

Title page

Title. Prevalence of hazardous drinking and suspected alcohol dependence in Japanese primary care settings

Author names and affiliations.

Name	Affiliation
Ryuhei So	Okayama Psychiatric Medical Center, Okayama, Japan; CureApp, Inc., Tokyo, Japan; Departments of Health Promotion and Human Behavior, Kyoto University Graduate School of Medicine / School of Public Health; Oku Medical Clinic, Osaka, Japan; Scientific Research WorkS Peer Support Group (SRWS-PSG), Osaka, Japan
Kazuya Kariyama	Department of Gastroenterology, Okayama City Hospital, Okayama, Japan
Shunsuke Oyamada	Department of Biostatistics, JORTC Data Center, Tokyo, Japan
Sachio Matsushita	National Hospital Organization Kurihama Medical and Addiction Center, Yokosuka, Kanagawa, Japan
Hiroki Nishimura	CureApp, Inc., Tokyo, Japan; Okayama Psychiatric Medical Center, Okayama, Japan
Yukio Tezuka	Department of Psychiatry, Okinawa Rehabilitation Center Hospital, Okinawa, Japan
Takashi Sunami	Saga Prefecture Medical Center Koseikan, Saga, Japan
Toshi A. Furukawa	Department of Health Promotion of Human Behavior, Kyoto University Graduate School of Medicine / School of Public Health, Kyoto, Japan
Mitsuhiko Kawaguchi	Kawaguchi Medical Clinic, Okayama, Japan
Haruhiko Kobashi	Department of Hepatology, Japanese Red Cross Okayama Hospital, Okayama, Japan
Sohji Nishina	Department of Gastroenterology and Hepatology, Kawasaki Medical School, Okayama, Japan
Yuki Otsuka	Department of General Medicine, Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Okayama, Japan.

Name	Affiliation
Yasushi Tsujimoto	Oku Medical Clinic, Osaka, Japan; Departments of Health Promotion and Human Behavior, Kyoto University Graduate School of Medicine / School of Public Health; Oku Medical Clinic, Osaka, Japan; Scientific Research WorkS Peer Support Group (SRWS-PSG), Osaka, Japan
Yoshinori Horie	Keiai Clinic, Tokyo, Japan
Hitoshi Yoshiji	Department of Gastroenterology, Nara Medical University, Nara, Japan
Takefumi Yuzuriha	National Hospital Organization Hizen Psychiatric Medical Center, Saga, Japan; Chikugo Yoshii Cocoro Hospital, Fukuoka, Japan
Kazuhiro Nouse	Department of Gastroenterology, Okayama City Hospital, Okayama, Japan

Corresponding author.

Ryuhei So, MD, MPH, PhD

Okayama Psychiatric Medical Center

3-16 Shikata-honmachi, Kita-ku, Okayama, Okayama, Japan

E-mail: nexttext@gmail.com

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Prevalence of hazardous drinking and suspected alcohol dependence in Japanese primary care settings

Alcohol-related-problems in Japanese primary care settings

Abstract

Objective

We aimed to assess the prevalence of hazardous drinking and potential alcohol dependence among Japanese primary care patients, and their readiness to change and awareness of others' concerns.

Methods

From July to August 2023, we conducted a multi-site cross-sectional study as a screening survey for participants in a cluster randomized controlled trial. The trial included outpatients aged 20–74 from primary care clinics. Using the Alcohol Use Disorders Identification Test (AUDIT) alongside a self-administered questionnaire, we evaluated the prevalence of hazardous drinking and suspected alcohol dependence, patients' readiness to change, and their awareness of others' concerns.

Results

Among the 1,388 participants from 18 clinics, 22% (95% confidence interval (CI): 20% to 24%) were identified as engaging in hazardous drinking or suspected of being alcohol dependent. As the AUDIT scores increased, so did their readiness to change. However, only 22% (95%CI: 16% to 28%) of those with scores ranging from 8 to 14 reported that others, including physicians, had expressed concerns about their drinking during the past year. For those with scores of 15 or higher, the figure was 74%.

Conclusions

This study underscores the need for universal or high-risk alcohol screening and brief intervention in Japanese primary care settings.

Keywords

Primary care, Alcohol Use Disorders Identification Test, Hazardous drinking, Alcohol dependence, Japan, Public health, Prevalence.

1. Introduction

Alcohol-related harm is a significant public health concern. Alcohol contributes to three million deaths each year and accounts for more than 5% of the global disease burden [1]. One strategy to manage this issue is Screening and Brief Intervention (SBI), a preventive approach that identifies and addresses harmful drinking before people suffer severe health consequences [2]. SBI involves a short conversation about drinking behaviors, providing feedback, and offering strategies to reduce alcohol consumption if necessary.

Primary care settings are ideally suited to the implementation of SBI due to their accessibility and continuity of care. Studies suggest that between 4 and 29% of patients in primary care settings are potential candidates for SBI due to their hazardous drinking habits [3]. However, less than 10% received it in these settings [4]. These prevalence estimates of hazardous drinking are primarily from Western countries mostly in 2000s [5–12], and evidence from other regions is scarce. Drinking behaviors, along with the primary care system, vary across countries and regions [13,14]. Therefore, findings from Western countries are particularly important and informative, while they may not be directly applicable to other regions.

Japan observed a higher proportion of its population engaging in at-risk drinking compared to the East Asian average [14]. This context underscores the urgency of addressing alcohol-related harm, a priority that is reflected in the Basic Plan for Promotion of Measures against Alcohol-related Harm, formulated by the government in 2021. This plan advocates for the promotion of SBI in primary care settings [15]. However, current evidence on alcohol-related problems in primary care settings is scarce. A study from the late 1990s estimated that the prevalence of problem drinking among outpatients in Japanese primary care clinics was 13% (95%CI: 11 to 15) [16]. By contrast, according to one 2001 study, 95% of primary care physicians underestimated this prevalence as less than 5% [17]. Furthermore, another study conducted in 2008 found that Japanese physicians failed to identify any patients who were diagnosed with alcohol dependence through structured diagnostic interviews by researchers [18]. It is likely that physicians' low awareness of patients' alcohol-related problems has not changed dramatically in recent years.

