

# BMJ Open A regionally specific drinking custom 'Otōri' and its association with alcohol consumption/alcohol use disorders: a cross-sectional study

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## ABSTRACT

**Objectives** The primary objective was to describe the characteristics of Otōri, a regionally specific drinking custom in the Miyakojima region of Okinawa, Japan, and its participants. The secondary objective was to clarify the distribution of alcohol consumption/alcohol use disorders as measured by the Alcohol Use Disorders Identification Test (AUDIT) and its association with the frequency of engagement in Otōri per month.

**Design** Cross-sectional study.

**Setting** Tarama Island, a remote island in Okinawa, Japan.

**Participants** Individuals who lived on Tarama Island, participated in a mass general health check or mass influenza vaccination programme, were aged ≥20 years and had decision-making capacity were eligible to participate.

**Primary outcome measures** Alcohol consumption/alcohol use disorders as measured by the AUDIT, frequency of engagement in Otōri per month, settings in which people engage in Otōri and attitudes toward Otōri.

**Results** Among 478 eligible participants, 401 answered the questionnaire. Approximately 15% reported attitudes toward Otōri of 'like' or 'somewhat like'; around 80% of these participants were middle-aged to older adult men. Compared with the national average, a higher percentage of people (9.2% and 40.9% of women and men, respectively) had AUDIT scores indicating 'hazardous drinking or more', which was associated with 'low or intermediate frequency' and 'high frequency' of engagement in Otōri per month (ORs of 7.626 and 20.321, respectively).

**Conclusions** Social obligation generated by some community members could pressure most of the population into participating in Otōri, possibly leading to a higher percentage of people engaging in hazardous/harmful alcohol consumption and alcohol dependence. However, healthcare professionals should carefully consider the beneficial and detrimental effects of the custom on biomedical and social conditions and avoid advocating to promote or abolish the custom by only highlighting one aspect.

## INTRODUCTION

Alcohol consumption has been identified as a factor in more than 200 different types

## Strengths and limitations of this study

- Most of the island's residents were expected to participate in the mass general health check or mass influenza vaccination programme (or both) because of considerable geographical barriers to attending medical institutions located off the island, meaning this study was population based.
- Variables that cause or prevent health problems could have been underestimated or overestimated, particularly Alcohol Use Disorders Identification Test (AUDIT) scores, which might have been underestimated because the study sample included people with good awareness about their health.
- Based on a preliminary study, the second and third AUDIT items were modified to increase the response rate, but this modification might have impaired the validity and reliability of the measure.

of diseases and injuries,<sup>1</sup> including physical conditions (eg, gastrointestinal diseases and various cancers) and neuropsychiatric conditions (eg, depression and anxiety disorders).<sup>2</sup> In addition to the harmful effects on physical and neuropsychiatric health, alcohol consumption is related to socioeconomic conditions, including loss of earnings, unemployment, stigma and barriers to accessing healthcare.<sup>3</sup>

Multiple complex factors affect alcohol consumption, from both individual-level dimensions, including genetic factors, and population-level dimensions, including social and cultural factors.<sup>4-7</sup> For example, the environment in which an individual lives influences their drinking behaviour, particularly the prevalence and availability of alcohol at social, ritual or festive events.<sup>8</sup>

A regionally specific drinking custom called 'Otōri' is commonly practised in the Miyakojima region (Miyakojima City and Tarama Village) of Okinawa, Japan.<sup>9</sup> As a custom,



Otōri allegedly originated approximately 600 years ago and was derived from a ritual to pray for a safe voyage. In Otōri, participants form a group and pass around a glass of 'awamori', which is an alcoholic beverage that is indigenous and unique to Okinawa.<sup>9</sup> The present style of Otōri is thought to have begun around the 1960s.<sup>9</sup> Some authors have argued that the custom now known as Otōri was initially a publicity stunt started by distilleries to promote alcohol consumption and differs markedly from the ritual of the past, although this theory has not been verified.<sup>10</sup> In Otōri, an 'oya' or temporary group leader, typically fills their own glass (almost exclusively with awamori, not other types of alcohol), makes a speech related to the members of the group and drains the entire glass in one gulp. The oya then fills the glass repeatedly, and each group member drains the glass in one gulp in turn. Finally, the last member fills the glass after draining it, and the oya drains it with an expression of gratitude to group members. The oya then selects the next oya and the cycle continues until the end of the party.<sup>9</sup> Awamori is a distilled alcohol beverage made from rice, with a typical alcohol content of 30%.<sup>11</sup> Although it is traditional to drink awamori straight, it is also consumed with ice, or mixed with cold water.<sup>11</sup> In Otōri, awamori is diluted with cold water, resulting in an alcohol content of 8%–10%.<sup>9</sup> A glass with a capacity of several hundred millilitres is typically used.<sup>12</sup> In Okinawa, more than 40 distilleries produce awamori,<sup>13</sup> the price of which is equivalent to other types of alcohol such as beer and sake.<sup>14</sup> Awamori is consumed in a variety of settings.<sup>11</sup> Participation in Otōri is broadly accepted across generations, and is more common among men than women.<sup>15</sup> However, the custom may contribute to alcohol-related health problems.<sup>15 16</sup> The population of Miyakojima City includes a much higher percentage of individuals with suspected alcohol dependence among both women (1.2%) and men (37.0%)<sup>16</sup> compared with the national average (0.6% of women and 5.3% of men).<sup>17</sup> Additionally, in Miyakojima City, 75% of liver cirrhosis is caused by alcohol, representing a much higher rate compared with the prefectural average (40.9%) and the national average (13.6%).<sup>18</sup>

