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Trends in inequalities of alcohol-related harms among Thai households: 2007-2017

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ABSTRACT

Background: To estimate and compare the socio-economic inequities in alcohol-related harms among households in Thailand between 2007 and 2017 adjusted for socioeconomic status with the proportions of current and binge drinkers in each household.

Methods: A secondary data analysis of the 2007 and 2017 National Cigarette and Alcohol Consumption Survey was conducted. The unit of analysis was household-level. Concentration index (CI) was used to measure household income-based inequalities in alcohol-related harms (i.e., workplace, domestic, non-domestic, financial, and drinking-and-driving) in the previous 12 months.

Results: Based on data from two waves of survey (n = 66,776 in 2007 and 39,630 in 2017), the prevalence of households that had at least one member who had an alcohol-related harm event was 21.8% and 26.2% in 2007 and 2017, respectively. The highest prevalence was the drinking-and-driving domain (about 20%). The prevalence increased between 2007 and 2017 with an annual rate of change ranged from 1.2 to 4.4%. All of the CI values were negative for both survey waves, except the drink-and-driving domain in 2007. The CI values for all domains in 2017 had a larger magnitude than in 2007, except the domestic domain. For any alcohol-related harm, the CI value was not significant at +0.002 (Standard error [SE] 0.004) in 2007, but significant at -0.014 (SE 0.004) in 2017. So, the index changed around -0.016.

Conclusions: The poor households had a slightly greater tendency to incur harms from alcohol and there existed more inequality in the prevalence of harms in 2017 compared with 2007.

1. Introduction

The harmful use of alcohol ranked among the top five modifiable risk factors for morbidity and mortality throughout the world (Lim et al., 2013). The worldwide social and economic consequences for drinkers and society at large are due to the effects of alcohol (Anderson and Baumberg, 2006; Sacks et al., 2013). Alcohol consumption results in substantial societal costs through loss of productivity, healthcare expense, criminal activity, and violence (Anderson et al., 2009).

Health inequalities are “systematic differences in health between different socioeconomic groups within a society” as defined by Whitehead (Whitehead, 2007). Social inequities in alcohol-related harm do not follow a consistent pattern and can vary due to demographic factors such as economic status, education, sex, ethnicity, and place of residence (Bryden et al., 2013; Grittner et al., 2012b; Katikireddi et al., 2017; Laslett et al., 2017). There is inconsistent evidence on the relationship between socioeconomic status (SES) and alcohol drinking behaviours (Bloomfield et al., 2006, 2008; Dzurova et al., 2010; Peña et al., 2017). Low-and middle-income countries and high-income countries also have different associations (Peña et al., 2017). For example, higher SES was associated with alcohol abuse in Brazil (Almeida-Filho et al., 2005) and alcohol use in India (Subramanian et al., 2005). On other hand, lower SES had a greater chance of alcohol-related mortality in Scotland (Katikireddi et al., 2017)

Most studies on the inequality of alcohol-related harms have focused on biological health effects (e.g., cancers, stroke, hypertension, hospitalization, and mortality) (Jones et al., 2015; Makela and Paljarvi, 2008) and not in terms of social consequences. The SES is often measured in terms of education and occupational social class (OSC) (Jones et al., 2015). The poor tend to suffer higher rates of mortality and morbidity. It depends on (i) preventive domains (i.e., health care utilization, immunization, education, and healthy behaviors – nutrition or exercise) and (ii) risk domains (e.g., living conditions, unhealthy

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Table 1
Questions and categorical responses used for asking alcohol-related harms in 2007 and 2017.

Domain	2007	2017
1st domain: workplace	Have you ever had problems because of you or someone's drinking in this following list? - Your occupation (e.g., sick, fire, low productivity) [] Yes [] No	Have you ever had alcohol-related problems with your occupation (e.g. sick, fire, arriving late, low productivity, jobless)? [] No [] Yes
2nd domain: domestic	Have you ever had problems because of you or someone's drinking in this following list? - Your house? [] Yes [] No	Have you ever had alcohol-related problems in your house? [] No [] Yes, (mental abuse) [] Yes (verbal abuse) [] Yes (physical abuse)
3rd domain: non-domestic	Have you ever had problems because of you or someone's drinking in this following list? - Outside your house? [] Yes [] No	Have you ever had alcohol-related problems outside your house? [] No [] Yes, (mental abuse) [] Yes (verbal abuse) [] Yes (physical abuse)
4th domain: financial	*No question item in 2007*	Have you ever had alcohol-related problems, in term of financial issue? [] No [] Yes
5th domain: drinking-and-driving	Have you ever drunk before or during driving? [] No [] Yes (regular) [] Yes (occasional)	Have you ever drunk before or during driving? [] Yes (regular) [] Yes (occasional) [] No

