Geographical disparities in heavy drinking in Japan

Mami Wakabayashi [a]
Takahiro Tabuchi [b]

[a] Women Leaders Program to Promote Well-being in Asia, Graduate School of Medicine, Nagoya University, Nagoya, Japan

[b] Cancer Control Center, Osaka International Cancer Institute, Osaka, Japan

Contextual introduction

In Japan, the total population was estimated to be 126 443 000 in October 2018, comprising 61 532 000 men and 64 911 000 women [1]. The population change rate was -0.21% from 2017 to 2018. With regard to distribution by age group, 12.2% of the population were aged 0-14 years, 59.7% were 15-64 years, and 28.1% were 65 years and over [1]. In 2017, Japan had a high proportion of elderly people and a long life expectancy at birth (87. 26 years in women, 81.09 years in men) [2]. On the other hand, the total fertility rate was 1.43 in 2017 [3]. Japan has 47 prefectures and the capital is Tokyo. Although the population of seven prefectures including Tokyo has increased, the population in the other forty prefectures has declined [1].

Japan was one of the world's largest economies in terms of gross domestic product per capita in 2016 (US $41 129 in 2016) [4]. The Human Development Index was 0.909 in 2018 [5]. This scale gave Japan a rank of 19 out of 189 countries, as one of the very high human development countries. On the other hand, the Gender Gap Index was 0.123, and was ranked 110 among 149 countries, which showed quite high gender inequality in Japan [6].

Japan achieved universal health insurance coverage in 1961 [7] and has maintained its health system ever since. Out-of-pocket expenditure per capita was US $573 368 (based on purchasing power parity) in 2015 and the distribution of medical professional density was in proportion to this (e.g., physicians: 2.4 per 1000 population, nurses: 11.3 per 1000 population) [8]. Disparities in health across regions and socioeconomic groups were fairly small in this homogeneous and egalitarian society [7]; however, some research projects recently revealed several aspects of health disparities in Japan (e.g., health disparities related social class projects from 2009 to 2013 [9]).

Overview of national health promotion policy in Japan

Japan faces an aging population with a falling birth rate and a transition of disease structure. Under these circumstances, Japan is promoting "The second term of National Health Promotion Movement in the twenty-first century (Health Japan 21 (the second term))," from 2013 to 2022 [10].

Healthy Japan 21 (the second term) included 5 basic goals for the implementation of national health promotion: 1) extension of healthy life expectancy and reduction of health disparities, especially focusing on geographical disparities in health, 2) prevention of onset and progression of lifestyle-related diseases (prevention of non-communicable diseases), 3) maintenance and improvement of functions necessary for engaging in social life, 4) establishment of a social environment where the health of individuals is protected and supported, and 5) improvement of the social environment and lifestyle in terms of nutrition and dietary habits, physical activity and exercise, rest, alcohol drinking, tobacco smoking, and oral health [10].

Each goal of Healthy Japan 21 (the second term) has indicators and targets that are scored based on 2010 data. For example, alcohol drinking is one of the lifestyle factors in the 5th basic goal of Healthy Japan 21 (the

second term) as mentioned. For alcohol drinking, there are three indicators: 1) reduction in the percentage of individuals who consume alcohol over the recommended limits (men > 40 g ethanol/day, women > 20 g ethanol/day), 2) eradication of underage drinking, and 3) eradication of alcohol consumption among pregnant women [10]. In this paper, we focus on the first indicator in relation to health disparities. The indicator aims at a 15% reduction by 2022 compared to 2010 (men 15.3% and women 7.5% in 2010). The target percentages of individuals who consume alcohol over the recommended limits were set at 13% in men and 6.4% in women by 2020 [10].

Geographical disparities in heavy drinking in Japan - An epidemiological study

Introduction

Alcohol is recognized as a cause of significant morbidity and mortality worldwide [11-13]. In Japan, heavy drinking contributes to and is a preventable risk factor for adult mortality and morbidity [14-18]. Drinking problems occur across broad health conditions, ranging from mental and physical disorders or diseases. The present study discusses heavy drinking, which is defined as a quantity of alcohol consumption that exceeds an established threshold value [19].

