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Prevalence of alcohol dependence in Mongolia: a nationwide population-based, cross-sectional study

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Abstract: Alcohol-related problems are a major health issue in Mongolia and remain underdiagnosed. The nationwide population-based, cross-sectional study reported here was carried out between September and November 2013. It aimed to determine the prevalence of alcohol dependence among the general population using two instruments: the Alcohol Use Disorder Identification Test (AUDIT) and an International Classification of Diseases (ICD)-10 based clinical interview. The AUDIT test, developed by the World Health Organization, was adopted to screen a full spectrum of alcohol-related disorders. Participants identified as at high risk of alcohol dependence were referred to a clinical interview for diagnosis of alcohol dependence. The interview was designed using ICD-10 diagnostic criteria. The study consisted of 11746 participants from 79 clusters, age 18–64 years (*n*=11746, males 49.1%, females 50.8%, mean age 39.6 ± 12.5 years). 45.4% of the participants (*n*=5336) abstained from alcohol use, 39% were at low risk of alcohol dependence (*n*=4582), 9.2% were at moderate risk (*n*=1075), and 6.4% were at high risk (*n*=753). Among the participants, a total of 522 participants (4.4%) were diagnosed as having alcohol dependence through the clinical interview. Increased risk of alcohol dependence was associated with those who were men, divorced or widowed, living in rural regions, unemployed, and less educated. The study results suggest that the prevalence of alcohol dependence is 4.4% among the general population of Mongolia. Gender, marital status, geographical location, and education significantly influence alcohol dependence.

Keywords: Alcohol dependence; Alcohol consumption; AUDIT; Clinical interview; ICD-10

1.0 INTRODUCTION

The World Health Organization (WHO) estimates that about two billion people worldwide consume alcoholic beverages, and 76.3 million with diagnosed alcohol-related disorders (WHO, 2004). Alcohol-related disorders include alcohol abuse and alcohol dependence as defined by the International Classification of Diseases (ICD-10). Alcohol dependence is described by the ICD-10 (WHO, 1993) as a chronic medical condition that typically includes a current habit or history of excessive drinking, a strong craving for alcohol, continued use despite repeated problems with drinking and an inability to control alcohol consumption. The major risk factor of alcohol dependence is harmful alcohol consumption. Harmful alcohol consumption is considered an important public health issue that causes 2.5 million deaths yearly worldwide. The global level of alcohol consumption in 2018 was estimated at 6.2 litres of pure alcohol per person older than 15 years (WHO, 2018).

Mongolia is a landlocked country located in East Asia with a population of three million people. The prevalence of alcohol dependence in the general population has not yet been clearly determined. Erdenebayar and colleagues (Erdenebayar et al., 1996) reported in a local journal that the prevalence of alcohol dependence was 0.21% among 815 residents. However, the sampling method, data collection and statistical analysis of the study were not clearly described and the diagnostic criteria for alcohol dependence were not adopted from ICD-10. Another survey reported the prevalence of harmful alcohol consumption at about 3% of 10,157 participants (1.2% among women and 5.5% among men) in 2006 (Tsetsegdari et al., 2006). Both reports were not peer-reviewed and were published in the Mongolian language.

According to the WHO report, the prevalence of alcohol dependence in Mongolia was estimated to be 2.8% of the population, and the level of alcohol consumption was determined to be seven litres of pure alcohol per person in 2010 (WHO, 2014). While the above studies have measured alcohol consumption and estimated the prevalence of alcohol dependence by national registry data in Mongolia, there has been no large-scale nationwide study of alcohol dependence. Moreover, a recent report on heavy drinking use in Mongolia was a secondary data analysis based on the WHO NCD Microdata repository (Pengpid & Pelzter, 2022). Therefore, this study aimed to determine the prevalence of alcohol dependence within the general population using a structured clinical interview following the ICD-10 diagnostic criteria after screening by AUDIT questionnaire.

2.0 MATERIALS AND METHODS

2.1 Study site and sample

This nationwide population-based, cross-sectional study was carried out between September and November 2013. People aged between 18 and 64 years living in Mongolia were the targeted population. The estimated baseline level of harmful alcohol consumption was 3%, as confirmed by a previous study of its prevalence in 2006 (Tsetsegdari et al., 2006). According to the WHO STEPS Surveillance Manual, the sample size was 12,200, with a formula of [n=(CI2*(BLI*(1-BLI))/MOE2)*DE*ASG*GA/RR], based on calculation of a 95% confidence interval (CI: margin of error of 0.05%), a design effect (DE) of 1.50, an anticipated response rate (RR) of 80%, 12 age-sex groups (ASG: <19, 20–29, 30–39, 40–49, 50–59, 60< years for men and women), and 12 geographical areas (GA: three cities and nine rural prefectures) (WHO, 2005). The study was designed using three-stage cluster sampling. In the first stage, 12 primary sampling locations were selected out of 22 enumeration areas.