behaviours – alcohol consumption or smoking). The poor often use health services less, despite having higher levels of need. A lower SES was associated with higher mortality due to alcohol attributable causes (Anderson and Baumberg, 2006) and alcohol-related mortality (Probst et al., 2014).

There is growing evidence in alcohol-related harms at the individual level. Very little is known about the prevalence, trends, and inequality at the household level. There is a clear need to fill this knowledge and evidence gap in this area. It will be beneficial to have the information at the household-level for designing the harms prevention strategies for policy maker. This study aimed to estimate and compare the socio-economic inequities in alcohol-related harms among households in Thailand between 2007 and 2017 adjusted for SES with the proportions of current and binge drinkers in each household. For this objective, the lower SES was hypothesized to be suffer higher probability of alcohol-related harms over the period.

2. Material and methods

2.1. Data and population

This study used data from the 2007 and 2017 National Cigarette and Alcohol Consumption Survey in Thailand, which was first conducted in 2007 and then again in 2011, 2014, and 2017. The surveys of 2007 and 2017 used a stratified two-stage sampling technique to randomly select the households. In the first stage, enumeration areas were randomly selected with probability proportional to size from 77 strata including 76 provinces and the capital city of Bangkok. In the second stage, the households were selected by stratified sampling method. All members aged 15 and older in each household were interviewed by the face-to-face method with trained interviewers.

2.2. Unit of analysis

The unit of analysis in this study was the household level and not the individual level. The household unit was aggregated by combining family units that reside at the same address.

2.3. Independent variables – economic and other socioeconomic status

2.3.1. Measurement of economic status – per capita monthly household income

The main independent variable was the *"per capita monthly individual income"*. For each member in the household, two questions asked about the salary and asset income. The per capita monthly household income was calculated as a summation of monthly individual (or per capita) income of all members in each household and then divided by the total number of members of each household. These values were divided into five equal intervals. The first quintile was the poorest group and fifth quintile was the richest group.

2.3.2. Other socioeconomic status

For other variables, information collected in the survey included community type, region, house owner, household size that were asked directly in the questionnaire and the highest education level, number of persons who were ≥ 60 years old, current drinker(s), and binge drinker (s) in the household. The proportions were calculated from the number of elderly persons, current drinkers, and binge drinkers in their households and then divided by the total household size. We categorized these proportions into three levels including "No", "$< 50\%$", and "$\geq 50\%$".

Current drinkers were defined as those who drank not less than one standard drink of alcohol during the previous 12 months and binge drinker defined as a heavy episodic alcohol consumer and was described as a person who had consumed not less than 60 g of pure alcohol on at least one single occasion during the previous 12 months. This was associated with acute-related harms (e.g., accident, injuries, and social consequence) (World Health Organization, 2015) by alcohol intoxication mechanism (Rehm et al., 2003).

2.4. Dependent variable – alcohol-related harms

The dependent variables were the experiences of five common alcohol-related harms related to (i) workplace, (ii) domestic, (iii) non-domestic, (iv) financial, and (iv) drinking-and-driving (Table 1). We defined the alcohol-related harms in this study as, *who had a history of alcohol-related harms from themselves or others in the last 12 months.* The formats between the 2007 and 2017 questionnaires had a few differences in this part. First, the financial domain was not included in 2007 and the categorical responses were revised in 2017. In 2007, each

Table 2
Number and prevalence of household with any alcohol-related harms.

