

# Comparison of Blood Pressure Control in Hypertensive Patients from Primary Care Units of University Hospital and Community in Southern Thailand

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**Background:** Hypertension (HT) is the most common condition seen in primary care. The proportion of patients with well-controlled HT reflects the quality of care in a given setting.

**Objective:** To compare the proportion of participants with controlled blood pressure (BP) in four primary care units (PCUs) in Hat Yai, Songkhla, Thailand.

**Materials and Methods:** Data concerning demography and antihypertensive drug usage were collected from the medical records of 1,690 patients in four PCUs (Songklanagarind Hospital, Municipal School 4, Banpru Municipality, and Kho Hong Municipality) between January 2019 and May 2019. The factors associated with uncontrolled HT were assessed using multiple logistic modeling and reported in terms of odds ratios and corresponding 95% confidence intervals (CI).

**Results:** The proportion of patients with controlled HT in the four PCUs and their corresponding 95% CI were 92.1% (90.8 to 93.6), 96.2% (90.3 to 98.7), 88.2% (84.3 to 90.1), and 74.5% (66.8 to 81.2). Of the total number of patients with controlled HT, 64.4% were female. The odds ratios and the 95% CI of the significantly associated factors with uncontrolled HT were PCU of site 3 and 4 (1.7, 1.1 to 2.6 and 3.0, 1.8 to 5.1), age of 65 years or older (0.7, 0.5 to 0.9), and dyslipidemia (0.7, 0.5 to 1.0).

**Conclusion:** There were differences in quality of care among the PCUs, and they are associated with patient age and comorbidities like dyslipidemia.

**Keywords:** Hypertension, Essential hypertension, Hypertensive treatment, Blood pressure, Primary care unit

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In primary health care, hypertension (HT) is the most commonly found disorder. It also relates to several complications such as ischemic heart disease, cerebrovascular accident, and death if it is not identified early and treated properly<sup>(1)</sup>. The prevalence of HT is on the rise globally, and in the Thai population, especially among those over 40 years old and in concomitance with diabetes mellitus, heart disease, kidney disease, and obesity

(Chaitheerapun S, 2015)<sup>(2)</sup>. HT can be occasionally difficult to control, and additional methods of care might be required. With the complexity of HT, many health care providers and institutions are cautious to the treatment of this pervasive disorder<sup>(3,4)</sup>.

According to the guidelines of treatment of Thailand Hypertension 2012 and its update in 2015<sup>(2)</sup>, HT was defined as a systolic blood pressure (SBP) greater than or equal to 140 mmHg or a diastolic blood pressure (DBP) greater than or equal to 90 mmHg. Controlled HT was defined as a blood pressure below 130 over 80 mmHg for people younger than 50, 140 over 90 mmHg for people between 50 and 60, below 140 to 150 over 90 mmHg for people between 60 and 80, and below 150 over 90 mmHg for people older than 80. Uncontrolled HT was defined as blood pressure greater than or equal to the target-controlled

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blood pressure for each group of population.

Songklanagarind Hospital is a university hospital of Prince of Songkla University. The primary care units (PCUs) of Songklanagarind Hospital was founded in 1987 to provide health care service for urban area of Hat Yai, Songkhla. The other PCUs were established to cover more groups of population in rural community of Hat Yai, Songkhla, including Municipal School 4, Banpru Municipality, and Kho Hong Municipality. The PCU of Banpru Municipality and Municipal School 4 have been operated for more than 10 years while the PCU of Kho Hong Municipality has been constructed less than five years ago. The laboratory assessment is readily available every day of the week in Songklanagarind Hospital and Municipal School 4, whereas, it is available only two days per week in Banpru Municipality and two days per month in Kho Hong Municipality.

The PCU of Banpru Municipality is located farther from downtown. Most of the population are agriculturist and self-employed, whereas the PCU of Municipal School 4 is located nearer to downtown. Most of the population also are self-employed. In addition, the PCU of Kho Hong Municipality is located near to downtown. In contrast to the other two sites, most of the population are employees and merchants.

Globally, HT is a dominant risk factor for many illnesses and early deaths<sup>(5)</sup>, and Songkhla Province in the South of Thailand is not an exception to this fact. Despite the importance of this disorder in healthcare in general, the exact proportion of patients with controlled blood pressure in PCUs of Songklanagarind Hospital, Municipal School 4, Banpru Municipality, and Kho Hong Municipality is not known. According to the medical records, and using the 2012 guideline for the treatment of HT in Thailand and its 2015 update, in 2016, there were 1,713 hypertensive patients in Songklanagarind Hospital PCU, 935 in Municipal School 4 PCU, 1,467 in Banpru Municipality PCU, and 38 in Kho Hong Municipality PCUs. Additionally, those number were rising every year.

The present study tried to compare the proportion of participants with controlled blood pressure in these four PCUs of Hat Yai District, and to determine the factors that help control blood pressure in the hypertensive patients. The results of the present study could serve as the database for future research with the aim of developing appropriate interventions to improve the effective protocols to control HT in these PCUs.