Some characteristics of Otōri have been reported, including the settings in which people engage in the custom and attitudes toward it.<sup>15</sup> However, the relationship between the frequency with which participants engage in Otōri per month and their attitudes toward Otōri, the proportion of participants with positive attitudes toward Otōri by age group and sex, and the frequency with which participants engage in Otōri per month by age group and sex have not been clarified. Because Otōri may cause heavy drinking and lead to alcohol-related problems,<sup>15 16</sup> it is important to clarify the characteristics of Otōri and its participants, and its association with heavy drinking. This will support development of effective policies to reduce alcohol consumption/alcohol use disorders, and eventually the alcohol-attributable biopsychosocial burden in the community.

The primary objective of this study was to describe the characteristics of Otōri and its participants. The secondary objective was to clarify the distribution of alcohol consumption/alcohol use disorders as measured by the Alcohol Use Disorders Identification Test (AUDIT)<sup>19 20</sup> and its association with the frequency of engagement in Otōri per month.

## METHODS

### Study design

This cross-sectional study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology guidelines.<sup>21</sup>

### Setting

This study was conducted on Tarama Island, a remote island in Okinawa, Japan. The island is located approximately 67 km west of Miyako Island (125 min by ferry<sup>22</sup> or 25 min by aeroplane<sup>23</sup>),<sup>24</sup> which is located approximately 300 km southeast of the main island of Okinawa (55 min by aeroplane<sup>23</sup>).<sup>25</sup> Tarama Island belongs to the subtropical zone and is an elevated coral reef with a relatively flat landscape, without mountains or rivers.<sup>26</sup> The island is the main part of Tarama Village,<sup>26</sup> which had a population of 1194 people (470 households) in 2015 (555 women and 639 men), and a population density of 54.3 people/km<sup>2</sup>.<sup>27 28</sup> There were 916 (76.7%) people aged 20 years or older.<sup>29</sup> In terms of the rate of population ageing, 315 (26.4%) people were aged ≥65 years, which was similar percentage to the national average (26.6%).<sup>29</sup> Tarama Village includes three hamlets in which the population is largely ethnically and culturally homogeneous.<sup>26</sup> Compared with the national average (3.8%),<sup>30</sup> a substantially higher percentage (41.6%) of people are engaged in the primary sector (agriculture, forestry and fishery), and most are engaged in agriculture (41.2% of 41.6%).<sup>31 32</sup> However, few people are engaged in fishing (0.4% of 41.6%).<sup>31 32</sup> Therefore, the majority of the island area (92.0%) is used for growing sugar cane and raising beef cattle.<sup>24 33</sup> The average income per person is 1 765 000 yen,<sup>34</sup> which is approximately 45% lower than the national average of 3 217 000 yen.<sup>35</sup>

### Participants

Individuals who lived on the island and who participated in a mass general health check or mass influenza vaccination programme conducted by the municipality were asked to participate in this study. The mass general health check was held on 25 and 26 September 2018, and the mass influenza vaccination programme was held on 13 October, 10 November and 8 December 2018. Individuals younger than 20 years or who lacked decision-making capacity were excluded. Drinking alcohol is prohibited among people under 20 years in Japan, which could potentially prevent respondents in that age group from responding truthfully. Therefore, we only included people aged 20 years or older. Those who met these

criteria were judged to be eligible. By answering a questionnaire, participants were deemed to have agreed to participate in this study. To avoid the possibility of participants completing the questionnaire more than once, participants were asked whether it was the first time they had received the questionnaire. The number of participants determined the sample size.

The mass general health check was intended to engage most people living on the island. In addition, the mass influenza vaccination programme, the cost of which was covered as a public expense, was intended for the whole population. Most of the island's residents were expected to participate in the mass general health check or mass influenza vaccination programme (or both) because of considerable geographical barriers to attending medical institutions located off the island. These conditions enabled this study to be population based.