To broadly implement SBI in Japan, it is crucial to provide clinicians and policymakers with up-to-date evidence of alcohol-related problems. A systematic review reported that physicians' low

awareness of alcohol-related problems among their patients and their concern that discussions about alcohol issues might harm the patient–physician relationship were significant barriers to the implementation of SBI [19,20]. Another review suggested that one of the key organizational facilitators to implement SBI is financial support [4]. To urge the government to allocate financial resources, fundamental evidence, including current prevalence of alcohol-related problems in primary care settings, is needed. Therefore, we sought to update the current understanding of the extent and nature of the problems by estimating the prevalence of hazardous drinking and potential alcohol dependence while elucidating patients’ readiness to change their drinking habits and awareness of others’ concerns using data from a screening survey for a cluster randomized controlled trial (RCT).

2. Methods

2.1. Study design

This study is a cross-sectional analysis using the data from the screening survey of the cluster RCT, named “EASY study,” conducted in Japan. The EASY study was intended to evaluate the effectiveness of an ultra-brief intervention (Ultra-BI) for hazardous drinking, which involves providing a leaflet with encouraging advice from physicians that can be implemented in one minute. We reported the methods and the results in accordance with the STROBE statement [21].

2.2. Settings and procedures

The EASY study was conducted in primary care clinics in Japan, which had not provided brief interventions, specialized treatment for alcohol dependence, or opportunities for self-help groups focused on alcohol dependence and had not routinely conducted screening with the Alcohol Use Disorders Identification Test (AUDIT) [22]. As research sites, we recruited clinics where the authors had personal connections and those engaged in medical collaboration with the authors. We conducted the screening survey for the EASY study between July 29th and August 7th, 2023. In the research sites randomly allocated to intervention group, participants answered the questionnaire for the below-mentioned variables and AUDIT. If their total score on the first three questions of AUDIT, that is AUDIT-C, were equal to or higher than 4 for women or 5 for men, they received the ultra-BI. In the control group sites, participants only answered the

questionnaire and AUDIT-C. For this cross-sectional study, we only used the screening survey data from the intervention group participants that included full AUDIT scores.

2.3. Participants

The participants in the screening survey were outpatients aged 20–74 who visited the research sites during the study period, were able to understand the informed consent document, and voluntarily provided written consent. We excluded patients who were pregnant, had COVID-19-like symptoms, or were deemed unsuitable by the principal investigator at each research site. We excluded patients with COVID-19-like symptoms to minimize infection risk from extended staff–patient contact during research procedures. For generalizability, we asked the research sites to invite all potentially eligible patients to the screening phase as frequently as possible, and participants screened at clinics that only invited outpatients suspected of having drinking problems were excluded from this study.

2.4. Variables

To assess the representativeness of outpatients in the EASY study, we asked the primary investigators at each research site to provide the approximate proportions of outpatients: one proportion representing those who were invited to participate and another proportion representing those who agreed to participate after the recruitment of participants was completed. At the same time, we confirmed with each site whether they only invited patients suspected of having drinking problems. We did not require research sites to track the exact numbers of patients seen, invited, or who agreed to participate in the screening phase of the EASY study so as not to interfere with the clinical operations of research sites that did not have dedicated research coordinators.

From the participants, we collected data on age, sex, medical histories, and visit types such as first visit, visit as needed, or routine appointments. Additionally, we evaluated their readiness to change their dietary, smoking, and drinking habits. To assess the readiness to change, we used questionnaires and response options from the Japanese National Health and Nutrition Survey [23]. Only participants enrolled at intervention group sites were assessed for their readiness to change drinking habits.

The readiness to change drinking habits was obtained using a self-administered questionnaire. The question and response options were developed by the authors based on the Japanese National Health and Nutrition Survey, and their psychometric validity has not been verified. The question used to assess readiness to change drinking habits was, "Are you considering improving your drinking habits?". The response options were: "Already working on improvement", "Intending to improve", "Interested but no intention to improve", "No intention to improve", and "No improvement needed". We categorized those who answered "Already working on improvement", "Intending to improve", and "Interested but no intention to improve" as having acknowledged the need to improve their drinking habits, regardless of their interest and intention to change.

We used the AUDIT and its shortened version, AUDIT-C, as instruments to evaluate the alcohol-related issues among participants [22,24]. Both AUDIT and AUDIT-C are globally recognized and broadly used to detect individuals exhibiting hazardous drinking or potential alcohol dependence [25]. The AUDIT is a comprehensive 10-item questionnaire encompassing the domains of alcohol consumption, drinking behavior, and alcohol-related problems. Each item is scored from 0 to 4. The total score, therefore, ranges between 0 and 40. A higher AUDIT score indicates more hazardous or harmful alcohol use. A score between 8 and 14 is generally indicative of hazardous drinking, while a score of 15 or higher is likely suggestive of alcohol dependence. AUDIT-C comprises the initial three questions that focus on alcohol consumption [24]. AUDIT-C scores range between 0 and 12. Within the Japanese population, a score of 4 or higher in women and 5 or higher in men on AUDIT-C corresponds to a score of 8 or higher on the full AUDIT, which is indicative of hazardous drinking or potential alcohol dependence [26].

To investigate participants' awareness of whether others are concerned about their drinking, we used question 10 of the AUDIT: "Has a relative or friend, doctor or other health worker been concerned about your drinking or suggested you cut down?" We coded those who answered "Yes, during the past year" as "Others expressed concerns."

2.5. Financial incentives

Each clinic that recruited at least one participant received 50,000 JPY to compensate for staff time spent on following study procedures. We provided patients who participated in the study

with a gift card equivalent to 500 JPY after they had completed the screening survey questionnaire.

