The Study of Association between COVID-19 Pandemic and Blood Pressure Control among Hypertensive Patients in Tha Luang Hospital, Lopburi Province, Thailand

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Abstract:

Background: COVID-19 infection, a coronavirus (SARS-CoV-2) infection causing severe acute respiratory distress syndrome is pandemic starting in December 2019 in Wuhan, China and then spreading rapidly throughout the world. This has an impact on every aspect of people life. In Thailand, the first case report was in January 2020 and spreading to the whole country rapidly. Due to the policy of Thai government to control this infection such as staying home, wearing masks, social distancing and limited going to any crowded places including hospitals. This would impact on people's health because many underlying diseases needed medical attention and regular medication, one of which was hypertension. However, during this situation, there was hospital service called 'home delivery pharmacy' of which the patients can register their preference with the hospital to deliver their routine medications to their home in order to reduce their risk of exposure to crowded places. However, there was still lack of the studies on the effects of COVID-19 pandemic on blood pressure control as well as efficacy of 'home delivery pharmacy' service.

Objective: The study aimed to study the impact of the COVID-19 pandemic on blood pressure control in hypertensive patients at Tha Luang Hospital, Lopburi Province.

Methods: This was a cross-sectional study conducted in Tha Luang Hospital, Lopburi Province between 2019 and 2020. Demographic data and blood pressure level of hypertensive patients were retrieved from the electronic medical records under the hospital permission. The data was collected into 2 durations 2019 (normal situation) and 2020 (COVID-19 pandemic). Uncontrolled blood pressure (BP) was defined by systolic BP > 140 mmHg, or diastolic BP > 90 mmHg in the latest visit. The demographic and prevalence of

uncontrolled blood pressure was analyzed by descriptive statistics. The average of SBP and DBP of hypertensive patients between in normal situation and COVID-19 pandemic were compared and analyzed by independent t-test.

Results: There were 4,045 and 4,063 hypertensive patients attended Tha Luang Hospital in 2019 and 2020 respectively. The prevalence of uncontrolled BP among these patients during 2 durations was 28.00% and 25.00% respectively (P = 0.003). The mean SBP was 132.87 mmHg in 2019 and 132.94 mmHg in 2020 (P < 0.05) and DBP was 74.96 mmHg in 2019 and 75.63 mmHg in 2020 (P < 0.05). The patients with a higher BMI tended to have better control of their blood pressure (P < 0.05).

Conclusion: During COVID-19 pandemic, the prevalence of uncontrolled BP in hypertensive patients attended at Tha Luang Hospital was lower than in 2019. This could be explained by the policy of Tha Luang Hospital that had a home delivery pharmacy to NCD patients, which made it more convenient for patients to access public health services. But during the pandemic, patients tended to have unhealthy lifestyle compared to the normal situation due to the government policy interfering healthy lifestyle such as confinement in home and closed public health care service which could affect blood pressure level. However, the patients with hypertension should have weight reduction for good blood pressure control and decreased further complication.

Keywords: COVID-19, Blood pressure control, Home delivery pharmacy, Lopburi, Thailand

Introduction

In December 2019, pneumonia of the unknown cause was firstly reported in Wuhan, China. This pneumonia was caused by novel coronavirus or severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), which resulted in coronavirus disease 2019 (COVID-19). The first case in Thailand was reported in 13 January 2020 and by 1 March 2020, total cases rising to 42 with first death by COVID-19 infection. These events caused the government to issue measures to control the disease, which started on 26 March, such as prohibiting entering designated areas. By 3 April, the government announced nation-wide lockdown which ban people from leaving their homes during the night across the country and limitation to go outside, especially to crowded areas such as market, malls, public parks and also hospitals with penalties on disobedience. The issued measure had significant impacts on patients with chronic diseases such as hypertension, diabetes and cancer, etc. by limited healthy eating habits, reduced physical activities, increased stress from confinement, poor socioeconomic from unemployment, limited access public health services and uses of tobacco and alcohol[1]. Most hospitals had policy to limit services in both outpatients and inpatients to prevent crowding in hospitals and extending services for COVID-19 patients. As a result, people with non-communicable diseases such as hypertension, diabetes and heart diseases which required regular health check-up had fewer accessibility for medical care and this might have impact on health conditions of these patients. As mentioned, the lack of medical services and supplies or delayed treatment would increase complications, disability and mortality among these patients during the COVID-19 pandemic[2].