Healthy Japan 21 (the second term) defined heavy drinking as consuming more than 40 g/day of pure alcohol for men and 20 g/day of pure alcohol for women, which increases the risk of non-communicable diseases in the Japanese population [20, 21]. Focusing on the goals of Healthy Japan 21 (the second term), we examined geographical disparities in the prevalence of heavy drinking in Japan. Our objective in this study was to investigate the time trends of geographical disparities in the prevalence of heavy drinking with large nationally representative data and with multiple disparity measurements according to sex and prefecture.

Method

Data

We used data from a nationally representative cross-sectional survey, the Comprehensive Survey of the Living Conditions of People on Health and Welfare (CSLC), which was conducted by the Japanese Ministry of Health, Labour and Welfare [22].The survey is part of a series of triennial surveys and used multi-stage stratified cluster sampling to select 5530 area units at random from approximately 1 040 000 area units as basic statistical areas (selected area had approximately 277 000 households including 688 000 people)[22].

The sample used in the analysis was aged 20-69 years, excluding hospitalized patients and people who did not complete questionnaire items concerning alcohol, in 2013 and 2016 (176 737 men and 186 243 women in 2013; 163 522 men and 171 338 women in 2016). The 2016 data did not include data from Kumamoto prefecture because of the Kumamoto Earthquake [23]. These analyzed data comprised of approximately average 3700 people segregated by sex and prefecture (minimum sample size: 2457 men in Wakayama prefecture in 2013, maximum sample size: 7068 women in Shizuoka prefecture in 2016). Using these samples from the CSLC, the change of prevalence of sex- and age-adjusted rates of heavy drinking and the trends of geographical disparities by prefectures in Japan were analyzed.

In term of ethical considerations, the data from the CSLC did not include any identifiable individual data and the study design was a secondary analysis of this public data.

Status of heavy drinking

The average frequency of alcohol consumption in the questionnaire was represented by eight choices: 7

days/week, 5-6 days/week, 3-4 days/week, 1-2 days/week, 1-3 days/month, seldom, quit, and no drinking. We categorized these average frequencies of alcohol consumption choices into six classes: 7 days/week, 5.5 days/week, 3.5 days/week, 1.5 days/week, 0.5 days/week, and 0 days/week (people who seldom drink, former drinkers, and people who do not drink were considered nondrinkers in this present study). People who reported alcohol consumption 1-3 days/month or more were asked further details on the usual amount of alcohol consumption per day calculated by units of sake (rice wine) when they drink. Each country has its own definition of a standard drink and the Japanese standard drink is one unit[1] of sake (rice wine), regarded as containing 20 g of ethanol [24]. The average amount of alcohol consumption per day when they drink was classified into six choices: < 1 unit/day, 1-2 units/day, 2-3 units/day, 3-4 units/day, 4-5 units/day, and 5 or more units/day. We categorized these average amounts of alcohol consumption choices into six classes: 0.5 units/day, 1.5 units/day, 2.5 units/day, 3.5 units/day, 4.5 units/day, and 5.5 units/day.

Daily alcohol consumption was calculated by combining the average frequency and the amount of alcohol consumption classes per day as follows: "the average frequency of alcohol consumption days/week" multiplied by "the amount of alcohol consumption/day" and then divided into 7 days/week. A heavy drinker was identified as consuming two or more units/day in men and one or more units/day in women, based on the criteria in Healthy Japan 21.

Statistical analysis

We observed the prevalence of heavy drinking adjusted by the standardized population according to sex and prefecture. Direct standardization was used to form an estimate that allows comparing rates from different frequency distributions by age in various prefectures. We calculated the prevalence of heavy drinking in each 5-year age group in each prefecture in each survey year (2013 and 2016) with 5-year age group population by the 2010 national census as the standardized population. Table 1 and figure 1 show the adjusted prevalence of heavy drinking. These statistical analysis were performed using STATA 15 (STATA Corporation College Station, TX, USA).