2.6. Sample size

We predetermined the sample size for the cluster RCT phase to be 1,125 participants, not for the screening survey. This sample size was set based on an assumed effect size of 0.25 for Ultra-BI, with an α level at 0.05, power at 0.80, and 40 clusters. Assuming a proportion of 10%, if we have 1000 participants, the 95% confidence intervals (CI) would be estimated to be between 8 and 12%, which we deem to be clinically narrow enough.

2.7. Statistical methods

We performed statistical analyses using R version 4.2.2 (2022-10-31) [28]. We aggregated the number of clinics that were invited and those that consented to participate in the EASY study. Additionally, we calculated the proportion of outpatients who participated among all potential participants. To calculate the proportion, we multiplied two proportions at each research site: the proportion of outpatients invited and the proportion of those who agreed to participate in the screening survey.

At the participant level, we presented the baseline demographics and characteristics, stratified by screening results. To simulate p-values for count data, we used Fisher's exact test based on 2,000 replicates. We estimated the prevalences with 95% CI of participants with AUDIT-C scores of ≥ 4 for women and ≥ 5 for men, as well as AUDIT scores of 8–14 and ≥ 15 [22,29]. To explore the influence of the proportions of people who were invited, agreed, and participated in the present study on the prevalences, we calculated Pearson's rank correlation coefficients between the proportions and the prevalences.

We conducted logistic regression analyses to identify predictors of the AUDIT score of ≥ 8 and ≥ 15 . The explanatory variables included age, sex, visit history, smoking habits, and the five most common medical histories among all the included participants, which would be routinely collected in primary care clinics. In the univariable regression analyses, each explanatory variable was individually included in the model. In the multivariable regression analyses, all explanatory variables were included in the model.

2.8. Ethical considerations

To avoid information bias, we provided only a general explanation of the study and indicated that the study was for investigating health-related lifestyles. The institutional review board of Kurihama Medical and Addiction Center approved the study protocol of the EASY study on May 22, 2023 (registration number: 423). We conducted the whole study process in accordance with the Declaration of Helsinki. All participants provided written consent to participate in the study.

2.9. Trial registration

We had prospectively registered the information on the design of the EASY study with the UMIN-CTR (<https://www.umin.ac.jp/ctr/>) on June 23rd, 2023, with the UMIN identifier UMIN000051388.

3. Results

We approached 53 primary care clinics spread across the prefectures of Okayama, Hyogo, Osaka, and Hiroshima, and 43 clinics consented to participate in our study as research sites. No clinics we approached provided BI, specialized treatment for alcohol dependence, or opportunities for self-help groups focused on alcohol dependence. Additionally, these clinics had not routinely conducted screening with the AUDIT. Of these, 22 clinics were allocated to the intervention group. One clinic did not invite any outpatients, and three clinics only invited patients who were suspected of alcohol-related problems before screening. Thus, we analyzed data from 18 clinics. Figure 1 shows the recruitment and allocation process for clinics and patients.

Regarding the study participants, a total of 1,388 patients participated in the baseline survey. Table 1 show the baseline characteristics of participants stratified by the category of the AUDIT score. Overall, the participants in their 60s and 70s consisted of half of the total and the sex ratio of the participants was approximately balanced. Reflecting the nature of primary care settings, 73% were patients with routine appointments. Around 50% of participants had hypertension, followed by diabetes mellitus, hyperuricemia, and dyslipidemia (sTable 1).

Table 2 shows the screening results by full AUDIT and AUDIT-C. The number of participants identified as engaging in hazardous drinking or suspected of alcohol dependence based on the

AUDIT-C score was 436 (31%, 95% CI 29% to 34%). Among 1,388 participants, 203 participants (15%, 95% CI 13% to 17%) scored between 8 and 14, indicative of hazardous drinking, and 103 (7%, 95% CI 6% to 9%) scored 15 or above, suggestive of alcohol dependence. Though 6 out of 18 research sites screened less than 70% of potential participants (sTable 2), which might lead to sampling bias, we did not find substantial correlations between the proportions invited, agreeing to, and participating, on the one hand, and the prevalences of patients scoring ≥ 8 or ≥ 15 on the AUDIT, on the other. The correlation coefficients ranged from -0.14 to 0.24 (sTable 3 and sFigure 1).

Among those identified as engaging in hazardous drinking by AUDIT, 22% (95% CI 16% to 28%) reported that relatives, friends, doctors, or other health workers had expressed concerns about their drinking in the previous 12 months. For those suspected of alcohol dependence by AUDIT, the figure was 74% (95% CI 64% to 82%). In the AUDIT 8–14 group, the proportion of expressed concerns by others showed a gender difference, with 25% for men and 11% for women. Figure 2 illustrates the distribution of AUDIT scores and the variation in readiness to change drinking habits across different full AUDIT scores using a stacked bar chart. As the full AUDIT score reached a threshold of 8 points for hazardous drinking, there was an incremental increase in the proportion of participants willing or taking action to change their drinking habits. As shown in Table 4, 82% of participants with full AUDIT scores ranging from 8 to 14, and 90% of those with a score of 15 or higher, acknowledged the need to improve their drinking habits.

Table 3 shows the results of the logistic regression analyses to identify predictors of the AUDIT score of ≥ 8 and ≥ 15 . The analyses revealed that males, ex- or current smokers, having hypertension, hyperuricemia, and liver diseases predicted AUDIT scores of ≥ 8 and ≥ 15 . Patients with routine appointments and those who visited as needed had a higher risk of scoring AUDIT ≥ 8 compared to first-visit patients, but this was not the case for the risk of scoring AUDIT ≥ 15 .

