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The web-based self-reported survey of Alcohol Use Disorders Identification Test and associated factors in Japan

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Abstract

Aim: While considerable data on the alcohol drinking behavior of the general population are available for the United States and Europe, data from Asian countries are scarce. We attempted to estimate the social backgrounds and other factors associated with high Alcohol Use Disorders Identification Test (AUDIT) scores in Japan.

Methods: This web-based survey was conducted in 2023. In order to ensure the representativeness of the sample, the population distribution by age and region was determined from the Statistics Bureau Census Basic Population Summary. The survey questionnaire items included AUDIT, educational background, occupation, income, marital status, body mass index (BMI), age at the time of the first alcoholic drink, age at the start of habitual drinking, Kessler Psychological Distress Scale (K6), and Link's Devaluation Discrimination Scale.

Results: A total of 40,720 responses were received from people aged between 20 and 75 years old. The proportion of potential alcohol use disorder based on AUDIT score ≥15 was 9.2% in men and 2.0% in women. The number of people with AUDIT scores ≥15 tended to be high in men in their 50s and women in their 20s and 40s. Among those with AUDIT scores ≥15, the age at the first drink and age at the start of habitual drinking were significantly lower, and the K6 score was significantly higher.

Conclusion: This web survey showed an association between AUDIT scores and age at first drinking and mental health condition. Since this survey was a web-monitored survey, caution should be taken in generalizing the prevalence.

KEYWORDS
alcohol drinking, alcohol use disorder, survey, mental health

INTRODUCTION

While considerable data on the alcohol drinking behavior of the general population are available for the United States and Europe, data from Asian countries are scarce. Drinking patterns differ between Asian countries and the United States or Europe, not only due to cultural differences, but also differences in the type of aldehyde dehydrogenase (ALDH2).[1]

The 2018 World Health Organization's *Global Status Report on Alcohol and Health* determined that harmful use of alcohol caused approximately 3 million deaths (or 5.3% of all deaths), more than hypertension (1.6%) and diabetes (2.8%) combined.[2] The results of

the World Mental Health Survey showed that the lifetime prevalence of alcohol use disorders among nonabstainers was 10.7% across all countries.[3] Differences in alcohol consumption and alcohol-related problems between women and men appear to be narrowing.[4,5] Therefore, increased rates of alcohol-related harm, including drunk driving, emergency department visits, hospitalizations, and deaths in women, are being reported.[6] Estimates from a meta-analysis of six large US studies suggest a significant increase in the prevalence of alcohol use in the population, especially among women.[7] In an aging society, drinking problems among the elderly also become a problem. The National Surveys on Drug Use and Health (NSDUH) conducted in the United States in 2019 reported that the rate of binge alcohol use was 10.7% in people aged 65 years or over.[8] The National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) conducted in the United States reported that 13.4% of people aged 65 years or over met the criteria for alcohol use disorder in their lifetime.[9] A UK database study reported that older people were more likely to be hospitalized for alcohol-related harm than younger people and that the alcohol-related age-adjusted mortality rates were the highest in the 55–74-years age group.[10] With the aging of the society as a whole, the burden on the medical and social services related to alcohol problems may increase, but there is little knowledge about this in Japan.

Against the background of the society, it is necessary to examine what factors might influence the drinking behaviors of people and obtain an update of the actual situation in Japan. As mentioned above, however, this is not a problem confined to Japan, but rather a global problem. We conducted the first large-scale survey on the state of drinking alcohol in Japan to estimate the social backgrounds and associated factors related to high Alcohol Use Disorders Identification Test (AUDIT) scores, and to devise measures to control alcohol-related health problems. In this paper, based on the results of a web-based survey of a large sample, we provide up-to-date information on the drinking behaviors in Japan.