## Materials and Methods

### Study design

Cross-sectional descriptive study.

### Participants

Patients with the diagnosis of essential HT from the PCUs of Songklanagarind Hospital, Municipal School 4, Banpru Municipality, and Kho Hong Municipality were invited to this study. Signed informed consent forms were obtained from all participants prior to enroll to the study. The study protocol was approved by the Ethics Committee of the Faculty of Medicine, Prince of Songkla University.

### Inclusion criteria

Participants aged 35 years and over with essential HT (according to ICD10 code I10) from the PCUs of Songklanagarind Hospital, Municipal School 4, Banpru Municipality, and Kho Hong Municipality, who provided an informed consent, were enrolled in the present study.

### Exclusion criteria

Participants with conditions like secondary HT and chronic kidney disease as well as pregnant women were excluded.

### Study samples

The sample size was calculated by G-power software, version 3.1.9.2. It was done by selecting the logistic regression as a statistical test. The intergroup comparisons between participants with controlled and uncontrolled blood pressure were performed using two independent proportions; Alpha=inserted by 0.05, Power of the test=inserted by 0.80; the proportion of participants with controlled blood pressure ( $p_1=0.6$ ,  $p_2=0.44$ , 0.5, 0.5). The authors estimated that a minimum sample size of 967, 104, 319, and 242 in the PCU of Site 1, Site 2, Site 3, and Site 4, respectively, were needed to generate a 95% confidence interval (CI) and 80% statistical power.

### Data collection

A socio-demographic characteristic questionnaire enquiring about age, gender, and name of PCU was administered by either the researcher or research assistants between January 2019 and May 2019. The clinical baseline data concerning SBP and DBP values, comorbidities, and antihypertensive prescriptions were gathered from the Hospital Information System (HIS) of Songklanagarind Hospital and the medical records of the outpatient departments of the other PCU

**Table 1.** Sociodemographic characteristics and clinical baseline of study population

Variable	Site 1 n (%)	Site 2 n (%)	Site 3 n (%)	Site 4 n (%)	Overall n (%)
Number of participants	1,061 (62.8)	130 (7.7)	346 (20.5)	153 (9.1)	1,690 (100)
Sex					
Male	386 (36.4)	44 (33.8)	105 (30.3)	76 (49.7)	611 (36.2)
Female	675 (63.5)	86 (66.2)	241 (69.7)	77 (50.3)	1,079 (63.8)
Age (years); mean±SD	65.5±10.8	61.3±9.8	64.5±11.7	57.8±11.6	64.27±10.78
SBP (mmHg); mean±SD	138±13.9	131±13.5	143±16.7	149±15.1	139.5±15.15
DBP (mmHg); mean±SD	76±10.2	77±9.8	76±12.2	84±10.1	77.2±10.81
Comorbidity					
Diabetes mellitus	443 (41.8)	9 (6.9)	63 (18.2)	36 (23.5)	551 (32.6)
Cardiovascular disease	3 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)	3 (0.2)
Dyslipidemia	843 (79.5)	83 (63.8)	246 (71.1)	15 (9.8)	1,187 (70.2)
Cerebrovascular disease	20 (1.9)	1 (0.8)	0 (0.0)	1 (0.7)	22 (1.3)
Number of antihypertensive drug prescriptions					
ACEIs/ARBs	657 (61.9)	76 (58.5)	119 (34.4)	58 (37.9)	910 (53.8)
Beta blockers	162 (15.3)	19 (14.6)	5 (1.4)	6 (3.9)	192 (11.4)
CCBs	643 (60.6)	87 (66.9)	222 (64.2)	134 (87.6)	1,086 (64.3)
Diuretics	262 (24.7)	27 (20.8)	49 (14.2)	30 (19.6)	368 (27.8)
Doxazosin	9 (0.8)	0 (0.0)	0 (0.0)	1 (0.7)	10 (0.6)
Hydralazine	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)
Prazosin	3 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)	3 (0.2)

SBP=systolic blood pressure; DBP=diastolic blood pressure; ACEIs/ARBs=angiotensin converting enzyme inhibitors/angiotensin receptor blockers; CCBs=calcium channel blockers; SD=standard deviation

by the researcher. The blood pressure was measured via an automatic blood pressure measurement device (OMRON® series HEM-7121) and patients were served by the same group of physicians according to the protocol recommended by the 2012 Guideline on the Treatment of Hypertension in Thailand and the 2015 update. The data were collected via Google forms and entered into a computer database management system using Microsoft Excel. The first hospital number (HN) was coded as number 1, the second was coded as number 2 and so on for every participant in order to ensure patient confidentiality.

### Data editing

Data cleansing to detect possible record inaccuracies was conducted using the Microsoft Excel software.

