The Distribution of Public Tobacco Cessation Clinics in Relation to the Socioeconomic Status of the Malaysian Population

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ABSTRACT

Objective: To identify, locate, and examine the distribution of public tobacco cessation clinics in all Malaysian states using a Geographical Information System (GIS) and determine the relationship between the distribution of public tobacco cessation clinics and the population's socioeconomic status.

Material and Methods: All registered public tobacco cessation clinics in each state were identified through the mQuit website. Based on the extracted addresses, each clinic's coordinates (longitudes and latitudes) were traced using Google Maps and transferred into Geographical Information System (GIS) for mapping purposes.

Results: Wilayah Persekutuan (W.P.) Kuala Lumpur recorded the lowest ratio of public tobacco cessation clinics to the number of smokers, with 1:25,265 (one clinic to 25,265 smokers), while the highest ratio was in W.P. Putrajaya, with 1:2,118. In relation to socioeconomic status, the highest mean household income was recorded in W.P. Kuala Lumpur (mean gross income: RM 11,692), the same state with the lowest ratio of public tobacco cessation clinics. In contrast, Kelantan had the lowest mean household income (mean gross income: RM 4,214), and the ratio of public tobacco cessation clinics to the number of smokers was 1: 8,383. The distribution of public tobacco cessation clinics was highly concentrated in the capital area compared to other areas in Malaysia.

Conclusion: This study demonstrated the distribution of public tobacco cessation clinics using GIS. The findings showed an unequal distribution of public tobacco cessation clinics, with low distribution, especially in Sabah and W.P. Kuala Lumpur.

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INTRODUCTION

Tobacco use is the single greatest preventable cause of death today (WHO, 2008). The World Health Organization (WHO) reported that tobacco use contributed to six leading causes of death worldwide (WHO, 2015). Based on the statistics from the Ministry of Health, Malaysia (MOH) in 2006, diseases related to smoking remained the top causes of mortality in the MOH hospitals, apart from accounting for more than 15% of hospitalisations and 35% of in-hospital deaths. The total burden of top cancers among men (cancers of the trachea, bronchus, lung, mouth, and oropharynx) are all attributable to smoking (Ministry of Health, 2008). Furthermore, smoking kills 20,000 Malaysians every year, and the number was estimated to increase to 30,000 by the year 2020 if the prevalence of smoking among the population remained high (Lim et al., 2022).

In May 2003, the 192 WHO Member States adopted the WHO Framework Convention on Tobacco Control (WHO FCTC), the first coordinated global effort to reduce tobacco use (WHO, 2003). The WHO FCTC was formally ratified on 27 February 2005. All the countries were expected to implement the necessary comprehensive measures encompassing the control of demand and supply of tobacco products, counteracting the tobacco industry, and promoting international cooperation for global action. The WHO FCTC is one of the most widely embraced treaties in the United Nations (UN) history. Malaysia is one of the countries that have participated in the treaty since its adoption in September 2005. Article 14 of the WHO FCTC demands that "each Party shall develop and disseminate comprehensive, appropriate, and integrated guidelines based on the scientific evidence and best practices that take into account national circumstances and priorities and shall take effective measures to promote cessation of tobacco use and adequate treatment for tobacco dependence" (WHO, 2003).

