

## Original article

# Prevalence patterns of alcohol consumption and factors associated with problematic drinking on remote islands of Okinawa, Japan: a cross-sectional study

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## Abstract

**Objective:** This study aims to investigate the drinking behavior on the remote islands of Okinawa Prefecture.

**Patients/Materials and Method:** This was a cross-sectional study conducted with residents of Okinawa Prefecture's small, isolated islands. Between October 1 and December 3, 2014, island residents over 20 years of age who visited island clinics for an annual health checkup or influenza vaccination were recruited. An anonymous entry survey was administered to those who provided their consent. The survey included information on age, sex, presence or absence of drinking, age at drinking initiation, smoking status, comorbidities, and family and social background. The Alcohol Use Disorder Identification Test (AUDIT) was used to assess alcohol consumption. Participant characteristics were analyzed descriptively, and logistic regression analysis was conducted to assess relationships between the high-risk drinking group (AUDIT score  $\geq 10$  points) and other measured variables (age, sex, age at drinking initiation, smoking, residence, and employment status).

**Results:** Compared to the results of a national survey in 2013, there was a significantly higher prevalence of male island residents who drank  $\geq 40$  g of alcohol per day and female island residents who drank  $\geq 20$  g/day, levels which are considered risk factors for lifestyle diseases. Among both male and female island residents, there were significantly higher proportions of those with AUDIT scores  $\geq 8$  points, referred to as high-risk drinkers, and those with AUDIT scores  $\geq 20$ , individuals considered to have probable alcohol dependence, as compared to the results of the national survey. In a logistic regression analysis, factors related to high-risk drinking included younger age, male sex, smoking history, inoccupation, and underage drinking initiation.

**Conclusion:** This is the first report on drinking behavior among inhabitants of Okinawa's remote islands. The degree of alcohol consumption is serious and must be recognized as a regional health problem.

**Key words:** alcohol, drinking behavior, rural health, islands, Japan

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## Introduction

Unhealthy alcohol use is associated with various physical, mental, and social problems, such as cancer, hypertension, diabetes, depression, etc<sup>1–5</sup>. Moreover, the social cost of problematic drinking is enormous<sup>6</sup>. Efforts to cope

with excessive alcohol consumption are important not only to reduce health-related problems but also associated social costs. The Okinawa Prefecture is located in the westernmost part of Japan. It consists of a main island, several relatively large and isolated islands, such as Miyako and Ishigaki, and various small, remote islands. The degree of problematic alcohol consumption in Okinawa is serious. As such, deaths owing to liver disease in the Okinawa Prefecture are approximately twice of the national average death rate<sup>7</sup>. Further, due to their unique cultural background, the remote islands of Okinawa may have problematic alcohol consumption that is more serious than on the main island of Okinawa. Surveys on alcohol consumption across relatively large areas of the prefecture have been conducted, as well as on larger islands, such as the main islands of Okinawa<sup>8</sup>, Miyako<sup>9</sup>, and Ishigaki<sup>10</sup>. However, there have been no reports

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on the actual conditions of drinking on the remote islands of Okinawa. The aim of the present research is to clarify the actual conditions of alcohol consumption on the distant, isolated islands of Okinawa and to examine the factors related to problematic drinking.

## Patients and Methods

### Design

This cross-sectional, multicenter collaborative research is an observational study that was conducted at nine remote rural clinics affiliated with the Okinawa Prefectural Hospitals.

### Participants and setting

The Okinawa Prefecture has 16 prefectural clinics on 15 islands. Of the 15 islands, the local governments of 9 islands (Iheya, Tsuken, Aguni, Kudaka, Zamami, Aka, Kitadaito, Minamidaito, and Iriomote) cooperated in conducting this survey.

The survey period ran from October 1 to December 31, 2014. An anonymous entry survey was conducted among people over 20 years of age who visited clinics located in the nine participating remote islands for residential annual health check-ups or influenza vaccinations within the survey period, and from whom consent had been obtained. Individuals among whom it would be difficult to conduct the survey were excluded, such as those who did not consent to participate and those with dementia or psychiatric disorders.

### Measures

We assessed demographic information (age; sex; presence or absence of alcohol use; age at drinking initiation; smoking habits; comorbidity of hypertension, diabetes mellitus, dyslipidemia, hyperuricemia, or insomnia; and family and social background) that was considered by previous research<sup>11</sup> and our clinical view to be related to alcohol use. In this survey, the Alcohol Use Disorder Identification Test (AUDIT)<sup>12</sup> was the measure used to assess unhealthy alcohol use. AUDIT is an alcoholism screening test developed based on research studies that took place in six countries; AUDIT scores have shown little difference according to race and sex<sup>12</sup>.