4. Discussion

We analyzed data from 1,388 participants in Japanese primary care clinics. Our analysis revealed that 31% of participants met the criteria for hazardous drinking based on AUDIT-C scores. Among the 1,388 participants, 22% scored 8 or above, indicating at least hazardous drinking and

7% scored 15 or above, suggesting suspected alcohol dependence. Male gender; being a current or former smoker; and having hypertension, hyperuricemia, or liver diseases were among the factors associated with these problematic AUDIT categories. As for those identified as engaging in hazardous drinking, only 22% reported that others had expressed concerns about their drinking behaviors, although 82% acknowledged the need to improve their habits.

The prevalence of AUDIT ≥ 8 in Japanese primary care settings (22%) closely aligns with rates observed in the UK (25%) [27], France, and Switzerland (16%) [11]. This consistency reflects the similarity in at-risk drinking proportions between Japan and these Western countries [14]. Given that Japan exhibits the highest proportion of at-risk drinking among the general population in East Asia [14], the prevalence of AUDIT ≥ 8 in primary care settings is likely lower than 22%, although medical systems vary across countries.

Our study's findings indicate that primary care settings in Japan are suitable for screening and intervention for people with alcohol-related problems. The prevalences were about twice as high as in the general population. A Japanese nationwide online survey reported that the prevalences of people scoring 8 or above and 16 or above on the AUDIT were 14% and 4% [30]. Another nationwide survey reported a prevalence of 3% for scores of 15 or higher [31]. The difference between our prevalences in primary care settings and those in general populations reflects the dose-response relationships between alcohol consumption and the risk of health problems [32]. The more alcohol people consume, the more likely they are to consult physicians. These health consequences due to alcohol also explain the higher prevalences among middle-aged and older individuals in our study, contrary to the general population, where younger people are more likely to engage in risky drinking [14]. Generally, younger people's alcohol consumption tends to decrease naturally over time, while middle-aged and older people with hazardous drinking do not [33]. This point further emphasizes the importance of primary care as a setting for providing SBI.

High-risk screening in primary care settings can also be an efficient alternative strategy if universal screening is unavailable due to a lack of resources. In our population, similar to prior studies, having hypertension, hyperuricemia, or liver diseases, and being a current or former smoker were associated with hazardous drinking and suspected alcohol dependence [35]. In the case of hypertension, which was present in about half of our sample, RCTs conducted in multiple

countries, including Japan, have indicated a causal relationship whereby reducing alcohol consumption by half leads to a decrease in systolic blood pressure by 5.50 mmHg and diastolic blood pressure by 3.97 mmHg [36]. Specifically, a nurse-led brief intervention for patients with hypertension and heavy drinking habits was found to be effective in reducing both blood pressure and alcohol consumption compared to usual care [37]. Interventions targeting drinking problems using lifestyle-sensitive indicators, such as blood pressure, are likely to be more acceptable to patients and more feasible for physicians to implement. Patients who smoke could also be candidates for high-risk screening. In our study, 42% of current smokers scored 8 or higher on the AUDIT. Concurrent smoking and drinking synergistically increase the risk of head, neck, oral, and esophageal cancers [38–41]. Therefore, this population could greatly benefit from screening and effective interventions aimed at reducing alcohol consumption, particularly in terms of cancer prevention.

Contrary to physicians' concerns [20], most of the outpatients with higher AUDIT scores recognized the need to change their drinking habits. As the AUDIT score increases, there is a corresponding increase in the patient's readiness to change. This aligns with research in American primary care settings, where over 90% of those with an AUDIT score of 8 or higher believed they drank more than they should [42]. However, only 22% with AUDIT scores between 8 and 14 in this study reported that others, including physicians, had expressed concerns about their drinking during the previous year. Physicians might have simply overlooked the hazardous drinking among outpatients due to lack of systematic screening [18,43]. Alternatively, even if they were aware, they might not have mentioned drinking habits because of a lack of time in a busy outpatient setting [44], anticipation of resistance from patients [45], and low perceived self-efficacy in addressing alcohol problems caused by insufficient knowledge and training [44,46]. If proven effective, systematic screening and one-minute Ultra-BI, which only includes providing a leaflet with short comments, could serve as a solution to these assumed challenges.

Furthermore, among those with AUDIT scores between 8 and 14, only 11% of women reported others expressing concerns, compared to 33% of men. This finding is consistent with previous studies in the United States [47] and Germany [48], which found that women with hazardous drinking were less likely to receive advice about their drinking than men with hazardous drinking. Given that women are more susceptible to the detrimental health and behavioral effects

of alcohol consumption [49], it is crucial to raise awareness among physicians in primary care settings about the need to actively screen for hazardous drinking in female patients and engage in discussions based on the screening results.

The first limitation of our study relates to the validity of the prevalence of the screening results with the AUDIT. Although we excluded data from clinics that selectively invited patients suspected of having alcohol-related problems, the proportion of outpatients invited, agreeing to, and participating in the study varied across clinics. However, based on the small correlations between these proportions and the prevalences, the variation of these proportions would not largely affect the validity of the estimates.

The second limitation concerns the generalizability of the estimated prevalences of alcohol-related problems. We used convenient sampling for our research sites, primarily requesting participation from clinics where some authors specialized in hepatology had connections. Additionally, we also approached clinics that have referred patients to a specialized clinic for addictive disorders, with which one of the authors was affiliated. This sampling method may have led to an overestimation or underestimation of the prevalences. However, as shown in sFigure 1, the proportion of participants who scored AUDIT ≥ 8 or 15 varied across research sites, suggesting that a diverse range of sites were included in the study. Though patterns of alcohol use vary significantly across regions within a country, we estimated the prevalences based on data from 18 clinics in four prefectures with varying average alcohol consumption among residents, with a slightly lower average in Okayama (13 clinics), a similar level in Hyogo (three clinics), and a slightly higher average in Osaka (one clinic) compared to the national average from the Japanese National Health and Nutrition Survey [48]. Further, the geographical concentration in research sites, with 70% of them located in Okayama, is likely to have at most a few percent impact on the estimates of the prevalences because Okayama shares similarities with mid-sized cities and their neighboring regions in Japan.

