate drinking and particularly, "it is normal to drink in parties". The drinking culture is embedded in numerous Tanzanian

ceremonies including engagements, weddings, and even funerals. However, one of our participants argued that people should abstain from alcohol because alcohol can be addictive and eventually you "cannot stop drinking".

The stigma of excessive alcohol use

Three groups of participants have similar views on those who drink excessively. Participants said they are usually despised and ignored because they are lazy, unconscious, "disrespectful to others," "do shameful things," "burdens on community and family," "no life goals," "cannot work," and "misuse money." Participants also said those people are viewed as "not healthy" as "drinking destroy their health especially the liver and kidney and end up dying" and "drinking too much leads to health problems such as HIV and TB."

We asked participants to draw a person who drinks excessively at the beginning of the focus group to relax the atmosphere. Some representative drawings are attached in Appendix D. Only 2 characters of 42 total drawings are females, which indicates our participants tend to associate excessive alcohol use with males. We might underestimate the number of female characters because Tanzania women tend to have short hairs, which makes it hard to distinguish women from men. The descriptions under the pictures serve as references as they are the author's subjective interpretation of the drawing. We did not ask participants to write down the meaning of the drawing.

Alcohol harm awareness

Alcohol harm awareness was assessed with three open-ended questions: Can medicine be taken together with alcohol; is drinking alcohol bad for health; and can pregnant and lactating women drink alcohol?

Can medicine be taken together with alcohol?

Patients would consult with doctors about matters needing attention when taking medicine, though knowledge on this issue varies greatly. Participants said "many people know that alcohol and medicine are forbidden, for example, many drunkards know he/she cannot take alcohol and antibiotic," but at the same time they also said, "I know one doctor takes medicine with beer." Although equipped with some pharmaceutic knowledge, some patients may forgo adherence to medicine because they crave alcohol so much so that "he may only take the medicine for three days (5-7 days dose) and starts drinking". A 36 years old female family member told a similar story that a young man with HIV forgot to take drugs and his health began deteriorating due to the alcohol use.

Is drinking alcohol bad for health?

Some participants argued that "any quantity is harmful" because "anything that influence people's behaviors are harmful" and drinking can lead to addiction. While others argue "a small amount of wine is good for our health" and they received this belief from "reading an article that says the benefit of drinking wine" and doctor's recommendation "it is good for your heart." Despite this argument, many participants maintained that "many people don't

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drink because of their (religious) belief, rather than health concerns."

Can pregnant and lactating women drink alcohol?

All research personnel knew that drinking is bad for pregnant women partly from doctors' suggestions. But many people in the rural area still drink during pregnancy because "they do not attend clinics." Participants gave some shocking answers that many lactating women drink alcohol because "they believe alcohol will help to bring out the milk and treat cramps," and "alcohol can help the baby sleep well thus the baby will not disturb the family." Participants also think women generally have more knowledge on this topic than men, despite the quality of knowledge.

<u>Different perceptions by genders</u>

Most participants agreed that men usually have paying jobs but women have unpaid domestic work, especially in the past. Therefore, one of the reasons why men usually start drinking earlier than women is because "when men go to work, it is easy for them to access alcohol". People assume women have a lot of domestic work and responsibilities so "they don't have time to drink alcohol". For example, the Chagga ethnic group does not allow girls to drink underage because "girls cannot become a good mother or housewife if she drinks alcohol." In other words, females' domestic role prevents them from encountering alcohol by separating them from social events and confining them to unpaid domestic labor. Thus, female drinking is still unwelcomed to some degree in the community. It is not surprising to see females generally start drink later than men. But the gender gap on alcohol use has diminished

in recent years to the degree that "the gap is very small now". It is "normal to see women drink in a bar together with their friends". But the gap for smoking is still very large.

Stigma of female vs male excessive drinking

The following answers are referring to excessive drinking, which is defined as drinking to the extent where he/she loses control over their actions. Participants' answers demonstrated an interesting pattern that female drinkers are shameful and they cannot shoulder the responsibility of taking care the children and the family. While male drinkers are not as bad and are viewed as either acceptable or just misusing their money. Several participants mentioned this pattern resulted from "there is patriarchy, so even if the man is drunk it doesn't seem like a problem," and "when a father comes home drunk, he can just get into bed and sleep, but for a woman you cannot just enter and get into bed while the (family) responsibilities are waiting."

Specifically, most participants thought female excessive drinkers "are very dangerous because they don't know if the children are eating or attending school;" "cause family separation and therefore increases the number of streets children;" "lack shyness and do wrong things such as touching men romantically without consent;" have negative impact to the family and children; and therefore "the community believes women have no right in using alcohol more than men and despise them" Male excessive drinkers may "use up all the money," aggressive and "find something is a little wrong and begin to beat his woman, and even his children without any reason."

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However, some participants argued males and females are equally responsible for the family, although their functions are different as males are the breadwinners and females are the domestic workers. Many of their personal stories were shared including, "even yesterday I saw a woman she was drunk she tried to force a man to sleep with her. The man beat her until she breaks her teeth I do not know where she is now."

Impact of negative perceptions on drinkers

The participants mentioned mostly adverse influence of negative perceptions on drinkers. Negative impact included people who would refuse to help them and the community might reject them because "they are despised;" "stigma makes them drink in secret and they might drink too much." One participant gave one example of this influence: "my dad was paying for my school fees but one day he was unable to pay because he was drinking a lot of alcohol. At the end of the day even when he went to neighbors to borrow money, they couldn't trust him. It (the stigma) seriously affects the drinker. My dad can't be trusted which led me to fail to continue studying and I stopped in grade six."

Some participants said the self-stigma might help drinkers in the way that they might feel ashamed when "seeing his fellows have development (in life and career) but he doesn't" or being advised by others so they might stop drinking.

3.2.3 *Risky behaviors associated with alcohol use*

A wide variety of alcohol-related risky behaviors were collected from the focus groups

and can be categorized in legal, physical, and social aspects. Some risky behaviors fit two or more categories, as shown in table 9.