Variables	2007		2017	
	Total (n = 66,776)	Any alcohol-related harm[1] (n = 14,539, 21.8%)	Total (n = 39,630)	Any alcohol-related harm[1] (n = 18,387, 26.2%)
Community type				
Urban	40,608	8,269 (20.4%)	20,444	5,001 (24.5%)
Rural	26,168	6,270 (24.0%)	19,186	5,386 (28.1%)
Region				
Bangkok (capital)	3,265	297 (9.1%)	2,505	369 (14.7%)
Central	21,877	4,092 (18.7%)	11,670	2,606 (22.3%)
Northern	15,187	4,554 (30.0%)	8,785	2,913 (33.2%)
Northeastern	15,668	4,067 (26.0%)	10,994	3,487 (31.7%)
Southern	10,779	1,529 (14.2%)	5,676	1,012 (17.8%)
House owner				
Own house	49,478	11,027 (22.3%)	31,199	8,329 (26.7%)
Rental house	17,298	3,512 (20.3%)	8,431	2,058 (24.4%)
Household size – Median (IQR)			3 (2, 4)	3 (2, 4)
1 person	8,510	1,026 (12.1%)	7,926	1,282 (16.2%)
2 persons	15,842	2,801 (17.7%)	11,137	2,538 (22.8%)
3 persons	15,851	3,675 (23.2%)	8,782	2,592 (29.5%)
4 persons	13,400	3,507 (26.2%)	6,217	1,947 (31.3%)
≥5 persons	13,173	3,530 (26.8%)	5,568	2,028 (36.4%)
Household member ≥60-year-old – Median (IQR)	0 (0, 1)	0 (0, 1)	0 (0, 1)	0 (0, 1)
Proportions (%)				
No	43,327	10,462 (24.1%)	22,371	6,635 (29.7%)
< 50%	12,180	2,868 (23.5%)	6,750	2,135 (31.6%)
≥50%	11,269	1,209 (10.7%)	10,509	1,617 (15.4%)
Highest education in household				
No formal education	1,167	74 (6.3%)	905	99 (10.9%)
Less than primary school	10,526	1,600 (15.2%)	2,253	406 (18.0%)
Primary school	13,568	3,134 (23.1%)	12,127	2,828 (23.3%)
High school	12,446	3,199 (25.7%)	6,672	2,137 (32.0%)
Senior high school	7,904	2,004 (25.4%)	5,593	1,801 (32.2%)
Vocational certification	7,853	1,979 (25.2%)	4,228	1,345 (31.8%)
Bachelor's degree or higher	12,098	2,321 (19.2%)	7,650	1,743 (22.8%)
Others	1,214	228 (18.8%)	202	28 (13.9%)
Current drinkers – Median (IQR)	1 (0, 1)	1 (1, 2)	0 (0, 1)	1 (1, 2)
Proportions (%)				
No	32,287	1,133 (3.5%)	21,709	1,012 (4.7%)
< 50%	19,523	7,350 (37.6%)	8,725	4,548 (52.1%)
≥50%	14,966	6,056 (40.5%)	9,196	4,827 (52.5%)
Binge drinkers – Median (IQR)	0 (0, 0)	0 (0, 1)	0 (0, 0)	1 (0, 1)
vProportions (%)				
No	59,655	10,621 (17.8%)	31,574	4,875 (15.4%)
< 50%	4,399	2,497 (56.8%)	4,571	3,169 (69.3%)
≥50%	2,722	1,421 (52.2%)	3,485	2,343 (67.2%)
Per capita monthly household income – Median (IQR)[2]	2,250.0 (1,250.0, 4,500.0)	2,000.0 (1,200.0, 4,000.0)	3,333.3 (1,875.0, 6,666.7)	3,000.0 (1,800.0, 5,833.3)
Proportions (%)				
Quintile 1 (poorest)	9,952	2,300 (23.1%)	7,901	2,120 (26.8%)
Quintile 2	16,389	3,986 (24.3%)	7,635	2,357 (30.9%)
Quintile 3	13,724	3,036 (22.1%)	8,241	2,295 (27.8%)
Quintile 4	11,014	2,231 (20.3%)	7,682	1,884 (24.5%)
Quintile 5 (richest)	15,697	2,986 (19.0%)	8,171	1,730 (21.2%)