The provision of universal health care service coverage is one of the key principles in the Alma Ata Declaration to improve population health (WHO, 1978). In commitment to Global NCD Target 2025, the Ministry of Health (MOH) Malaysia proposed two main strategies in 2015 to achieve a reduction of the number of smokers to 30% by the year 2025 (Ministry of Health, 2015). They are i) to achieve tobacco cessation by helping existing smokers to beat their nicotine addiction and ii) to reduce smoking initiation among youths (Ministry of Health, 2015). In line with that, a National Strategic Plan on Tobacco Control was put in place by the MOH in 2015 (Ministry of Health, 2015). Under the plan, the MPOWER (Monitor tobacco use and prevention policies, Protect people from tobacco smoke, Offer help to quit tobacco, Warn about the danger of tobacco, Enforce ban on tobacco advertising, promotion and sponsorship, Raise taxes on tobacco) strategy was established to coordinate tobacco control in Malaysia. One of MPOWER's strategies was to develop a standardised service across the public (government subsidised) and private (non-government subsidised) healthcare facilities in Malaysia through the development of the mQuit Programme and Clinical Practice Guideline (CPG) (Malaysian Pharmaceutical Society, 2019). mQuit is an integrated service to support smoking cessation among the population by providing: (i) customised plans, resources, and advice on quitting smoking; (ii) dedicated healthcare professionals for comprehensive follow-up sessions; and (iii) nicotine replacement therapy to those who need pharmacological assistance in quitting smoking. This programme was developed by the Department of Public Health of MOH and C-Tob (Clearing House of Tobacco Control of the National Poison Center) (Malaysian Pharmaceutical Society, 2019). It involves collaborative efforts from the MOH, Academy of Pharmacy, Malaysian Pharmaceutical Society, Johnson & Johnson, and various other non-governmental organisations (NGOs). The tobacco cessation services are free-of-charge in public health clinics and are favoured by Malaysian smokers from low and middle socioeconomic classes because similar services are quite costly in private clinics (Syed Junid, 2007). Additionally, MOH and the National Poison Centre established 'Infoline' and 'Quitline', respectively, to offer cessation assistance for smokers intending to quit.

Geographical Information System (GIS) is software designed to capture, store, manipulate, and comprehensively analyse geographical data (Ali, 2020). GIS is widely used in many sectors to visualise secondary data, including health and human services, telecommunication, urban planning, and insurance (Cowen, 1990). Previously, GIS has been used in studies in Malaysia that analysed dental service distribution in 2016 and flood disaster management (Bohari et al., 2019). Apart from that, GIS has also been applied in recent research that mapped the distribution of smokers across the capital city (Valiente et al., 2019). This study aimed to identify, locate, and examine the distribution of public tobacco cessation clinics in every state in Malaysia by using GIS and to determine the distribution of government tobacco cessation clinics in relation to the number of smokers and socioeconomic status of the population.

MATERIAL AND METHODS

Data were collected from 1 May 2019 to 30 November 2019 from open-access sources. All data were de-identified; thus, no ethical approval was required.

To obtain the addresses of public tobacco cessation clinics, all registered public tobacco cessation clinics in Malaysia were identified from the mQuit website (http://jomquit.moh.gov.my/), a platform established by the MOH. The data were entered into Microsoft Excel 2010 version 14.0. The addresses of the clinics were reduced to the minimum accuracy of the street level before being converted to longitudes and latitudes using Google Maps (www.google.com/maps).

The data of smokers in each state were obtained from the National Health and Morbidity Survey 2015 (Institute for Public Health, 2015) and categorised into different administrative districts. The survey collects data on the characteristics of Malaysian households using a face-to-face interview approach. Probability sampling that represents all households of Malaysian citizens was applied to include urban and rural areas in every state. The report contains statistics on household income, the incidence of poverty, and the basic amenities of households (Department of Statistics Malaysia 2016). The State and District boundaries were extracted from DIVA-GIS, a free computer programme from the Internet that supports mapping and geographical data analysis.

To determine the socioeconomic status of the Malaysian Population, the population relative wealth data of each State was obtained from the 2016 Report on Household Income and Basic Amenities Survey for Malaysia (Department of Statistics Malaysia, 2016). Population relative wealth data represents the average annual income of each individual in the state.

All geographical and linked population data were imported and analysed using Microsoft Excel 2010 (version 14.0; Microsoft, Redmond, WA, USA). Geographic mapping was conducted on Quantum Geographic Information Systems (QGIS version 3.8). All data from Microsoft Excel 2010 were imported into QGIS software to map the location of tobacco cessation clinics in relation to the population. Descriptive analyses for the number of tobacco cessation clinics in Malaysia within each state or district and the calculation of tobacco cessation clinics: population ratios were completed using Microsoft Excel 2010 version 14.0.