Table 7. Identified risky behaviors

Categories	Subjects
Legal	Stealing; drink drive; substance abuse; rape; stealing;
Physical	Unprotected sex; getting sexually transmitted diseases (STD); domestic violence; road crashes; injury; substance abuse; fighting; drink during pregnancy and breastfeeding
Social	Domestic violence; conflicts; undress, peeing, or using abusive language in public; fail to take care of children; no respect for parents;

Our participants gave several personal stories to support their points and these stories. Below are six representative stories.

1. [Physical-violence] "I have come from a family that I grew up with my brother who drinks too much. When I was in primary school in grade six, he beat me a lot with no reason. There was a day he beat me until he breaks me (suffered a fracture) when he was drunk."

2. [Social-conflicts] "One of my neighbors drinks a lot of alcohol. After he was drunk and returned home in the midnight when his wife and children were asleep, he started fighting using the excuses of 'you have stolen my money' or 'I hide my money somewhere and you have stolen it.' They started fighting and throwing pans and cookers at each other and wake the children up"

3. [Physical-violence] "I witnessed this with my eyes. The parents were drunkards when they got drunk, they used to play on the road like little children. Then the woman had a baby and she went to drink with the baby on her back. One day they were chasing each other on the road and fighting, they fell and sat

on the baby, and the baby died. This is murdering."

4. [Social-fail to take care of children] "I know a woman who drinks alcohol excessively and she slept with different men when she is drunk. So, every child of hers has a different father. Those fathers don't take care of the children because they don't know whose kid is whom. This leads the children to suffer from a lack of care."

5. [Physical] "I have a neighbor who drank alcohol excessively for four days continuously without eating anything, he died."

6. [Legal-stealing & Physical] "I am working in an HIV/AIDS clinic in Moshi where I met a young man. You know, people living with HIV/AIDS should be taking their drugs every day. But this young man involved himself into excessive consumption of alcohol and he completely forgot taking the drugs. His health began deteriorating due to alcohol use. He started stealing because he joined a group of boys with excessive drinking, he even started stealing.

Alcohol's contribution to risky behaviors

Alcohol contributed to alcohol-related risky behaviors in both direct and indirect ways. Direct influences are related to the effect of alcohol, which is making people unconscious so they might be involved in road accidents, unprotective sex, fight, and even rape. A 47 years old female nurse said: "If someone hadn't drunk alcohol he wouldn't be walking unsteadily and fall into the furrow and get a head injury, so there is a big relationship between alcohol drinking and risky behaviors." The nurse sat next to her (age 55) added: "like my colleagues said, he will not have a sound mind and may use abusive language, having unplanned children." Another nurse (age 62) pointed out "the relationship is, after drinking the brain is

destroyed by alcohol so it makes the drunkard not realizing anything he is doing, so he may involve himself in risky behaviors like raping and abusing people."

Indirect influences are behaviors resulted from the behavior related to drinking alcohol but not the effect of alcohol itself, which include theft because they need money to buy alcohol; contracting STD from unprotective sex behavior and conducting illicit acts due to the influence of peers with whom they drink alcohol. A 45 years old female family member said "I see these drinkers take items from their home. Then sell it to get the money for drinking alcohol. They do all the bad and risky behaviors just to get money to buy alcohol. They will do anything for them to acquire money." Another 45 years old female in the group added: "he (a drinker) is willing to sell bags of maize for him to get money for buying beer, even if there is no food, no fees for children." A 36 years old female injury patient commented: "drunkards can join in groups or friends with behaviors like theft, marijuana smoking or drug abuse and alcohol can make him easily convinced into doing such things."

Contributors to risky behaviors other than alcohol

Other contributors are divided into two categories: external as an environmental influence and internal like personal characteristics. External contributors include peer influence, drinking culture (especially for Chagga ethnic group) such as the marriage customs which encourage people to drink, unemployment, family influence, popular beliefs of the effect of alcohol as "even some doctors drink during work because other people believe doctors need to drink to relax so that they can do surgery," and the lack of knowledge about

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the recommended drinking limits and regulation policies. Internal contributors contain personal habit, ill-mannered personality, and beliefs about alcohol, such as drink to relax and relieve stress.

<u>*Risky behaviors' impact on community and perceptions*</u>

Risky behaviors not only negatively impact the community but also people's perceptions of those who drink. The impacts on the community include less of the labor force due to alcohol-related illness and injuries, more noise, fail to educate and take care of children which lead to drop out, worsen public security resulted from increasing theft for getting money to buy alcohol, and economic burden as people have to treat their diseases.

Alcohol-related risky behaviors also have impacts on people's perceptions of drinkers. Most of the participants said there will be a negative impact such as "they will be ignored and despised," "they caused poverty in their homes, and they do shameful," "the society takes them as burdens." Particularly, one participant said "we (community) may consider alcohol drinkers does not have enough education about the effects of alcohol" and people suggested to have a more educational program in the country to educate people.

3.2.4 *Macro-level factors that influence perceptions*

<u>*Alcohol use culture in Moshi*</u>

Alcohol use is widely accepted in Tanzanian culture and it has been an obbligatory part of ceremonies. Most of our participants agree that alcohol use is increasing each year.

Most people go to bars to drink because people think "drinking at home is boring". Now it is becoming increasingly common for females to go to bars. Based on my personal observation, the ratio of males to females in the bar is about 6:1. Home-made alcohol (mbega) is very popular in Moshi. Chagga people sometimes put a certain type of grass on the front of the door, telling people that the banana beer is ready. Because banana beer can be only saved for one day after fermentation as it will become too sour on the second day, people might invite villagers to drink for free. But people often also sell homebrew alcohol.

Religion is playing an important role in alcohol use considering Tanzania is a relatively religious and conservative society. For example, theoretically, alcohol is forbidden among Muslims and Lutherans. But according to participants, a large portion of people do not follow this religious belief.

Parents sometimes share alcohol with children when they drink. Some parents may even "give them alcohol so that they don't feel cold" or "children are bothering him, he will pour a glass of alcohol and give it to each of the children."