We analyzed the geographical disparities in heavy drinking with the adjusted prevalence of heavy drinking. Table 2 and figure 2 show the geographical disparities in heavy drinking and the trend from 2013 to 2016 by multiple disparity indicators. We utilized HD*calc software, version 1.2.4 (the National Cancer Institute, Rockville, MD, USA) [25].

Disparity indicators [26-28]

A detailed explanation of the indicators below are given in Harper and colleagues' work. The present study used two absolute disparity indicators: 1) Rate Difference (RD), the absolute inequality between two health status indicators, and 2) Between-Group Variance (BGV), the all squared deviations' summary from a population average. The present study used three relative disparity indicators: 1) Rate Ratio (RR), the comparison between the least healthy group and the healthiest group, 2) Index of Disparity (IDisp), the summary of differences as a proportion of the reference rate, and 3) Mean Log Deviation (MLD), the summary of disproportionality between shares of health and shares of the population. In the present study, the absolute concentration index and relative concentration index were not used because these indicators are based on the seriation of variable groups.

[1] Approximately 2 units of sake (rice wine) is equal to one standard drink in the United Status.

Results

Table 1 shows the prevalence of heavy drinking according to sex and prefecture in Japan. The average heavy drinking rate in men aged 20-69 years was 14.0% in 2013, and 13.3% in 2016. Among men, Akita prefecture had the highest prevalence of heavy drinking in both 2013 and 2016 (21.1% and 20.5%, respectively), while Oita prefecture had the lowest prevalence of heavy drinking in 2013 (11.4%) and Gifu prefecture was lowest in 2016 (10.5%). Among men, Akita prefecture, Aomori prefecture, Kochi prefecture, and Iwate prefecture had considerably higher prevalence of heavy drinking both in 2013 and in 2016 comparing the other fortuy-three prefectures.

Among women, Tokyo had the highest prevalence of heavy drinking in 2013 (11.1%) and Hokkaido was highest in 2016 (11.3%), while Shiga prefecture had the lowest prevalence of heavy drinking in 2013 (6.4%) and Mie prefecture was lowest in 2016 (6.1%).

The prevalence of heavy drinking in men in Japan slightly declined from 14.0% (2013) to 13.3% (2016), while that in women almost remained from 8.2% (2013) to 8.3% (2016). The time trend of heavy drinking prevalence according to sex and prefecture can be observed in figure 1. The prevalence of heavy drinking according to prefecture in men generally decreased from 2013 to 2016, and the prevalence in women slightly increased from 2013 to 2016.

Table 2 shows the values of geographical disparities in the prevalence of heavy drinking by each health disparity indicator. The change in the disparity rate according to sex from 2013 to 2016 is shown in figure 2. The range of change rates in disparity indicators in men was from -16.0% to +17.8%, while that in women was from +13.7% to +51.1%. The range did not exceed 100% in either men or women.