RESULTS

Based on the results, there are 648 registered tobacco cessation clinics in Malaysia, of which 449 are public clinics and the remaining 199 are private clinics. Table 1 shows the number of public tobacco cessation clinics, the number of smokers in each state, and the ratio of the clinic to the number of smokers. The overall ratio of clinics to the number of smokers in Malaysia is 1: 11,562 (one clinic with 11,562 smokers).

The ratio of clinics to the number of smokers in W.P. Kuala Lumpur is 1:25,265 (one clinic to 25,265 smokers), while the ratio for W.P Putrajaya is 1:2118 (one clinic to 2118 smokers).

Table 1. The number of public tobacco cessation clinics in relation to the number of smokers in each state of Malaysia.

State	Number of public tobacco cessation clinic	Number of smokers (National Health and Morbidity Survey 2015)	Ratio of each clinic with smoker (clinic: smoker)
Penang	16	240,162	1: 15,010
Terengganu	38	169,312	1: 4,456
Perlis	9	37,976	1: 4,220
Sarawak	44	465,723	1: 10,585
Kedah	38	375,397	1: 9,879
Sabah & W.P. Labuan	33	711,719	1: 21,567
Kelantan	33	276,634	1: 8,383
Johor	46	557,930	1: 12,129
Melaka	18	100,512	1: 5,584
Negeri Sembilan	42	151,769	1: 3,614
Pahang	47	278,262	1: 5,920
Perak	27	374,963	1: 13,888
Selangor	45	919,070	1: 20,424
W.P. Putrajaya	3	6,354	1: 2,118
W.P. Kuala Lumpur	10	252,646	1: 25,265
TOTAL	449	5,191,429	1: 11,562

Table 2. The ratio of public tobacco clinics to the number of smokers in relation to the mean monthly gross household income by state (Department of Statistics Malaysia, 2016).

States	Malaysia Income Groups	Mean monthly gross household income (RM)	Ratio of each clinic to number of smokers (clinic: smoker)
Perak	B40	5,065	1: 13,888
Terengganu	B40	5,776	1: 4,456
Perlis	B40	4,998	1: 4,220
Sarawak	B40	5,387	1: 10,585
Kedah	B40	4,971	1: 9,879
Sabah & W.P. Labuan	B40	5,354	1: 21,567
Kelantan	B40	4,214	1: 8,383
Pahang	B40	5,012	1: 5,920
Negeri Sembilan	B40	5,887	1: 3,614
Melaka	M40	6,849	1: 5,584
Johor	M40	6,928	1: 12,129
Penang	M40	6,771	1: 15,010
Selangor	M40	9,463	1: 20,424
W.P. Putrajaya	M40	11,555	1: 2,118
W.P. Kuala Lumpur	M40	11,692	1: 25,265

Table 2 shows the ratio of public tobacco cessation clinics to the number of smokers and the mean household income by State. Based on the Malaysian Income Groups, the average income of the residents in Selangor, W.P. Putrajaya, W.P. Kuala Lumpur, Johor, Melaka, and Pulau Pinang fall under the Middle 40% group or M40 (M40 represents the middle-tier households whose income falls between RM 6,275-RM 13,147 monthly). In contrast, residents in the remaining states were mainly in the Bottom 40% group or B40 (B40 represents the bottom-tier households whose income is less than RM3,000 monthly on average) (Department of Statistics Malaysia, 2016).

Among all the States in Malaysia, the highest mean household income was recorded in W.P. Kuala Lumpur (mean gross income: RM 11,692). The lowest ratio of public tobacco cessation clinics to the number of smokers (1: 25,265) was also reported in the same state. On the contrary, Kelantan had the lowest mean household income (mean gross income: RM 4,214), with a ratio of public tobacco cessation clinics to the number of smokers of 1: 8,383.