Due to Mongolia's large area and low population density, 9 sites out of 19 rural areas from all four regions (Western, Central, Mountain and Eastern) were randomly selected to save travel costs. The nine prefectures were Khovd, Zavkhan (Western region), Bulgan, Uvurkhangai, Khuvsgul (Mountain region), Selenge, Dornogobi (Central region), Dornod and Khentii (Eastern region). Proportional allocation was used to keep the same proportion of individuals from each site for the generalizability of the target population. All three cities (Ulaanbaatar, Erdenet, and Darkhan) were included in the three urban areas. In the second stage, 79 secondary sampling locations were selected as clusters out of 171 administration locations from 12 primary sampling locations. Using proportional probability sampling 53 administrative locations from the rural areas and 26 administrative locations from the urban areas were randomly selected. Each administrative location (a soum or a subdistrict) had a full registration of all residents. The registration system contained specific information on each individual including name, ID, age and gender. In the final stage, 150 to 155 individuals aged 18 years or older were randomly selected from the registration system of each of the 79 clusters. If the selected individuals were not available, they were replaced by the next individual with the same age and gender.

Data were obtained with the informed consent of all participants. The Ethics Supervision Committee of the Ministry of Health approved the ethics permission, code Resolution No. 1 of September 27, 2011. All procedures performed in studies involving human participants were in accordance with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

2.2 Screening of alcohol dependence by AUDIT

A Mongolian translation of AUDIT was used for screening. The AUDIT was developed by WHO as a method of screening for possible alcohol dependence based on life events in the previous 12 months. Since being updated in 1992, it has become widely used as an assessment tool by both health workers and researchers. Validated over a period of two decades it has been found to provide an accurate measure of risk across gender, age and culture (Babor et al., 1992). Previous studies have shown the AUDIT compares with other well-known alcohol screening measurements according to its diagnostic performance and it effectively identifies harmful alcohol consumption in different countries and cultural groups (Gache et al., 2005). AUDIT contains 10 questions that assess recent alcohol use (questions 1–3), alcohol dependence (questions 4–6) and alcohol abuse (questions 7–10). Questions 1–8 are scored from 0 to 4, and questions 9 and 10 are scored 0, 2, or 4, resulting in a maximum score of 40. The overall Cronbach's alpha score was found to be 0.93.

2.3 Diagnosis of alcohol dependence by structured clinical interview

Participants who scored above 20 on the AUDIT questionnaire were asked to take a structured clinical interview. The interview was conducted face to face by a trained interviewer who was also a licensed psychiatrist. According to the ICD-10 criteria for alcohol dependence, a 26-item structured clinical interview was used to identify live events and alcohol consumption during the previous 12 months. It consisted of six sections; each of which describe the following items: 1. Identifying information (item 1–4); 2. Clinical characteristics of alcohol dependence (item 5–16); 3. Aetiology (item 17–20); 4. Diagnostic Criteria; 5. Diagnosis (item 21, 22); 6. Intervention (item 23–26).

The interview was conducted in a fully structured way as follows. Initially, the interviewer took informed consent from a participant after an explanation of why the subject had been selected for an interview and how their data would be used. Afterwards, the interviewer built a rapport with each participant by giving details of their confidentiality and anonymity. During the interview, the participant was encouraged to speak freely, rarely interrupted and given time for reflection and recollection for their mental status examination. The interviewer was permitted to ask for detailed information and to amend the rating if important new information emerged during the interview. Finally, the interviewer checked whether each participant was asked all questions. The average length of an interview was 40 minutes. To minimise errors, an experienced research psychiatrist supervised each interview and allocation of the ICD-10 diagnosis. The response rate of the interview depended on the interviewer's commitment to evaluating all items. Assessment of diagnosis was never based on a simple yes/no answer, but always required self-descriptions, i.e., the examples formulated in the participant's own words.

According to the ICD-10, diagnostic criteria for alcohol dependence (F10.2) included a sense of compulsion to consume alcohol, impaired capacity to control drinking, physiological withdrawal state when alcohol use is reduced or ceased, evidence of tolerance to the effects of alcohol, preoccupation with alcohol and persistent alcohol use. If the participant exhibited three or more of the following manifestations together for at least one month or, in cases persisting for periods of less than one month, showed symptoms that occurred together repeatedly within 12 months, they were diagnosed with alcohol dependence. The diagnostic criteria for alcohol dependence may have been changed in ICD-11 (6C40.2), however, it has not been in effect in Mongolia yet.

2.4 Procedure

Study teams consisted of psychiatrists and researchers who had completed a training program on screening and the clinical interview. Citizens residing for at least six months in Mongolia aged between 18 and 64 were considered to meet the study inclusion criteria. Data collection was conducted by paper-based administration of both the screening and the diagnosis. At the screening step, demographic information was gathered and the paper-based AUDIT questionnaire was completed by each participant. Primary sampling locations were based at primary health care centres of each administrative location across the country. A sample size of 12,200 participants was required for the study. In total 454 individuals were excluded as they did not complete the questionnaire. 11,746 participants were included in the analysis. Subsequently, participants were classified into four categories according to their AUDIT score: Participants with 0 points were defined as alcohol abstainers, 1–7 points were considered to be at low risk, 8–19 points at

moderate risk and above 20 points at high risk of alcohol dependence. At the diagnosis step, participants who scored above 20 on the AUDIT questionnaire were asked to undergo a 26-item structured interview with a trained psychiatrist for a possible diagnosis of alcohol dependence **(Figure 1)**. This accorded with the guidelines of the AUDIT manual which recommends that a participant with an AUDIT score of 20 or above should be further diagnostically evaluated for alcohol dependence in a process that takes into account the individual's medical condition, family history of alcohol problems and perception of the questionnaire (Babor et al., 1992).