METHODS

Participants

This web-based self-report survey was administered in March 2023 by a leading internet research company with approximately 11 million panel members. Panelists who agreed to participate accessed a designated website and answered a questionnaire. In order to ensure the representativeness of the sample used to assess the drinking behaviors of the population and self-awareness of alcohol dependence, the population distribution by age and region was determined from the Ministry of Internal Affairs and Communications Statistics Bureau Census Basic Population Summary. Furthermore, in order to avoid a biased distribution of drinkers and nondrinkers in the areas surveyed, we used the ratio of drinkers to non-drinkers from the National Survey of Living Conditions to determine the target number by age, region, gender, and ratio of drinkers to nondrinkers. We

obtained responses from a total of 40,720 subjects aged between 20 and 75 years old. We excluded samples with clearly abnormal values, such as cases in which the same response of 1 or 4 was given to all items on the Link's Devaluation Discrimination Scale including reversed items, and those whose "Age of First Drinking" is higher than "Age of Start of Habitual Drinking," and finally analyzed the responses from the remaining 39,081 subjects.

Measurements

The survey questionnaire items included current age, AUDIT,[11] questions to determine the educational background, occupation, income, marital status, body mass index (BMI), age at the time of the first alcoholic drink (hereinafter, age at first drink), age at the start of habitual drinking, presence/absence of a flushing reaction, the Kessler Psychological Distress Scale (K6), and Link's Devaluation Discrimination Scale, in order to understand how factors such as social background, anxiety, and stigma affect people's drinking behavior.

The AUDIT has been developed from a WHO collaborative project as a screening instrument for hazardous and harmful alcohol consumption. Among subjects diagnosed as engaging in hazardous or harmful alcohol use, 92% had AUDIT scores of ≥8; on the other hand, 94% of those not found to engage in hazardous consumption had AUDIT scores of <8. In this survey, we calculated the percentage of subjects with AUDIT scores ≥8 (problem drinkers), ≥15 (potential alcohol use disorder), and ≥20 (suspected alcohol dependence).[12,13] The computerized version of AUDIT has been shown to be as acceptable as the paper-and-pencil version, with the two formats yielding comparable scores.[14,15] A systematic review of various psychiatric symptom self-report instruments showed that digital and paper instruments are generally reliable.[16] Those who had never drunk alcohol in their lifetime or in the past year were assigned an AUDIT score of 0.

The survey population was asked the following question to determine the age at the first drink: "At what age did you first drink an alcoholic beverage, apart from just a little try?" To determine the age at the start of habitual drinking, they were asked: "At what age did you start drinking alcoholic beverages regularly (at least once a week for at least 6 months)?"

Heavy episodic drinking (HED) was defined as consumption of 60 g or more of pure alcohol on at least one occasion at least once a month.[2]

The simple flushing questionnaire consisted of two questions: (A) "Do you have a tendency to develop facial flushing immediately after drinking a glass (180 mL) of beer?" (B) "Did you have a tendency to develop facial flushing immediately after drinking a glass of beer during the first or second year after you started drinking?" If it is assumed that current/former flushers carry inactive-type ALDH2, the questionnaire could identify subjects with the inactive type of ALDH2 with 90% sensitivity and 88% specificity in men and 88% sensitivity and 92% specificity in women.[17,18]

The K6 scale is mental health screening in the general adult population.[19] The screening performance of the Japanese version of K6 has been demonstrated to show a high area under the curve, comparable with that of the Center for Epidemiologic Studies—Depression Scale.[20]

The Link's Devaluation Discrimination Scale assesses the degree of perceived discrimination against people with mental illnesses and a treatment history.[21] The higher the total score, the more people with mental disorders are perceived to be discriminated against. The four-grade version was used for this survey.