### Statistical analysis

Analysis commenced with descriptive statistics. The following characteristics were determined according to sex and age group, and compared to a national survey conducted in Japan in 2013<sup>13</sup>: the prevalence of remote island residents who drank alcohol  $\geq 1$  time in the previous year, those with average daily alcohol consumption of  $\geq 40$  g for men and  $\geq 20$  g for women, and AUDIT scores  $\geq 8$  and scores  $\geq 20$ . To correct the difference in age structures, an overall compari-

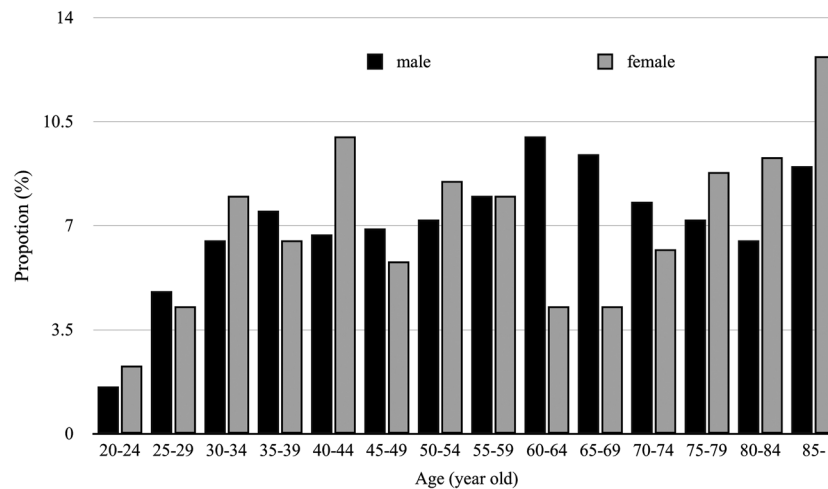
son was made using the Japanese population's age groups in 2003<sup>14</sup> as the reference population after adjustment for age. Daily alcohol consumption of  $\geq 40$  g for men and  $\geq 20$  g for women are the doses that have been shown by previous studies to indicate risk of trauma or social problems<sup>15,16</sup>. According to the World Health Organization (WHO) AUDIT guidelines for use in primary care, AUDIT scores  $\geq 8$  are considered to indicate the possibility of harmful alcohol use, and AUDIT scores  $\geq 20$  are considered to indicate the need for diagnostic evaluation of alcoholism<sup>17</sup>. Subsequently, logistic regression analysis was conducted to analyze the relationship between the high-risk drinking group (AUDIT score  $\geq 10$ ) and other variables (age, sex, age at drinking initiation, smoking, residence, and employment status). For AUDIT scores, 8 is the cut-off by which emerges the disadvantage and tradeoff of increasing sensitivity in detecting unhealthy alcohol use but decreasing specificity. However, WHO AUDIT guidelines for use in primary care<sup>17</sup> specify that the cut-off value should be modified by region and target populations. To improve the detection of high-risk populations, we set an AUDIT score  $\geq 10$  as the cut-off point for multivariate analysis. The selection of variables related to the outcome was based on prior literature<sup>11, 18–20</sup> and our clinical view. In addition, if the *P* value was  $<0.20$  in the univariate analysis, it was included in the multivariate regression model. A *P* value of  $<0.05$  was used to establish statistical significance. Statistical analysis was performed using Stata Version 12 (Stata Corp LLC, College Station, TX, USA).

### Ethics approval

Prior to the survey, participants were given an explanation of the purpose and method of this survey and research as well as assured protection of their privacy; consent was obtained from all participants. This study was approved by the Research Ethics Committee of Okinawa Nanbu Medical Center/Nanbu Child Medical Center in Japan (August 18, 2014).

