Alcohol Consumption in Spatial Dimension

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Abstract

The objective of this study is to present the Prevalent Rate of alcohol Consumption in Phayao through the Spatial dimension. The number of a sampling group is 4,830. Those are Phayao population aged between 10 and 70 years old. The study presents the result analysis with the Prevalent Rate, Moran's Index and Kernel Density Estimation. The study finds that the prevalence of alcohol consumption of Phayao population is 54.6 and the Spatial Distribution Pattern of consumption is a random pattern. The alcohol consumption is prevalent in the north and the west of Phayao, especially municipality of Mueang Phayao district, Dok Khamtai district and Chiang Kham district. The output of the study shall be deemed as an academic research. It is to examine the real situation of the alcohol consumption in Phayao province. This can be further used as for decision-making on planning, preventing, controlling and monitoring problem.

1. Introduction

Alcohol consumption is the crucial health problem in most countries around the world. As per the World Health Organization's report, it notes that throughout the world there have been populations caused to death due to injury and disease attributable to alcohol consumption approximately 3 million ones per year or accounting for 5.3 % of all deaths worldwide whereas 7.2 % have early died from disease and illness related to alcohol consumption particularly from injury caused by accidents and suicide (WHO, 2018) due to excessive alcohol consumption (Demirkol et al., 2011). The 2016 report showed that an approximate 2.3 billion of populations around the world or 43 % of the whole were heavy drinkers with an average/person/year was 6.4 liters of pure alcohol. It is forecasted that in future the consumption quantity, particularly in Southeast Asia, shall increasingly reach to 1.7 liters/person/year in 2025 (WHO, 2018). For Thailand, alcohol prevalence tends to be higher every year. As per the survey data of the National Statistical Office of Thailand in 2017, it is found that the numbers of heavy drinkers or alcohol drinkers are 15.89 million accounting for 28.4 % of all Thai populations and 35.4 % or the highest proportion are in northern whereas 32.8 % in northeastern, respectively. The highest numbers or 16.0 % of populations drinking more frequently or at least once a week show in northern and ranking in order as central region at 13.7%. The top 5 of provinces reflecting the alcohol prevalence in older age groups consist of Chiang Rai, Lamphun, Phayao, Nan and Surin representing 45.3, 44.1, 44.0, 42.4 and 40.6 %, respectively. According to the afore mentioned data, the numbers of northern drinkers are proportionately higher than an overall of the country (National Statistical Office, 2017). This is in line with the survey data on local liquor factories of the Center of Alcohol Studies (CAS) stating that in 2013, there were 3,800 liquor factories in rural areas and a half of them were located in northern. This therefore indicates behavioral tendency of the alcohol consumption and production which appear apprehensively high (Center of Alcohol Studies, 2014) particularly in Phayao that once in 2011 used to be the top of provinces having the highest alcohol consumption rate of Thailand and currently its consumption rate remains on top and

higher continuously. Most populations drinking habit are partly influenced by their northern culture particularly in a rural agglomerative and united community society whose lifestyle relies on agriculture and cooperation of neighbors or people in the same society. According to the study of Wises Sujinnapram and Sahathaya Wises in 2016, it explained that in Phayao communities, alcohol was consumed during both traditional events i.e. wedding ceremony, housewarming, other celebrations and temple festival (Poi Luang Festival) as well as thank-you party for people rendering assistance for crop harvest. Consequently, the local liquor or homemade liquor then becomes a part of such social activities and helps economize the expenses of buying other fermented or distillated ones. In addition, as a result of the rapid growth of Phayao, it causes an availability of alcoholic beverages (Sujinnapram et al., 2016) as currently appeared that there are plenty of supplying sources or alcohol selling shops in both urban and rural areas which provide more convenience of availability of alcoholic beverages for both old and new drinkers (Ministry of Public Health, 2015) particularly in pubs near the main educational institutes of the province including Phayao Lake at the municipal area, the center of the province and pubs.