Statistical analysis

Statistical analysis was performed using IBM SPSS Statistics Version 29.0.1.0 for Windows (IBM Corp.). First, we calculated the descriptive statistics for the sociodemographic characteristics and drinking behaviors for the entire sample. Means and standard deviations were calculated for continuous variables, and percentages were calculated for categorical variables. We also calculated the percentages of people with a drinking habit by gender and age group. In addition, the significance of each sociodemographic characteristic was tested for AUDIT scores of <8, 8–14, and ≥15. The Kruskal–Wallis test was used to compare the three groups. Finally, we used logistic regression analysis to control for potentially confounding factors, including years of education, marital status, living circumstance, employment status, occupational status, income, flusher/non-flusher, K6 score, and score on Link's Devaluation Discrimination Scale. We stratify by gender, and the explanatory variable of primary interest is age category. Age categories were set in 10-year increments (70–75 years old being an exception). The relationship between the age category and response variables was evaluated by determining the odds ratios (ORs) and their 95% confidence intervals (CIs). Three response variables were used: AUDIT score ≥15, drinking alcohol twice or more per week, and HED.

Ethics approval

This survey was conducted with the approval of the ethics committee of Kurihama Medical and Addiction Center (No. 419). Participants were given the option of refraining from responding to any part of the survey at any time or to quit the survey altogether. The research members did not have access to personal information about the respondents.

RESULTS

We analyzed the responses from a total of 39,081 subjects (mean age 48.8 years, standard deviation [SD] 15.1 years), including 19,346 women (mean age 48.7 years, SD 15.0 years) and 19,735 men (mean age 49.0 years, SD 15.2 years). The demographic characteristics and drinking behaviors of the entire sample are shown in Table 1. As

compared with the analysis group, the proportion of lifetime non-drinkers was slightly higher in the exclusion group, and effect sizes for sex, age, and marital status were smaller.

Table 2 shows the percentage of subjects with high AUDIT scores and the drinking behaviors by gender and age group. Among women, 39.8% were lifetime nondrinkers, 16.0% were nondrinkers in the past year, and 44.2% were current drinkers. Among men, 20.5% were lifetime nondrinkers, 12.9% were nondrinkers in the past year, and 66.6% were current drinkers. The proportion of AUDIT score ≥8 was 23.1% in men and 6.5% in women. The proportion of AUDIT score ≥15 was 9.2% in men and 2.0% in women. The proportion of AUDIT score ≥20 was 4.1% in men and 0.9% in women. The survey also indicated that 28.8% of male drinkers and 10.7% of female drinkers engaged in HED. The average age at the first drink in all age groups was 19.82 years for women and 19.25 years for men. However, among young people under the age of 29 years, the age at the first drink was lower for women. The average age at the start of habitual drinking across all age groups was 26.50 years for women and 24.32 years for men. However, the age at the start of habitual drinking was lower in women as compared with men in the age group of 20–39 years.

In women with high AUDIT scores, the average age at the first drink and age at the start of habitual drinking were significantly lower, and the K6 score was significantly higher (Table 3). In men with high AUDIT scores also, the age at the first drink and age at the start of habitual drinking were significantly lower, and the K6 score was significantly higher. About 38.2% of men and 39.7% of women were presumed to have the inactive type of ALDH2, which causes a flushing reaction, where the face turns red after consumption of alcohol.

Table 4 shows the odds ratios and their 95% confidence intervals for the age categories obtained by logistic regression analysis with adjustment for the above sociodemographic characteristics and using AUDIT scores of ≥15, alcohol consumption at least twice a week, and HED as the response variables. Note that the odds ratios of variables other than the age category, which is the explanatory variable of primary interest, were omitted (confounding variable candidates). In women, there was no significant difference in the percentage of subjects with AUDIT score ≥15 between women in their 40s and women in their 20s (OR 0.92, 95% CI: 0.64, 1.33, $p = 0.671$), whereas the percentage was significantly lower in women in their 30s (OR 0.60, 95% CI: 0.40, 0.90, $p = 0.014$). Men in their 40s had a slightly lower odds ratio for AUDIT score ≥15. As a sensitivity analysis to verify this, when employment status, occupational status, and personal income were excluded from the adjustment variables, no significant difference by age group was observed, except in men in their 70s (Appendix 1). When we further adjusted for marital status, the odds of AUDIT score ≥15 were significantly higher in people in their 50s (OR 1.44, 95%CI: 1.21, 1.71, $p < 0.001$) (Appendix 2). The results of logistic regression analysis showed that the proportions of subjects, among both men and women, who drank alcohol twice or more a week was low in the younger age groups, and clearly increased as the age group increased. On the other hand, the odds of HED were higher in younger generations, with women in their 40s (OR 0.70, 95%CI: 0.54, 0.91, $p = 0.006$) and in their 50s (OR 0.68, 95%CI: 0.51, 0.89, $p = 0.006$), showing relatively low odds.