## Results

The total number of survey participants was 1,910. Of these, 652 were excluded owing to the exclusion criteria ( $n=48$ ) or not consenting to participate ( $n=604$ ); thus, 1,258 respondents (627 males, 599 females) were included in the final analysis. The effective response rate was 65.9%. Figure 1 shows the age distribution of the respondents, while Table 1 shows the characteristics of the participants. The prevalence of respondents on remote Okinawan islands who consumed alcohol  $\geq 1$  time in the past year was 85.6% among men (the national rate is 83.6% for men), and 59.2% among women (the national rate for women is 63.1%). The overall comparison is shown in Figure 2, and the age-specific



**Figure 1** Age distribution of the participants.

**Table 1** Characteristics of the 1,258 participants

Characteristics	n=1,258
Sex (male), n (%)	627/1,226 (51%)
Missings, n	32
Smoking status	
Never-smokers, n (%)	764/1,246 (61%)
Ex-smokers, n (%)	242/1,246 (19%)
Current smokers, n (%)	240/1,246 (19%)
Missings, n	12
Comorbidity	
Hypertention, n (%)	456/1,242 (37%)
Missing, n	16
Diabetes mellitus, n (%)	86/1,242 (6.9%)
Missings, n	16
Dyslipidemia, n (%)	128/1,242 (10%)
Missing, n	16
Hyperuricemia, n (%)	57/1,241 (4.6%)
Missings, n	17
Insomnia, n (%)	37/1,242 (3.0%)
Missings, n	16
Living alone, n (%)	294/1,250 (24%)
Missings, n	8
Occupational status	
Inoccupation, n (%)	252/1,254 (20%)
Employed person, n (%)	886/1,254 (71%)
Housewife, n (%)	100/1,254 (8.0%)
Absences from work, n (%)	16/1,254 (1.3%)
Missings, n	4
AUDIT score	3 [0, 10]

Continuous variables were expressed as median [25%, 75%].

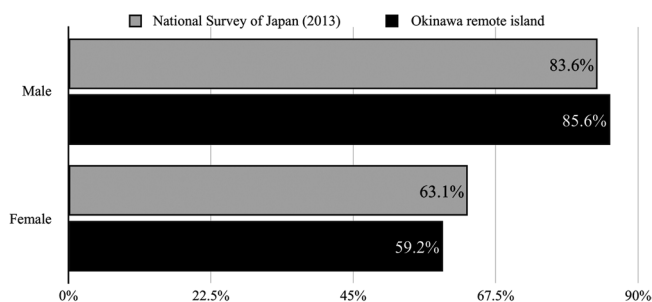
comparison is shown in Figure 3. The prevalence of male respondents who consumed  $\geq 40$  g/day of alcohol was 71.2% (national prevalence, 14.3%), and that for women who con-

sumed  $\geq 20$  g/day of alcohol was 63.8% (national prevalence, 5.9%). The overall comparison is shown in Figure 4, and the age-specific comparison is shown in Figure 5. The prevalence of male remote island residents with AUDIT scores  $\geq 8$  (high-risk drinkers) was 57.3% (national prevalence, 24.5%) and 17.2% in women (national prevalence, 3.7%). The overall comparison is shown in Figure 6, and the age-specific comparison is shown in Figure 7. The prevalence of respondents with AUDIT scores  $\geq 20$  (which is categorized as probable alcohol dependence) was 8.7% among men (national prevalence, 2.1%) and 1.9% among women (national prevalence, 0.2%). The overall comparison is shown in Figure 8, and the age-specific comparison is shown in Figure 9.

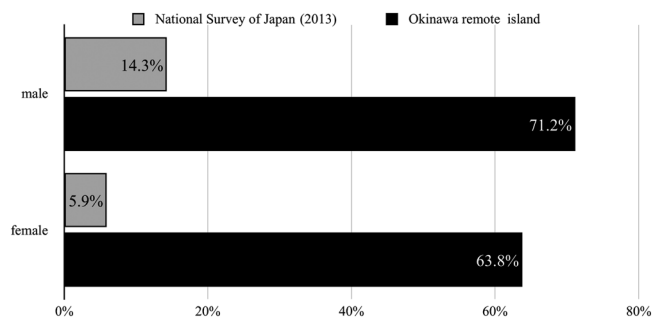
A logistic regression analysis was performed on factors related to the problematic drinkers who had AUDIT scores  $\geq 10$ . Odds ratios were calculated, and the results are shown in Table 2. Older age (odds ratio=0.89, 95% CI=0.85–0.92,  $P$  value  $<0.001$ ), male sex (odds ratio=2.67, 95% CI=2.00–3.66,  $P$  value  $<0.001$ ), smoking history (odds ratio=1.89, 95% CI=1.42–2.52,  $P$  value  $<0.001$ ), inoccupation (odds ratio=0.49, 95% CI=0.33–0.73,  $P$  value  $<0.001$ ), and underage drinking initiation (odds ratio=1.81, 95% CI=1.31–2.51,  $P$  value  $<0.001$ ) were statistically significant variables.