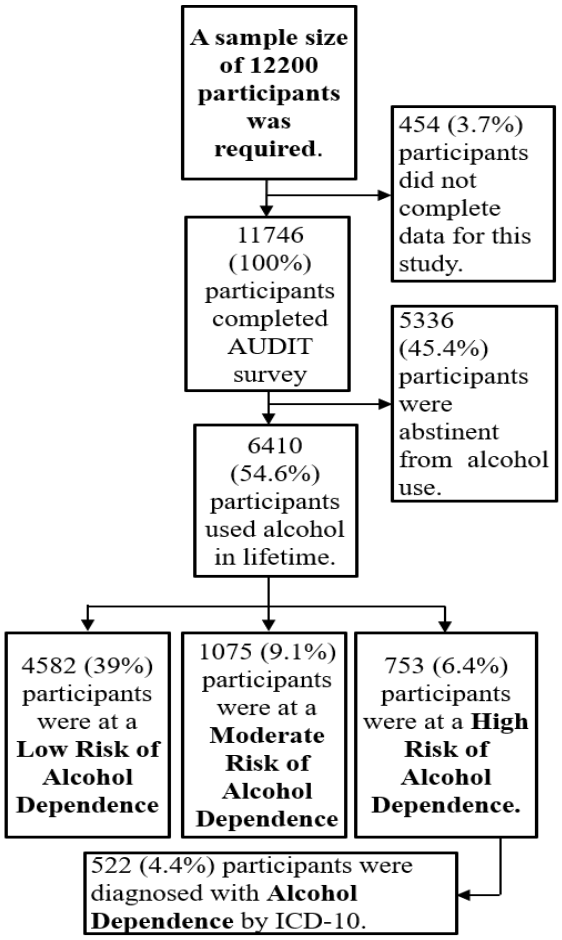

Figure 1: Flowchart outlining the study procedure. 12200 participants were required for the sample representing the target population. 454 (3.7%) were excluded due to incomplete data. The participants were divided into 4 groups after the AUDIT questionnaire had been performed. A total of 5336 participants were classified as abstinent from alcohol, 4582 (39%) as at low risk of alcohol dependence, 1075 (9.1%) as at moderate risk of alcohol dependence, and 753 (6.4%) participants as at high risk of alcohol dependence, respectively. A 26-item structured clinical interview was performed with those who were at a high risk of alcohol dependence. In total, 522 (4.4%) participants were diagnosed with alcohol dependence.

2.5 Statistical analysis

Data were presented as mean ± standard deviation. Distributions of continuous variables were tested by the Kolmogorov-Smirnov test. Differences between categorical variables were tested where appropriate by either the Chi-Square or the Kruskal-Wallis tests. A binary logistic regression test was used to determine the effect of risk factors (socio-demographic characteristics) on alcohol dependence. An odds ratio (OR) was used to measure the association between an exposure and an outcome (i.e., how risk factors affect alcohol dependence). A 95% confidence interval (CI) was used to estimate the precision of the OR, with statistical significance set at $P<0.05$. The internal consistency of the AUDIT was estimated using Cronbach's α test. SPSS 21.0 was used for statistical analyses.

3.0 RESULTS

3.1 Demographics

Detailed demographic information of the participants (n=11,746, mean age=39.6 ± 12.5) is given in **Table 1**.

3.2 Screening of alcohol dependence by AUDIT

Study participants were divided into four groups by their AUDIT score. A total of 45.4% of the participants were alcohol abstinent, 39% were at low risk, 9.2% were at moderate risk and 6.4% were at high risk of alcohol dependence. There was a significant difference in gender, age, marital status and employment between the AUDIT groups (P <0.001). Among the participants who consumed alcohol in their lifetime (n=6410), there was a difference in gender and age groups (both P<0.001). Regardless of gender, the age group of 25–29 showed the highest prevalence of lifetime alcohol consumption **(Figure 2A)**.

3.3 Prevalence of alcohol dependence

Of 753 participants who scored higher than 20 in the AUDIT, 522 were diagnosed with alcohol dependence through the clinical interview. This result suggests the overall prevalence of alcohol dependence in the general population was 4.4%. A majority of the alcohol-dependent participants were males (P<0.001). The prevalence of alcohol dependence differed in gender, residence, education, marital status, and employment **(Table 1)**. Among the age groups, those aged 35–39 showed the highest prevalence of alcohol dependence **(Figure 2B)**. By marital status, the prevalence of alcohol dependence was higher among divorced or widowed participants **(Figure 3A)**. The prevalence of alcohol dependence differed between the regions **(Figure 3B)**. The prevalence of alcohol dependence in cities and regions is described in **Table 2**.

Table 1. Demographic characteristics and prevalence of alcohol dependence.