As mentioned above, the alcohol consumption behavior of Phayao populations are diversified and different in each area, both in urban and rural ones, in view of availability including type or category of alcoholic beverages. Understanding the alcohol consumption in spatial dimension and consumption prevalence scattering in each area of Phayao shall thereby contribute to project or activity arrangement to promote and launch a campaign to reduce abandon and abstain from alcohol consumption that are appropriate and consistent with the social contexts of each different area. Currently, the spatial information and map are considerably applied for public health works since both can indicate location and dispersion of health data and spatial analysis to demonstrate size, quantity, dispersion direction, density and difference of spatial health data as well as correlation between prevalence and dispersion of health incidents focusing on characteristic of geographic environment or relevant factors that shall be very helpful for planning the development of health utility and spatial surveillance of people health problem (Matthews, 1990). Thus, the study on alcohol consumption of the people in Phayao through analysis of the prevalent rate, prevalent dispersion pattern and reflection of the prevalent rate or density of the alcohol consumption in spatial dimension at community level shall be deemed as an academic research to examine the real situation in this area to be further used as database of alcohol-related harm in parallel with the implementation of task in compliance with the government policies of driving health and social problem solving so as to be conducted properly, acceptable, consistent with the target, minimize time spent and budget of effective solving problem of alcohol consumption in Phayao.

2. Research Objective

To analyze the spatial patterns of alcohol consumption in Phayao province, Upper Northern Thailand, in terms of their geographical distributions.

3. Research Methodology

The Research Methodology is summarized in the flowchart shown in Figure 1.

3.1 Data Acquisition

3.1.1 Research papers relevant to the prevalence and alcohol consumption behavior of people in upper northern area were studied and reviewed.

3.1.2 Population consists of people at age between 10 – 70 years old in Phayao house registration, totally 401,271 persons (data gained from statistic system of house registration as of December 2017).

3.1.3 Sampling group consists of people at age between 10 – 70 years old in Phayao calculated by prevalence of Phayao drinkers in 2017 (P = 0.44) (National Statistical Office, 2017) with 5% deviation of the prevalent rate (e = 0.022), design effect = 2.5 gaining the sampling group of 4,889 participants. The random sampling was conducted, without nonprobability sampling, by quota sampling scattering based on population size in each sub-district (68 sub-districts) of Phayao.

3.1.4 The survey on alcohol consumption behavior was conducted by using a developed questionnaire with the sampling group of 4,889 participants from 9 districts (68 sub-districts) of Phayao with no evidence record of names, surnames or actual addresses to prevent them from an unintentional impact. The respondents were not charged for answering the questionnaire, no risk or negative effect that maybe incurred. Moreover, the research was conducted with the respondents, willingness and in case of unwillingness or reluctance during answering, their withdraws can be made at all times.

All these data were incorporated into a geographic information system (GIS).

3.2 Data Preparation

3.2.1 The prevalent rate of alcohol consumption was calculated, then dividing the number of drinkers by the number of all samplings and forecasted at 95% confidence interval: CI (Hosiri et al., 2016).

3.2.2 The alcohol consumption prevalence of Phayao people was analyzed and concluded through demonstration of spatial information in view of current consumption behavior (no drinking, rarely drinking (at average of not less than 4 times/month), regular weekly drinking (at average of at least once a week) and regular daily drinking) whereas those information and research findings shall not be disclosed or demonstrated at an individual level but at the sub-district level including an overview of the province.