[1]Any alcohol-related harm: household with any member who experienced harm related to workplace, domestic, non-domestic, financial, or drinking-and-driving domain in the previous 12 months.
[2]Per capita monthly household income.
- 2007: 0–999 Baht for quintile 1, 1,000–1,749 for quintile 2, 1,750-2,982 for quintile 3, 2,983-4,999 for quintile 4, and 5,000–142,000 for quintile 5.
- 2017: 0–1,624 Baht for quintile 1, 1,625-2,666 for quintile 2, 2,667-4,499 for quintile 3, 4500-7,999 for quintile 4, and 8,000–140,000 for quintile 5.

domain (except the drinking-and-driving) was asked in binary responses (No, Yes), while there were four categorical responses (No, Yes – psychological, Yes – verbal, and Yes – Physical) in the 2017 questionnaire. For both waves of survey, the questions about alcohol drinking behaviours and alcohol-related harms used the same time frame of 12 months prior to the interview.

2.5. Statistical analysis

2.5.1. Descriptive statistic and binary logistic regression

The median with interquartile range (IQR) and percentage were used to describe general information. Multiple binary logistic regression analyses were used to examine the associations between socioeconomic factors and alcohol-related harms. All data management and statistical analyses were performed with R-software version 3.4.4 (R Development Core Team, 2015) with the" IC2" package (Plat and Plat, 2015), except calculating 95%CI of the concentration index using STATA 14.1. The level of statistical significance was set to 0.05.

2.5.2. Inequality among poor and rich households using concentration index

We calculated the concentration index (CI) of the prevalence rate to explain the underlying inequity between the alcohol-related harms and their rank in income distribution (Kakwani et al., 1997; Kakwani,

1977). The CI ranges from -1 to 1. The index can be calculated by Eq. 1:

$$CI = \frac{2}{\mu} cov(h_i, r_i) \quad (1)$$

where h_i is alcohol-related harms of i^{th} individual, r_i is the rank of i^{th} individual in terms of household per capita income and μ is the mean of the alcohol-related harms. A positive (negative) index suggests the harms concentrated among rich (poor). A value of zero means there is no inequality. However, the prevalence rate can be influenced by various factors. Therefore, before the calculation, we standardized the rate to keep the other factors, except for the economy status, at the same level to ensure that the rate was influenced by the economy only.

2.5.3. Indirect standardization

The indirect standardization was analyzed by the method of O'Donnel et al (O'donnell et al., 2007). In our study, the household was not self-weighted. Therefore, the standardized y-variable ($\hat{y}_i^{is}$) is obtained from Eq.s 2 and 3:

$$y_i = \alpha + \sum_j \beta_j x_{ji} + \varepsilon_i \quad (2)$$

$$\hat{y}_i^{is} = y_i - \hat{y}_i^{x} + \bar{y} \quad (3)$$

where y is the outcome, x are confounding variables, β_j are the coefficient variables on particular x, and ε_i is the error term of the model (Eq. 2). For Eq. 3, $\bar{y}$ is the sample mean of y, and $\hat{y}_i^{x}$ is the predicted y-variable in a probit regression using the confounding variables including the community type, region, household size, proportion of ageing in household, highest education in household, and proportion of current and binge drinkers in household.

2.6. Ethical consideration

The data used in this study was derived from the Thai National Statistical Office (NSO) directly. Ethical clearance was approved by the Human Research Ethics Committee of the Faculty of Medicine, Prince of Songkla University, Thailand (Ref No. 62-054-18-1).

3. Results

3.1. Descriptive analysis

Among 217,154 and 120,003 eligible participants, the survey was carried out in 66,776 and 39,630 households in 2007 and 2017, respectively (Table 2). Overall, the prevalence of households that had at least one member who had an alcohol-related harm event (i.e., workplace, domestic, non-domestic, financial, and drinking-and-driving) in the previous 12 months was 21.8% and 26.2% in 2007 and 2017, respectively. The prevalence in all geographic data (i.e., community types and regions in Thailand), household profiles (i.e., house owner, household size, and highest education of household member), household member profiles (i.e., proportion of ageing, current or binge drinkers), and economic status (per capital monthly household income) increased from 2007 to 2017.

About half (37.6 to 52.5%) of the households with current drinkers had a history of experiencing harms from alcohol between 2007 and 2017. Moreover, the prevalence of experiencing harms was about 70% in the households that had binge drinkers over the period. The increase in the prevalence of households with current and binge drinkers between 2007 and 2017 was more than 10 percentage points.