TABLE 1 Demographic characteristics and drinking behaviors of the entire sample.

Characteristics of the respondents	Included in the analysis n = 39,081		Excluded from the analysis n = 1639		p	Effect size
	%	Total	%	Total		
Sex					<0.001	0.017
Men	50.5	19,735	46.2	757		
Women	49.5	19,346	53.8	882		
Age (years)					<0.001	0.039
20–29	14	5468	17.6	288		
30–29	16.3	6362	19.8	324		
40–49	21.2	8300	22.3	366		
50–59	19.4	7563	18.9	309		
60–69	18.2	7098	14.7	241		
70–75	11	4290	6.8	111		
Marital status					<0.001	0.081
Currently married	56.8	22,211	51.3	840		
Partnered	0.9	349	1.1	18		
Widowed	2.2	860	1.2	20		
Divorced	7	2722	6	98		
Never married	30.5	11,913	31.5	517		
Separated	0.4	143	0.4	6		
Did not answer	2.3	883	8.5	140		
Region					0.398	0.013
Hokkaido	4.2	1639	4.1	68		
Tohoku	6.6	2595	7.4	122		
Kanto	35.5	13,889	37.1	608		
Chubu	18.2	7100	16	263		
Kinki/Kansai	16.3	6363	16.3	267		
Chugoku	5.6	2172	5.7	93		
Shikoku	2.9	1122	2.5	41		
Kyushu (incl. Okinawa)	10.7	4201	10.8	177		
Drinking behavior					<0.001	0.11
Never drinker, lifetime	30.1	11,748	55.8	915		
Never drinker, in 12 months	14.5	5655	9.8	161		
Drinker, <2 times/week	27	10,548	18.1	297		
Drinker, ≥2 times/week	28.5	11,130	16.2	266		

DISCUSSION

The percentage of subjects with AUDIT score ≥15 tended to be particularly high in men in their 50s and women in their 20s and 40s. There could be various possible reasons to explain the difference in the age groups showing the highest rate of AUDIT score ≥15 between men and women. The interval between the age at the first drink and progression to alcohol use disorder is shorter in women than in men, which is thought to be due to factors, such as the volume of body water, metabolism, hormones, and lifestyle factors.[22,23] Women with alcohol dependence are more likely to have psychiatric comorbidities than men.[24] Comorbid psychiatric disorders

TABLE 2 Drinking behaviors and AUDIT scores by gender and age group.