## Outcome measures

### Alcohol Use Disorders Identification Test

The AUDIT is a 10-item screening tool for hazardous drinking, harmful drinking and alcohol dependence.<sup>19</sup> Each item is scored from 0 to 4 (or 0, 2, or 4), meaning the lowest overall score is 0 and the highest overall score is 40. Higher scores are associated with more severe hazardous drinking, harmful drinking and alcohol dependence. According to the guidelines, AUDIT scores are generally divided into four categories: AUDIT scores <8 indicate 'low-risk drinking'; scores of 8–15 indicate 'hazardous drinking'; scores of 16–19 indicate 'harmful drinking or potential alcohol dependence'; and scores >19 indicate 'suspected alcohol dependence'.<sup>36</sup> These cut-off values are slightly different in Japan: AUDIT scores <12 indicate 'low-risk drinking'; scores of 12–14 indicate 'hazardous drinking'; scores of 15–19 indicate 'harmful drinking or potential alcohol dependence'; and scores >19 indicate 'suspected alcohol dependence'.<sup>17</sup> These Japanese cut-off values were used in this study. For statistical analysis, AUDIT scores were divided into two categories: 'low-risk drinking' reflected by AUDIT scores <12 and 'hazardous drinking or more' reflected by scores of 12–40.<sup>17</sup> AUDIT scores were determined by filling in a self-administered questionnaire.

The second AUDIT item ('How many drinks containing alcohol do you have on a typical day when you are drinking?'<sup>19 20</sup>) and the third item ('How often do you have six or more drinks on one occasion?'<sup>19 20</sup>) required respondents to convert the total amount of alcohol and the concentration they drank into a total amount of ethanol in a 'drink' unit. A preliminary study showed many respondents were unable to answer these two items because of the relatively complicated calculations required for the unit conversion. Therefore, to increase the response rate, these items were modified in accordance with a previously conducted survey<sup>15</sup> with permission of the authors, as follows. The second item was changed to 'What types of alcohol (beer, low-malt beer, chūhai, awamori, haibōru, whisky, wine and sake)

and how much of it do you have on a typical day when you are drinking?' and the third item was changed to 'How often do you have more than four and a half cans of beer or one and a half go of awamori (more than two and a half cans of 9% chūhai, five and a half cans of 4% chūhai, three cans of haibōru, three glasses of double whiskey, five and a half glasses of wine, or three go of sake) on one occasion?' Low-malt beer is a type of alcohol defined by the Japanese Liquor Tax Act as having a taste similar to beer; chūhai is a beverage made by mixing distilled liquor with soda and juice; awamori is a distilled liquor that is indigenous and unique to Okinawa; and haibōru is a beverage made from whiskey with soda. A 'go' is a unit of cubic volume in Japan that is equal to 180 mL. A can contains 350 mL, a glass of double whiskey contains 60 mL and a glass of wine contains 120 mL. The ethanol content is: beer, 5%; low-malt beer, 5%; chūhai, 9% or 4%; awamori, 30%; haibōru, 7%; whisky, 40%; wine, 12%; and sake, 15%. The type of beverage, container size and alcohol content were determined based on availability on the island. In the analysis, the type and number of beverages consumed were converted into a total amount of ethanol in a 'drink' unit.

### Other explanatory variables

Age, sex ('female' or 'male'), marital status ('single', 'married or remarried', or 'divorced or other'), currently living with another person ('not living alone' or 'living alone'), education ('elementary school or junior high school', 'high school or junior high school under the old system', or 'vocational school, junior college, technical school, university, college, graduate school or other'), employment ('full-time job', 'part-time job', or 'not working or other'), physical activity ('not exercising' or 'exercising'), smoking ('never smoker or ex-smoker' or 'current smoker'), age of first drinking, aldehyde dehydrogenase 2 (ALDH2) activity and frequency of engagement in Otōri per month were obtained using a self-administered questionnaire. 'Exercising' was defined as engaging in physical activity for more than 30 min a day two times per week. For statistical analysis, age of first drinking was divided into two categories: '≥20 years or non-drinker' or '<20 years'. Alcohol metabolism involves several major enzymes, including ALDH2.<sup>37</sup> The variant ALDH2\*2 allele is genetic polymorphism that reduces ALDH2 activity dramatically,<sup>37</sup> causing facial flushing, nausea, headache and tachycardia when alcohol is consumed.<sup>38</sup> ALDH2\*2 is uncommon among Europeans but is prevalent in East Asian populations, including Japanese.<sup>39</sup> People with inactive ALDH2 are expected to consume lower amounts of alcohol.<sup>37</sup> In this study, ALDH2 activity was determined based on a previous study.<sup>40</sup> Specifically, the sensitivity and specificity of the method for detecting inactive ALDH2 are reported to be high if two questions are asked:<sup>40</sup> (1) 'Do you have a tendency to flush in the face immediately after drinking a glass of beer (yes, no or unknown)?' and (2) 'Did you have a tendency to flush in the face immediately after



drinking a glass of beer during the first to second year after you started drinking (yes, no or unknown)?' Individuals who answered 'yes' to question (1) were categorised as the 'current flushing' group; those who answered 'yes' to question (2) but not to question (1) were categorised as the 'former flushing' group. Individuals in the 'current flushing' or 'former flushing' groups were classified as having inactive ALDH2. Therefore, ALDH2 activity was divided into two categories: 'active' or 'inactive'.