Characteristics	Total	Screening by AUDIT					Alcohol dependence		
		Abstinent from alcohol use	Low risk of alcohol dependence	Moderate risk of alcohol dependence	High risk of alcohol dependence	P-Value*	Yes	No	P-Value*
Total, n (%)	11746 (100.0)	5336 (45.4)	4582 (39.0)	1075 (9.2)	753 (6.4)		522 (4.4)	11224 (95.6)	
Gender									
Male	5768 (49.1)	1849 (32.1)	2314 (40.1)	916 (15.9)	689 (11.9)	<0.001[b]	484(8.4)	5284 (91.4)	<0.001[a]
Female	5978 (50.9)	3487 (58.3)	2268 (37.9)	159 (2.7)	64 (1.1)		38 (0.6)	5940 (99.4)	
Age group									
<19	350 (3.0)	251 (71.7)	20 (25.7)	6 (1.7)	3 (0.9)		2 (0.6)	348 (99.4)	
20-29	2928 (24.9)	1326 (45.3)	1245 (42.5)	233 (8.0)	124 (4.2)		68 (2.3)	2860 (97.7)	
30-39	2671 (22.7)	1068 (40.0)	1089 (40.8)	308 (11.5)	206 (7.7)	<0.001[b]	144 (5.4)	2527 (94.6)	<0.001[b]
40-49	2666 (22.7)	1124 (42.2)	1036 (38.9)	287 (10.8)	219 (8.2)		157 (5.9)	2509 (94.1)	
50-59	2451 (20.9)	1188 (48.5)	901 (36.8)	188 (7.7)	174 (7.1)		129 (5.3)	2322 (94.7)	
>60	680 (5.8)	379 (55.7)	221 (32.5)	53 (7.8)	27 (4.0)		22 (3.2)	658 (96.8)	
Geographical locations									
Urban areas	6341(54.0)	3009 (47.5)	2271 (35.8)	744 (11.7)	317 (5.0)	<0.001[b]	256 (4.0)	6085 (96.0)	0.020[a]
Rural areas	5405 (46.0)	2327 (43.1)	2311 (42.8)	331 (6.1)	436 (8.1)		266 (4.9)	5139 (95.1)	
Education									
Primary	2813 (23.9)	1281 (45.5)	1048 (37.3)	243 (8.6)	241 (8.6)		185 (6.6)	2628 (93.4)	
Secondary	5614 (47.8)	2622 (46.7)	2120 (37.3)	502 (8.9)	370 (6.6)	0.115[b]	245 (4.4)	5369 (95.6)	<0.001[b]
High	3319 (28.3)	1433 (43.2)	1414 (42.6)	330 (9.9)	142 (4.3)		92 (2.8)	3227 (97.2)	
Marital status									
Married	9506 (80.9)	4216 (44.4)	3766 (39.6)	924 (9.7)	600 (6.3)		407 (4.3)	9099 (95.7)	
Never married	1546 (13.2)	769 (49.7)	595 (38.9)	99 (6.4)	83 (5.4)	<0.001[b]	54 (3.5)	1492 (96.5)	<0.001[b]
Divorced/ widowed	694 (5.9)	351 (50.6)	221 (31.8)	52 (7.5)	70 (10.1)		61 (8.8)	633 (91.2)	
Employment									
Employed	7134 (60.7)	2751 (38.6)	3087 (43.3)	802 (11.2)	494 (6.9)		320 (4.5)	6814 (95.5)	
Student	431 (3.7)	275 (63.8)	130 (30.2)	17 (3.9)	9 (2.1)	<0.001[b]	5 (1.2)	426 (98.8)	<0.001[b]
Pensioner	1812 (15.4)	1055 (58.2)	569 (31.4)	100 (5.5)	88 (4.9)		67 (3.7)	1745 (96.3)	
Unemployed	2369 (20.2)	1255 (53.0)	796 (33.6)	156 (6.6)	162 (6.8)		130 (5.5)	2239 (94.5)	
Income									
<174 $	1434 (12.2)	637 (44.4)	565 (39.4)	129 (9.0)	103 (7.2)		76 (5.3)	1358 (94.7)	
175-524 $	9611 (81.8)	4395 (45.7)	3738 (38.9)	858 (8.9)	620 (6.5)	0.330[b]	424 (4.4)	9187 (95.6)	0.070[b]
>525 $	701 (6.0)	304 (43.4)	279 (39.8)	88 (12.6)	30 (4.3)		22 (3.1)	679 (96.9)	

** P-Values were analysed using [a] Chi-Square test or [b] Kruskal-Wallis test.*

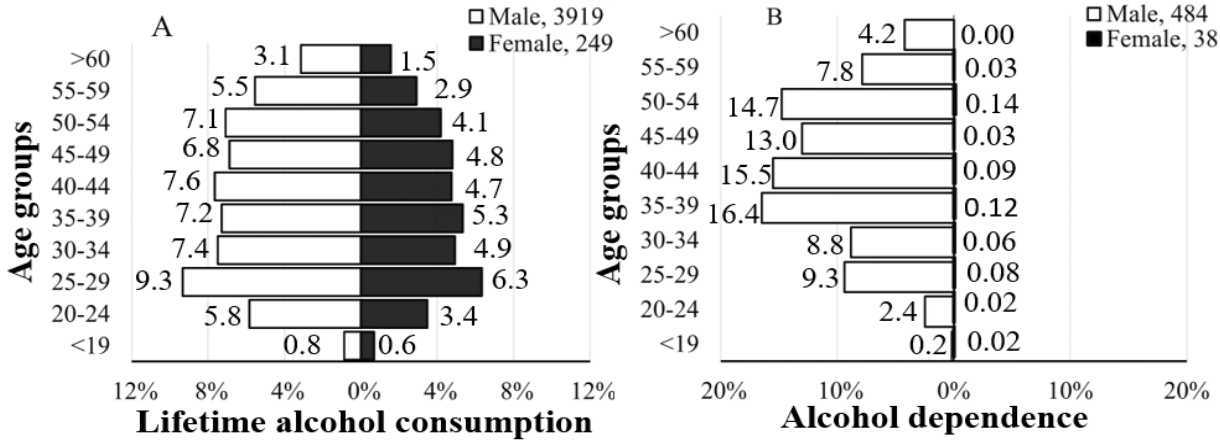

Figure 2: Prevalence of lifetime alcohol consumption and alcohol dependence by age and gender. White bars indicate the prevalence among men, whereas black bars are among women. **(A)** Prevalence of lifetime alcohol consumption. Men consumed alcohol more than women in all age groups, and lifetime alcohol consumption was lowest in the age group below 19 years and highest in the age group between 25 and 29 years for both genders. **(B)** Prevalence of alcohol dependence. Alcohol dependence was more prevalent in men than women, and men aged 35-39 had the highest prevalence of alcohol dependence.