		Drinking behavior						Age at start of habitual drinking, mean	AUDIT score			
	n	Never drinker, lifetime	Never drinker, in 12 months	Drinker, <2 times /week	Drinker, ≥2 times /week	Heavy episodic drinking	Age at first alcoholic drink, mean		Mean	≥8	≥15	≥20
Women												
20–29	2691	33.00%	12.60%	41.60%	12.80%	14.50%	19.63	20.92	2.47	10.30%	3.00%	1.40%
30–39	3131	41.70%	18.70%	26.90%	12.60%	12.90%	19.62	22.66	1.64	6.20%	1.90%	0.80%
40–49	4113	35.80%	18.00%	27.00%	19.20%	12.10%	19.59	25.00	2.14	8.30%	3.10%	1.40%
50–59	3766	38.10%	16.60%	23.80%	21.50%	11.70%	19.71	27.95	2.01	7.00%	2.30%	1.10%
60–69	3584	46.30%	14.30%	19.90%	19.50%	5.90%	20.04	31.38	1.45	3.90%	1.00%	0.30%
70–75	2061	45.70%	14.60%	21.60%	18.10%	3.40%	21.06	36.74	1.20	1.60%	0.30%	0.10%
Total	19,346	39.80%	16.00%	26.50%	17.60%	10.70%	19.82	26.50	1.85	6.50%	2.00%	0.90%
Men												
20–29	2777	23.80%	10.40%	44.30%	21.50%	26.70%	19.78	21.09	4.27	19.80%	9.00%	3.70%
30–39	3231	22.70%	12.70%	32.40%	32.20%	29.60%	19.48	23.17	4.67	21.80%	9.60%	4.40%
40–49	4187	20.80%	13.50%	28.50%	37.30%	28.20%	19.27	24.43	4.71	22.40%	9.50%	4.80%
50–59	3797	17.80%	14.20%	23.30%	44.70%	32.00%	19.01	24.94	5.25	25.80%	11.00%	5.00%
60–69	3514	18.60%	12.60%	18.90%	49.90%	31.20%	18.92	24.98	5.30	26.90%	9.50%	4.10%
70–75	2229	20.30%	13.80%	17.90%	48.00%	21.30%	19.26	25.93	4.24	20.00%	4.80%	1.70%
Total	19,735	20.50%	12.90%	27.50%	39.10%	28.80%	19.25	24.32	4.80	23.10%	9.20%	4.10%

may drive individuals toward dangerous drinking, thereby more rapidly leading to alcohol use disorder. In a study of patients with alcohol dependence, women with inactive ALDH2 also had higher rates of psychiatric comorbidities, particularly eating disorders and borderline personality disorders, than women with active ALDH2.[25] Among women, the younger the age group included in this survey, the higher the alcohol consumption rate, and the proportion of women with AUDIT score ≥15 showed a bimodal distribution in their 20s and 40s. The relatively low percentage of women in their 30s with AUDIT score ≥15 may be due to factors such as employment, occupational status, income, pregnancy, and childcare, but this has not yet been fully elucidated from this survey and further research is needed. According to NSDUH data for the period between 2002 and 2017, among adults aged 21–44 years, drinking decreased in pregnant women (−3.3%).[26]

The tendency for rates of potential alcohol use disorder to be higher among middle-aged men than among younger people is unique to Japan compared with Europe and the United States. In a combined report from seven European countries, the young age group of 18–34 years showed the highest prevalence of alcohol use disorder.[27] In the 2001–2002 NESARC based on a US representative sample of 43,093 respondents, the 12-month prevalence of alcohol use disorder was the highest in the 18–29-years age group and decreased with age.[28,29] Due to the trend toward later marriages in Japan, there were many unmarried people in their 20s who

were used as reference, and it is thought that marital status also influenced the relationship between age and AUDIT score ≥15. According to the Population Census of Japan, the unmarried rate for men in their late 40s was 25.9% and 16.1% for women, while for those in their late 20s it was 72.7% for men and 61.3% for women in 2015. Among men, the percentage of subjects with AUDIT score ≥15 peaked in the 50s age group, but the proportion of men with AUDIT score ≥8 was also high among subjects aged 60 years or over, suggesting latent alcohol problems in the elderly. We should take into account the increased vulnerability of older people to the many subtle adverse effects of alcohol and the numerous pitfalls associated with underdetection and misdiagnosis of this problem in these age groups.[30]

Women with AUDIT score ≥15 reported a lower age at the first drink and age at the onset of habitual drinking than those with AUDIT score ≤7. The fact that higher AUDIT scores are associated with a lower age at the first drink seems to lend support to previous reports.[31,32] Although the average age at the first drink and age at the start of habitual drinking were lower in men, on average, across all age groups, it was lower among women of younger age groups. The NSDUH study found a correlation between the level of alcohol dependence and age at the first drink.[33] The review, which includes reports mainly from the EU and the United States, shows that the gender gap in alcohol use is narrowing, especially among young people.[34] According to the Global Status Report on Alcohol and Health 2018, in many countries of the Americas and Europe, alcohol use

TABLE 3 Sociodemographic characteristics and results of chi-square and Kruskal–Wallis test results between three groups of AUDIT score among drinkers.