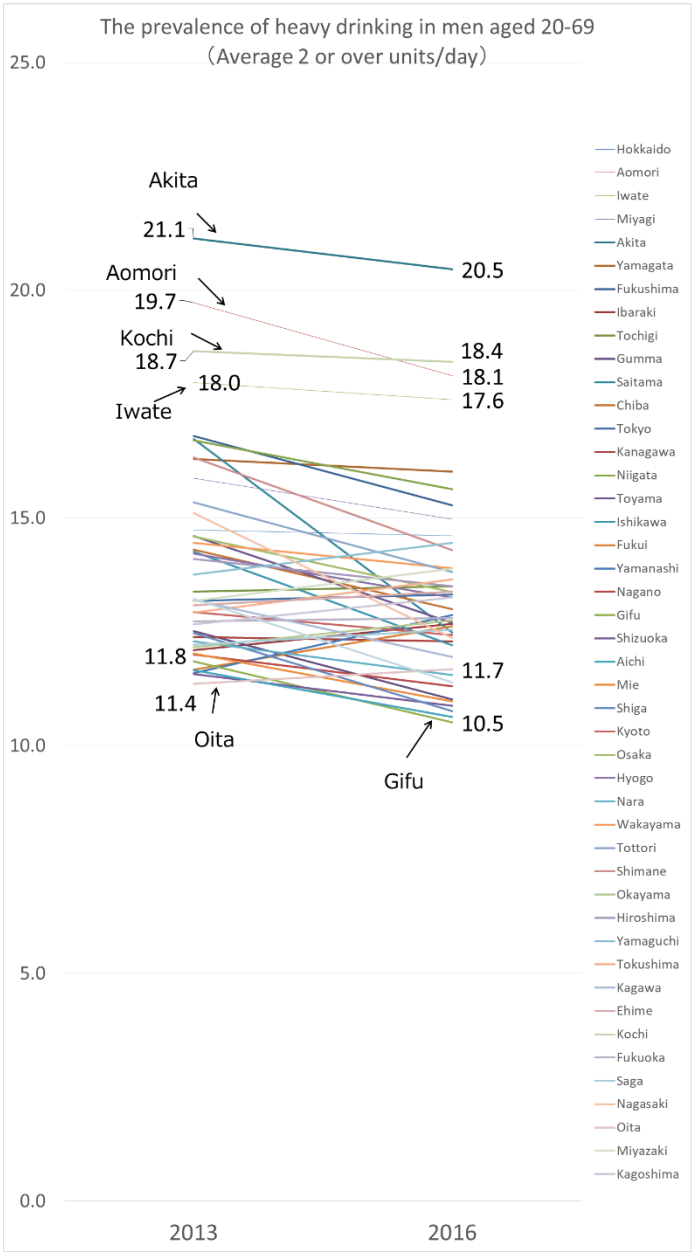
RD and RR in men remained about flat from 2013 to 2016. BGV and MLD in men showed a slight decrease from 2013 to 2016, while IDisp showed a slight increase from 2013 to 2016. There were no extreme values in the range of change rates among all disparity indicators in men, but the directions of each disparity indicator in men were different. In women, all disparity indicators showed an increase from 2013 to 2016 and RD in women had the largest increase among the indicators (the change rate of RD was 51.1%).

Table 1. The adjusted prevalence of heavy drinking in people aged 20-69 in 2013 and 2016 according to sex and prefecture (Men: 2 or more units/day, Women: 1 or more units/day)

	Men		Women	
	2013	2016	2013	2016
Hokkaido	14.7	14.6	10.9	11.3
Aomori	19.7	18.1	10.1	10.4
Iwate	18.0	17.6	9.0	8.9
Miyagi	15.9	15.0	8.4	8.5
Akita	21.1	20.5	9.9	10.9
Yamagata	16.3	16.0	8.1	8.2
Fukushima	16.8	15.3	8.6	8.3
Ibaraki	12.1	12.7	8.0	7.2
Tochigi	13.4	13.5	6.9	8.3
Gumma	12.5	11.0	7.2	7.9
Saitama	16.7	12.5	9.4	8.3
Chiba	14.3	13.0	8.2	9.1
Tokyo	13.2	13.3	11.1	10.6
Kanagawa	12.4	12.3	9.2	9.3
Niigata	16.7	15.6	10.0	11.0
Toyama	14.6	12.7	7.1	7.5
Ishikawa	14.3	12.2	7.7	9.1
Fukui	11.7	12.6	6.6	6.7
Yamanashi	11.6	12.9	7.6	8.1
Nagano	12.0	11.3	7.5	8.4
Gifu	11.8	10.5	6.6	6.4
Shizuoka	11.6	10.9	6.6	7.4
Aichi	11.7	10.6	7.6	7.3
Mie	12.0	11.0	6.9	6.1
Shiga	12.5	10.8	6.4	6.3
Kyoto	12.9	12.4	8.8	9.3
Osaka	14.6	13.4	10.2	9.7
Hyogo	14.2	13.2	7.8	8.1
Nara	12.3	11.6	6.5	7.5
Wakayama	14.4	13.9	7.6	6.8
Tottori	15.3	13.8	7.1	7.3
Shimane	16.3	14.3	7.7	7.5
Okayama	12.2	12.7	6.5	7.7
Hiroshima	14.1	13.5	8.8	8.7
Yamaguchi	13.8	14.4	7.1	8.3
Tokushima	12.9	13.7	7.4	7.5
Kagawa	13.2	11.9	7.7	7.2
Ehime	13.1	13.4	7.4	7.4
Kochi	18.7	18.4	10.9	9.8
Fukuoka	12.7	12.8	8.5	9.0
Saga	12.2	12.5	6.5	6.4
Nagasaki	15.1	12.4	7.3	7.1
Kumamoto	15.1	-	7.2	-
Oita	11.4	11.7	6.8	7.1
Miyazaki	13.2	13.9	8.4	8.8
Kagoshima	12.7	13.2	7.7	7.2
Okinawa	13.2	11.4	8.9	8.7
Japan	14.0	13.3	8.2	8.3