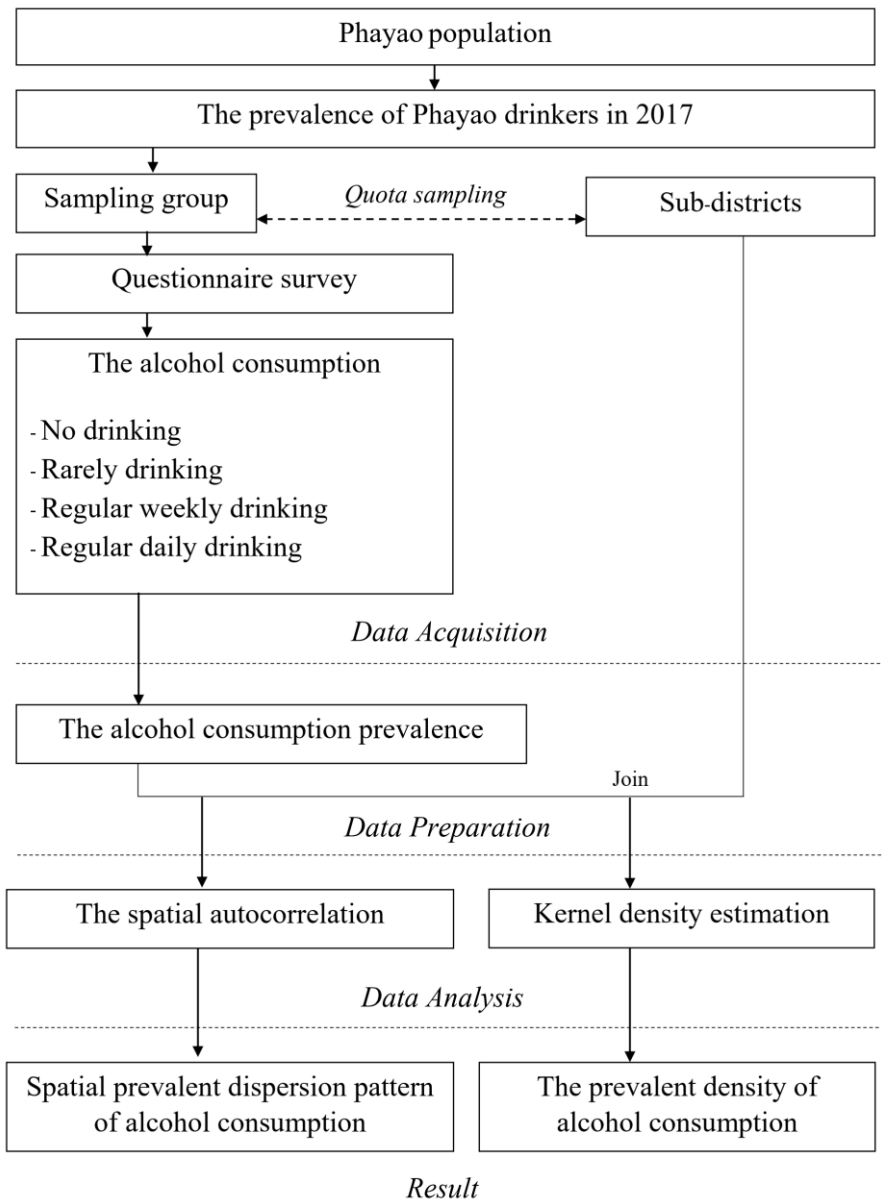

Figure 1: Geospatial trend of alcohol consumption

3.3 Data Analysis

3.3.1 The classic index of spatial autocorrelation (Moran's I) was used to evaluate autocorrelation in the spatial distribution of alcohol consumption. Moran's I was the best way to measure the spatial autocorrelation (feature similarity) based on both feature locations and feature values simultaneously. The spatial statistic was given as:

$$Moran's\ I = \frac{n \sum_{i=1}^{n} \sum_{j=1}^{n} w_{i,j} z_i z_j}{S_o \ z_i^2}$$

Equation 1

where z_i was the deviation of the prevalent rate attribute for sub-district feature i from its mean ($x_i - \bar{X}$), $w_{i,j}$ was the spatial weight between sub-district feature i and j, n was equal to the total number of sub-district features, and was the aggregate of all the spatial weights:

$$S_o = \sum_{i=1}^{n} \sum_{i=j}^{n} w_{i,j}$$

Equation 2

In this study, given a set of sub-district features and an associated the prevalent rate attribute, it evaluates whether the spatial pattern presented was clustered, dispersed, or random. When the index was calculated, the value was between -1 and 1. In case the value was nearly 1, it indicated that the prevalent dispersion was the clustered pattern whereas the value nearly -1, it was the dispersed pattern. in case of the value was equivalent to 0, therefore it was the random pattern or variable pattern (Goodchild, 1986, Harries, 1999, Nakhapakorn and Jirakajohnkool, 2006 and Fang et al., 2006). The statistical significance level for this research was set at 0.05.

3.3.2 Previous spatial autocorrelation analyses evaluated the spatial distribution pattern of alcohol consumption only the global level. In the local level, kernel density estimation (KDE) can be used to detect the hotspot of observed events by creating a continuous surface representing the prevalent density of alcohol consumption per unit area. Across the study area, KDE created a set of cones or kernel centered over each sub-district feature points, generating a continuous map of the prevalent density. The predicted density at a new location was determined by the following equation:

$$The\ Predicted\ Density = \frac{1}{r^2} \sum_{i=1}^{n} [\frac{3}{\pi} x_i \ (1 - \left(\frac{d_i}{r}\right)^2)^2]$$

Equation 3

where x_i was the prevalent rate attribute of sub-district feature i within the radius distance (r) of the kernel centered, d_i was the distance between sub-district feature i and the kernel centered.

The calculated prevalent density was then multiplied by the number of sub-district feature points, or the sum of the prevalent rate field if one was provided. In this study, the radius of each cone was set to 6,327 meters (an average of nearest distance between sub-districts) that was estimated to reflect the intensity of alcohol consumption. Each cell on the map surface was assigned KDE such that cells at the center of the cone receive higher prevalent rate estimates, and cell at the cone's periphery receive smaller prevalent rate estimates (Parzen, 1962, Osei and Duker, 2008 and Chainey and Ratcliffe, 2005).