3.2. Prevalence of alcohol-related harms

The highest prevalence of alcohol-related harms was the drinking-and-driving domain. About 20% had a history of drinking-and-driving in their households in last 12 months (Table 3). Other domains were less than 6% of all households. The low-income households had more alcohol-related harms in all domains than did the wealthier households.

The prevalence of having experienced all alcohol-related harms increased between 2007 and 2017 with an annual rate of change that ranged from 1.2 to 4.4%. The workplace and drinking-and-driving had the highest annual rate of change during the previous 10 years. In 2007, the highest proportions of alcohol-related harms were in the 2nd income quintile (1,000–1,749 Baht/month), except the domestic and non-domestic domains which were in the poorest quintile. The poorest household groups were the majority that were exposed to all alcohol-related harms, except the drinking-and-driving which was still the highest among quintile 2 in 2017.

3.3. Socioeconomic factors associated with any alcohol-related harms

Eight variables were identified as potentially associated with alcohol-related harms according to the multivariate logistic regression analysis (Table 4).

For the economic status, households in the income quintile 2 were associated with alcohol-related harms in 2007. However, all of the poorer quintiles were associated with higher alcohol-related harm outcomes in 2017: odds ratio (OR) 1.22 (IQR, 1.10–1.37) for poorest quintile, OR 1.32 (IQR, 1.20–1.47) for quintile 2, OR 1.28 (IQR, 1.16–1.41) for quintile 3, and OR 1.07 (IQR, 1.04–1.10) for quintile 4.

There was some consistency in both survey waves. The experiences of any alcohol-related harms were more likely to occur in the Northern and Northeastern regions of Thailand. High school education level or higher increased the probability of alcohol-related harms. Having a current or binge drinker in household also increased the probability of experiencing harms, even if current or binge drinkers were less than 50% of the household members. On the other hand, harms from alcohol drinking were less likely to occur when a member of the household was $\geq$60 years old.

3.4. Any alcohol-related harm and its inequality according to economic status

Table 5 provides the results of using the CI to measure the inequality of alcohol-related harms among the different per capita monthly household income groups. After adjusting for general socioeconomic status (i.e., community type, region, household size, proportion of elderly in the household, highest education in the household, and proportion of current and binge drinkers in the household), all of the CI values were negative for both survey waves, except the drinking-and-driving domain. The results indicated that the poor were at a higher risk of having any alcohol-related harm. The CI values for all domains in 2017 had a larger magnitude than in 2007, except the domestic domain. This meant that the harms were frequent among the poor in 2007 and more frequent in 2017.

For any alcohol-related harm, the CI value was not significant at -0.002 (Standard error [SE] 0.004) in 2007, but significant at -0.014 (SE 0.004) and 2017. So, the index changed around -0.016 (negative direction) which indicated that poor households had a slightly greater tendency to incur harms from alcohol and there existed more inequality in the prevalence of harms in 2017 compared with 2007.

4. Discussion

4.1. Summary of results

This study showed that the lower-income households had more alcohol-related harms in all domains than did the wealthier group in Thailand. The CIs in all domains and both survey waves had negative values and increased during the 10 years (2007–2017). The results of the CI showed a slight increase in economic inequalities in alcohol-related harms among Thai households between 2007 and 2017.

Table 3
Descriptive statistics and socioeconomic characteristics of the sample by income quintile.