Figure 1 shows the distribution of public tobacco cessation clinics in Peninsular Malaysia as analysed with GIS. The green dots are the public tobacco cessation clinics outside the capital area, whereas the yellow dots represent clinics in the capital area of each state. Many public tobacco cessation clinics were in Kedah, Selangor, Johor, Negeri Sembilan, and Terengganu. Selangor has the highest number of public tobacco cessation clinics in the capital area, followed by Johor and Kedah. Similarly, Figure 2 shows the distribution of public tobacco cessation clinics in Borneo Island of Malaysia. The results show an unequal distribution of public tobacco cessation clinics. Most of the clinics in Sabah and Sarawak are located outside of the capital area, and there was a lack of clinics on the east side of Sabah and Sarawak.

Public tobacco cessation clinics located outside the capital of the State
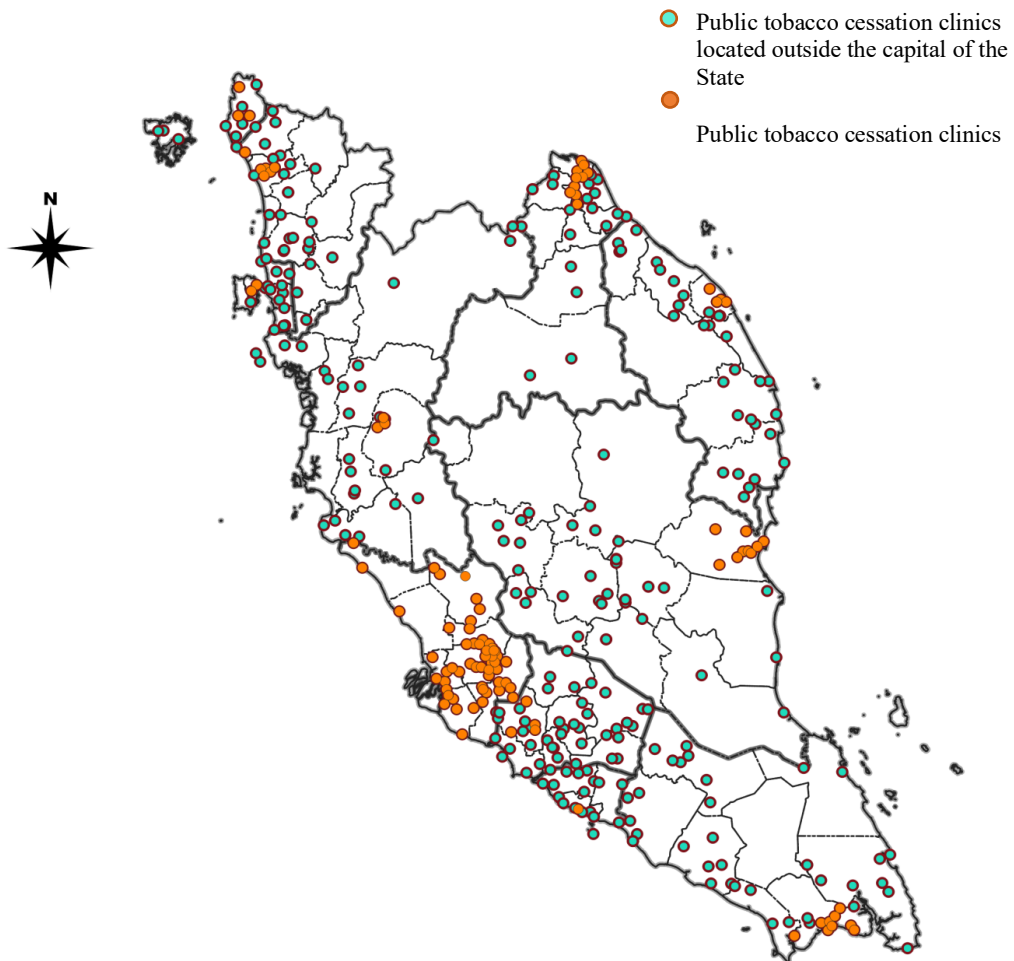
Public tobacco cessation clinics