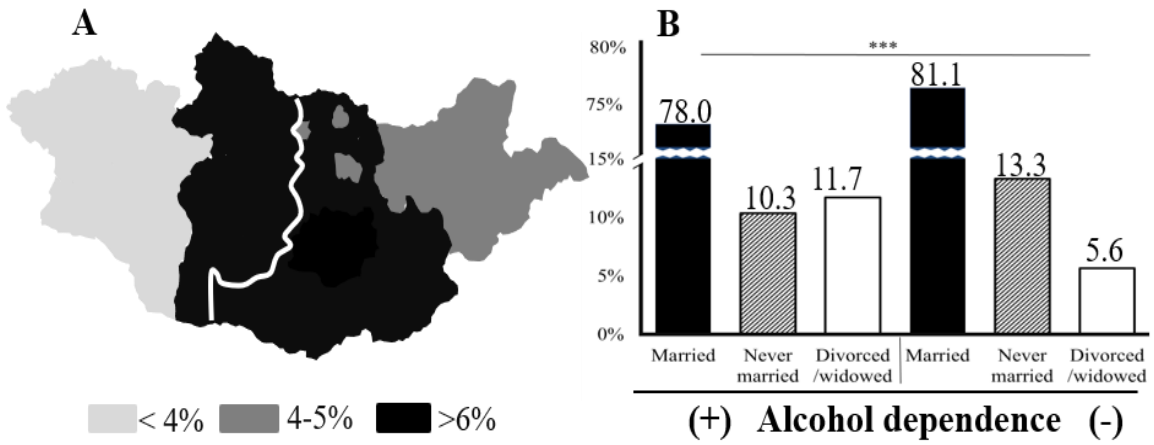

Figure 3: The prevalence of alcohol dependence. (A) Prevalence of alcohol dependence by geographical regions. The colour bars indicate the prevalence of alcohol dependence in percentages. Light grey colour indicates a prevalence of less than 4% (the Eastern region), grey colour a prevalence of 4% to 5% (the Western region), and dark grey colour a prevalence of more than 6% (the Central and Mountain regions), respectively. There is a significant difference in the prevalence of alcohol dependence between the regions (p<0.001). **(B)** Prevalence of alcohol dependence by marital status. (+) indicates the participants with alcohol dependence, whereas (-) the participants without alcohol dependence. *** Kruskal-Wallis test indicates a significant difference between the groups in the prevalence of alcohol dependence (p<0.001).

3.4 Risk factors associated with alcohol dependence demographics

Binary logistic regression showed that an increased risk of alcohol dependence was associated with men (OR: 0.564, p=0.049 vs women), those with a primary education level (OR: 0.569, p=0.028 vs higher education level), those who were divorced or widowed (OR: 0.463, p=0.045 vs married), those who were unemployed (OR: 0.489, p=0.002 vs employed), and those who reside in the Eastern, Central, Western, and Mountain regions (OR: 3.15, p<0.001; OR: 1.741, p=0.030; OR: 4.543, p<0.001; OR: 2.793, p<0.001 vs cities) **(Table 3)**.

4.0 DISCUSSION

This study found that the prevalence of alcohol dependence was 4.4% among the general population in Mongolia. Compared to a previous study of 1996 in Mongolia, the prevalence has increased by a factor of 21. However, there were several limitations in the methodology of that study, including the sampling method, data collection, statistical analysis and diagnostic criteria for alcohol dependence. Although ICD-10 was used by WHO member countries in 1994, it was only introduced to Mongolia in 2001. During the 1990s, psychiatrists and specialists on drug use disorders were still following the diagnostic guidelines of former Soviet psychiatry for alcohol dependence in Mongolia. Therefore, the surprisingly low rate of the prevalence of alcohol dependence might be related to the diagnostic criteria for alcohol dependence, which included alcohol-induced psychosis, amnesia and dementia, whereas alcohol abuse (F10.1 by ICD-10) was not considered a clinical diagnosis. Moreover, the sample size was too small to be generalised to the entire population (Erdenebayar et al., 1996).

The most plausible explanation of the striking increase in the prevalence of alcohol dependence is increased alcohol consumption. Although there has been no study on alcohol consumption during the 90s in Mongolia, it may have been increased by the shift in the political regime from communism to democracy in 1990. During the "transition period" of the socio-political change, in many former Soviet countries alcohol consumption was one of the leading causes of mortality, with a particular increase in rural areas (Pomerleau et al., 2008; Razvodovsky & Stickley, 2007) Furthermore, Nemtsov *et al*. (Nemtsov, 2003) noted that in post-Soviet Russia, between 1990 and 2001 during the political transition, more than 30% (7 million cases) of all mortality was related to alcohol consumption. Russia, Ukraine and Belarus have alcohol consumption rates that far surpassed their previous level 20 years ago in 2001 (Stickley et al., 2007). In line with previous studies, the current findings suggest that alcohol consumption has increased by about a factor of two in nine years when compared with the prevalence of harmful alcohol consumption found in Mongolia in 2006 (Tsetsegdari et al., 2006).