Year	Income quintile	Range of per capita monthly household income (Baht)	Number of households	Outcome domain (n, %)					
				1st domain Workplace	2nd domain Domestic	3rd domain Non-domestic	4th domain Financial	5th domain Drinking-and-driving	Any domain[1]
2007	**Quintile 1 (poorest)**	0-999	9,952	308 (3.1)	**443 (4.5)**	**193 (1.9)**	NA	1,934 (19.4)	2,300 (23.1)
	Quintile 2	1,000-1,749	16,389	**545 (3.3)**	701 (4.3)	297 (1.8)	NA	**3,428 (20.9)**	**3,986 (24.3)**
	Quintile 3	1,750-2,982	13,724	384 (2.8)	487 (3.5)	220 (1.6)	NA	2,658 (19.4)	3,036 (22.1)
	Quintile 4	2,983-4,999	11,014	303 (2.8)	328 (3.0)	185 (1.7)	NA	1,916 (17.4)	2,231 (20.3)
	Quintile 5 (richest)	5,000-142,000	15,697	356 (2.3)	370 (2.4)	240 (1.5)	NA	2,606 (16.6)	2,986 (19.0)
	Total		**66,776**	**1,896 (2.8)**	**2,329 (3.5)**	**1,135 (1.7)**	NA	**12,542 (18.8)**	**14,539 (21.8)**
2017	**Quintile 1 (poorest)**	0-1,624	7,901	**562 (7.1)**	**457 (5.8)**	**317 (4.0)**	**299 (3.8)**	1,645 (20.8)	2,120 (26.8)
	Quintile 2	1,625-2,666	7,635	530 (6.9)	426 (5.6)	280 (3.7)	271 (3.5)	**1,958 (25.6)**	**2,357 (30.9)**
	Quintile 3	2,667-4,499	8,241	512 (6.2)	436 (5.3)	255 (3.1)	281 (3.4)	1,868 (22.7)	2,295 (27.8)
	Quintile 4	4500-7,999	7,682	334 (4.3)	321 (4.2)	158 (2.1)	212 (2.8)	1,535 (20.0)	1,884 (24.5)
	Quintile 5 (richest)	8,000-140,000	8,171	187 (2.3)	287 (3.5)	133 (1.6)	193 (2.4)	1,400 (17.1)	1,731 (21.2)
	Total		**39,630**	**2,125 (5.4)**	**1,927 (4.9)**	**1,143 (2.9)**	**1,256 (3.2)**	**8,406 (21.2)**	**10,3387 (26.2)**
Annual rate of change 2007-2017				***+2.6%***	***+2.1%***	***+1.2%***	NA	***+2.4%***	***+4.4%***

NA: No Available Data in 2007.
[1] Any alcohol-related harm: household with any member who experienced harm related to workplace, domestic, non-domestic, financial, or drinking-and-driving domain in the previous 12 months.

Table 4
Socioeconomic factors associated with any alcohol-related harms[1].

Variables	Survey year			
	2007		2017	
	AOR	95% CI	AOR	95% CI
Community type (ref. = Urban)				
Rural	***1.15****	***(1.10, 1.20)***	1.02	(0.96, 1.08)
Region (ref. = Bangkok)				
Central	***2.21****	***(1.94, 2.53)***	***1.77****	***(1.53, 2.04)***
Northern	***3.75****	***(3.27, 4.29)***	***2.70****	***(2.34, 3.13)***
Northeastern	***2.76****	***(2.41, 3.16)***	***2.47****	***(2.14, 2.85)***
Southern	***2.26****	***(1.96, 2.61)***	***1.93****	***(1.65, 2.25)***
Per capita monthly household income (ref. = Quintile 5 (richest))				
Quintile 1 (poorest)	0.93	(0.85, 1.01)	***1.22****	***(1.10, 1.37)***
Quintile 2	***1.07****	***(1.00, 1.14)***	***1.32****	***(1.20, 1.47)***
Quintile 3	1.04	(0.97, 1.11)	***1.28****	***(1.16, 1.41)***
Quintile 4	0.99	(0.93, 1.07)	***1.11****	***(1.01, 1.22)***
Household size (members)	***1.12****	***(1.10, 1.14)***	***1.07****	***(1.04, 1.10)***
Household member ≥60-year-old (ref. = No)				
< 50%	***0.92****	***(0.87, 0.97)***	***0.89****	***(0.82, 0.97)***
≥50%	***0.70****	***(0.65, 0.76)***	***0.75****	***(0.70, 0.81)***
Highest education in household (ref. = Primary school or less)				
High school or higher	***1.16****	***(1.10, 1.22)***	***1.09****	***(1.02, 1.16)***
Current drinkers (ref. = No)				
< 50%	***11.19****	***(10.43, 12.00)***	***10.87****	***(9.95, 11.88)***
≥50%	***14.43****	***(13.43, 15.51)***	***12.84****	***(11.79, 13.99)***
Binge drinkers (ref. = No)				
< 50%	***2.38****	***(2.23, 2.55)***	***3.27****	***(3.02, 3.55)***
≥50%	***2.28****	***(2.09, 2.49)***	***3.37****	***(3.07, 3.69)***

AOR = Adjusted Odds Ratio.
[1] Any alcohol-related harm: household with any member who experienced harm related to workplace, domestic, non-domestic, financial, or drinking-and-driving domain in the previous 12 months.
* p-value < 0.05.