4. Results

Among 4,889 respondents, the data of 4,830 were collected accounting for 98.8% as per the following findings:

4.1 The analysis result of alcohol consumption prevalence of the sampling group shows that currently there are alcohol consumption in 2,640 respondents representing the prevalent rate of 0.546 or 54.6% and it is forecasted that in fact, the drinkers will be accounted for approximately 53% to 56 % (Prevalent Rate = 54.6; 95% CI: 53.2, 56.0). Considering and classifying based on their consumption behavior, it is found that the consumption of the sampling group is rarely/infrequent drinkers (at average of lower than 4 times/month) and the number of them is 1,088 or equivalent to 0.225 prevalent rate or 29.5 % while it is forecasted that in fact, there may be rarely/infrequent drinkers accounted for approximately 21 to 24 % (Prevalent Rate = 22.5; 95% CI: 21.4, 23.7) whereas 1,423 are the weekly drinkers (at average of at least once per week) equivalent to 0.295 prevalent rate or 29.5 % and in fact there may be approximately 28 to 31 % weekly drinkers (Prevalent Rate = 29.5; 95% CI: 28.2, 30.7). The number of the respondents who are the daily drinkers or drink every day is accounted for 129 which is equivalent to 0.027 prevalent rate or 2.7 % and in fact there may be

approximately 2 to 3 % daily drinkers (Prevalent Rate = 2.7; 95% CI: 2.2, 3.1).

4.2 The analysis result of the prevalent dispersion pattern of alcohol consumption is as shown in Table 1. Considering based on Moran's Index, it is found that overall value of the prevalent dispersion of alcohol consumption in Phayao is nearly 0 meaning that the prevalent dispersion is the random pattern or uncertain pattern; in other word, high prevalence of alcohol consumption is not limit to any specific area and can be thereby arisen in all areas of Phayao.

4.3 The analysis result of the prevalent density of alcohol consumption per unit area can be demonstrated in a form of spatial information or map for more understanding about the prevalence or consumption behavior of the people in each area of Phayao as shown in Figure 2.