A further reason for increased alcohol consumption might be associated with the increase in the economy

of the country. According to World Bank data reports, the gross domestic product (GDP) of Mongolia was 1.3 billion United States dollars (USD) in 1996, 7.73 billion USD in 2006 and 12.5 billion USD in 2013 (WorldBank, 2013). Accordingly, when the GDP increased to twice as much in 2013 as it was in 2006, harmful alcohol consumption increased by a factor of two in Mongolia. It is known that there is a correlation between increased alcohol consumption and increased household income or GDP of a country (WHO, 2014). Monzavi and colleagues (Monzavi et al., 2015) reported in a secondary analysis of the 2014 edition of the WHO report that among the Asia Pacific Region countries, Mongolia has one of the highest rates of alcohol use disorders at 6.4%. As this study was based on data from 2010, the primary report of WHO estimated the prevalence of alcohol dependence in Mongolia at 2.8%. However, the data reported by the Mongolian authorities was registry-based data not population-based data, thus the prevalence may have been underestimated.

Alternatively, when compared, the prevalence of alcohol dependence in Mongolia was found was found to be higher than in China (~3%) but significantly lower than that found in Russia (~9%) (Cheng et al., 2015; Li et al., 2011; Neufeld & Rehm, 2013; Tang et al., 2013). These different results may be due to the cultural differences in the drinking behaviours in these countries. As nomadic herders, Mongolians have a long tradition of drinking traditional alcoholic beverages, such as fermented mare's milk called "airag, and distilled alcohol drink called "arkhi". These traditional drinks have a relatively low content of alcohol, i.e., airag contains three percent alcohol, whereas arkhi contains twelve percent alcohol. However, vodka became one the most favourite and the highest grade of spirit possible drink in Mongolia until the collapse of the Soviet Union. Since 1990, diverse alcoholic beverages have been available on the market, and it has changed the drinking behaviour of Mongolians. Recent reports indicated that drinking played an important role in Mongolian culture (Armstrong et al., 2010), and alcoholism causes a public health burden (Demaio et al., 2013).

An examination of the risk factors associated with alcohol dependence showed gender, marital status, education level, and living areas were all risk factors for alcohol dependence. Gender was found to be an important risk factor for alcohol consumption not only in this study but also in other studies (Jhingan et al., 2003). Previous studies have shown that men were more likely to consume alcohol when compared with women (Giang et al., 2005; Guo et al., 2008; Li et al., 2011). As men are likely to work and be involved in social matters more than women, their exposure to alcoholic beverages is likely to be higher. Moreover, men are more likely to consume alcohol during stressful events than women (Keyes et al., 2011).

Further, unemployment or being divorced or widowed raised the likelihood of alcohol dependence (Veenstra et al., 2006). In accordance with previous studies, this study confirmed that lower education was associated with alcohol dependence. As for geographical locations, in this study all the rural regions had a higher prevalence than urban areas, indicating that the living environment (urban/rural) can be a potential risk factor. The prevalence of alcohol consumption and dependence was higher in rural areas than in urban areas. This may be related to the lower level of education and high rate of unemployment in rural areas and is similar to that found by a previous study in Belarus (Razvodovsky & Stickley, 2007).

Table 2. Prevalence of alcohol dependence by geographical regions

Characteristics	Total	Screening by AUDIT					Alcohol dependence		
		Abstinent from alcohol use	Low risk of alcohol dependence	Moderate risk of alcohol dependence	High risk of alcohol dependence	P-Value*	Yes	No	P-Value*
Cities, n (%)	6341 (100.0)	3009 (47.5)	2271 (35.8)	744 (11.7)	317 (5.0)		256 (4.0)	6085 (96.0)	
Ulaanbaatar	5150 (81.2)	2460 (47.8)	1786 (34.7)	660 (12.8)	244 (4.7)		224 (4.3)	4926 (95.7)	
Darkhan	591 (9.3)	289 (48.9)	229 (38.7)	24 (4.1)	49 (8.3)	0.300	26 (4.4)	565 (95.6)	<0.001
Erdenet	600 (9.5)	260 (43.3)	256 (42.7)	60 (10.0)	24 (4.0)		6 (1.0)	594 (99.0)	
Regions, n (%)	5405 (100.0)	2327 (43.1)	2311 (42.7)	331 (6.1)	436 (8.1)		266 (4.9)	5139 (95.1)	
Eastern	1189 (22.0)	657 (55.3)	385 (32.4)	63 (5.3)	84 (7.1)		51 (4.3)	1138 (95.7)	
Central	1197 (22.1)	568 (47.5)	438 (36.6)	74 (6.2)	117 (9.8)	<0.001	81 (6.8)	1116 (93.2)	<0.001
Mountain	1705 (31.6)	570 (33.4)	872 (51.1)	97 (5.7)	166 (9.7)		102 (6.0)	1603 (94.0)	
Western	1314 (24.3)	532 (40.5)	616 (46.9)	97 (7.4)	69 (5.3)		32 (2.4)	1282 (97.6)	
Total	**11746 (100.0)**	**5336 (45.4)**	**4582 (39.0)**	**1075 (9.1)**	**753 (6.4)**		**522 (4.4)**	**11224 (95.6)**	