Figure 1. The trend adjusted prevalence of heavy drinking in people aged 20-69 in 2013 and 2016 (Men: 2 or more units/day, Women: 1 or more units/day)

(a) Men



(b) Women

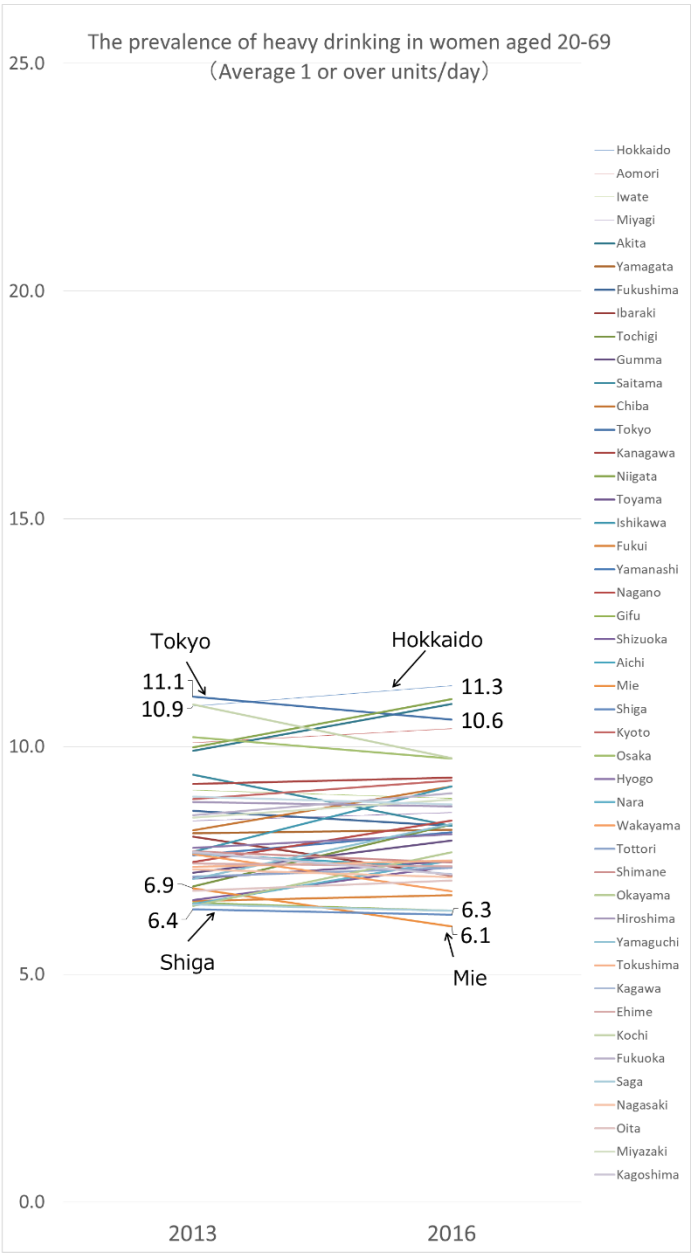
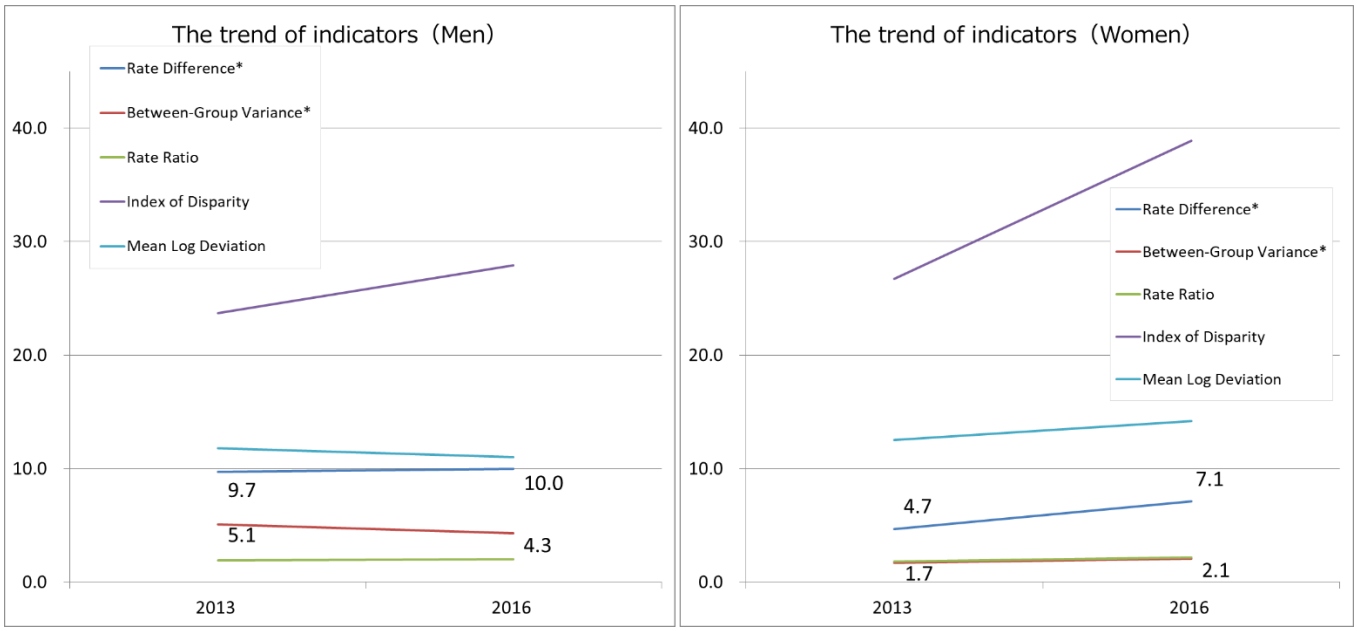


Table 2.Trends in geographic disparities in heavy drinking in people aged 20-69 in 2013 and 2016 (Men: 2 or more units/day, Women: 1 or more units/day)

Disparity indicators	2013 Value (95% CI)	2016 Value (95% CI)	Change rate from 2013 to 2016, %
Men			
Rate Difference*	9.7 (15.3, 4.1)	10.0 (16.2, 3.8)	3.1
Between-Group Variance*	5.1 (8.3, 1.9)	4.3 (7.3, 1.2)	-16.0
Rate Ratio	1.9 (2.6,1.3)	2.0 (2.8, 1.3)	5.5
Index of Disparity	23.7 (52.4, -5.0)	27.9 (61.9, -6.0)	17.8
Mean Log Deviation	11.8 (18.0, 5.7)	11.0 (17.2, 4.8)	-7.2
Women			
Rate Difference*	4.7 (7.6, 1.8)	7.1 (10.7, 3.5)	51.1
Between-Group Variance*	1.7 (2.9, 0.6)	2.1 (3.4, 0.8)	22.6
Range Ratio	1.8 (2.5, 1.2)	2.2 (3.1, 1.5)	24.8
Index of Disparity	26.7 (63.2, -9.9)	38.9 (78.6, -0.8)	45.8
Mean Log Deviation	12.5 (19.2, 5.8)	14.2 (21.1, 7.3)	13.7