## Discussion

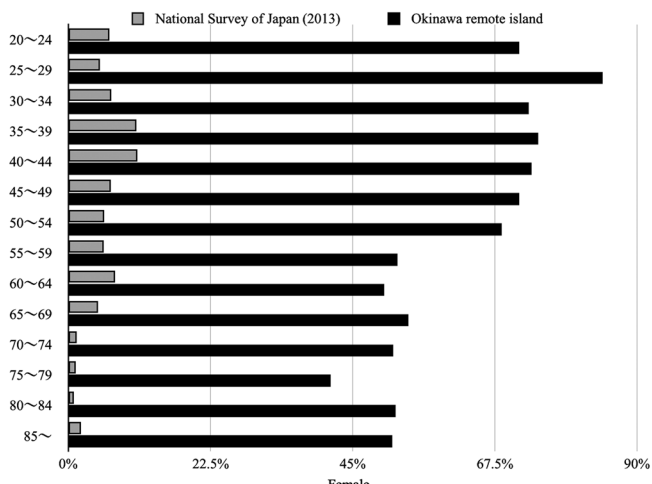
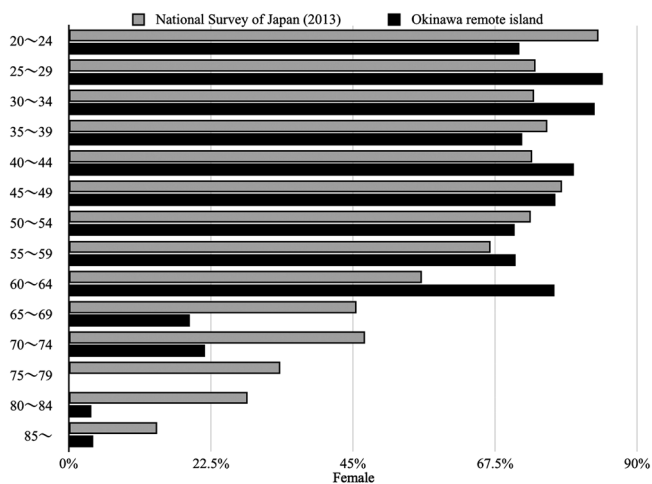
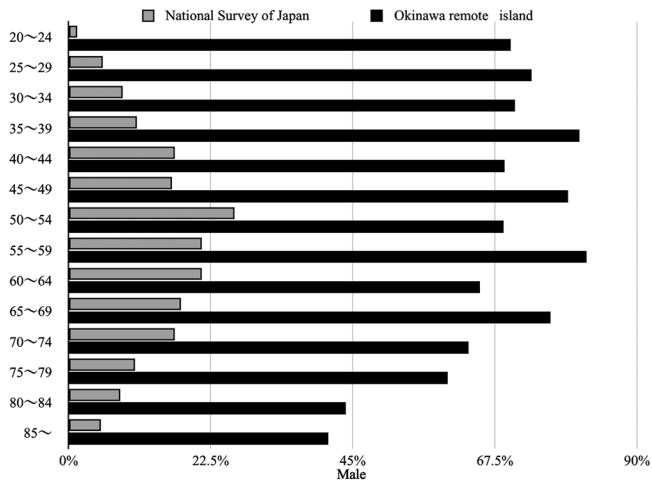
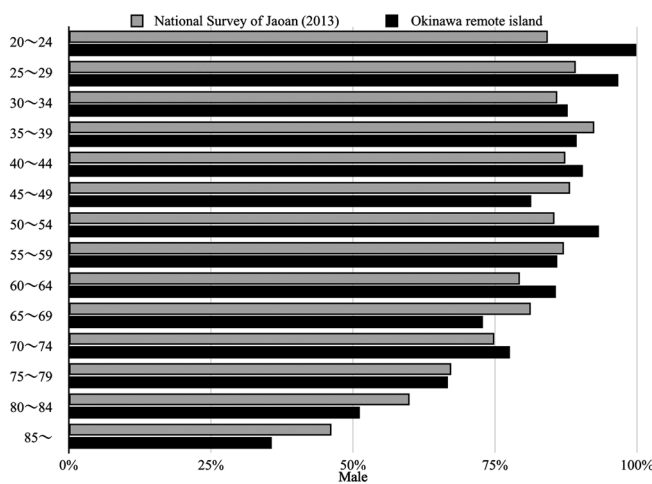
This is the first report on drinking behavior among residents of Okinawa's isolated islands. The prevalence of drinkers (drinking  $\geq 1$  time in the previous year), average daily alcohol consumption ( $\geq 40$  g for men,  $\geq 20$  g for women), dangerous use of alcohol (AUDIT score  $\geq 8$ ), and suspected alcohol dependence (AUDIT score  $\geq 20$ ) were compared to the 2013 nationwide survey conducted by Higuchi *et al*<sup>3)</sup>. Regarding the proportion of those who had consumed alcohol at least once in the past year, there was no significant