Fig. 1. GIS illustration of the distribution of public tobacco cessation clinics in Peninsular Malaysia (N=372)
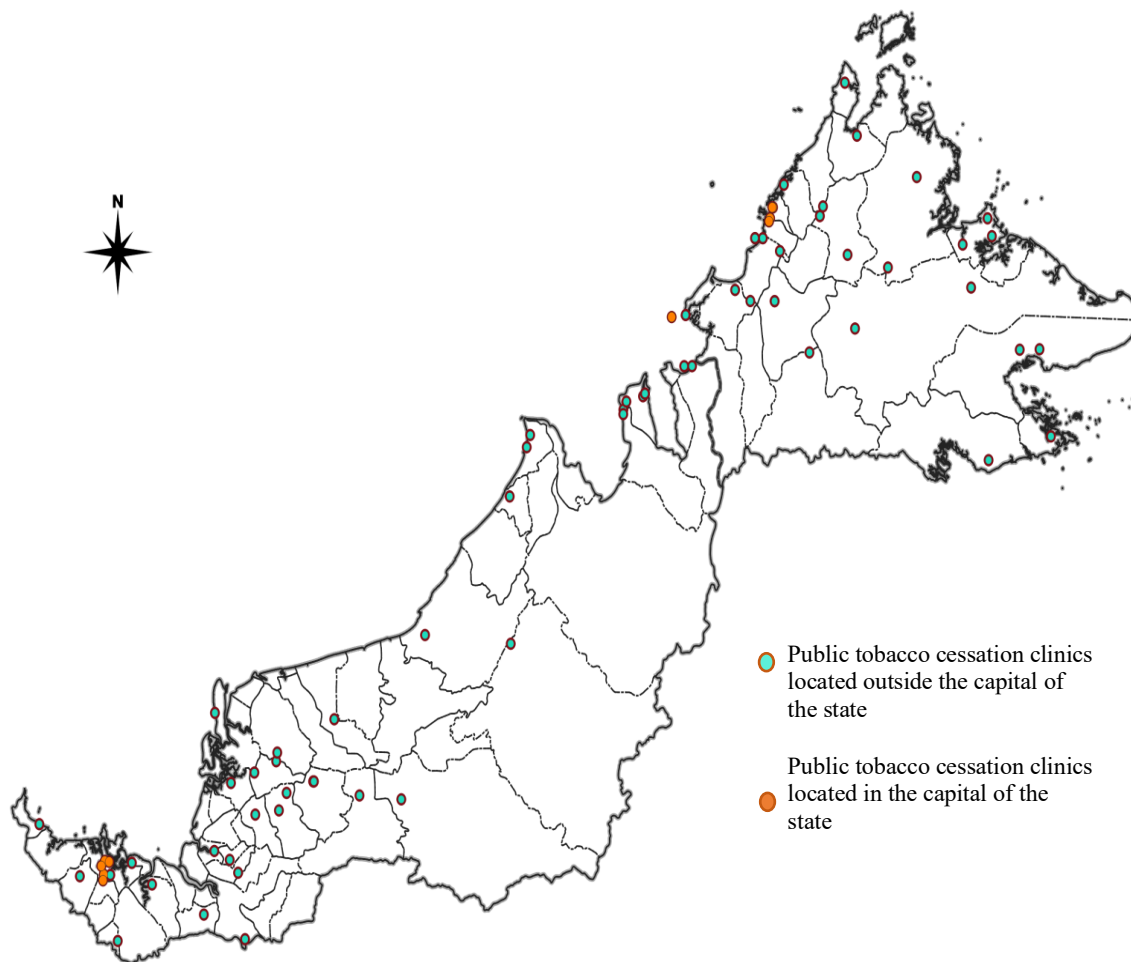

Fig. 2. GIS illustration of the distribution of public tobacco cessation clinics in Borneo Island of Malaysia (N=77)