### Otōri

The frequencies of engagement in Otōri per week, month and year were obtained using a self-administered questionnaire. The frequencies of engagement in Otōri per week and year were converted into frequency per month by being multiplied by 4 or divided by 12, respectively. For statistical analysis, the frequency of engagement in Otōri per month was divided into three categories: 'not engaging' was designated as a frequency of 0; 'low or intermediate frequency' designated as  $\leq 66$ th percentile of those who engaged in Otōri; and 'high frequency' designated as  $>66$ th percentile. Settings in which people engage in Otōri ('at festive occasions', 'with friends', 'with colleagues' or 'with members of a mutual support group') and attitudes toward Otōri ('like', 'somewhat like', 'neither like nor dislike', 'somewhat dislike' or 'dislike') were also obtained using a self-administered questionnaire.

### Statistical analysis

Descriptive analysis was performed to elucidate settings in which participants engaged in Otōri, attitudes toward Otōri, the frequency of engagement in Otōri per month by attitudes toward Otōri, the proportion of participants whose attitudes toward Otōri were 'like' or 'somewhat like' by age group and sex, and the frequency of engagement in Otōri per month by age group and sex. Additionally, the distribution of AUDIT scores and the type and amount of alcohol per day per person calculated in accordance with the second item of the AUDIT were presented. The association between AUDIT scores and the frequency with which participants engaged in Otōri per month was also described.

Logistic regression analysis was performed to evaluate the association between AUDIT scores and frequency of engagement in Otōri per month/other explanatory variables. Using univariate logistic regression analysis, crude ORs and 95% CIs were calculated for the frequency of engagement in Otōri per month/other explanatory variables. Moreover, using multiple logistic regression analysis, adjusted ORs and 95% CIs of frequency of engagement in Otōri per month were calculated with adjustment for age,<sup>2 3</sup> sex,<sup>2 3</sup> marital status,<sup>2 3</sup> currently living with another person,<sup>2 3</sup> education,<sup>2 3</sup> employment,<sup>2 3</sup> physical activity,<sup>2</sup> smoking,<sup>2</sup> age of first drinking<sup>2</sup> and ALDH2 activity.<sup>41</sup> These explanatory variables were selected based on previous research.<sup>2 3 41</sup> Univariate logistic regression analysis was performed using complete data after

listwise deletion. Multiple logistic regression analysis was performed using both complete data after listwise deletion and imputed data after multiple imputation.

Multiple imputation with multivariate imputation by chained equation algorithm was used to deal with missing data. This imputation used all covariates considered to be associated with the missing value. The covariates were AUDIT score, frequency of engagement in Otōri per month, age, sex, marital status, currently living with another person, education, employment, physical activity, smoking, age of first drinking and ALDH2 activity. The results across 100 imputed datasets were combined.

The statistical analyses were performed using Stata/MP V.16.1 (StataCorp, College Station, Texas, USA), and *p* values less than 0.05 were considered statistically significant.

### Patient and public involvement

This study was conducted without patient or public involvement.

### RESULTS

In total, 374 and 573 people participated in the mass general health check and mass influenza vaccination programme, respectively. There was some overlap between these groups. Among 478 eligible participants, 401 answered a questionnaire (the response rate was 83.9%). Of these, 107 did not answer part of the questionnaire but the remaining 294 answered the questionnaire completely (response rate with complete answers was 61.5%). The characteristics of study participants are shown in [table 1](#).

The proportions of women aged 40–59 years and 60–79 years in this study were 17.6% and 19.1%, respectively, which were greater than those in Tarama Village (14.3% and 14.6%, respectively) (online supplemental file A).<sup>42</sup> The proportions of men aged 20–39 years and 40–59 years in this study were 5.5% and 13.1%, respectively, which were smaller than those in Tarama Village (9.5% and 21.7%, respectively) (online supplemental file A).<sup>42</sup>

Among the 91 women and 117 men who drank alcohol, 25 women (29.4%) and 91 men (82.0%) engaged in Otōri (unknown for six women and six men). Among the 127 participants who engaged in Otōri, 72 (56.7%) engaged at festive occasions, 88 (69.3%) with friends, 50 (39.4%) with colleagues and 33 (26.0%) with members of a mutual support group (multiple answers allowed).

The proportion of participants with attitudes toward Otōri of 'like' or 'somewhat like' was 13.8%, whereas the proportion for 'neither like nor dislike' was 31.5% and for 'somewhat dislike' or 'dislike' was 54.8% ([table 2](#)). By group, the frequencies with which participants engaged in Otōri per month were: 4.81 times for 'like', 5.78 times for 'somewhat like', 1.85 times for 'neither like nor dislike', 0.86 times for 'somewhat dislike' and 0.35 times for 'dislike' ([table 2](#)).