**Figure 2** Prevalence of drinkers (overall comparison). Overall comparison was made by adjusting for the Japanese population in 2013.



**Figure 4** Daily drink dose  $\geq 40$  g for males or  $\geq 20$  g for females (overall comparison). Overall comparison was made by adjusting for the Japanese population in 2013.

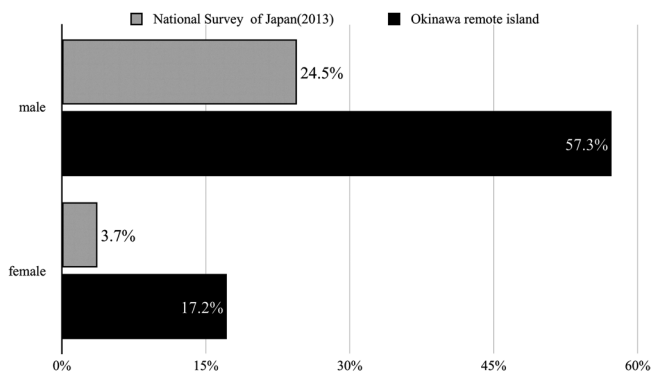


**Figure 3** Prevalence of drinkers (comparison by age group).

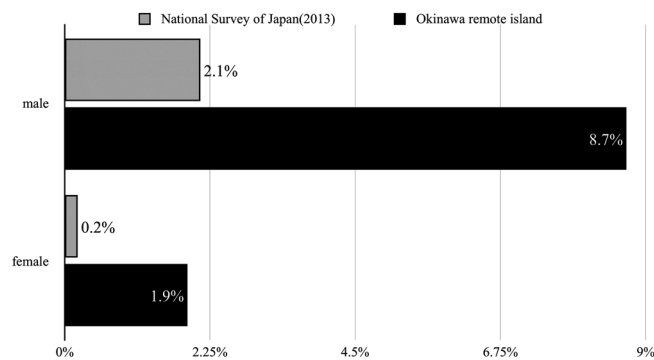
**Figure 5** Daily drink dose  $\geq 40$  g for males or  $\geq 20$  g for females (comparison by age group).

difference between remote island residents and men and women nationwide. However, the prevalence of male island residents who drank  $\geq 40$  g/day and of female residents who drank  $\geq 20$  g/day were both significantly higher than the corresponding national rates, which is considered to reflect a