Age at first drink

Participants said most drinkers either start to drink between age 15-18 or after they go to college when they are away from home. For Chagga ethnic group, children might start to drink alcohol from a very early age and "it is not something to be surprised to see children (aged 4 or 5) in the villages drinking alcohol with their parents."

Alcohol education

All participants agreed that there is currently little or no education about alcohol in schools and society. There is a health program on the radio that says the effect of alcohol and the harm of excessive drinking but "it is not interesting, we don't listen." At least ten of our participants maintained that the government should educate people about alcohol via different media, including schools, newspaper, TV, and radio. A 27 years old male nurse said: "the government and religious institution should intervene by giving education in order to avoid drinking excessively."

Alcohol advertisements

Alcohol advertisements are everywhere in Moshi: buses, restaurants, and roadsides. Participants said alcohol advertisement on street and TV makes people drink more and "the alcohol companies have more advertisement and promotions than before." Not only do those alcohol companies continue to put up more advertisements, but they have designed more attractive selling strategies such as "when the beers are going to expire, instead of destroying them, they will sell it with a cheaper price," "they put a lot of music and dancing in the advertisement and give people t-shirts to wear" a research assistant mentioned.

Alcohol policy and regulation

Currently, there are no policies to regulate underage and workplace drinking. The government banned workplace drinking in 2017 and which successfully implemented. But the

policy was "dead" and had no enforcement after only six months, as one participant described "they usually start (a policy) as a political thing with very high energy. Some people will say: 'oh this is a good leader.' But after a short time, there is no follow-up". The government also banned the sachet (a small bag of liquor, locals call *viroba*) last year due to environmental reasons. Participants say "banned viroba helps to reduce drinking. Because viroba is easy to have access to. People can just put them in the pocket." This policy has significantly reduced harmful drinking. Though viroba is still available on the black market, its availability was greatly reduced. With the disappointment of the current political and policy environment, the participants gave the following recommendations.

1. "Set a law that bans selling alcohol to children. Parents should be responsible. If parents send a child to buy alcohol, the child will think alcohol is a good thing and they might drink. Because when my husband was young, he was sent to buy alcohol so he thinks alcohol is a good thing and he tasted," said a 26 years old female research assistant.

2. "I will ban alcohol totally, because you get revenue from alcohol, but the revenue is supposed to benefit the people. But before they can be benefited from the revenue, their health was hurt," said a 29 years old male research assistant.

3. "I will reduce the factories of alcohol;" "all the alcohol industry they come from Kenya and the money goes to Kenya," said a 54 years old female research nurse.

4. "I will give people education and tell people the right amount to drink," said a 27 years old female research assis

4. Discussionussion

4.1 Quantitative discussion: Latent class analysis

Three adequately large classes of participants with distinct risky behavior patterns were identified. 59.7% of the sample reported very low risky behaviors and were classified as no risky behavior class (class 1). Coinciding with previous literature, this class contains far more women (51.3%) and has significantly lower alcohol use quantities and frequencies compared with the other two classes (Chiauzzi, DasMahapatra, & Black, 2013; Hair, Park, Ling, & Moore, 2009; Reboussin, Song, Shrestha, Lohman, & Wolfson, 2006). Class 2 "moderate risky behaviors" was prominently characterized by having a high risk of doing foolish risks and impulsive things that he/she regrets later, as well as a medium risk of being involved in drink driving and physical fights. Class 3 "high risky behaviors" was mostly characterized by the most alcohol use and high AUDIT scores, as well as fewer women and younger population compared with the other two classes. The mean age of participants in class 3 is 6 years older than those in class 1 and 2, indicating those who have the most risky behaviors are younger than those who have medium or less. Members in class 3 have overall high risky behaviors and the most evident risky behaviors including self-defined foolish risks (91.74%), doing impulsive things that he/she regrets later (85.84%), fighting (58.71%), smoking (46.45%), having an accident (42.36%), and drink drive (30.33%). Considering these high-frequency risky behaviors, specialty treatment

might be more appropriate than brief intervention for class 3 alcohol users.

Three classes showed obvious differences in AUDIT score, alcohol use quantity, frequency, and binge drinking frequency. Those with more risky behaviors also drink more and more often. These relationships are not surprising since those who drink more are more likely to suffer from alcohol-related consequences (Cooper, 2002; Swahn & Bossarte, 2007). But it should be noted that alcohol use quantity and binge drinking frequency are more diverse among three classes than alcohol use frequency. This can be explained by the pervasive habitual drinking behavior among people in Moshi (Castens, Luginga, Shayo, & Tolias, 2012). Many people drink home-brew alcohol made by banana, which is a dominant crop in the Moshi area. Essentially, many people drink every day but differ greatly in the amount consumed.

However, the classes differ in all aspects related to alcohol use but all have a high perceived alcohol stigma (range between 38.3-39.1). To our knowledge, no previous literature illustrated the relationship between perceived alcohol stigma and risky behaviors pattern. Some studies have shown that disproportionately high perceived-stigma among affected drinkers may prevent them from seeking treatment (Smith et al., 2010). As the relatively strong perceived alcohol stigma is so prevalent in this population and stigma does not differ between three classes, we believe stigma does not associate with excessive alcohol use nor risky behaviors.

Having these risky behaviors classes, we can group alcohol users based on their

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risky behaviors rather than their alcohol use disorder status measured by the AUDIT. The advantage of using risky behavior classification when applying interventions lays in it is closer to the crux of the problems alcohol causes. AUDIT classification system might fail to help to apply the right intervention to someone who drinks more but have less risky behaviors or someone who drinks moderately but has many risky behaviors. This risky behaviors classification system can target problem drinking more accurately thus may have better intervention effectiveness.

4.2 Qualitative discussion

Our assessment of the perceptions of alcohol use and risky behaviors in Moshi, Tanzania proposed a complex interaction of individual, societal and macro level vulnerability factors including alcohol use, risky behaviors, alcohol price and availability, perceptions of alcohol use, alcohol harm awareness, and alcohol laws, education and advertisement. Previous studies have demonstrated the interplay of these factors in other settings (Gilmore et al., 2016; Organization & Unit, 2014). This study provides insight into the association of these factors in the Tanzanian setting.