**Table 1** Characteristics of study participants

	n	Drinker, n/N (%)
Age, mean (SD), years	60.8 (17.0)	
By age group		
20–39 years	56	43/49 (87.8)
40–59 years	122	90/113 (79.6)
60–79 years	162	62/133 (46.6)
≥80 years	58	11/53 (20.8)
Unknown	3	
Sex		
Female	215	91/198 (46.0)
Male	186	117/153 (76.5)
Unknown	0	
Marital status		
Single	50	29/41 (70.7)
Married or remarried	297	156/263 (59.3)
Divorced or other	52	23/46 (50.0)
Unknown	2	
Currently living with another person		
Not living alone	342	185/300 (61.7)
Living alone	55	22/48 (45.8)
Unknown	4	
Education		
Elementary school or junior high school	161	53/138 (38.4)
High school or junior high school under the old system	139	90/123 (73.2)
Vocational school, junior college, technical school, university, college, graduate school or other	96	63/86 (73.3)
Unknown	5	
Employment		
Full-time job	227	143/202 (70.8)
Part-time job	42	26/42 (61.9)
Not working or other	88	23/83 (27.7)
Unknown	44	
Physical activity		
Not exercising	243	130/221 (58.8)
Exercising	117	65/109 (59.6)
Unknown	41	
Smoking		
Never smoker or ex-smoker	292	145/269 (53.9)
Current smoker	67	50/61 (82.0)
Unknown	42	
Age of first drinking		
≥20 years or non-drinker	248	100/221 (45.2)
<20 years	139	106/123 (86.2)
Unknown	14	

Continued

**Table 1** Continued

	n	Drinker, n/N (%)
ALDH2 activity		
Active	317	171/285 (60.0)
Inactive	72	36/62 (58.1)
Unknown	12	
Frequency of engagement in Otōri per month		
Not engaging	236	80/220 (36.4)
Low or intermediate frequency	93	86/86 (100.0)
High frequency	34	30/30 (100.0)
Unknown	38	
AUDIT scores		
<12	251	115/251 (45.8)
12–14	22	22/22 (100.0)
15–19	33	33/33 (100.0)
>19	20	20/20 (100.0)
Unknown	75	

‘Low or intermediate frequency’=frequency of ≤4 times per month; ‘high frequency’=more than 4 times per month. ALDH2, aldehyde dehydrogenase 2; AUDIT, Alcohol Use Disorders Identification Test; n, number of respondents; N, total number of participants with available data for that variable.

Among the 49 participants whose attitudes toward Otōri were ‘like’ or ‘somewhat like’, 6 were women and 43 were men. Additionally, 38 (77.6%) of these 49 participants were men aged ≥40 years.

The frequency of engagement in Otōri per month by age group and sex is shown in [table 3](#). Women younger than 80 years and men of all ages were found to engage in Otōri.

The distribution of AUDIT scores is shown in [figure 1](#) and [table 1](#). AUDIT scores of ≥12 (‘hazardous drinking or more’) were found in 17 women (9.2%) and 58 men (40.9%) ([figure 1](#)).

Analysis of the second AUDIT item showed that the type and amount of alcohol per day per person were: beer or low-malt beer, 1.77 drinks; chūhai, 0.91 drinks; awamori, 2.56 drinks; haibōru, 0.43 drinks; whisky, 0.08 drinks; wine, 0.14 drinks; and sake, 0.06 drinks.

Among the 251 participants with AUDIT scores <12, 42 (13.1%) participants had ‘low or intermediate frequency’ of engagement in Otōri per month and 7 (2.2%) had ‘high frequency’ of engagement in Otōri per month (unknown for one participant). Among the 75 participants with AUDIT scores of 12–40, 40 (12.5%) participants had ‘low or intermediate frequency’ of engagement in Otōri per month and 21 (6.5%) had ‘high frequency’ of engagement in Otōri per month (unknown for four participants).

Univariate logistic regression analysis showed that compared with ‘not engaging’ in Otōri, ‘low

**Table 2** Attitudes toward Otōri and the frequency of engagement in Otōri per month

	n (%)	N	Frequency of engagement in Otōri				Mean (SD) of frequency of engagement in Otōri
			Women		Men		
			Low or intermediate frequency n (%)	High frequency n (%)	Low or intermediate frequency n (%)	High frequency n (%)	
Like	23 (6.5)	22	1 (0.3)	0 (0.0)	9 (2.5)	6 (1.7)	4.81 (6.56)
Somewhat like	26 (7.3)	26	2 (0.6)	0 (0.0)	10 (2.8)	9 (2.5)	5.78 (6.96)
Neither like nor dislike	112 (31.5)	111	10 (2.8)	2 (0.6)	26 (7.4)	12 (3.4)	1.85 (3.30)
Somewhat dislike	55 (15.5)	55	6 (1.7)	1 (0.3)	12 (3.4)	1 (0.3)	0.86 (1.83)
Dislike	140 (39.3)	139	3 (0.8)	0 (0.0)	14 (4.0)	3 (0.8)	0.35 (1.18)
Unknown	45	10	0	0	0	0	
Total	401	363	22	3	71	31	

'Low or intermediate frequency'=frequency of ≤4 times per month; 'high frequency'=more than 4 times per month. n, number of respondents; N, total number of participants with available data for that variable.