In conclusion, one-quarter to one-fifth of outpatients in Japanese primary care clinics were classified as engaging in hazardous drinking or suspected of alcohol dependence. These findings indicate the need to screen all outpatients and intervene in the case of those who exceed a certain threshold, in line with the government's 2021 initiative. If screening all patients is challenging due to time constraints or other factors, a practical alternative strategy could be to focus on high-

risk screening for specific groups with predictive factors, such as smokers or those with hypertension.

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During the preparation of this manuscript, we used chatGPT and Grammarly for proofreading and sentence revision. After using these tools, we thoroughly reviewed and edited the content where necessary. We assume full responsibility for the content of the publication.

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Table 1. Baseline characteristics of patients

Characteristic	Overall, N = 1,388	AUDIT 0–7, N = 1,082	AUDIT 8– 14, N = 203	AUDIT ≥ 15, N = 103	p-value ¹
Age group, n (%)					0.083
20–29	78 (5.6%)	67 (6.2%)	7 (3.4%)	4 (3.9%)	
30–39	96 (6.9%)	73 (6.8%)	15 (7.4%)	8 (7.8%)	
40–49	195 (14%)	143 (13%)	32 (16%)	20 (19%)	
50–59	282 (20%)	216 (20%)	37 (18%)	29 (28%)	
60–69	410 (30%)	316 (29%)	64 (32%)	30 (29%)	
70–74	324 (23%)	264 (24%)	48 (24%)	12 (12%)	
Sex, n (%)					<0.001

Characteristic	Overall, N = 1,388	AUDIT 0–7, N = 1,082	AUDIT 8– 14, N = 203	AUDIT ≥ 15, N = 103	p-value¹
Men	697 (50%)	465 (43%)	150 (74%)	82 (80%)	0.067
Women	691 (50%)	617 (57%)	53 (26%)	21 (20%)	
Visit type, n (%)					
First visit	85 (6.2%)	75 (7.0%)	4 (2.0%)	6 (5.9%)	
Routine appointments	1,009 (73%)	773 (72%)	157 (78%)	79 (77%)	
Visit as needed	280 (20%)	223 (21%)	40 (20%)	17 (17%)	<0.001
Smoking status, n (%)					
Never smoked	655 (47%)	604 (56%)	44 (22%)	7 (6.8%)	
Smoked but quit	461 (33%)	320 (30%)	88 (43%)	53 (51%)	
Smoking	271 (20%)	157 (15%)	71 (35%)	43 (42%)	
Readiness to change diet, n (%)					0.031
Already working on improvement	386 (28%)	312 (29%)	48 (24%)	26 (25%)	
Intending to improve	627 (45%)	481 (45%)	92 (45%)	54 (52%)	
No Improvement Needed	200 (14%)	163 (15%)	31 (15%)	6 (5.8%)	
No intention to improve	168 (12%)	119 (11%)	32 (16%)	17 (17%)	
Readiness to change smoking habits, n (%)					<0.001
Intending to improve	188 (14%)	107 (9.9%)	48 (24%)	33 (32%)	
Never smoked	655 (47%)	604 (56%)	44 (22%)	7 (6.8%)	
No intention to improve	83 (6.0%)	50 (4.6%)	23 (11%)	10 (9.7%)	
Smoked but quit	461 (33%)	320 (30%)	88 (43%)	53 (51%)	
Readiness to change drinking habits, n (%)					<0.001
No Improvement Needed	903 (66%)	857 (80%)	36 (18%)	10 (9.7%)	
No intention to improve	63 (4.6%)	37 (3.5%)	19 (9.4%)	7 (6.8%)	
Interested but no intention to improve	91 (6.6%)	34 (3.2%)	36 (18%)	21 (20%)	
Intending to improve	170 (12%)	58 (5.4%)	67 (33%)	45 (44%)	
Already working on improvement	146 (11%)	82 (7.7%)	44 (22%)	20 (19%)	

¹Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

AUDIT: Alcohol Use Disorders Identification Test

Table 2. Screening results by full AUDIT and AUDIT-C

Characteristic	Overall, N = 1,388	95% CI	Men, N = 697	95% CI	Women, N = 691	95% CI
AUDIT-C, Mean (SD)	3.0 (3.4)		4.0 (3.6)	3.7, 4.2	2.0 (2.8)	1.8, 2.2
AUDIT-C $\geq$ 5 among men or $\geq$ 4 among women, n (%)	436 (31%)	29%, 34%	281 (40%)	37%, 44%	155 (22%)	19%, 26%
Others expressed concerns, n (%)	107 (25%)	21%, 29%	89 (32%)	26%, 38%	18 (12%)	7%, 18%
AUDIT, Mean (SD)	4.2 (5.7)		5.8 (6.2)	5.4, 6.3	2.6 (4.5)	2.3, 2.9
AUDIT 8–14, n (%)	203 (15%)	13%, 17%	150 (22%)	19%, 25%	53 (7.7%)	6%, 10%
Others expressed concerns, n (%)	44 (22%)	16%, 28%	38 (25%)	19%, 33%	6 (11%)	5%, 24%
AUDIT $\geq$ 8, n (%)	306 (22%)	20%, 24%	232 (33%)	30%, 37%	74 (11%)	8.6%, 13%
Others expressed concerns, n (%)	120 (39%)	34%, 45%	100 (43%)	37%, 50%	20 (27%)	18%, 39%
AUDIT $\geq$ 15, n (%)	103 (7%)	6%, 9%	82 (12%)	10%, 14%	21 (3.0%)	2%, 5%
Others expressed concerns, n (%)	76 (74%)	64%, 82%	62 (76%)	65%, 84%	14 (67%)	43%, 85%

AUDIT: Alcohol Use Disorders Identification Test, CI: Confidence Interval, SD: Standard Deviation

Table 3. Univariate and Multivariate Regression Analysis Predictors of AUDIT categories