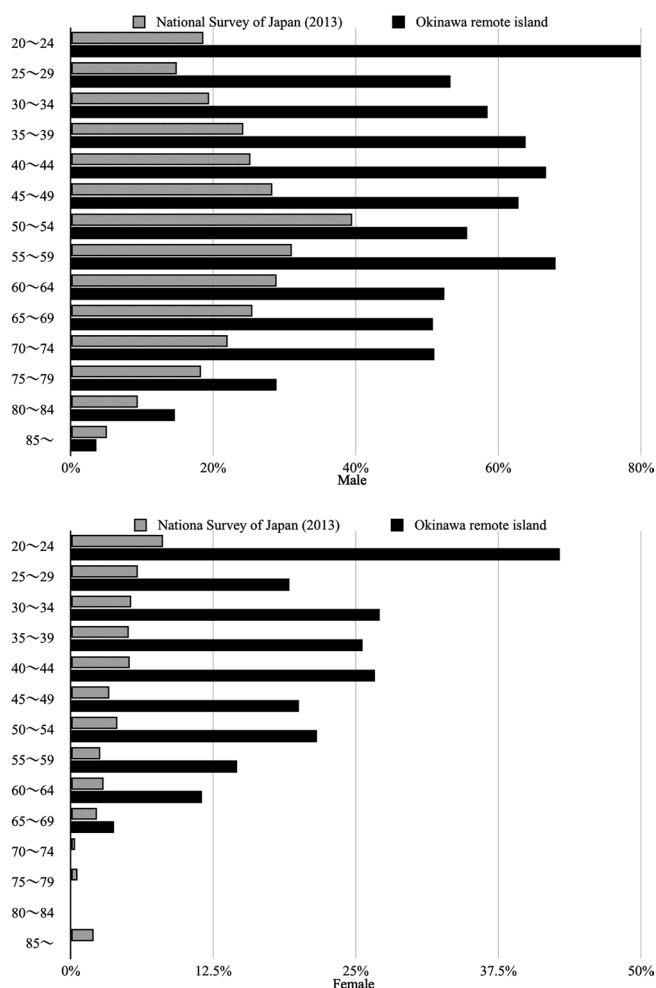
level of alcohol consumption that can give rise to chronic diseases. Among both male and female island residents, the proportions of high-risk drinkers (AUDIT score  $\geq 8$ )<sup>21)</sup> and individuals with probable alcohol dependence (AUDIT



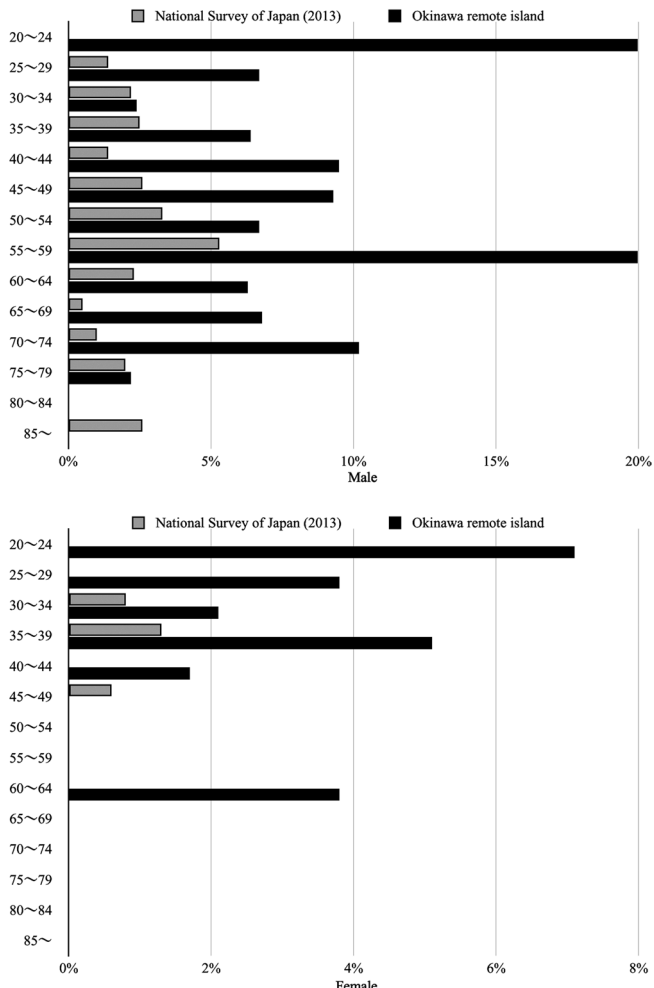
**Figure 6** Prevalence of high-risk drinkers (AUDIT score  $\geq 8$ ) (overall comparison). Overall comparison was made by adjusting for the Japanese population in 2013.



**Figure 8** Prevalence of probable alcohol dependence (AUDIT score  $\geq 20$ ) (overall comparison). Overall comparison was made by adjusting for the Japanese population in 2013.



**Figure 7** Prevalence of high-risk drinkers (AUDIT score  $\geq 8$ ) (comparison by age group).



**Figure 9** Prevalence of probable alcohol dependence (AUDIT score  $\geq 20$ ) (comparison by age group).

score  $\geq 20$ )<sup>21)</sup> were significantly higher than the corresponding national rates.