4.2.1 *Perception of alcohol use*

Alcohol has become an indispensable part of Tanzanian culture, especially when it comes to parties and celebration. It is generally acceptable for people drinking during celebration and on daily bases. Bars are ubiquitous in Moshi, even in rural areas. People in rural areas often make banana alcohol at home and share within and between families.

However, all our participants expressed a strong stigma against those who abuse alcohol (drink excessively), though the stigma varies depending on drinker's age and gender. Overall, participants view those who abuse alcohol as a burden on the community, misuse money and are not healthy. The strong stigma against alcohol abusers revealed by our focus group calls attention to considering stigma when designing alcohol abuse treatment as studies have found stigma may deter people from seeking help in both developed and developing countries (Amundsen et al., 2016; Keyes et al., 2010; Nolen-Hoeksema & Hilt, 2006; Sorsdahl, Stein, & Myers, 2012). In addition, participants did not view addiction as a disease that can be treated. This might further deter alcohol abusers to seek help and treatment in the Tanzania setting.

Alcohol harm awareness

Alcohol harm awareness not only closely linked to people's perception of alcohol use but also directly influence alcohol use and the types of risky behaviors people do. Participants often held an impression of "a glass of wine is good for health." A glass of

wine has been argued to be able to prevent heart disease (Renaud & de Lorgeril, 1992). But recent studies argued this effect is limited and this benefit can be easily offset by other diseases caused by alcohol (Stockwell et al., 2016; J. Zhao, Stockwell, Roemer, Naimi, & Chikritzhs, 2017). Participants mentioned the cases of people taking medicine with alcohol, or they deliberately shortened the treatment period to drink alcohol. The negative effects of taking many types of medications with alcohol have been well documented (Moore, Whiteman, & Ward, 2007). We also found many women drink during pregnancy and breast feeding. It has been frequently reported that drinking during pregnancy may lead to low birth weight, preterm delivery and even disastrous consequences such as fetal alcohol spectrum disorder (FASD) (Jaddoe et al., 2007; Streissguth, 2001; Virji, 1991). Alcohol can also get into breast milk through passive diffusion and influence infants' nervous system development (Giglia & Binns, 2008; Pop et al., 1999). This effect is particularly notable when breastfeeding happens within two hours after alcohol consumption or drinking above the moderate amount. Using alcohol during breastfeeding may lead to shortened breastfeeding duration due to decreased milk production (Giglia, Binns, Alfonso, Scott, & Oddy, 2008). The misuse of alcohol during breastfeeding as an analgesic for the mother and tranquilizer for the baby might affect an infant's early development. These misconceptions of alcohol can and should be corrected through educational programs.

Gender was mentioned several times in different groups when discussing perceptions of alcohol use in focus groups. The difference between male and female alcohol consumption is pervasive among many countries. For example, Chinese male consumes 95% of all alcohol (T. Babor et al., 2003). Corresponding to our quantitative result, compared to males, females drink less and are more likely to drink privately at home, possibly due to traditional gender roles and the stigma on female drinking. Previous interviews in this population also found men in villages drink more because they have nothing to do at home (Castens et al., 2012). Alcohol use is seeming to be contradicting females' role in nuclear families. As Tanzania slowly transforms from traditional patriarchy society to a modern capitalist society, females are still highly valued by their femininity and domesticity. Along with this transformation, females are, slowly but surely, forced to enter the paid labor force. As Marx wrote in The Communist Manifesto, "The bourgeoisie, wherever it has got the upper hand, has put an end to all feudal, patriarchal, idyllic relations. (Marx & Engels, 1967)" As the division of labor diminishes with the development of its current economy, the gap of gender inequality will reduce inevitably in Tanzania. Alcohol stigma is a double-edged sword for Tanzanian women. On one hand, stigma protects women from drinking too much and developing an AUD. Though the protective effect of stigma on female drinking will be smaller in Tanzania in the foreseeable future, as have seen by our participants. On the other hand,

globally, women feel more stigmatized for having AUDs and facing more barriers to access to alcohol treatment (Brady & Ashley, 2005).

Impact of negative perceptions on drinkers

Participants argued stigma influence drinkers both positively and negatively. Self-stigma around drinkers might reduce harmful drinking, as reported in literature (Livingston et al., 2012). However, the stigma around drinkers might exacerbate their harmful drinking behaviors and worsen their living conditions (Room, 2005).

4.2.2 *Risky behaviors*

Throughout the focus groups, participants identified numerous alcohol-related risky behaviors such as stealing, unprotected sex behaviors, fighting, and injury. External harms caused by risky behaviors include physical harm, economic harm, psychological harm. Violence (including rape, domestic violence, fighting) was mentioned frequently as a risky behavior, which corresponding to the global data of 45% of alcohol deaths is attributed to violence or injuries (Organization, 2007). Although, we did not focus on other substance use in this study, we observed a very low rate of other substance use, including tobacco and marijuana, as well as cocaine. Smoking rate is usually low among the local adults. People often buy cigarettes one by one because cigarettes are relatively expensive.

However, in one study among adolescents (n=??) smoking rate was 26.2% for men and 15.5% for women; the prevalence of marijuana smoking were 4.1% for men and women respectively (Mnyika, Masatu, & Klepp, 2011).

Alcohol use contributes to risky behaviors in two ways. First, alcohol use directly creates psychological effects that may cause road crashes and fights. Second, alcohol use might lead to poverty and unemployment thus increase the crime rate. Our participants also mentioned other factors that might contribute to risky behaviors including drinking culture, misconception about alcohol use, and the lack of regulation. These factors call for attention to macro-level factors that influence alcohol use perceptions and risky behaviors.

4.2.3 *Macro-level factors that influence perceptions*

While drinking alcohol is an individual behavior, it can be taught and learned and is certainly influenced by culture and social environment (Edwards, 1997). Overall, we found alcohol culture, including age at first drink, alcohol education, advertising, policy, and regulation to be socially constructed vulnerability factors of alcohol use.