	Female drinkers (n = 8541)					Male drinkers (n = 13,137)				
	AUDIT score <8 n = 7288–85.30%	AUDIT score 8–14 n = 857–10.00%	AUDIT score ≥15 n = 396–4.60%	Test	Effect size	AUDIT score <8 n = 8572–65.30%	AUDIT score 8–14 n = 2744–20.90%	AUDIT score ≥15 n = 1821–13.90%	Test	Effect size
Age (years), mean (SD)	48.3 (15.3)	43.9 (13.9)	43.4 (12.5)	$p < 0.001$ $H = 95.702$	0.07	48.8 (15.4)	51.2 (14.7)	47.9 (14.0)	$p < 0.001$ $H = 65.472$	0.025
Years of education, %				$p < 0.001$					$p = 0.083$	
<12	3.2	5.4	8.9			3.6	3.8	5		
12–15	64	63.4	61.3			39.4	39.2	39.1		
≥16	32.9	31.2	29.9			57	57	55.9		
Marital status, %				$p < 0.001$	0.12				$p < 0.001$	0.075
Currently married	62.9	52.6	51.5			57.7	65.7	63		
Partnered	1	2.3	4.8			0.7	1.2	1.2		
Widowed	2.7	1.5	1.3			0.9	1.1	1.2		
Divorced	7.7	11.4	14.6			4.6	5.4	7.2		
Never married	25	31	26.5			35.4	25.8	26.2		
Separated	0.3	0.5	0.3			0.2	0.4	0.4		
Did not answer	0.5	0.6	1			0.6	0.5	0.8		
Living circumstance, %				$p < 0.001$	0.101				$p = 0.009$	0.032
Alone	15.1	22.1	23.5			20.8	20.2	22.2		
With family	82.9	73	71.7			78	78.3	75.7		
Other	2	4.9	4.8			1.2	1.5	2.1		
Employment status, %				$p < 0.001$	0.126				$p < 0.001$	0.088
Full-time	24.4	36.4	40.2			53.5	57.3	62.5		
Part-time	30.3	28.1	26.8			13.2	11.7	11		
Self-employed	4.2	5.1	6.8			11.5	13.2	11.6		
Student	2.5	2.3	1.8			2.7	1.7	1.6		
Houseworker	30.2	21.4	16.2			0.7	0.4	0.5		
Unemployed	2.8	3	3.3			3.5	1.9	2.5		
Retirement	5.1	3.3	4			14.3	13.4	9.9		
Other	0.5	0.4	1			0.7	0.4	0.2		

TABLE 3 (Continued)