On the other hand, instead of neglecting these patients entirely, most hospitals had

other measurements for them in order to deliver managements to them as best as hospitals could. One of these measurements was 'home delivery pharmacy' of which the patients can register their preference with the hospital to deliver their routine medications to their home in order to reduce their risk of exposure to crowded places i.e., hospitals. Other previous studies demonstrated that 'home delivery pharmacy' service as well as telemedicine met some levels of effectiveness in maintaining contacts and health care to these patients[3]. However, there was still lack of studies about efficacy of this method in Thailand.

Objectives:

The study aimed to study the relationship between the COVID-19 pandemic period and the inability to control blood pressure (uncontrolled blood pressure) in hypertensive patients at Tha Luang Hospital, Lopburi Province during COVID-19 pandemic.

The secondary objective was to study the prevalence of inability to control blood pressure (uncontrolled blood pressure) in hypertensive patients and the factors related to uncontrolled blood pressure among hypertensive patients.

Methods
Study design

This was the quantitative, serial cross-sectional study of prevalence, associated factors of ineffective control of blood pressure in hypertensive patients in Tha Luang Hospital, Lopburi Province during COVID-19 pandemic.

Study date and setting

This study was conducted during 1 January 2019 to 1 June 2019 and 1 January 2020 to 1 June 2020 at Tha Luang Hospital. Tha Luang Hospital was a government medium-sized community hospital in Tha Luang District, Lopburi Province in central

Thailand. Major tasks of medium-sized community hospitals included primary and secondary care of patients in the rural areas.

Target population

This study targeted at patients with primary hypertension who were treated and monitored at Tha Luang Hospital, Lopburi Province.

Sample selection and data collection

The inclusion criteria included being a patient diagnosed as hypertension by physician with follow up and treated at Tha Luang Hospital and granted consent to provide information to the researcher. Exclusion criteria included patients who did not receive treatment and monitored symptoms during the assessment and did not agree to provide information to the study. The study was retrieved from electronic records which contain of demographic data of the population, comorbidity, body mass index and blood pressure level.

Statistical analyses

The data divided in to 2019 and 2020. The demographic data and prevalence of uncontrolled blood pressure was analyzed by descriptive analysis. The mean systolic and diastolic blood pressure in 2019 and 2020 was analyzed and compared by independent t-test.

Ethical consideration

This study was approved by institutional board of Thai Army Medical Department. The approval code was R103h/63_Exp

Result
General characteristics

During 1 January 2019 to 30 June 2019, there were 4045 hypertensive patients who got check-up and treated at Tha Luang Hospital which 2913 (72.01%) patients could control blood pressure and 1132 (27.99%) could not control blood pressure. During 1 January 2020 to 30 June 2020, there were 4063 patients which 3046 (74.97%) could control blood pressure and 1017 (25.03%)

could not control blood pressure. The data was shown in table 1.

In 2019, the majority of the population was in 60-69 age group (29.74%) with an average age of 61.2 years old. BMI was mostly in the range of 25.00-29.99 (33.98%). In this population we found a comorbidity disease such as diabetes 1373 patients (33.94%) and other comorbidity such as gout, hyperlipidemia, cardiovascular disease and asthma (89.93%). The data was shown in table 2.