In Tanzania, like in other Eastern Afrasian countries, alcohol is viewed as a mean of social interaction rather than merely a way to be intoxicated (Vissoci, 2018). The relaxed drinking culture led to the normalization of drinking-related behaviors and pervasive early exposure to alcohol among people in Moshi. Alcohol use is so accepted by the community that parents may introduce alcohol to their children when they are only 4 or 5 years old. Our quantitative

finding, together with other studies, have shown that the early onset of alcohol is associated with higher alcohol use and alcohol-related adverse consequences (Benjet, Borges, Méndez, Casanova, & Medina-Mora, 2014; Dawson, Goldstein, Patricia Chou, June Ruan, & Grant, 2008; Fischer, Najman, Plotnikova, & Clavarino, 2015; Foster, Hicks, Iacono, & McGue, 2014). Family influence may put children at higher risk for developing alcohol use disorders and anti-social behaviors (Velleman, 1993).

The early age of alcohol consumption is tightly linked to the common practice of home-brew. Banana beer and banana wine are very common in rural Moshi. People can either make them at home using widely available banana or buy them cheaply from stories with 500 TSH ($0.23) per 500 ml. Alcohol is most embedded in the Chagga culture, where people frequently make homebrew and share alcohol with families and even strangers. Homebrew has been associated with increased injuries and reported containing harmful levels of bacteria due to its lack of regulation and unhygienic production environment (Adelekan, Razvodovsky, Liyanage, & Ndetei, 2008; B. Shayo, 2000).

Participants mentioned the lack of regulation and enforcement of alcohol policies in Moshi, as there is no minimum age enforcement, no direct regulation over homebrew, and no enforcement of the ban of alcohol in the workplace. The ubiquitous alcohol advertisement and the relatively low alcohol price also induces people to drink more. One of the major obstacles of slowing down the rising alcohol consumption is the alcohol industry's influence on the government and its market strategies. The Tanzania alcohol industry contributed 157 million USD in tax revenue in 2011 alone (Castens et al., 2012).

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With no restrictive laws, alcohol industry's market strategies, as mentioned by our participants, attracted young people specifically.

Though the wide availability of raw material—the main crop banana—and related drinking culture make it hard to regulate homebrew directly, education and regulation with enforcement may reduce alcohol-related risky behaviors as have been shown in other settings. For example, studies have found education or the enforcement of drink driving laws can effectively reduce car crashes in both low and middle-income countries like Botswana, Brazil, and high-income countries like the US (Fell et al., 2014; Peden et al., 2004; Sebego et al., 2014; C. Staton et al., 2016).

Our focus group revealed that there is currently almost no alcohol education in Tanzania. Although previous research results vary on the effectiveness of alcohol education on reducing alcohol use disorders in high-income countries, safety education in Tanzania is important as some of the local dangerous behaviors should and could be avoided by giving people education (Giesbrecht, 2007; Hanson, 1982; Morgenstern, Wiborg, Isensee, & Hanewinkel, 2009). As described earlier, common local practice such as drinking during breastfeeding to put babies to sleep and sharing alcohol with children can lead to a catastrophic outcome. Education on alcohol use complications and addiction may be the best approaches to reduce risky behavior in Tanzania.

4.3 Implications for policy and practice

Identification of these 3 risky behavior patterns offers valuable information for public health and health practitioners. Previous literature has recommended using additional information when designing prevention and intervention programs that address alcohol-related risky behaviors (Borsari, 2004; Borsari et al., 2007; Ray, Stapleton, Turrisi, & Philion, 2012). The US Department of Health and Human Services suggests for those with mild to moderate substance use disorders, treatment through the normal health care system may be enough, while those with severe substance use disorders may require specialty treatment (Abuse, US, & General, 2016). A similar intervention process might also be applicable for alcohol use disorders. Our classification system may help the individualization of alcohol interventions to focus on behaviors specifically considering alcohol use patterns. A brief intervention might be suitable for people classified in the class "no risky behavior" and "moderate risky behaviors"; while people classified in "high risky behaviors" group may need specialty treatment.

We believe this study provides important evidence regarding early alcohol onset and alcohol-related consequences. This study calls attention to the need for programs and initiatives that seek to prevent and delay alcohol use among youth. This study also brings up the necessity of paying attention to the macro alcohol use environment and culture in Tanzania. Although the legal drinking age in Tanzania is 18 years old, enforcement of this law is challenging, and few strategies target the prevention of underage drinking

specifically. In fact, in Tanzania, alcoholic beverages are easily accessible for youth, and there is limited enforcement of the legal minimum age for serving and selling alcohol to youth (Castens et al., 2012). As mentioned earlier, there is also no minimum alcohol price in Tanzania as the lack of regulation and the pervasive home-brew activity. An education program should be provided, as the public is largely unaware of the risk of excessive drinking. Alcohol use warning signs should be added to the education package and schools should also make stricter rules to prevent underage drinking. Alcohol use interventions are needed in Moshi considering its high alcohol consumption and alcohol-related injuries, but an intervention may not function well without considering these local factors such as alcohol regulation, home-brew alcohol, and alcohol use culture.

4.4 Implications for further research

As the first analysis of alcohol-related risky behaviors patterns in a sub-Saharan African country with an LCA, future study replications would help to validate our findings. Additionally, longitudinal studies concerning the course of development of risky behavior pattern are desired to learn the condition where the transition from one risky behavior pattern to another. Future research should also explore whether the intervention effectiveness varies among classes and whether we should apply different alcohol use intervention methods to different classes. Finally, since we only explored the associations between risky behaviors and perceived external stigma, we believe it is also

essential to explore the associations between risky behaviors and internal alcohol-related stigma.