In addition, a logistic regression analysis was performed

on factors related to problematic drinkers with AUDIT scores  $\geq 10$  (Table 2). Younger age, male, smoking history, employed individuals, and underage drinking initiation

**Table 2** Factors associated with the problem drinkers using univariate and multivariate logistic regression analysis

Variables	Univariate analysis		Multivariate analysis	
	Crude OR (95%CI)	P value	Adjusted OR (95%CI)	P value
Age (per 5 years-old)	0.86 (0.83–0.89)	<0.001	0.89 (0.85–0.92)	<0.001
Male (vs. female)	3.67 (2.83–4.78)	<0.001	2.67 (2.00–3.66)	<0.001
Smoking history (vs. never smoked)	3.00 (2.34–3.83)	<0.001	1.89 (1.42–2.52)	<0.001
Not living alone (vs. living alone)	0.74 (0.56–0.98)	0.034	0.85 (0.62–1.16)	0.3
Inoccupation (vs. employed)	0.25 (0.18–0.34)	<0.001	0.49 (0.33–0.73)	<0.001
Age at drinking <20 yrs	3.59 (2.67–4.82)	<0.001	1.81 (1.31–2.51)	<0.001

OR: odds ratio; CI: confidence interval.

were statistically significant. The present findings, regarding the associations with males and underage drinking initiation, agree with those of previous research<sup>11, 20</sup>. According to a survey conducted in 2014 and 2015 on adults aged 20 to 69 at the time of their driver's license renewal on the main island of Okinawa<sup>8</sup>, the prevalence of those with AUDIT scores between 8 and 14, inclusive, was 35.2% (n=12,304) for men and 14.5% (n=11,751) for women, and the prevalence of those with AUDIT scores between 15 and 40, inclusive, was 14.0% (n=12,304) for men and 4.6% (n=11,751) for women. According to a survey on drinking habits on the island of Miyako conducted from 2013 to 2012<sup>9</sup>, the prevalence of those with AUDIT scores between 8 and 14, inclusive, was 43.9% (n=792) for men and 12.0% (n=828) for women, and the prevalence of those with AUDIT scores between 15 and 40, inclusive, was 23.1% (n=792) for men and 3.0% (n=828) for women. In a 2016 similar survey of adults aged 20 to 69 on the island of Ishigaki<sup>10</sup>, the percentage of those with AUDIT scores between 8 and 14, inclusive, was 39.6% (n=709) for men and 10.8% (n=752) for women, and the percentage of those with AUDIT scores between 15 and 40, inclusive, was 13.5% (n=709) for men and 1.6% (n=752) for women. Although it is difficult to make a precise comparison due to the differences in sampling methods and target ages, our study revealed that the drinking situation on the remote islands of Okinawa was more serious than that on the main island of Okinawa, while it was similar to that on the larger islands of Ishigaki and Miyako. Interestingly, a previous report<sup>22</sup> explored the relationship between geographical factors and drinking habits, and suggested that the geographical factor of the remote islands might be related to the drinking conditions.

Overall, these findings suggest that heavy drinking contributes to health problems among the residents of the remote Okinawan islands. Therefore, it is extremely important to implement drinking control measures to safeguard the health of these rural residents. Factors involved in alcohol use disorders are multifactorial, but environmental factors have been highlighted in previous research<sup>23, 24</sup>. Thus, it is important to carry out a population approach not only for

individuals but also for the entire region. The results of this study suggest that interventions targeting high-risk groups, such as young people and men, may be effective in preventing drinking initiation among young residents on the isolated islands of the Okinawa Prefecture.

### Study limitations

As sampling methods among studies differed, accurate comparisons are difficult. The nationwide survey carried out in 2013 by Higuchi *et al.*<sup>13</sup> was conducted via random sampling from a phone survey. In this study, however, study participants were recruited from among island inhabitants aged 20 years or more at the time of health checks or influenza vaccinations during the survey period; thus, this study used an anonymous entry survey that specifically targeted that population of island residents. Therefore, our sample may have included more individuals with greater health consciousness than a random sample would, leading to possible bias. Selection bias in sampling or measurement bias in the data acquisition may therefore not have been sufficiently controlled for. Geographical requirements, such as the number of immigrants between remote islands from other areas and the distance from the main island of Okinawa, have not been adjusted for in this study. In addition, because this was a cross-sectional study, causal relationships could not be established.

### Conclusion

This is the first report on the actual conditions of alcohol consumption in Okinawa's small, isolated islands. The degree of drinking in this area of Japan is serious and should be recognized as a regional health problem. Regional commitment is required to address this critical situation in the Okinawa Prefecture.

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