According to the data in 2020 the mean age of the patient was 62.5 years, mostly during 60-69 years (30.56%). BMI was mostly in the range of 25.00-29.99 (33.01%). In our population we found comorbidity diseases such as diabetes 1339 patients (32.95%) and other comorbidity such as gout, hyperlipidemia, cardiovascular disease and asthma (89.40%). The data was shown in table 3.

Risk factors of uncontrolled hypertension in 2019

The factor that related to uncontrolled hypertension among population during 2019 which analyzed by multivariate analysis shown as in the age group 40-49, 50-59, 60-69, 70-79 and $\geq$ 80 having a chance of uncontrolled hypertension compared to age < 40 shown as 0.93, 0.92, 1.05, 0.91 and 1.19 times respectively. The unemployed had a higher chance of uncontrolled hypertension compared to farmer 1.71 times. Patients who had other comorbidity (such as dyslipidemia, cardiovascular disease, asthmas, emphysema, allergies) had a higher chance to have uncontrolled hypertension compared to not having other comorbidity 2.91 times. Sub-district where the patient lived, including Hua Lam and areas outside Tha Luang District had a higher chance of uncontrolled hypertension compared to Tha Luang sub-district by 1.52 and 1.61 times respectively. BMI level in range of 18.50-22.99, 23.00-24.99, 25.00-29.99

had a lower chance of uncontrolled hypertension compared to <18.49 by 0.55, 0.58, 0.67 times respectively. Risk factors were shown in Table 2.

Risk factors of uncontrolled hypertension in 2020

The factor associated with uncontrolled hypertension among population during 2020 which analyzed by multivariate analysis shown in the age group 40-49, 50-59, 60-69 and 70-79 having a chance of uncontrolled hypertension compared to age < 40 shown as 0.41 0.44 0.46 and 0.46 times respectively. People with diabetes had a higher chance of uncontrolled hypertension compared to those who had no diabetes 1.38 times. The patients with other comorbidity (such as dyslipidemia, cardiovascular disease, asthmas, emphysema, allergies) had a higher chance of uncontrolled hypertension compared to having no other comorbidity 2.89 times. As compared to Tha Luang district patients who lived in Kaeng Phak Kut, Sap Champa, Nong Phak Wan, Thalae wang wat, Hua Lam and areas outside Tha Luang district had a higher chance of uncontrolled hypertension by 1.50, 1.38, 2.13, 1.39, 1.68 and 1.53 times respectively. BMI in the range of 18.50-22.99 and 23.00-24.99 had a lower chance of uncontrolled hypertension compared to <18.49 by 0.68 and 0.64 times respectively. Risk factors were shown in Table 3.

Discussion

This hospital-based, cross-sectional study, designed to find out the factors associated in hypertension control during the COVID-19 pandemic. The study found that in year 2020, which had COVID-19 outbreak, patients had better control of blood pressure levels which contradicted to study of the World Health Organization. This could be explained by the policy of Tha Luang Hospital that had home delivery pharmacy to NCD patients, which enabled

convenience for patient accessibility to health care services[5]. This delivery program sent the medication to NCD patient house which ensured continuity of care and adherence to epidemiological safety during the COVID-19 crisis. From the analysis of the data obtained in 2019, significant variables of uncontrolled hypertension included occupation, comorbidity, sub-district and BMI. In 2020, significant variables were diabetes, other diseases (gout, hyperlipidemia, cardiovascular disease and asthma), sub-district and BMI. In 2019, it was found that unemployed and merchant were less likely to control blood pressure compared to the farmer. This could be explained by the study that people who were in the lower class and repetitive tasks under time pressure, recognition of completed tasks and jobs with productivity-related income tended to have higher blood pressure level[4]. People with other diseases were less likely to control their blood pressure compared to those who did not. Sub-districts other than Tha Luang sub-district which was nearest to the hospital tended to have less well blood pressure level and ability to control blood pressure was decreased in relation to distance from Tha Luang hospital. The farthest district from the hospital is Hua Lam Sub-district with a distance of 23 kilometers had a chance of uncontrolled blood pressure 1.52 times compared to Tha Luang sub-district, which could explain by the difficulties in obtaining public health services and home delivery system. The patients with a higher BMI tended to have better control of their blood pressure, which could be explained by these groups having regular monitoring of body weight, pressure and nutritional status from public health volunteers and community hospitals.