In addition, currently, there are minimal alcohol use disorder treatment options in northern Tanzania. Alcohol has been argued creating more negative impacts on society than other substance and yet has received much less attention to its treatment. Future research is needed to examine the cultural practices and norms regarding drinking, particularly by tribes, by socioeconomic status and how these may vary by gender. Considering the cultural acceptance of alcohol and the widespread use of homebrew in Moshi, it is also important to explain any differences in the use of regulated and unregulated alcohol. Understanding how drinking culture relates to the occurrence of alcohol use disorders and consequences, we can further develop goals and strategies of future alcohol abuse prevention and intervention programs in Tanzania and in the Eastern Africa region.

4.5 Study strengths and limitations

There are five main limitations of this study. First, this self-reported survey does not include racial or ethnic affiliation, biological factors (e.g., early puberty), socioeconomic status, family factors or exposure to alcohol in the home, involvement with delinquent peers, childhood conduct problems, as well as early adverse life events or circumstances. Therefore, these factors cannot be taken into consideration. These factors may influence the risk of developing problems with alcohol in the adult years. Also, self-

report data on the standard drinks of alcohol consumed may be imprecise due to the common drinking habit of sharing one cup of homebrew among family members or friends. Injury patients might be unwilling to self-report alcohol use immediately after an injury, which might lead to an underestimation of alcohol use. Focus group participants might be deterred to disclose personal alcohol use due to the presence of research nurses. But this is unlikely to influence participants' perception of alcohol use.

Secondly, we purposely oversampled injury patients because the selection of this population also increased our sensitivity because injury patients suffer more consequences than the general population, thus making it easier to elucidate these associations. However, our mixed participants are unlikely to represent the whole of the Tanzanian population; it is possible that different drinking patterns would have been found in other regions and populations within Tanzania. Also, injury patients and their family members might have more negative views on alcohol use because their relative or themselves might already suffer from alcohol-related consequence.

Third, we did not dive into other substance use such as marijuana and smoking in our qualitative phase, as alcohol is the primary substance used in Moshi area. We hope future study can focus more to assess how alcohol use associate with other substance abuse. Fourth, though qualitative results showed alcohol stigma relates to people's risky behaviors in various ways, our quantitative results did not show the association between

the two factors. The inconsistent of results might cause by the lacking of self-stigma data and our imperfect categorization of risky behaviors, as described below.

Fifth, one previous validation study classified DrInC risky behaviors into three categories: mild, moderate, and severe consequences (Kirouac & Witkiewitz, 2018). Such categorization might improve the intelligibility of our three profile groups and their risky behaviors distribution. However, we did not adopt such categorization because the lack of specific item categorization criteria. We also did not separate injury patients and the general population in the quantitative analyses stage, which might yield different latent classes and related results. We hope future studies can address these factors and further examine the interaction between these variables.

The strength of this study was its mixed method design which revealed risky behaviors and related negative perception in a setting that had not been studied. Also, this study involved with an injury population, who suffers the most harmful alcohol use, as well as family members, and medical and research personnel who provided different perception angles.

5. Conclusion

To our knowledge, this is the first study to investigate alcohol-related risky behaviors and stigma in a mixed sample from a sub-Saharan African country. We identified three latent class system that can be used to classify alcohol-related risky behaviors in Tanzania. Although alcohol stigma may not associate with the number of risky behaviors directly, our qualitative study helped us to understand how stigma associated with risky behaviors. This study may serve as a reference for designing and adjusting interventions to alcohol-related injury patients' needs by using our knowledge about perceptions and the identified risky behaviors classes as a form of classification system. Information about community perceptions, alcohol stigma, gender differences, and risky behaviors also provides support for future research to address harmful alcohol use in Tanzania.

Appendix A. Summarizes the consequences by each subscale in DrInC.

Subscale	Number of items	Description	Sample item
Physical	8	Reflect acute and chronic adverse physical states resulting from excessive drinking	My physical appearance has been harmed by my drinking
Intrapersonal	8	Subjective perceptions	I have felt guilty or ashamed because of my drinking
Social responsibility	7	Consequences observable by others	I have had money problems because of my drinking
Interpersonal	10	The impact of drinking on the respondent's relationships	While drinking, I have said harsh or cruel things to someone
Impulse control	12	Impulsive actions, risk-taking, exacerbation of other substance use and legal problems	I have been overweight because of my drinking

Appendix B. Variables used

Variable name	Full questions	Independent/ dependent	Type of variable
Age	Age	Independent	Continuous
Gender	Gender	Independent	Binary
DrInC Impulse control scale			
Drink drive	1. I have driven a motor vehicle after having three or more drinks.	Independent	Binary
Use other drugs	2. My drinking has caused me to use other drugs more.	Independent	Binary
Foolish risk	3. I have taken foolish risks when I have been drinking.	Independent	Binary
Impulsive things	4. When drinking, I have done impulsive things	Independent	Binary

that regret	that I regretted later.		
Physical fight	5. I have gotten into a physical fight while drinking.	Independent	Binary
Smoke more	6. I have smoked more when I am drinking.	Independent	Binary
Overweight	7. I have been overweight because of my drinking.	Independent	Binary
DUI	8. I have been arrested for driving under the influence of alcohol.	Independent	Binary
Legal trouble (not drink drive)	9. I have had trouble with the law (other than driving while intoxicated) because of my drinking.	Independent	Binary
Had accident	10. I have had an accident while drinking or intoxicated.	Independent	Binary
AUDIT	Full scale	Dependent	Continuous / Binary
Quantity	How many drinks containing alcohol do you have on a typical day when you are drinking? 0) Never; 1) Monthly or less; 2) 2 to 4 times a month; 3) 2 to 3 times a week; 4) 4 or more times a week	Dependent	Ordinal
Frequency	How often do you have a drink containing alcohol? 0) 1 or 2; 1) 3 or 4; 2) 5 or 6; 3) 7 8 or 9; 4) 10 or more	Dependent	Ordinal
Binge drinking frequency	How often do you have six or more drinks on one occasion? 0) Never; 1) Less than monthly; 2) Monthly; 3) Weekly; 4) Daily or almost daily	Dependent	Ordinal
Perceived alcohol-related stigma	Alcohol adaptive PDD full scale	Dependent	Continuous

Appendix C. Focus group questions

Category	No.	Question
Perception & risky behaviors	1	Can you draw a person who have alcohol use disorders? How do people view those who have alcohol use disorders?
	2	Are there any difference between views on male and female with alcohol use disorders?
	3	What kind of risky behaviors do people engage in after they drink?