DISCUSSION

This study aimed to identify, locate, and examine the distribution of public tobacco cessation clinics in every state in Malaysia by using GIS and to determine the distribution of government tobacco cessation

clinics in relation to the number of smokers and socioeconomic status of the population. The ratio of clinics to the number of smokers in W.P. Kuala Lumpur is 1:25,265, while the ratio for W.P. Putrajaya is 1:2118. This ratio represents an approximate number of potential quitters to be catered to at each public tobacco cessation clinic. For instance, in W.P. Kuala Lumpur, the ratio of clinics to the number of smokers was 1 to 25,265, thus indicating that one public tobacco cessation clinic in W.P. Kuala Lumpur needs to cater for 25,265 smokers. Such a low ratio might result in overcrowded facilities and less time for consultation with patients, not to mention burnout among healthcare workers (Carayon & Gurses, 2008; Virtanen et al., 2008; Asplin et al., 2003; Patel et al., 2019). Previous studies have shown that a high number of patients seeking consultation in hospitals may cause a delay in their assessment and treatment (Morley et al., 2018). Hwang U. et al. concluded that hospital overcrowding negatively impacts patient care (Hwang et al., 2006). In comparison, the ratio of clinics to the number of smokers in Putrajaya was the highest at 1: 2,118. Such a ratio can ensure a more optimum service for patients. It is clear from these data that more public tobacco cessation clinics should be established in areas with high numbers of smokers.

This study shows an uneven distribution of public tobacco clinics across Peninsular Malaysia and the Borneo Islands of Malaysia (Sabah and Sarawak), especially on the East side of Sabah and Sarawak. This may be due to the limited availability of existing public healthcare services which offer tobacco cessation services mainly located in primary health clinics (Md Bohari et al., 2021), and the low number of health professionals certified and practised tobacco cessation in the government sector (Hum et al., 2016).

One of the primary aims of this study was to evaluate the distribution of public tobacco cessation clinics in Malaysia in relation to the socioeconomic status of the Malaysian population. Socioeconomic status at the state level (Department of Statistics Malaysia, 2016) was used to obtain insight into the current scenario, particularly the association between SES and the number of smokers and clinics. Generally, the states with a higher proportion of residents in the B40 income group recorded a lower ratio of tobacco cessation clinics. In contrast, the states with a bigger proportion of M40 residents had a higher ratio of tobacco cessation clinics than the number of smokers, except for W.P. Kuala Lumpur, with the highest income among the states but with the lowest ratio of tobacco clinics. For instance, W.P. Putrajaya, with a mean household income of RM 11,555 (M40 category), recorded a clinic: smoker ratio of 1: 2,118. In contrast, Sabah & W.P. Labuan, with a lower mean household income of RM 5,354 (B40 category), showed a clinic: smoker ratio of 1: 21,567. These ratios indicate that disadvantaged smokers from lower socioeconomic areas (B40 category) have lesser access to health care services, particularly tobacco cessation assistance services, where the number of clinics was lower in these areas. A similar scenario is observed with the distribution of other public healthcare facilities, such as hospitals and clinics in Malaysia (Gan et al., 2015). The imbalanced ratio of smokers to public tobacco cessation clinics and the unequal distribution by socioeconomic status may contribute to health inequalities that might become more prevalent in the population over time. This finding is supported by Lim et al., which has shown that populations with lower socioeconomic status have a higher prevalence of smokers (Lim et al., 2015). One possible impact may be the limited access to the government's subsidised treatment services, especially for the people who need it the most. Such a scenario defeats the ultimate goal of primary health care, which is to provide better health for all, including accessibility, equity, and affordability of health care as adopted by the Declaration of the International Conference on Primary Health Care in Alma Ata, Russia in 1978 (WHO, 2012) and against one of the United Nation's Sustainable Development Goals, which is to reduce inequalities including in health.