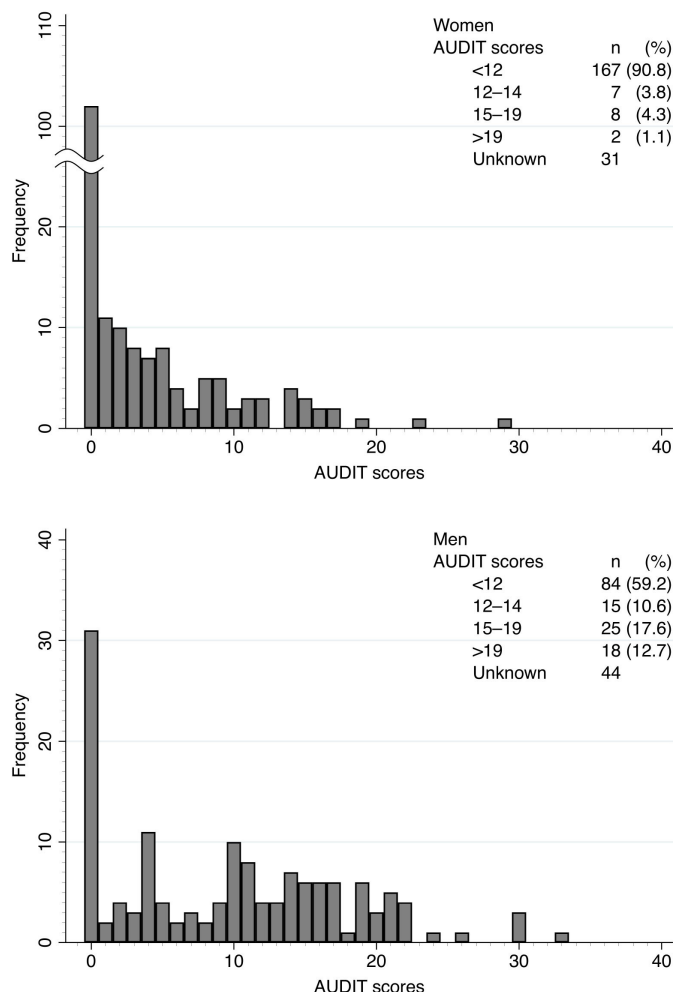
or intermediate frequency' and 'high frequency' of engaging in Otōri per month were associated with AUDIT scores of 'hazardous drinking or more' (ORs of 17.441 and 53.700, respectively; table 4). After adjusting for age, sex, marital status, currently living with another person, education, employment, physical activity, smoking, age of first drinking and ALDH2 activity, multiple logistic regression analysis with listwise deletion

and multiple imputation showed that compared with 'not engaging' in Otōri, 'low or intermediate frequency' and 'high frequency' of engaging in Otōri per month

**Table 3** Frequency of engagement in Otōri per month by age group and sex

	n (%)	N	Low or intermediate frequency n (%)	High frequency n (%)
<b>Women</b>				
By age group				
20–39 years	34 (8.5)	33	10 (2.8)	1 (0.3)
40–59 years	70 (17.6)	64	10 (2.8)	2 (0.6)
60–79 years	76 (19.1)	69	2 (0.6)	0 (0.0)
≥80 years	33 (8.3)	32	0 (0.0)	0 (0.0)
Unknown	2	2	0	0
Total	215	200	22 (6.1)	3 (0.8)
<b>Men</b>				
By age group				
20–39 years	22 (5.5)	20	19 (5.3)	1 (0.3)
40–59 years	52 (13.1)	48	20 (5.6)	19 (5.3)
60–79 years	86 (21.6)	70	26 (7.2)	11 (3.1)
≥80 years	25 (6.3)	24	6 (1.7)	0 (0.0)
Unknown	1	1	0	0
Total	186	163	71	31

'Low or intermediate frequency'=frequency of ≤4 times per month; 'high frequency'=more than four times per month. n, number of respondents; N, total number of participants with available data for that variable.



**Figure 1** Distribution of Alcohol Use Disorders Identification Test (AUDIT) scores. n, number of respondents.

**Table 4** Logistic regression analysis of Alcohol Use Disorders Identification Test scores of ‘hazardous drinking or more’