Determinants of any alcohol-related harms were household factors (community type and region), family member factors (household size, elderly members, and education level), and alcohol behaviours (number of currents and binge drinkers in household), and economic status based on per capita monthly household income.

4.2. Comparison with previous studies

We applied the monthly income or wealth, not education level, as the main predictor because the status of education can be affected by age cohort effects. This means that the levels of education increased normally over the years.

Only one study used the CI of wealth-related inequality in the distribution of alcohol-related harms at the household level in Vietnam (Hanh et al., 2019). However, the living-standard was based on only "expenditure in the household". At the individual level, few studies have reported on the CI of the *"education level"* of drinking patterns (Laslett et al., 2017; Peña et al., 2017) which are not directly alcohol-related harms. A study by Grittner U et al (Grittner et al., 2012b) focused on *"alcohol dependence symptoms"* which was close to alcohol-related harms. That study found that a lower education level in both sexes was more likely to report the alcohol dependence symptoms that included feeling of guilt and remorse, loss of short-term memory, unable to stop drinking, and needing a drink in the morning. Our study was also concerned of the inequality based on the level of education. So, we standardized the probability of alcohol-related harms and the CI by education status.

For Thailand during 2012–2013 (Laslett et al., 2017), 10.9%, 16.9%, and 18.0% of high, middle, and low income households, respectively, reported alcohol-related harms to children. The high-income group was less likely to experience harms with an OR of 0.5, compared with the low-income group. The presence of a binge drinker in the household had a 2.5 higher risk of harms to the children. The prevalence of harms to children was 20.2% which was lower than the prevalence of 55% harms to any age group.

In our study, alcohol-related harms were concentrated among the lower economic status. From Alcohol Consumption in Thai Society Report 2017 (Wichaidit et al., 2017), there were slight differences in

Table 5
Inequality in alcohol-related harm in Thailand.2007–2017.

Harms	*2007*		2017		Index change from 2007 to 2017	
	Concentration index (standard error)		Concentration index (standard error)			
	Unstandardized	Standardized[1]	Unstandardized	Standardized[1]	Unstandardized	Standardized[1]
Outcome 1: Workplace domain	***−0.074*** * ***(0.013)***	***−0.033*** * ***(0.013)***	***−0.181*** * ***(0.012)***	***−0.078*** * ***(0.012)***	−0.107	−0.045
Outcome 2: Domestic domain	***−0.128*** * ***(0.012)***	***−0.062*** * ***(0.012)***	***−0.100*** * ***(0.013)***	***−0.045*** * ***(0.013)***	+0.028	+0.017
Outcome 3: Non-domestic domain	***−0.045*** * ***(0.017)***	***−0.042*** * ***(0.017)***	***−0.181*** * ***(0.017)***	***−0.115*** * ***(0.016)***	−0.136	−0.073
Outcome 4: Financial domain	NA	NA	***−0.094*** * ***(0.016)***	***−0.051*** * ***(0.016)***	NA	NA
Outcome 5: Drinking-and-driving domain	***−0.039*** * ***(0.005)***	***+0.010*** * ***(0.004)***	***−0.049*** * ***(0.006)***	−0.005 (0.004)	−0.010	−0.015
Any domains[2]	***−0.046*** * ***(0.004)***	+0.002 (0.004)	***−0.054*** * ***(0.005)***	***−0.014*** * ***(0.004)***	−0.008	−0.016

NA: No Available Data in 2007.
[1] standardized with community type, region, household size, proportion of ageing in household, highest education in household, and proportion of current and binge drinkers in household.
[2] Any alcohol-related harm: household with any member who experienced harm related to workplace, domestic, non-domestic, financial, or drinking-and-driving domain in the previous 12 months.
* p-value < 0.05.