In 2020, diabetic patients had a higher chance of uncontrolled hypertension 1.38 times compared to non-diabetic. The two variables mentioned were consistent with the study of Sakboonyarat, et al.[6] Besides that, during the COVID-19 period people tended to have unhealthy behavior during lockdown.[7] The confinement to residents and the interruption of the work-related routine could lead to irregular eating patterns and frequent snacking, both of which were associated with increased food intake and consequently more positive caloric balance. During the quarantine, continuously hearing of or listening to the pandemic spread and its associated mortality could be so stressful. The other diseases (e.g., high blood lipids, heart disease, asthma, etc.) were have a higher chance of uncontrolled blood pressure were 2.89 times higher than those who were not suffering from the disease. Sub-districts other than Tha Luang sub-district which was the closest to the hospital tended to have worsen blood pressure level and controlling of blood pressure was decreased in relation to distance from Tha Luang hospital. As mentioned above, in 2020 Tha Luang hospital was using home delivery pharmacy policy but in the area outside the Tha Luang sub-districted had a higher chance of missed and delayed delivery due to the size of area and the area topography of farm and forest. As mentioned above the authors suggested patients and physicians to promote regular blood pressure measurement and appropriate practice to control blood pressure to reduce inability of blood pressure control. In addition to home delivery of medicine by mail, hospitals should provide clinical examination services for hypertension people by nurses and doctors in order to facilitate access to public health services during the COVID-19 outbreak which limited travel and public transport to help solve problems in some patients who had uncontrolled blood pressure. This study was based on the database of Tha Luang Hospital only not from other part of Thailand. Comparison of blood pressure control by collecting data from the last

follow-up visit in 2019 and comparing with COVID-19 pandemic period (1 January - 30 June 2020). There were some limitations from the obtained information only in the patients who visited the hospital. According to the hospital policy some patients who received treatment at the nearby sub-district health promotion centers or received drug refill promptly after emergency visit for other reasons would not be included in the home delivery pharmacy. These patient data was not used to analyzed in this research which might affect the research results.

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Table 1 Comparison of number of controlled and uncontrolled hypertension patients at Tha Luang Hospital in 2019 and 2020

Year	Total	Uncontrolled (%)	Controlled (%)	Odds ratio (95% CI)	P-value
2019	4045	1132 (28)	2913 (72)	1 (Reference)	0.003
2020	4063	1017 (25)	3046 (75)	0.859	