Positive percent change means widening the inequality, whereas negative percent change means reducing the inequality.
*Absolute disparity indicators
CI; confidence interval
Estimates were adjusted by x1,000 for Mean Log Deviation.

Figure 2. Trends in geographic disparities in heavy drinking in people aged 20-69 in 2013 and 2016 (Men: 2 or more units/day, Women: 1 or more units/day)



*Absolute disparity indicators

Discussion

The prevalence of heavy drinking across prefectures in women no decreased from 2013 to 2016 (8.2% to 8.3%), while that in men slightly decreased on the whole (14.0% to 13.3%). The prevalence of heavy drinking in women in all prefectures in 2013 exceeded the target prevalence of heavy drinking, which was set in 6.4% for women by 2020 in Healthy Japan 21 (the second term), and in 2016 only two prefectures, Mie prefecture and Shiga prefecture, had newly achieved the target

prevalence in women. On the other hand, the prevalence of heavy drinking in men was close to the target prevalence for 2020 (13% in men). Nineteen prefectures had less than 13% for men in 2013, and twenty-four prefectures in 2016 had achieved this target prevalence in men.

Women have generally lower alcohol consumption compared to men [29, 30], and Asian countries had relatively lower alcohol consumption compared to European countries around 2010 [31, 32]. However, some research showed that women's alcohol consumption tended to increase according to changes in gender norms in the country [33, 34]. The present study showed no decrease in the prevalence of heavy drinking in women in Japan. The prevalence of heavy drinking was relatively higher in some prefectures including big cities such as Sapporo, Tokyo, Yokohama, Osaka, and Fukuoka. The geographic characteristics may also affect heavy drinking in women. Women have a lower capacity for alcohol consumption because of lower ability to metabolize alcohol and lower gastric alcohol dehydrogenase activities. Therefore, we need to consider the long-term effects of heavy drinking on women's health, even though the average prevalence of heavy drinking is still lower than that in men.

The results showed that all disparity indicators in women showed that geographical disparities in heavy drinking had increased, whereas there was a lack of consistency of direction among geographic disparities in heavy drinking in men. There are two type of disparity indicators: absolute disparity indicators and relative disparity indicators. Some authors have said that we need to utilize multiple disparity indicators, including both absolute and relative disparity indicators to evaluate disparity trends [26, 35, 36]. On the other hand, Bhopal suggested that we should use absolute rather than relative indicators [37]. Further discussion is needed to build a broad consensus among researchers about appropriate indicators when evaluating and monitoring disparities.

In women, we observed increases in both absolute and relative disparity indicators. We cannot draw conclusions about geographic disparities in heavy drinking in men because of the lack of consistency, as we could not observe any trends in men among absolute and relative disparity indicators. However this study show the only three years tread of prevalence of heavy drinking. We need to observe more long-term the trends and to evaluate these health disparities indicators carefully to avoid misunderstanding them.

Conclusion with policy implications

To achieve reductions in health disparities as mentioned in Healthy Japan 21 (the second term), it is necessary to evaluate the exact health disparities in Japan. We evaluated geographical disparities in heavy drinking with multiple indicators. The results showed that geographic disparities in the prevalence of heavy drinking in men remained flat, while geographic disparities in the prevalence in women slightly increased. There was a lack of consistency in changes in measures of disparities in men from 2013 to 2016, while changes in all measurements in women showed increases. This study provides basic data for understanding geographical disparities in heavy drinking in Japan. Public health policy and its implementation need to monitor the impact to reassess the effectiveness of the policy.

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