drinking behaviors (i.e., drinking frequency, drinking location, and beverage) among income quintiles. However, this may be explained by lower physical and mental health status (e.g., diabetes, hypertension, and obesity), unhealthy behaviors (e.g., physical inactivity, current smoking) (Lago et al., 2018; Stringhini et al., 2017). This is inconsistent with previous research that included systematic reviews showing controversial results (Bryden et al., 2013; Laslett et al., 2017). The controversial results can be explained by different measurement on SES (i.e., education, occupational class, and economic status), differences study population, or study quality. For example, lower education-based SES was associated with higher abstinence rate in Chile and Finland but a higher prevalence of binge drinkers in Finland (Grittner et al., 2012b). The lowest quintile of household income had a greater risk of alcohol-attributable hospital admission or death in Scotland (OR 3.58, 95% CI 2.43–5.27) (Katikireddi et al., 2017). This could be explained by household members who often faced the effects of alcohol consumption from drinkers in their households. However, this evidence did not apply the CI. A systematic review showed intimate partner violence in the elderly was associated with both low income and a low level of education (Warmling et al., 2017). To date, no systematic review has evaluated these. It would be worthwhile in the future to systematically assess this issue via the systematic review or meta-analysis.

The results from a meta-analysis of the GENACIS study showed that current drinkers were frequent among those who attained a higher education in both sexes (Grittner et al., 2012a). However, some published literature reported opposite results. For example, the CI of binge drinkers was concentrated among those with a lower education in the United States (Harper and Lynch, 2007) and the Czech Republic (Dzurova et al., 2010).

4.3. Strengths and limitations

Most previous studies on alcohol behaviors applied the individual level as the unit of analysis. However, the impact of alcohol can affect not only the drinkers but also the surrounding people, especially the family or household members. The individual level may be appropriate to study the prevalence of drinkers but not for alcohol-related harms. For example, according to Thai Provincial Alcohol Report 2017 (Vichitkunakorn and Tanaree, 2017), 28.4% of the general population was distributed in 53.0% of households in Thailand (data not shown). In policy-driven research or reports, the prevalence at the household level can reflect the real situation rather than the individual level.

However, our study also has some limitations. First, the lack of information on "*monthly expenditure*" was revealed in the survey. Both survey waves included only the *"monthly income"* from salary and asset income. Actually, the most appropriate outcome should be ***"net income"***, which is calculated as the difference between the total income and expenditures. Second, the weighted CI values and prevalence for household level were not included in this study because the NSO did not allow the researchers to represent their data at the household level as the surveys were designed, and the calculated sample size was based on the generalizability at the individual level. Third, the surveys from the NSO were not designed for a comparison between the survey waves because they had some differences in the categorical responses in 2007 and 2017 which could lead to information bias. However, the responses were the largest available and most useful data set to test our research hypothesis. Lastly, the relationship between alcohol consumption and alcohol-related harms is complicated since other behaviours are associated (e.g., smoking, excess weight, and poor diet/exercise) (Bellis et al., 2016). Based on our limited data and secondary analysis, we do not have a credible explanation for the mechanisms between alcohol drinking and harms (e.g., intoxication, emotional response, using substance abuse).

4.4. Implications and further research

The government should more pay attention at the household level in the low-economic status groups. There should be an increase in the number of interventions campaigns and continued support for strategies to prevent new drinkers and binge drinkers, particularly in the lower economic status groups. Pathways or mechanisms of the relationship among socioeconomic status, alcohol consumption, and their harms require further study.

4.5. Conclusion

Our study revealed a disproportionate concentration of the prevalence of alcohol-related harms which was concentrated more in the low-income group. Moreover, the inequality shrunk from 2007 to 2017, which was possibly the result of poorer households having fewer higher alcohol-related harms in 2007 compared with 2017. When the government attempts to develop a new alcohol policy or prevention

strategy, they should keep in mind the inequality of economic status and alcohol-related harms.

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Contributors

Polathep Vichitkunakorn contributed to the study conception, data collection and analysis, wrote the manuscript. Sawitri Assanangkornchai helped to seed the idea of the study, provided guidance throughout the study and revised the manuscript. All of the authors contributed to the manuscript approval.

Declaration of Competing Interest

No conflict declared.

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