Table 2 Demographics of population with hypertension in year 2019

Variables	Total	Uncontrolled (%)	Controlled (%)	Crude ratio (95% CI)	P-value	Adjusted odds ratio (95% CI)	P-value
Gender							
Male	1514	439 (29)	1075 (71)	1 (Reference)			
Female	2531	693 (27.4)	1838 (72.6)	0.923 (0.802-1.063)	0.268		
Age groups							
<40	114	42 (36.8)	72 (63.2)	1 (Reference)		1 (Reference)	
40-49	489	135 (27.6)	354 (72.4)	0.654 (0.426-1.004)	0.052	0.930 (0.497-1.742)	0.821
50-59	1126	281 (25)	845 (75)	0.570 (0.381-0.854)	0.006	0.915 (0.502-1.671)	0.774
60-69	1195	331 (27.7)	864 (72.3)	0.657 (0.440-0.981)	0.04	1.047 (0.572-1.917)	0.882
70-79	733	215 (29.3)	518 (70.7)	0.712 (0.471-1.075)	0.106	0.911 (0.485-1.711)	0.772
≥ 80	361	121 (33.5)	240 (66.5)	0.864 (0.557-1.340)	0.515	1.186 (0.608-2.313)	0.616
Occupations							
Agriculture	1269	346 (27.3)	923 (72.7)	1 (Reference)		1 (Reference)	
Employee	2163	584 (27)	1579 (73)	0.987 ((0.844-1.153)	0.866	0.974 (0.775-1.224)	0.819
Merchant	160	51 (31.9)	109 (68.1)	1.248 (0.875-1.780)	0.221	1.438 (0.875-2.361)	0.152
Unemployed	331	113 (34.1)	218 (65.9)	1.383 (1.068-1.791)	0.014	1.712 (1.196-2.451)	0.003
Others	112	38 (31.1)	84 (68.9)	1.207 (0.807-1.805)	0.36	1.365 (0.785-2.313)	0.616
Education							
Illiterate	314	94 (29.9)	220 (70.1)	1 (Reference)		1 (Reference)	
Primary	1649	418 (25.3)	1231 (74.7)	0.795 (0.609-1.037)	0.09	0.800 (0.607-1.056)	0.115
Secondary	132	43 (32.6)	89 (67.4)	1.131 (0.731-1.750)	0.581	1.159 (0.713-1.885)	0.551
University	20	4 (20)	16 (80)	0.585 (0.191-1.797)	0.349	0.517 (0.158-1.691)	0.275
Diploma	11	3 (27.3)	8 (72.7)	0.878 (0.228-3.381)	0.85	0.841 (0.211-3.360)	0.807
Unknown	115	32 (27.8)	83 (72.2)	0.902 (0.562-1.449)	0.671	0.861 (0.529-1.401)	0.548
Health coverage							
Universal (UC)	3249	907 (27.9)	2342 (72.1)	1 (Reference)			
Other	796	225 (28.3)	571 (71.7)	1.017 (0.856-1.208)	0.844		
Smoking							
Non	3481	962 (27.6)	2519 (72.4)	1 (Reference)			
Current smoke	552	166 (30.1)	386 (69.9)	1.324 (1.013-1.732)	0.04		
Ex-smoke	12	4 (33.3)	8 (66.7)	0.971 (0.742-1.271)	0.831		

Table 2 Demographics of population with hypertension in year 2019

Variables	Total	Uncontrolled (%)	Controlled (%)	Crude ratio (95% CI)	P-value	Adjusted odds ratio (95% CI)	P-value
Alcohol drinking							
No	3432	934 (27.2)	2498 (72.8)	1 (Reference)		1 (Reference)	
Yes	613	198 (32.3)	415 (67.7)	1.279 (1.063-1.539)	0.009	1.207 (0.922-1.579)	0.171
Diabetes Mellitus							
No	2672	836 (31.3)	1836 (68.7)	1 (Reference)		1 (Reference)	
Yes	1373	296 (21.6)	1077 (78.4)	0.604 (0.518-0.703)	<0.001	1.197 (0.975-1.469)	0.085
Chronic kidney disease							
No	3989	1119 (28.1)	2870 (71.9)	1 (Reference)			
Yes	56	13 (23.2)	43 (76.8)	0.775 (0.415-1.447)	0.424		
Other diseases							
No	407	172 (42.3)	235 (57.7)	1 (Reference)		1 (Reference)	
Yes	3638	960 (26.4)	2678 (73.6)	0.49 (0.397-0.604)	<0.001	2.917 (1.947-4.370)	<0.001
Region							
Tha Luang	1201	290 (24.1)	911 (75.9)	1 (Reference)		1 (Reference)	
Kaeng Pak Kut	568	145 (25.5)	423 (74.5)	1.077 (0.855-1.356)	0.529	1.298 (0.947-1.778)	0.105
Sap Champa	621	178 (28.7)	443 (71.3)	1.262 (1.015-1.570)	0.037	1.347 (0.989-1.834)	0.059
Nong Pak Wan	480	155 (32.3)	325 (67.7)	1.498 (1.187-1.890)	0.001	1.323 (0.948-1.846)	0.099
Thale Wang Wat	342	72 (21.1)	270 (78.9)	0.838 (0.626-1.121)	0.234	0.905 (0.606-1.350)	0.624
Hua Lum	664	235 (35.4)	429 (64.6)	1.721 (1.399-2.116)	<0.001	1.521 (1.121-2.063)	0.007
Other	169	57 (33.7)	112 (66.3)	1.599 (1.132-2.258)	0.008	1.616 (1.021-2.560)	0.04
BMI							
<18.5	307	116 (37.8)	191 (62.2)	1 (Reference)		1 (Reference)	
18.5-22.99	991	243 (24.5)	748 (75.5)	0.535 (0.407-0.702)	<0.001	0.550 (0.379-0.797)	0.002
23.00-24.99	673	180 (26.7)	493 (73.3)	0.601 (0.451-0.801)	0.001	0.585 (0.394-0.869)	0.008
25.00-29.99	1373	380 (27.7)	993 (72.3)	0.630 (0.486-0.817)	<0.001	0.667 (0.462-0.962)	0.03
≥30	696	212 (30.5)	484 (69.5)	0.721 (0.544-0.956)	0.023	0.9 (0.602-1.345)	0.606