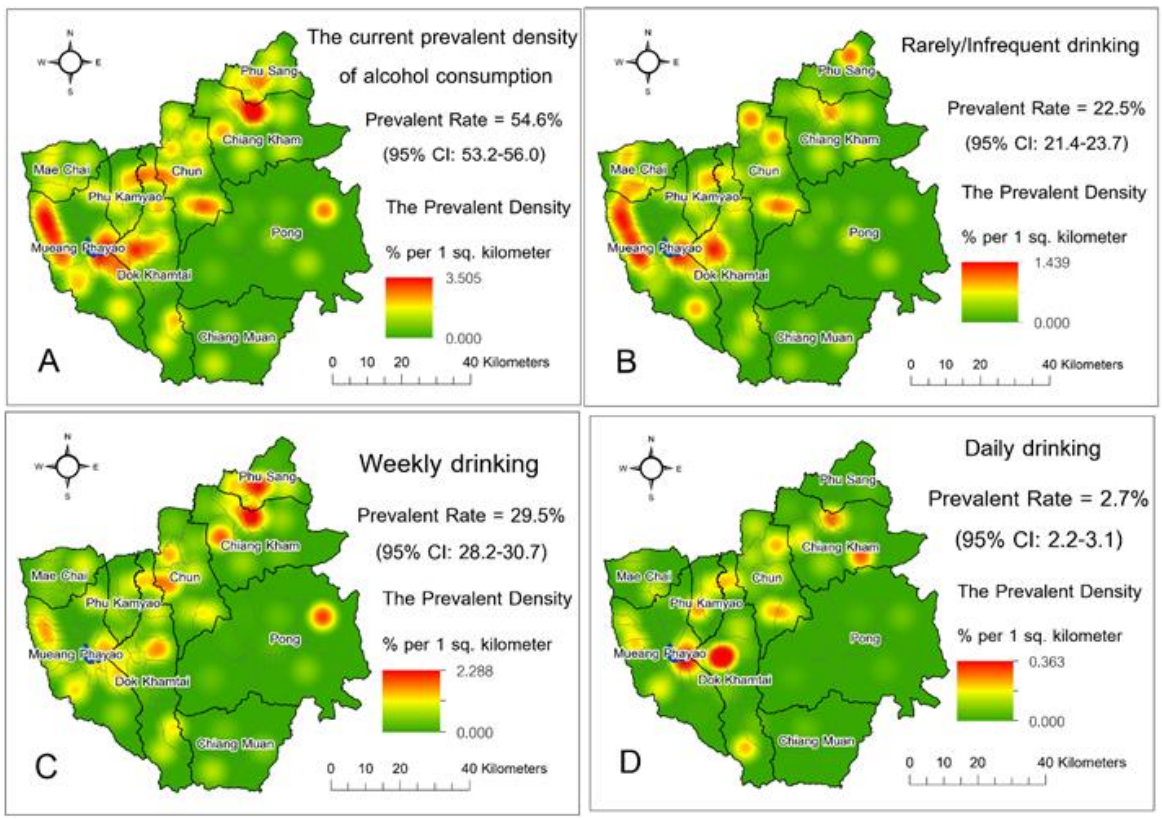

Figure 2: The current prevalent density of alcohol consumption (A), The prevalent density of rarely/infrequent alcohol consumption (B), The prevalent density of weekly alcohol consumption (C) and The prevalent density daily/everyday alcohol consumption (D)

Table 1: Spatial Prevalent Dispersion Pattern of Alcohol Consumption in Phayao

Consumption Behavior	Moran's I	P-value	Spatial Dispersion Pattern
Rarely/Infrequent drinking	0.023	0.544	Random Pattern
Weekly drinking	0.026	0.502	Random Pattern
Daily drinking	-0.012	0.967	Random Pattern
Currently keep drinking	0.017	0.608	Random Pattern

Applying Kernel density estimation method to display the results of the prevalent density of alcohol consumption per unit area in a form of continuous surface can obviously indicate the different prevalent dispersion of alcohol consumption in each area of Phayao. In other words, the prevalent density of alcohol consumption in Phayao currently appears in the plain areas between mountains where people reside and highest density is equivalent to 3.505 % per 1 sq. kilometer. The current prevalent density of consumption also appears in the north and west of the province particularly in municipal area of Mueang Phayao, Dok Khamtai and Chiang Kham Districts having urbanization and high population density per unit area. Considering the prevalent rate in terms of consumption behavior classified into 3 groups, it is found that the current prevalent rate of rarely/infrequent consumption in Mueang Phayao and Dok Khamtai Districts are different from the prevalence of weekly consumption (at average of at least once per week) whose density of consumption appears in the north of the province or in Chiang Kham and Phu Sang Districts and the prevalence of daily/everyday consumption obviously appears in the commercial zone of Mueang Phayao District close to Phayao Lake and municipal areas of Dok Khamtai District.

5. Discussion and Conclusion

In spatial dimension, Phayao prevalent rate of alcohol consumption is not limit to any specific area and can occur in all areas of both urban and rural ones since probably its society and areas mostly have similar community culture of which lifestyle relies on agriculture and community activity required for collaboration of people in the same society. The alcoholic beverages are traditionally used to be a part of activity arrangement for festivals, celebration or other activities within their community (Sujinnapram and Wises, 2016). Demonstration of the prevalent data by applying Kernel density estimation method can obviously indicate location, size, dispersion pattern, density of alcohol consumption data as well as difference of the prevalent rate in each Phayao area (Chaikaew et al., 2009 and Pimsawan, 2010), help provide a guideline for risk and health impact assessment attributable to alcohol consumption of the people at area level of authorities concerned with public health of the province. Those authorities can utilize these spatial data showing risk level, incident and severity level including scope of impacted or at-risk areas related to people health problem attributable to alcohol consumption for their decision-making on planning for appropriate and efficient provision of substantial and adequate resource for handling, preventing, controlling and monitoring problem (Kongman, 2010).

This study concentrated on the issue of analyzing and demonstrating of consumption behavior of Phayao people in spatial dimension reflecting an overview at the district and provincial levels only excluding the analysis of significant difference or correlation between factors affecting alcohol consumption behavior in each area; individual factor (gender, age, income, occupation, knowledge on consumption and alcohol-related harmful side effect, etc.), social context (alcohol consumption of close persons) and physical & cultural environment (number and location of beverage supply shops, pubs, attitude towards alcohol consumption), etc. (Ministry of Public Health, 2015, Kimwatu et al., 2015, Papomma, 2015, Hashim et al., 2017 and Changkit and Nualchawee, 2018). These factors can be analyzed, explained and interpreted in spatial dimension to enhance understanding about alcohol consumption behavior of Phayao people in terms of both direction/dispersion pattern and quantity of correlation that are varied in each area to be more completed, reliable and further theoretically referable.

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