	Female drinkers (n = 8541)					Male drinkers (n = 13,137)				
	AUDIT score <8 n = 7288–85.30%	AUDIT score 8–14 n = 857–10.00%	AUDIT score ≥15 n = 396–4.60%	Test	Effect size	AUDIT score <8 n = 8572–65.30%	AUDIT score 8–14 n = 2744–20.90%	AUDIT score ≥15 n = 1821–13.90%	Test	Effect size
Personal income (USD), %				p < 0.001	0.119				p < 0.001	0.126
<6666	10.6	9.9	8.1			2.1	0.8	1.2		
6666–20,000	27.5	21.9	18.2			7.1	5.1	4.2		
20,000–40,000	29.7	30.9	26			21.8	18.3	18.6		
40,000–66,666	15.3	22.9	28.5			36.8	39.6	38.8		
>66,666	2.4	4	4.3			16	19.3	21.5		
None	0.6	0.9	2			4.1	7.2	8.1		
Unknown/did not answer	14	9.5	12.9			12.2	9.7	7.6		
BMI, mean (SD)	21.1 (3.5)	21.1 (3.5)	20.8 (3.3)	H = 2.323 p = .313		23.1 (3.6)	23.3 (3.4)	23.1 (3.5)	H = 13.892 p < 0.001	
Age at the first alcoholic drink, mean (SD)	19.9 (2.7)	19.4 (3.0)	19.4 (2.7)	H = 75.512 p < 0.001		19.4 (2.2)	18.9 (2.5)	18.8 (2.5)	H = 167.564 p < 0.001	
Age at the start of habitual drinking, mean (SD)	27.6 (10.2)	25.2 (7.7)	24.2 (6.3)	H = 47.620 p < 0.001		25.1 (7.1)	23.9 (6.1)	23.3 (5.6)	H = 117.172 p < 0.001	
Heavy episodic drinking, %	2.3	50.4	78.5	p < 0.001	0.672	5.8	61.4	87.5	p < 0.001	0.715
Flusher, %	35.7	17	23	p < 0.001	0.128	40.3	21.7	25	p < 0.001	0.175
K6 score, mean (SD)	3.7 (4.7)	4.8 (5.3)	7.2 (5.8)	H = 218.240 p < 0.001		3.4 (4.8)	3.7 (4.7)	6.4 (5.7)	H = 599.341 p < 0.001	
Link's scale score, mean (SD)	31.6 (4.7)	31.8 (4.9)	32.5 (5.7)	H = 9.289 p = 0.010		31.2 (4.7)	31.2 (4.8)	31.3 (4.5)	H = 0.224 p = 0.894	

Note: Flusher: assumed to have inactive ALDH2 from the results of the simple flushing questionnaire.

Currency conversion rate used: 150 yen to a dollar.

TABLE 4 Results of adjusted logistic regression analysis to determine the associations with sociodemographic characteristics and drinking behaviors.

	Female drinkers			Male drinkers		
	OR	95%CI	p	OR	95%CI	p
AUDIT score ≥15						
Age (years)						
20–29	Ref.			Ref.		
30–39	0.6	0.40, 0.90	0.014	0.83	0.67, 1.01	0.063
40–49	0.92	0.64, 1.33	0.671	0.78	0.64, 0.95	0.015
50–59	0.77	0.51, 1.16	0.207	0.89	0.72, 1.09	0.253
60–69	0.56	0.33, 0.98	0.041	0.9	0.70, 1.14	0.363
70–75	0.18	0.04, 0.78	0.022	0.62	0.42, 0.91	0.014
Drinker, 2 times/week or more						
Age (years)						
20–29	Ref.			Ref.		
30–39	1.35	1.10, 1.66	0.004	1.74	1.50, 2.02	<0.001
40–49	1.95	1.60, 2.37	<0.001	2.24	1.93, 2.59	<0.001
50–59	2.54	2.06, 3.14	<0.001	3.13	2.67, 3.66	<0.001
60–69	2.64	2.06, 3.38	<0.001	4.62	3.85, 5.54	<0.001
70–75	2.85	1.92, 4.21	<0.001	4.28	3.28, 5.58	<0.001
Heavy episodic drinking						
Age (years)						
20–29	Ref.			Ref.		
30–39	0.78	0.60, 1.01	0.064	0.92	0.78, 1.08	0.297
40–49	0.7	0.54, 0.91	0.006	0.81	0.69, 0.95	0.008
50–59	0.68	0.51, 0.89	0.006	0.91	0.77, 1.08	0.274
60–69	0.38	0.26, 0.56	<0.001	1.04	0.86, 1.25	0.704
70–75	0.35	0.17, 0.71	0.004	0.79	0.60, 1.03	0.084

Note: Adjusted for the following potential confounders: years of education, marital status, living circumstances, employment status, occupational status, personal income, non-flusher, K6 score, and Link's scale score.

starts before the age of 15 years.[2] In our survey, the average age at the first drink was over 19 years in Japan.