Table 3 Demographics of population with hypertension in year 2020

Variables	Total	Uncontrol (%)	Control (%)	Crude ratio (95% CI)	P-value	Adjusted odds ratio (95% CI)	P-value
Gender							
Male	1505	385 (25.6)	1120 (74.4)	1 (Reference)			
Female	2558	632 (24.7)	1926 (75.3)	0.955 (0.824-1.105)	0.534		
Age groups							
<40	88	31 (35.2)	57 (64.8)	1 (Reference)		1 (Reference)	
40-49	461	116 (25.2)	345 (74.8)	0.618 (0.381-1.004)	0.052	0.413 (0.212-0.803)	0.009
50-59	1098	247 (22.5)	851 (77.5)	0.534 (0.337-0.845)	0.007	0.442 (0.234-0.838)	0.012
60-69	1235	280 (22.7)	955 (77.3)	0.539 (0.341-0.852)	0.008	0.456 (0.239-0.868)	0.017
70-79	762	204 (26.8)	558 (73.2)	0.672 (0.422-1.071)	0.095	0.456 (0.234-0.890)	0.021
≥ 80	396	130 (32.8)	266 (67.2)	0.898 (0.553-1.460)	0.666	0.693 (0.345-1.390)	0.302
Occupations							
Agriculture	1268	292 (23)	976 (77)	1 (Reference)		1 (Reference)	
Employee	2187	549 (25.1)	1638 (74.9)	1.120 ((0.952-1.318)	0.171	1.160 (0.916-1.469)	0.219
Merchant	160	38 (23.8)	122 (76.2)	1.041 (0.707-1.533)	0.838	1.145 (0.666-1.968)	0.623
Unemployed	331	106 (32)	225 (68)	1.575 (1.208-2.053)	0.001	1.386 (0.951-2.019)	0.089
Others	117	32 (27.4)	85 (22.6)	1.258 (0.821-1.929)	0.292	1.638 (0.925-2.900)	0.113
Education							
Illiterate	318	98 (30.8)	220 (69.2)	1 (Reference)		1 (Reference)	
Primary	1638	383 (23.4)	1255 (76.6)	0.685 (0.526-0.892)	0.005	0.766 ((0.580-1.012)	0.061
Secondary	124	40 (32.3)	84 (67.7)	1.069 (0.685-1.669)	0.769	1.015 (0.609-1.692)	0.955
University	22	10 (45.5)	12 (54.5)	1.871 (0.782-4.476)	0.159	1.787 (0.676-4.726)	0.242
Diploma	15	5 (33.3)	10 (66.7)	1.122 (0.347-3.371)	0.837	1.487 (0.471-4.692)	0.499
Unknown	111	26 (23.4)	85 (76.6)	0.687 (0.417-1.132)	0.14	0.796 (0.475-1.335)	0.387
Health coverage							
Universal (UC)	3360	843 (25.1)	2517 (74.9)	1 (Reference)		1 (Reference)	
Other	703	174 (24.8)	529 (75.2)	0.982 (0.814-1.185)	0.851		
Smoking							
Non	3536	870 (24.6)	2660 (75.4)	1 (Reference)		1 (Reference)	
Current smoke	270	92 (34.1)	178 (65.9)	1.584 (1.218-2.060)	0.004	1.266 (0.857-1.868)	0.236
Ex-smoke	235	50 (21.3)	185 (78.7)	0.819 (0.594-1.130)	0.224	0.843 (0.541-1.312)	0.449