Why alcohol use and risky behaviors are related?

	4	Do you know any alcohol-related risky behavior stories? What is your opinion? What might have contributed to these behaviors?
	5	Can you give some examples of how drinkers' risky behaviors impact the community?

Because of those bad things how do people perceive those who drink?

Can you give some examples of how people's perception on those who drink influence drinkers and their risky behaviors?

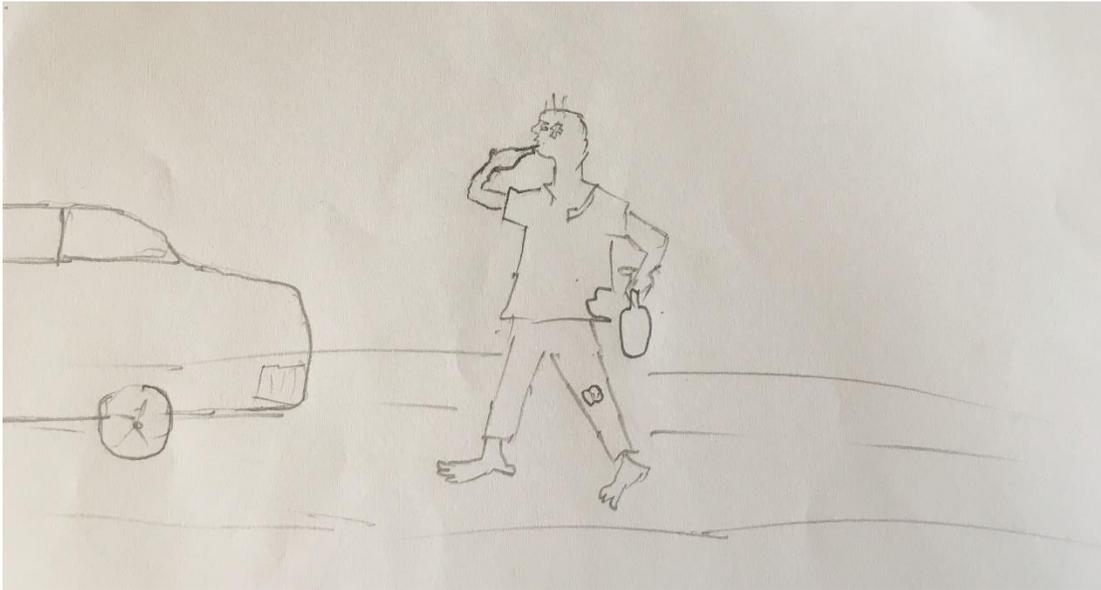| Alcohol knowledge	1	When is the first time people start drinking alcohol? (Age)
	2	What are parents' attitudes toward children drinking alcohol?
	3	Do you think drinking alcohol harms you?
	4	Do you think drinking a small amount of wine is good for you?
	5	Which of the following can cure hangovers and make you feel less influenced by alcohol?
	6	What do you need to pay attention to when drinking? For example, is it okay to take medicine when drinking?
	7	Do you think pregnant and lactating women can drink alcohol?
	8	Do you think alcohol is addictive?
	9	Do you think your government should limit the drinking age? When?
	10	Do you classify alcohol as a drug? Why?
	11	Are you satisfied with the alcohol education in school?
	12	What are the general views on moderate or occasional drinking?
	13	We know the government banned the sachet last year, do you think it works?

Appendix D. Participants' drawing

Drawing 1. *[A wife is waiting at home but her husband is drunk and fall by the side of the road.] Drew by a 62 years old female nurse.*

Drawing 2. *[A woman (Tanzania men rarely have long hair) holds two bottles of alcohol in her hands.] Drew by a 25 years old male family member.*

Drawing 3. *[A poor man (seen from the patch on his pants) with head bruise drinking alcohol in the middle of the road.] Drew by a 19 years old male injury patient (left hand injury).*
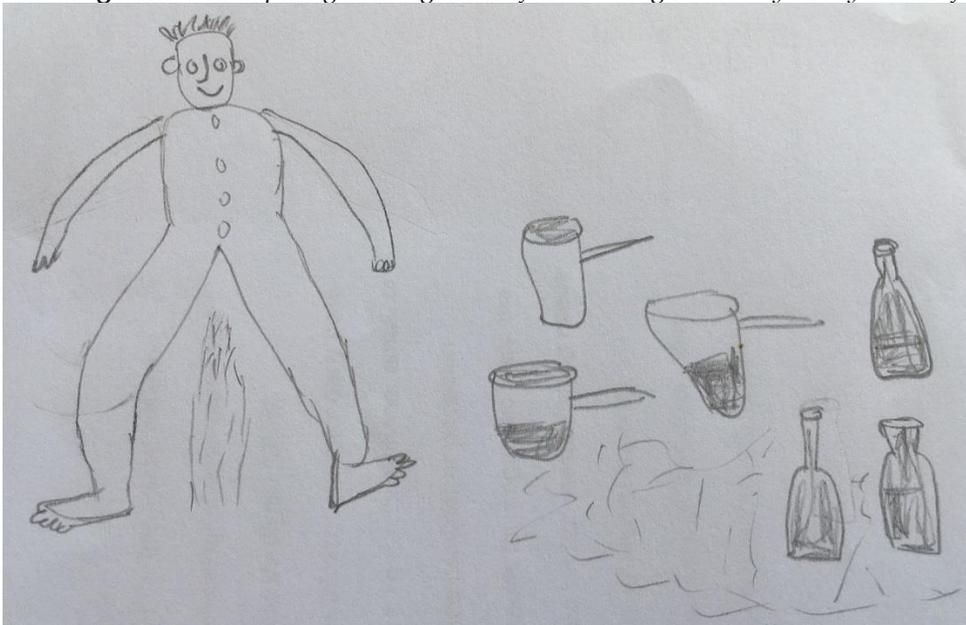
Drawing 4. *[A malnutrition man is vomiting after drinking.] Drew by a 41 years old female injury patient (mild traumatic brain injury).*