Characteristic	AUDIT ≥ 8		AUDIT ≥ 15	
	Crude	Adjusted ¹	Crude	Adjusted ¹
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age group				
70–74	Reference	Reference	Reference	Reference
20–29	0.72 (0.34 to 1.40)	2.24 (0.96 to 4.98)	1.41 (0.38 to 4.17)	5.37 (1.26 to 19.7)
30–39	1.39 (0.79 to 2.37)	2.93 (1.50 to 5.68)	2.36 (0.90 to 5.90)	5.05 (1.65 to 15.0)
40–49	1.60 (1.05 to 2.44)	2.01 (1.22 to 3.31)	2.97 (1.44 to 6.40)	3.76 (1.67 to 8.78)
50–59	1.34 (0.91 to 2.00)	1.59 (1.02 to 2.49)	2.98 (1.53 to 6.18)	3.79 (1.83 to 8.32)
60–69	1.31 (0.91 to 1.89)	1.36 (0.91 to 2.04)	2.05 (1.06 to 4.23)	1.94 (0.95 to 4.18)
Sex				
Men	Reference	Reference	Reference	Reference
Women	0.24 (0.18 to 0.32)	0.50 (0.35 to 0.71)	0.24 (0.14 to 0.38)	0.61 (0.34 to 1.07)
Visit type				
First visit	Reference	Reference	Reference	Reference
Visit as needed	1.92 (0.97 to 4.16)	2.93 (1.40 to 6.69)	0.85 (0.34 to 2.42)	1.24 (0.46 to 3.77)
Routine appointments	2.29 (1.22 to 4.78)	2.20 (1.08 to 4.88)	1.12 (0.51 to 2.95)	1.03 (0.41 to 2.99)
Smoking status				
Never smoked	Reference	Reference	Reference	Reference
Smoked but quit	5.22 (3.71 to 7.44)	3.75 (2.55 to 5.58)	12.0 (5.79 to 29.2)	9.91 (4.50 to 25.1)
Smoking	8.60 (5.95 to 12.6)	5.85 (3.89 to 8.88)	17.5 (8.25 to 43.0)	11.5 (5.16 to 29.2)
Hypertension	1.98 (1.53 to 2.57)	2.09 (1.50 to 2.93)	1.84 (1.22 to 2.79)	2.09 (1.24 to 3.59)
Diabetes	1.12 (0.78 to 1.57)	0.86 (0.58 to 1.28)	1.14 (0.64 to 1.91)	0.96 (0.51 to 1.72)
Hyperuricemia	3.78 (2.58 to 5.55)	2.22 (1.44 to 3.44)	3.72 (2.22 to 6.07)	2.16 (1.20 to 3.80)
Dyslipidemia	0.76 (0.54 to 1.06)	0.73 (0.49 to 1.06)	0.65 (0.36 to 1.11)	0.50 (0.26 to 0.93)
Liver diseases	2.63 (1.74 to 3.93)	1.75 (1.09 to 2.79)	5.21 (3.14 to 8.45)	3.97 (2.22 to 7.03)
Digestive diseases	1.14 (0.81 to 1.59)	1.12 (0.75 to 1.65)	1.13 (0.65 to 1.87)	1.03 (0.55 to 1.85)

¹Adjusted variables included age, sex, visit history, smoking habits, and the five most common medical histories among all the included participants.

AUDIT: Alcohol Use Disorders Identification Test, CI: Confidence Interval

Table 4. Readiness to change drinking habits stratified by AUDIT categories

Readiness to change drinking habits	AUDIT 8–14		AUDIT ≥ 15	
	N = 202	95% CI	N = 103	95% CI
No Improvement Needed	36 (18%)	13%, 24%	10 (9.7%)	5.0%, 18%
No intention to improve	19 (9.4%)	5.9%, 15%	7 (6.8%)	3.0%, 14%
Interested but no intention to improve	36 (18%)	13%, 24%	21 (20%)	13%, 30%
Intending to improve	67 (33%)	27%, 40%	45 (44%)	34%, 54%
Already working on improvement	44 (22%)	16%, 28%	20 (19%)	13%, 29%

AUDIT: Alcohol Use Disorders Identification Test, CI: Confidence Interval

sTable1. Medical histories of participants

Characteristic	Overall, N = 1,388	AUDIT 0–7, N = 1,082	AUDIT 8– 14, N = 203	AUDIT ≥ 15, N = 103	p-value ¹
Hypertension, n (%)	656 (47%)	471 (44)	122 (60%)	63 (61%)	<0.001
Diabetes, n (%)	207 (15%)	158 (15%)	32 (16%)	17 (17%)	0.82
Hyperuricemia, n (%)	121 (8.7%)	63 (5.8%)	34 (17%)	24 (23%)	<0.001
Dyslipidemia, n (%)	281 (20%)	229 (21%)	37 (18%)	15 (15%)	0.21
Cerebral infarction, n (%)	31 (2.2%)	26 (2.4%)	4 (2.0%)	1 (1.0%)	0.84
Cerebral hemorrhage, n (%)	8 (0.6%)	8 (0.7%)	0 (0%)	0 (0%)	0.67
Myocardial infarction, n (%)	23 (1.7%)	18 (1.7%)	4 (2.0%)	1 (1.0%)	0.86
Angina, n (%)	32 (2.3%)	24 (2.2%)	5 (2.5%)	3 (2.9%)	0.78
Liver diseases, n (%)	109 (7.9%)	65 (6.0%)	17 (8.4%)	27 (26%)	<0.001
Pancreatic diseases, n (%)	18 (1.3%)	13 (1.2%)	4 (2.0%)	1 (1.0%)	0.49
Digestive diseases, n (%)	221 (16%)	168 (16%)	35 (17%)	18 (17%)	0.75
Cancer, n (%)	81 (5.8%)	63 (5.8%)	13 (6.4%)	5 (4.9%)	0.86
Others, n (%)	266 (19%)	219 (20%)	34 (17%)	13 (13%)	0.11