Table 3 Demographics of population with hypertension in year 2020

Variables	Total	Uncontrol (%)	Control (%)	Crude ratio (95% CI)	P-value	Adjusted odds ratio (95% CI)	P-value
Alcohol drinking							
No	3517	871 (24.8)	2646 (75.2)	1 (Reference)		1 (Reference)	
Yes	546	146 (26.7)	400 (73.3)	1.109 (0.904-1.360)	0.322	1.029 (0.632-1.676)	0.907
Diabetes Mellitus							
No	2724	769 (28.2)	1955 (71.8)	1 (Reference)		1 (Reference)	
Yes	1339	248 (18.5)	1091 (81.5)	0.578 (0.492-0.679)	<0.001	1.379 (1.186-1.603)	<0.001
Chronic kidney disease							
No	4018	1008 (25.1)	3010 (74.9)	1 (Reference)			
Yes	45	9 (20)	36 (80)	0.747 (0.358-1.555)	0.435		
Other diseases							
No	430	156 (36.3)	274 (63.7)	1 (Reference)		1 (Reference)	
Yes	3626	854 (23.6)	2772 (76.4)	0.541 (0.438-0.658)	<0.001	2.887 (2.092-3.984)	<0.001
Region							
Tha Luang	1235	241 (29.5)	994 (80.5)	1 (Reference)		1 (Reference)	
Kaeng Pak Kut	584	154 (26.4)	430 (73.6)	1.477 (1.172-1.862)	0.001	1.504 (1.086-2.082)	0.014
Sap Champa	628	153 (24.4)	475 (75.6)	1.329 (1.055-1.672)	0.016	1.376 (0.994-1.904)	0.054
Nong Pak Wan	491	164 (33.4)	327 (66.6)	2.069 (1.636-2.615)	<0.001	2.128 (1.533-2.952)	<0.001
Thale Wang Wat	310	72 (23.2)	238 (76.8)	1.248 (0.925-1.682)	0.147	1.392 (0.927-2.089)	0.11
Hua Lum	677	188 (27.8)	489 (72.2)	1.586 (1.273-1.975)	<0.001	1.676 (1.222-2.299)	0.001
Other	138	45 (32.6)	93 (67.4)	1.996 (1.361-2.926)	0.008	1.528 (0.900-2.592)	<0.001
BMI							
<18.5	332	216 (65.1)	116 (34.9)	1 (Reference)		1 (Reference)	
18.5-22.99	1033	799 (77.43)	234 (22.6)	0.545 (0.417-0.713)	<0.001	0.677 (0.464-0.987)	0.042
23.00-24.99	684	526 (76.9)	158 (23.1)	0.559 (0.420-0.745)	<0.001	0.641 (0.422-0.972)	0.036
25.00-29.99	1338	1000 (74.7)	338 (25.3)	0.629 (0.487-0.814)	<0.001	0.757 (0.517-1.108)	0.152
≥30	666	498 (74.8)	168 (25.2)	0.628 (0.472-0.836)	0.001	0.820 (0.535-1.256)	0.362