** P-Values were analysed using the Kruskal-Wallis test.*

This study had several limitations. First, the prevalence of alcohol dependence may have been underestimated as only participants who scored above 20 in the AUDIT questionnaire were diagnosed. To save time and expense, not all participants were interviewed. This was in line with the guidelines of AUDIT, which recommends that only a participant with an AUDIT score of 20 or above is suited for further diagnostic evaluation for alcohol dependence. However, it cannot be ruled out that participants who scored less than 20 and non-participants may also be associated with alcohol dependence. Therefore, the prevalence of alcohol dependence could be higher than the result, 4.4%, reported here. Another limitation is related to the limited number of risk factors apart from the assessed socio-demographic characteristics. Other risk factors, such as physical factors (i.e., medical condition), should also have been investigated. As a further limitation, the participants' characteristics may differ from those of the general population. The exclusion of some rural areas might also lower the generalizability of the study. A selection bias due to replaced participants having different characteristics from those who did not participate cannot be excluded. Finally, this descriptive study does not provide a full explanation for the increase in alcohol dependence over the years since the study data were collected in 2013. Further investigation is required to determine the actual prevalence without selection bias by including participants who scored lower at the initial screening. In particular, future studies should determine including, but not be limited to, the prevalence of alcohol dependence and alcohol abuse, along with addressing alcohol consumption and drinking behaviours in the population, particularly during the period of the COVID-19 pandemic, which may trigger an increase in alcohol consumption and risky behaviours. Despite its limitations, this study determined the prevalence of alcohol dependence in the general population of Mongolia for the first time using a clinical interview by ICD-10 criteria and an internationally accepted screening tool, AUDIT.

Introducing AUDIT to primary health care, providing healthcare for patients with alcohol use disorders in clinical settings, developing a population-based mental health registry, and conducting epidemiological and clinical studies regularly on alcohol use disorders are recommended to improve the diagnosis, prognosis and treatment of alcohol dependence.

Table 3. Risk factors associated with alcohol dependence.

Characteristics	B	SE.	Wald	P-Value*	Exp(B)	95% C.I.for EXP(B)	
						Lower	Lower
Constant	-1.063	0.670	2.515	0.113	0.345		
Gender (male)	-0.572	0.292	3.851	0.049	0.564	0.319	0.999
Age group			5.591	0.348			
<19	0.954	1.430	0.445	0.505	2.596	0.157	42.802
20-29	0.942	0.600	2.466	0.116	2.565	0.792	8.311
30-39	0.457	0.578	0.626	0.429	1.579	0.509	4.902
40-49	0.424	0.572	0.549	0.459	1.528	0.498	4.686
50-59	0.403	0.565	0.509	0.475	1.497	0.494	4.532
Education Level			8.489	0.014			
Primary	-0.564	0.256	4.847	0.028	0.569	0.344	0.940
Secondary	0.006	0.228	0.001	0.978	1.006	0.644	1.573
Marital status			4.019	0.134			
Never married	-0.029	0.285	0.010	0.919	0.971	0.556	1.698
Divorced/widow	-0.769	0.384	4.015	0.045	0.463	0.218	0.983
Employment			9.282	0.026			
Unemployed	-0.715	0.235	9.228	0.002	0.489	0.309	0.776
Student	0.025	0.750	0.001	0.973	1.025	0.236	4.458
Pensioner	-0.186	0.310	0.360	0.549	0.830	0.452	1.525
Geographical locations			39.635	<0.001			
Eastern region	1.148	0.285	16.263	<0.001	3.150	1.804	5.503
Central region	0.555	0.256	4.694	0.030	1.741	1.054	2.876
Western region	1.514	0.293	26.627	<0.001	4.543	2.557	8.072
Mountain region	1.027	0.225	20.877	<0.001	2.793	1.798	4.339

*B, Unstandardised Beta; Exp(B), Odds ratio; * P-values were analysed using the binary logistic regression.*

5.0 CONCLUSIONS

The results suggest that the prevalence of alcohol dependence is 4.4% among the general population of Mongolia. Gender, marital status, geographical location, age, and education significantly influence alcohol dependence.

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References

Armstrong, S. C., & Tsogtbaatar, B. (2010). The dual nature of alcohol use and abuse in Mongolia: reflections through policy. *Asia Pac J Public Health, 22*(3 Suppl), 209S-215S. https://doi.org/10.1177/1010539510372836

Babor, T., DeLaFuentes, J., Saunders, J. & Grant, M. (1992). AUDIT: the alcohol use disorders identification test: guidelines for use in primary health care. World Health Organization.

Cheng, H. G., Deng, F., Xiong, W., & Phillips, M. R. (2015). Prevalence of alcohol use disorders in mainland China: a systematic review. *Addiction, 110*(5), 761-774. https://doi.org/10.1111/add.12876

Demaio, A. R., Dugee, O., de Courten, M., Bygbjerg, I. C., Enkhtuya, P., & Meyrowitsch, D. W. (2013). Exploring knowledge, attitudes, and practices related to alcohol in Mongolia: a national population-based survey. *BMC Public Health, 13*, 178. https://doi.org/10.1186/1471-2458-13-178

Erdenebayar, L., Byambasuren, S., Oryol, N., & Dorjjadamba, S. (1996). Prevalence of alcohol dependence. Epidemiology of Mental Illness in Mongolia in the 20th Century. 1: 58–63.