People with alcohol use disorders tend to be more likely to suffer from symptoms of depression/anxiety. In both men and women, subjects with high AUDIT scores had significantly higher total K6 scores. According to the results of NESARC, 40.3% of people with lifetime major depressive disorder had alcohol use disorder.[35] The odds ratio for comorbidity of alcohol use disorder with any anxiety disorder has been reported to range from 2.1 to 3.3. Additionally, some primary pathways have been proposed to explain how anxiety and alcohol use disorders coalesce, including the common-factor model, self-medication model, and substance-induced anxiety model.[36]

In women with high AUDIT scores, the scores on Link's Devaluation Discrimination Scale were also higher. According to a NESARC data analysis to evaluate the Perceived Devaluation Discrimination Scale developed by Link, individuals with alcohol use disorders who perceived high stigma were less likely to have utilized alcohol treatment services.[37] It has been pointed out stigma results in underutilization of both treatment and counseling among those most in need.

Among subjects with AUDIT score ≥15, 25.0% of men and 23.0% of women were assumed to have inactive ALDH2. As the number of patients with alcohol dependence with inactive ALDH2 has increased in clinical practice, it is important to raise awareness of the risk of alcohol and acetaldehyde-related disease.[38]

Limitations

This study did have some limitations. Due to the characteristics of the panel members, the upper limit was set at the age of 75 years. Since this survey was a web-monitored survey using the proportion of

drinkers from the National Survey of Living Conditions, caution should be taken in generalizing the prevalence. In the present study, we focus on the relationship of factors within the survey subjects. Web-based self-report surveys are a convenient and cost-effective way to collect data, but it has been pointed out that the survey population does not adequately represent the population characteristics.[39] Homeless people and people without internet access would have been excluded. However, according to the White Paper "Information and Communications in Japan," the internet usage rate (individuals) was 82.9% in 2021.[40]

It has been reported that participants in web-based surveys show significantly lower scores on the social desirability scale than those participating in paper-and-pencil questionnaire surveys.[41] According to a study that assessed nonresponse bias estimates for alcohol consumption in the United Kingdom, the prevalence of heavy episodic alcohol consumption and the average weekly alcohol consumption were higher in those who were harder to contact according to the number of contacts attempts.[42] On the other hand, this web-based self-report survey was continued until the target number set by the drinker/non-drinker ratio was reached. Further research is needed, as the COVID-19 outbreak could also have affected the drinking behaviors and sociodemographic factors, such as the employment status and income levels.

CONCLUSIONS

This is the first time that a large-scale web-based self-report survey of alcohol consumption behaviors has been conducted in Japan. The percentage of subjects with AUDIT score ≥15 tended to be particularly high in men in their 50s and women in their 20s and 40s. The higher proportion of potential alcohol use disorder in middle-aged men than among younger people is unique to Japan when compared with Europe and the United States. The finding of an association between higher AUDIT scores and lower age at the first drink seems to lend support to previous reports on this subject. Subjects with higher AUDIT scores had significantly higher total K6 scores, supporting previous findings regarding the comorbidity of alcohol use disorders and anxiety disorders.

AUTHOR CONTRIBUTIONS

All authors prepared the questionnaire and analyzed the data. Chie Nitta prepared the specifications for the monitor survey, discussed with the contracted monitor survey company, and designed the detailed survey methodology. Tomomi Toyama wrote the original manuscript. All authors participated in discussion and revisions. All read and approved the final version of the manuscript.

DATA AVAILABILITY STATEMENT

Data used in this study can be accessed through correspondence with the lead author.

ETHICS APPROVAL STATEMENT

This study was approved by the ethics committee of Kurihama Medical and Addiction Center (No. 419).

PATIENT CONSENT STATEMENT

N/A

CLINICAL TRIAL REGISTRATION

N/A

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.