Drawing 5. *[A man falls asleep on a table after drinking a lot of alcohol.] Drew by a 42 years old female nurse.*
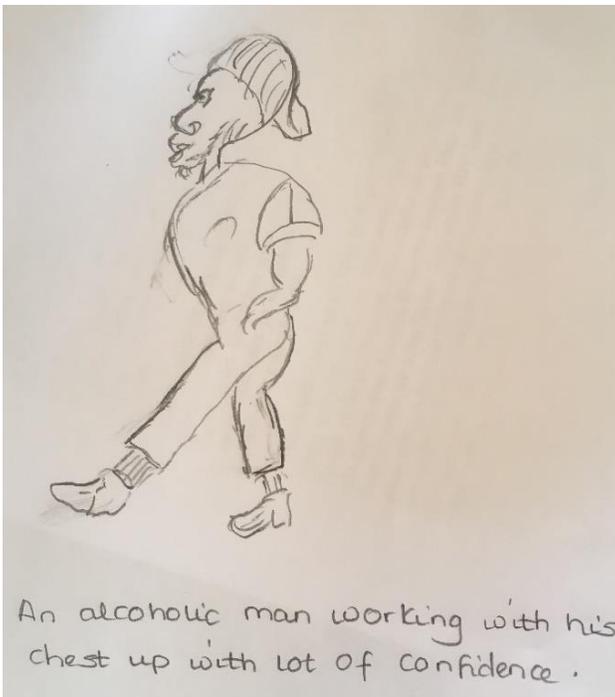
Drawing 6. *[A man is peeing on the ground after drinking.] Drew by a 55 years old female nurse.*
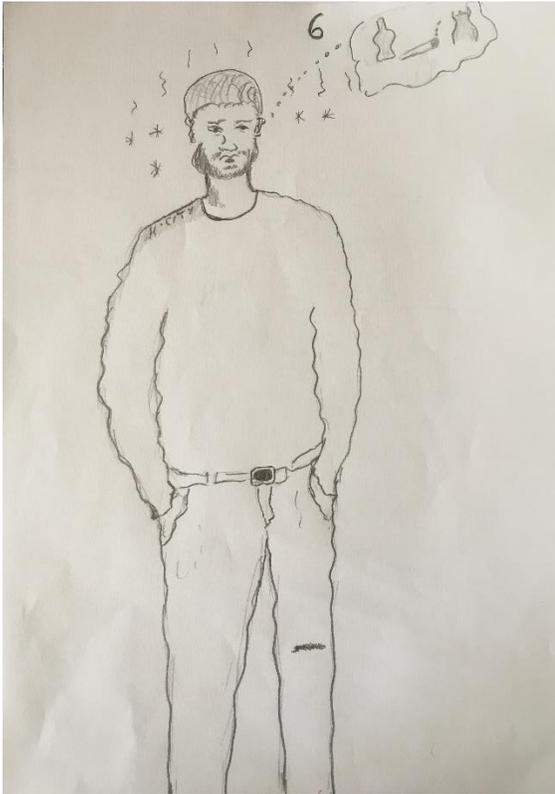

Drawing 7. *[An alcoholic man lying on a bed and looks seriously ill] Drew by a 36 years old female injury patient (right hand injury).*
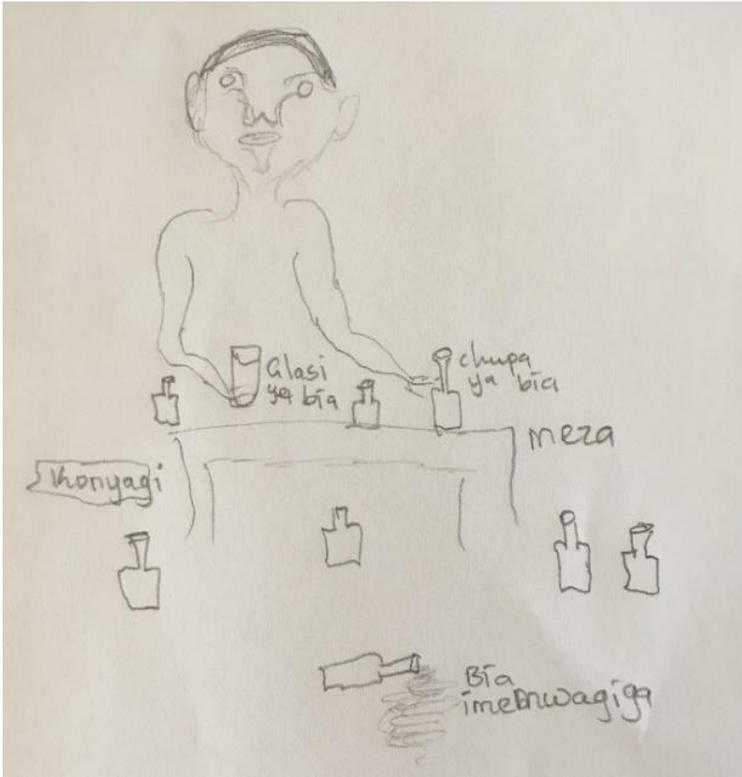
Drawing 8. *Written by the participant: [An alcoholic man walking with his chest up with a lot of confidence.] Drew by a 62 years old male injury patient (left hand injury).*

An alcoholic man working with his
chest up with lot of confidence.

Drawing 9. *[A dizzy man thinking about alcohol and cigarette (indicating they tend to co-occur).] Drew by a 40 years old male injury patient (right hand injury).*

Drawing 10. *[A man with a variety of alcohol in front of him (from left to right: liquor, a glass of beer, a bottle of beer, and spilled beer] Drew by a 51 years old female family member.*

Glasi ya bia

chupa ya bia

meza

konyagi

Bia imeanwagiqa

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