Explanatory variables	Listwise deletion (N=294)				Multiple imputation (N=401)	
	Crude		Adjusted		Adjusted	
	OR	95% CI	OR	95% CI	OR	95% CI
Age	0.961	0.945 to 0.977	0.981	0.949 to 1.013	0.979	0.949 to 1.010
Sex						
Female	Reference		Reference		Reference	
Male	8.445	4.349 to 16.400	2.775	1.031 to 7.473	2.088	0.832 to 5.238
Marital status						
Single	Reference		Reference		Reference	
Married or remarried	0.735	0.331 to 1.635	2.464	0.750 to 8.089	1.563	0.524 to 4.663
Divorced or other	0.514	0.163 to 1.624	3.567	0.686 to 18.536	1.803	0.395 to 8.231
Currently living with another person						
Not living alone	Reference		Reference		Reference	
Living alone	0.763	0.335 to 1.740	0.814	0.215 to 3.087	0.967	0.274 to 3.408
Education						
Elementary school or junior high school	Reference		Reference		Reference	
High school or junior high school under the old system	2.020	1.042 to 3.918	0.560	0.205 to 1.528	0.673	0.265 to 1.710
Vocational school, junior college, technical school, university, college, graduate school or other	2.662	1.314 to 5.395	1.215	0.383 to 3.848	1.042	0.346 to 3.142
Employment						
Full-time job	Reference		Reference		Reference	
Part-time job	0.298	0.111 to 0.802	0.724	0.202 to 2.602	0.627	0.179 to 2.189
Not working or other	0.082	0.025 to 0.271	0.332	0.084 to 1.318	0.325	0.081 to 1.303
Physical activity						
Not exercising	Reference		Reference		Reference	
Exercising	0.975	0.547 to 1.738	1.482	0.651 to 3.376	1.372	0.621 to 3.029
Smoking						
Never smoker or ex-smoker	Reference		Reference		Reference	
Current smoker	3.433	1.798 to 6.553	1.909	0.750 to 4.864	2.057	0.857 to 4.933
Age of first drinking						
≥20 years or non-drinker	Reference		Reference		Reference	
<20 years	6.737	3.718 to 12.206	2.573	1.137 to 5.823	2.261	1.032 to 4.953
ALDH2 activity						
Active	Reference		Reference		Reference	
Inactive	0.539	0.241 to 1.209	0.658	0.241 to 1.797	0.811	0.326 to 2.019
Frequency of engagement in Otōri per month						
Not engaging	Reference		Reference		Reference	
Low or intermediate frequency	17.441	8.012 to 37.969	6.467	2.469 to 16.941	7.626	2.947 to 19.733
High frequency	53.700	18.485 to 156.001	15.586	4.452 to 54.573	20.321	5.760 to 71.693
Constant			0.056	0.005 to 0.658	0.098	0.010 to 0.982

‘Low or intermediate frequency’=frequency of ≤4 times per month; ‘high frequency’=more than 4 times per month. ALDH2, aldehyde dehydrogenase 2; N, total number of participants with available data.

were associated with AUDIT scores of ‘hazardous drinking or more’ (listwise deletion: ORs of 6.467 and 15.586, respectively; multiple imputation: ORs of 7.626 and 20.321, respectively; [table 4](#)).

## DISCUSSION

Among respondents who drank alcohol, approximately 30% of women and over 80% of men engaged in Otōri in a variety of settings, from casual settings (eg, with friends)

to formal settings (eg, festive occasions). However, approximately 15% reported attitudes toward Otōri of 'like' or 'somewhat like', and around 80% of these participants were middle-aged to older adult men. Additionally, a higher percentage of people on the island had AUDIT scores indicating 'hazardous drinking or more' compared with the national average. 'Low or intermediate frequency' and 'high frequency' of engagement in Otōri per month were associated with AUDIT scores of 'hazardous drinking or more'.

First, approximately 80% of participants with positive attitudes regarding Otōri were middle-aged to older adult men. This suggested that although Otōri appeared to be a drinking custom that had taken root in Tarama Village,<sup>9</sup> the custom was mainly led by middle-aged to older adult men. In Japan, gender equality has not been achieved and the country ranks below the global average because of low economic participation/opportunity and political empowerment for women.<sup>43</sup> In Okinawa, particularly in Tarama Village, the achievement of gender equality is at the lowest level in Japan.<sup>44 45</sup> Therefore, women in Tarama Village may feel obliged to follow the rules of a traditional male-dominated society. Additionally, seniority-based hierarchical relationships are prevalent in Japanese society, where younger people are generally regarded as having less experience and knowledge.<sup>46</sup> Confucianism based on ancestor worship is particularly prevalent in Okinawa, exerting a strong influence and maintaining a culture of reverence for older people.<sup>47 48</sup> Therefore, younger people are expected to defer to older people. Social obligation generated by only approximately 15% of the population, accompanied by gender inequality and seniority-based hierarchical relationships, appeared to exert sufficient pressure on the rest of the population to conform to Otōri. In this study, many of the 85% of respondents who reported 'neither like nor dislike', 'somewhat dislike' or 'dislike' regarding Otōri still engaged in the custom. In terms of age and sex, the results revealed that women under 80 years and men under 40 years who did not have positive attitudes toward Otōri still engaged in the custom.

Second, a higher percentage of people on the island had AUDIT scores indicating 'hazardous drinking or more' compared with the national average. 'Low or intermediate frequency' and 'high frequency' of engagement in Otōri per month were associated with AUDIT scores of 'hazardous drinking or more'. The percentages of AUDIT scores indicating 'hazardous drinking or more' for women and men were 7.1 and 3.9 times higher compared with the national average (1.3% and 10.6%, respectively).<sup>17</sup> The current results revealed a similar tendency to a previous report.<sup>16</sup> An association between heavy drinking and Otōri has also been suggested previously,<sup>15 16</sup> but this is the first study to establish a link between the two. The results described above suggest that social obligation generated by some community members could pressure most of the population into participating in Otōri, possibly leading to a higher percentage of people engaging in hazardous

and harmful alcohol consumption as well as alcohol dependence. Similar examples can be found in other parts of the world.<sup>49</sup> For example, 'buying and shouting rounds' (purchasing alcohol beverages for oneself and others at the same time) is a prevalent cultural practice in Australia, which is believed to increase the amount of alcohol intake through implicit and explicit pressure to consume more and has been suggested to cause alcohol-related harm.<sup>49</sup>