Gache, P., Michaud, P., Landry, U., Accietto, C., Arfaoui, S., Wenger, O., & Daeppen, J. B. (2005). The Alcohol Use Disorders Identification Test (AUDIT) as a screening tool for excessive drinking in primary care: reliability and validity of a French version. *Alcohol Clin Exp Res, 29*(11), 2001-2007. https://doi.org/10.1097/01.alc.0000187034.58955.64

Giang, K. B., Spak, F., Dzung, T. V., & Allebeck, P. (2005). The use of audit to assess level of alcohol problems in rural Vietnam. *Alcohol Alcohol, 40*(6), 578-583. https://doi.org/10.1093/alcalc/agh198

Guo, W., Lanzi, G., Luobu, O., Ma, X., Zhen, P., Ji, Y., . . . Li, T. (2008). An epidemiological survey of alcohol use disorders in a Tibetan population. *Psychiatry Res, 159*(1-2), 56-66. https://doi.org/10.1016/j.psychres.2007.09.012

Jhingan, H. P., Shyangwa, P., Sharma, A., Prasad, K. M., & Khandelwal, S. K. (2003). Prevalence of alcohol dependence in a town in Nepal as assessed by the CAGE questionnaire. *Addiction, 98*(3), 339-343.
https://doi.org/10.1046/j.1360-0443.2003.00301.x

Keyes, K. M., Hatzenbuehler, M. L., & Hasin, D. S. (2011). Stressful life experiences, alcohol consumption, and alcohol use disorders: the epidemiologic evidence for four main types of stressors. *Psychopharmacology (Berl), 218*(1), 1-17. https://doi.org/10.1007/s00213-011-2236-1

Li, Y., Jiang, Y., Zhang, M., Yin, P., Wu, F., & Zhao, W. (2011). Drinking behaviour among men and women in China: the 2007 China Chronic Disease and Risk Factor Surveillance. *Addiction, 106*(11), 1946-1956.
https://doi.org/10.1111/j.1360-0443.2011.03514.x

Monzavi, S.M., Afshari, R., & Rehman, N. (2015). Alcohol related disorders in Asia pacific region: prevalence, health consequences and impacts on the nations. Asia Pacific Journal of Medical Toxicology. 4: 1–9.

Nemtsov, A. (2003). Russia: alcohol yesterday and today. Addiction. 100: 146–149.

Neufeld, M., & Rehm, J. (2013). Alcohol consumption and mortality in Russia since 2000: are there any changes following the alcohol policy changes starting in 2006? *Alcohol Alcohol, 48*(2), 222-230. https://doi.org/10.1093/alcalc/ags134

Pengpid, S. & Pelzter. K. (2022). Trends in concurrent tobacco use and heavy drinking among individuals 15 years and older in Mongolia. *Sci Rep,* 12(1):16639. https://doi.org/10.1038/s41598-022-21094-7

Pomerleau, J., McKee, M., Rose, R., Haerpfer, C. W., Rotman, D., & Tumanov, S. (2008). Hazardous alcohol drinking in the former Soviet Union: a cross-sectional study of eight countries. *Alcohol Alcohol, 43*(3), 351-359. https://doi.org/10.1093/alcalc/agm167

Razvodovsky, Y. & Stickley, A. (2007). The level and structure of alcoholrelated mortality in Grodno, Belarus. Alcoholism. 43: 91–103.

Stickley, A., Leinsalu, M., Andreev, E., Razvodovsky, Y., Vagero, D., & McKee, M. (2007). Alcohol poisoning in Russia and the countries in the European part of the former Soviet Union, 1970 2002. *Eur J Public Health, 17*(5), 444-449. https://doi.org/10.1093/eurpub/ckl275

Tang, Y. L., Xiang, X. J., Wang, X. Y., Cubells, J. F., Babor, T. F., & Hao, W. (2013). Alcohol and alcohol-related harm in China: policy changes needed. *Bull World Health Organ, 91*(4), 270-276. https://doi.org/10.2471/BLT.12.107318

Tsetsegdari.G, Elena.K, Erdenebayar.L, Khishigsuren.Z, Demidmaa.N, Ayushjav.B, & al., e. (2006). Epidemiological study on the prevalence of alcohol consumption, alcohol drinking patterns and alcohol related harms in Mongolia. 1:18–20.

Veenstra, M. Y., Lemmens, P. H., Friesema, I. H., Garretsen, H. F., Knottnerus, J. A., & Zwietering, P. J. (2006). A literature overview of the relationship between life-events and alcohol use in the general population. *Alcohol Alcohol, 41*(4), 455-463. https://doi.org/10.1093/alcalc/agl023

WHO. (1993). World Health Organization. The ICD-10 classification of mental and behavioural disorders: diagnostic criteria for research. World Health Organization. .

WHO. (2004). Global status report: alcohol policy. World Health Organization Department of Mental Health and Substance Abuse.

WHO. (2005). WHO STEPS surveillance manual: The WHO STEPwise approach to chronic disease risk factor surveillance. World Health Organization.

WHO. (2018). World Health Organization. Global status report on alcohol and health. World Health Organization.

WHO. (2014). Global status report on alcohol and health—2014. World Health Organization.

WorldBank. (2013). World Development Indicators. The World Bank Group. Available at: https://data.worldbank.org/country/MN (Accessed 14 March 2021).