¹Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

AUDIT: Alcohol Use Disorders Identification Test

sTable 2. Reported proportions of patients invited to, agreeing to, and participating in each clinic

Clinic	n	Proportion Invited	Proportion Agreeing to Participate	Proportion Participating
1	124	0.9	0.9	0.81
2	79	0.8	0.7	0.56
3	126	0.7	1.0	0.70
4	7	0	0.0 [†]	0.00
5	49	0.5	0.5	0.25
6	84	0.9	0.8	0.72
7	67	1.0	1.0	1.00
8	94	0.9	0.9	0.81
9	99	0.9	1.0	0.90
10	74	1.0	1.0	1.00
11	48	0.8	0.9	0.72
12	30	0.5	1.0	0.50
13	96	1.0	1.0	1.00
14	67	1.0	0.9	0.90
15	86	1.0	0.8	0.80
16	108	0.5	1.0	0.50
17	52	0.5	0.9	0.45
18	98	1.0	1.0	1.00

[†] Responses indicating “almost 0%” were treated as 0 for analysis purposes.

sTable 3. Correlations between the screening results and the proportion invited, agreeing to, and participating

	AUDIT ≥ 8	AUDIT ≥ 15
Proportion Invited	0.13 (95%CI -0.35–0.57, p value 0.59)	-0.086 (95%CI -0.53–0.4, p value 0.73)
Proportion Agreed to Participate	0.09 (95%CI -0.39–0.53, p value 0.72)	-0.14 (95%CI -0.57–0.35, p value 0.59)
Proportion Participated	0.24 (95%CI -0.26–0.63, p value 0.34)	-0.033 (95%CI -0.49–0.44, p value 0.9)

AUDIT: Alcohol Use Disorders Identification Test, CI: Confidence Interval

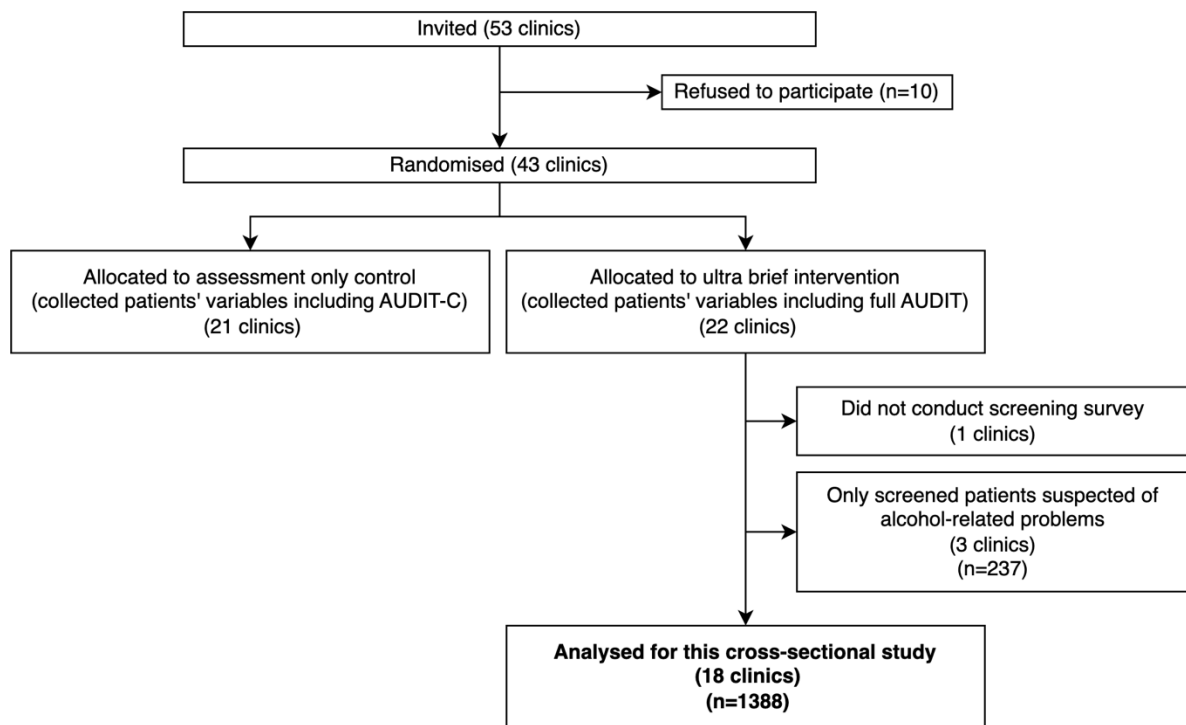


Figure 1. Flowchart of the recruitment and allocation process for clinics and patients