The smoking cessation program is designed to help individuals to recognise and cope with the problems that may occur during smoking cessation attempts (Gauld et al., 2012; Vahidi et al., 2014). It contains at least four face-to-face individual and group counselling sessions that deliver behavioural techniques for smoking cessation to smokers and their family members. Healthcare professionals play an important role in this process. In a previous study, as many as 74% of participants indicated that a physician's advice was

a key determinant for successful smoking cessation (Gauld et al., 2012; Vahidi et al., 2014). Individuals without access to smoking cessation support may find it more challenging to quit smoking, especially those highly dependent on nicotine and requiring medication. Many commercially available Nicotine Replacement Therapy (NRT) forms include gum, transdermal patch, nasal spray, inhaler, and sublingual tablets/lozenges. NRT can improve the chances of successfully stopping smoking. Studies have shown that NRT increases the rate of quitting by 50-70%, regardless of the setting. Furthermore, NRT appears largely effective regardless of the additional support provided to the individual (Rahmah & Oktamianti, 2018). Thus, NRT should be provided in smoking cessation clinics.

In this study, GIS was applied to provide a clear visual of the geographical distribution of tobacco cessation clinics in Malaysia. It used the coordinates of the tobacco cessation clinics to detect areas with high saturation of registered clinics. The results clearly showed the unequal distribution of tobacco cessation clinics across Malaysia, with few clinics in the east of Borneo Island of Malaysia (Sabah and Sarawak). Therefore, it is crucial to identify those areas that require more resources and infrastructure planning via GIS. Some solution that can be recommended to improve the ratio of tobacco cessation clinics to smokers is collaborating with private health providers to offer tobacco cessation services to complement the services provided by the public sector. The availability of these services should be publicised in healthcare settings and in the mass media, where smokers can gain awareness and relevant information on where and how to seek assistance to quit smoking.

There are several limitations to this study. Firstly, the study relied on the availability of secondary data such as the mean household income, the number of smokers in each state, and the registered public tobacco cessation clinic on the mQuit website. The mean household income and the number of smokers were measured at the state level. At the same time, the longitudes and latitudes of the public tobacco cessation clinics originated at the district level. In addition, the data archives were not from the same year. A second limitation is that this study did not include unregistered public tobacco cessation clinics or pending registration during the data collection period. Consequently, this might affect the study findings, such as the ratio of the number of tobacco cessation clinics to the number of smokers. However, a study by Bohari et al. in 2021 reported that W.P. Kuala Lumpur was among the states with the lowest tobacco cessation services to smoker ratio, including private tobacco cessation service providers (Md Bohari et al., 2021). This shows that although the ratio of public tobacco cessation clinics was high in W.P. Kuala Lumpur, there are more choices for the urban smokers who reside in the city centre to receive tobacco cessation services from the private sector. Despite the limitations, secondary data can be considered an advantage of this study, as national-level data was freely available. Even though different years of secondary data were used for household income (in 2016), the number of smokers (in 2015), and registered tobacco cessation clinics (in 2019), we assume that the study findings would outweigh the possible discrepancies arising from the different sources of data.

CONCLUSION

The distribution of public tobacco cessation clinics in Malaysia was demonstrated using GIS in this study. The results show a low ratio of public tobacco cessation clinics in relation to smokers, especially in Sabah and W.P. Kuala Lumpur. The findings highlighted the need for comprehensive planning when setting up public healthcare facilities in the future. More tobacco cessation clinics should be established in areas with a high number of smokers to help smokers who intend to quit. Furthermore, a customised smoking cessation plan should be put in place to cater to the individual needs of different smokers.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest with respect to the authorship and/or publication of this article.

AUTHORS' CONTRIBUTIONS

Khairunissa Nabila Ruzhan and Nor Aida Amir carried out the research and wrote the original draft of the article. Nor Faezah Md Bohari and Noor Nazahiah Bakri conceptualised the central research idea, designed the research, supervised research progress and revised and rewrite the article. Noor Nazahiah Bakri anchored the review revisions, and submission of the article.

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