Why does Otōri persist despite its association with hazardous/harmful alcohol consumption and alcohol dependence, and being a possible cause of heavy drinking? A potential explanation is that drinking alcohol plays a role in creating and maintaining social identity and relationships.<sup>8 50–53</sup> For example, in a study of longshoremen in Newfoundland, Canada, drinking was shown to define and strengthen the boundaries of a group of dockworkers. The longshoremen provided mutual support for one another, such as collecting funds for a sick member and donating blood for an injured member. They drank alcohol only with other members of the group, and drinking together played a role in cementing their relationships.<sup>51</sup> Similarly, in a study of fishermen in Clontarf, Ireland, heavy alcohol consumption, which was portrayed as part of masculine identity, was important for cementing relationships in the group.<sup>52</sup> In Japan, social participation is reported to decrease with increasing age among older adults aged 60 years or older.<sup>54</sup> This potential explanation may also be supported by the results of this study that the frequency of engagement in Otōri among older adults aged 80 years or older was relatively low. Therefore, Otōri is predicted to persist in the future as it has over past decades, despite younger people not having a favourable attitude toward the custom, as found in this study. Through social pressure exerted on young men in Otōri via seniority-based hierarchical relationships, these individuals are likely to start undertaking roles in leading the custom as they age. From a biomedical point of view, this regionally specific custom appears to be superficially detrimental to health conditions via the intermediary of alcohol consumption. Similarly, social capital can be a potentially problematic factor that does not always promote better health.<sup>55</sup> For example, this mechanism has been scrutinised in terms of illicit drug use and HIV infection.<sup>56</sup> Less problematic but still harmful behaviour, such as binge drinking, has been found to be positively related to social capital.<sup>57</sup> However, many previous studies reported that social involvement can have a beneficial impact on various aspects of health, including lower total mortality and better health-related behaviour.<sup>58–60</sup> Therefore, healthcare professionals should carefully consider both the beneficial effects on social conditions and detrimental effects on biomedical conditions. Additionally, they should not highlight only one aspect of the two-sided effects when advocating for promoting or abolishing the custom. In alcohol-related policymaking, it is important for discussions to focus on



the regionally specific contexts. For example, in 1983, Ueno Village (present Ueno, Miyakojima City) Assembly approved a resolution to abolish Otōri because excessive drinking associated with Otōri led to several drunk driving-related car accidents, including among minors.<sup>9</sup> However, the resolution failed to abolish Otōri, which still takes place in the area, and a top-down approach to policy decisions was found to be ineffective. The practice of Otōri has been widely and deeply disseminated among the local population; therefore, a bottom-up approach, such as public involvement<sup>61</sup> or community-oriented primary care,<sup>62</sup> could be more appropriate. The same is true of other customs with negative health impacts.

This study had several limitations. First, among participants who answered the questionnaire, 26.7% (107 of 401 participants) did not answer part of the questionnaire. This resulted in missing values, which might have caused selection bias. However, to evaluate the association between AUDIT scores and frequency of engagement in Otōri per month/other explanatory variables, we performed logistic regression analyses using both complete data after listwise deletion and imputed data after multiple imputation. The results showed a similar trend, which partially ensured the internal validity of this study. Second, the proportions of women aged 40–79 years and men aged 20–59 years were greater and smaller than those in Tarama Village, respectively. Therefore, the number of women and men in these age groups who belonged to the frequency of engagement in Otōri per month of ‘low or intermediate frequency’ and ‘high frequency’ categories could have been overestimated or underestimated, respectively. Third, the study sample included people who participated in a mass general health check or mass influenza vaccination programme. This sampling procedure might have selected for people with good awareness about their health compared with the rest of the population. Conversely, those who did not participate in the mass general health check or mass influenza vaccination programme might have had low awareness about their health. These inclusion and exclusion criteria might have led to selection bias; variables that cause or prevent health problems could have been underestimated or overestimated. Moreover, the Japanese Ministry of Health, Labour and Welfare defines moderate drinking as an average of approximately 20 g of pure alcohol (two drinks) per day, and recommends that people drink less than this amount.<sup>63</sup> This recommendation was also announced in a mass general health check in Tarama Village. As a result, AUDIT scores might have been underestimated, particularly among those who participated in a mass general health check every year. Finally, based on a preliminary study, the second and third AUDIT items were modified to increase the response rate. The validity and reliability of the AUDIT has been examined and its guidelines allow researchers to be flexible in modifying the order and wording of AUDIT items to some extent.<sup>15</sup> However, this modification might

have impaired the validity and reliability of the measure. Accordingly, this prevalence study has some recognised weaknesses.

## CONCLUSION

Social obligation generated by some community members could pressure most of the population into participating in Otōri, possibly leading to a higher percentage of people engaging in hazardous/harmful alcohol consumption and alcohol dependence. However, healthcare professionals should carefully consider the beneficial and detrimental effects of the custom on biomedical and social conditions and avoid advocating to promote or abolish the custom by only highlighting one aspect.

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