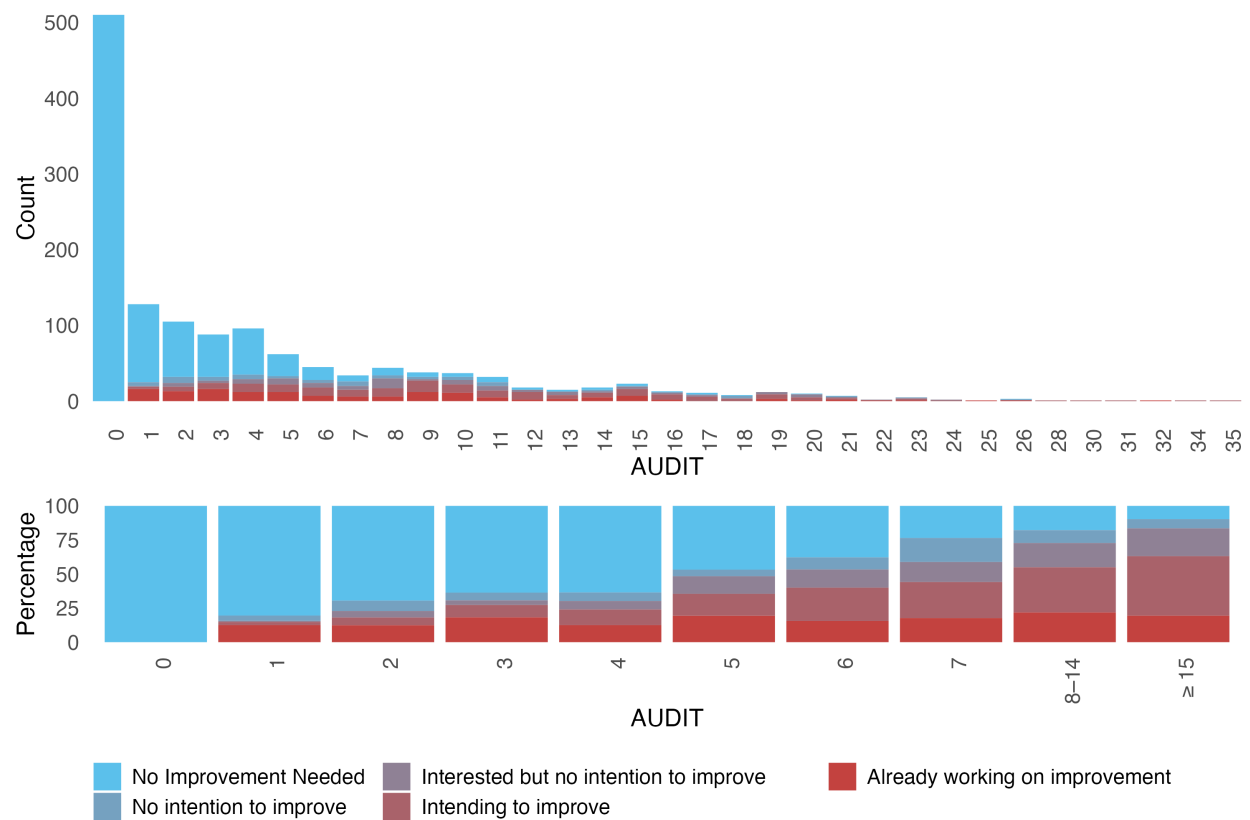
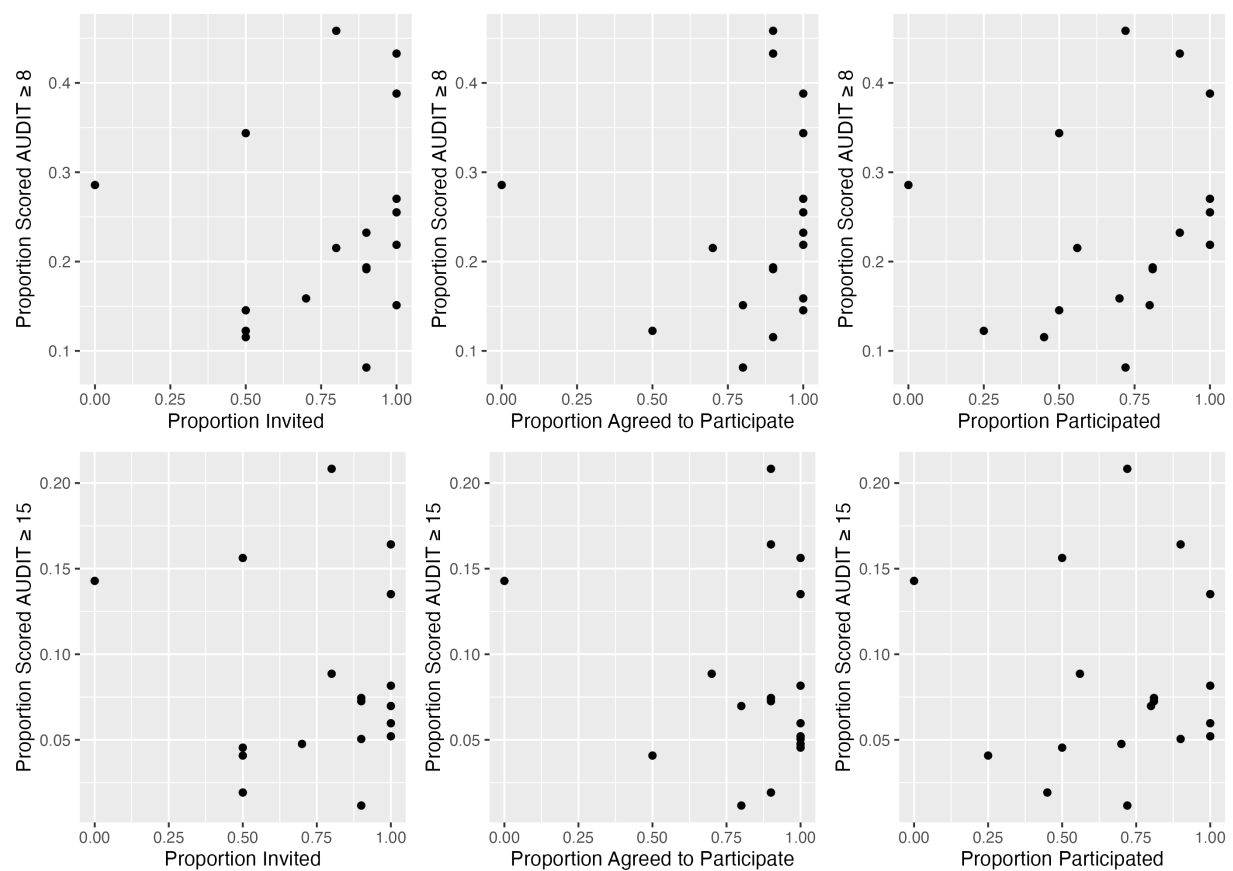


Figure 2. Readiness to change drinking habits across the AUDIT scores



sFigure 1. Scatter plots between the proportions invited, agreeing to, and participating, and the screening results