### Data analysis

The authors collected data using Microsoft Excel, and the statistical analyses were performed by means of the R software, version 1.2.1335. For

the descriptive data, descriptive statistics were used to assess patient demographics and patient-reported outcomes. Frequencies and percentages were calculated for descriptive variables (gender, age, comorbidities and antihypertensive prescriptions), whereas the mean and standard deviation were calculated for quantitative variables (SBP and DBP values). The authors compared the proportions of the participants with controlled blood pressure from each PCU using the Pearson's chi-square test. Multiple logistic regression analyses were performed to evaluate the associations between the significantly associated factors. The results of the logistic model were expressed as proportions with their 95% CIs. A p-value of less than 0.05 was regarded as statistically significant in the models. The R software, version 1.2.1335 was used for the statistical calculations.

### Results

The sites of the PCU were represented as Site 1, Site 2, Site 3 and Site 4, respectively. From the 1,690 participants, there were 1,061 (62.8%), 130

**Table 2.** Hypertension control and its associating factors (multiple logistic regression)

Factors	Uncontrolled BP (n=169) n (%)	Controlled BP (n=1,521) n (%)	Adjusted OR (95% CI)	p-value
Primary care unit sites				
Site 1	84 (49.7)	977 (64.2)	1	
Site 2	5 (2.9)	125 (8.2)	0.47 (0.17 to 1.12)	0.08
Site 3	41 (24.3)	305 (20.1)	1.69 (1.1 to 2.6)	0.01
Site 4	39 (23.1)	114 (7.5)	3 (1.77 to 5.09)	<0.001
Age group				
<65 years	49 (29.0)	773 (50.8)		
≥65 years	120 (71.0)	748 (49.2)	0.66 (0.47 to 0.93)	0.017
Sex				
Male	70 (41.4)	541 (35.6)		
Female	99 (58.6)	980 (64.4)	0.84 (0.6 to 1.17)	0.3
Comorbidity				
Diabetes mellitus	61 (36.1)	490 (32.2)	1.25 (0.87 to 1.79)	0.23
Cardiovascular disease	1 (0.6)	2 (0.1)	4.95 (0.43 to 57.67)	0.2
Dyslipidemia	93 (55.0)	1,094 (71.9)	0.67 (0.46 to 0.99)	0.04
Antihypertensive drug prescriptions				
ACEIs/ARBs	97 (57.4)	813 (53.5)	1.31 (0.89 to 1.91)	0.17
Beta blockers	15 (8.9)	177 (11.6)	0.97 (0.55 to 1.74)	0.93
CCBs	105 (62.1)	981 (64.5)	0.82 (0.56 to 1.2)	0.3
Diuretics	34 (20.1)	334 (22.0)	0.95 (0.62 to 1.44)	0.8

BP=blood pressure; ACEIs/ARBs=angiotensin converting enzyme inhibitors/angiotensin receptor blockers; CCBs=calcium channel blockers; OR=odds ratio; CI=confidence interval

(7.7%), 346 (20.5%), and 153 (9.1%) hypertensive patients in the PCU of Site 1, Site 2, Site 3 and Site 4, respectively. Six hundred eleven participants were male (36.2%), and 1,079 were female (63.8%). The mean age of the patients was 64.27±10.78 years, the mean SBP value was 139.5±15.15 mmHg, and the mean DBP value was 77.2±10.81 mmHg.

Approximately 70.2% of participants had hyperlipidemia. Furthermore, 32.6%, 1.30%, and 0.2% of them suffered from diabetes mellitus, cerebrovascular accidents, and ischemic heart disease or congestive heart failure, respectively.

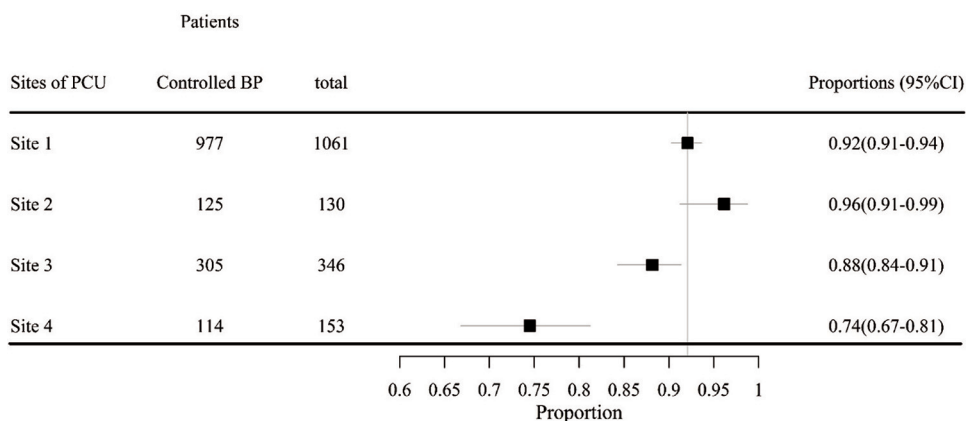
More than half of the patients were prescribed antihypertensive drugs like calcium channel blockers (CCBs) (64.3%) and angiotensin converting enzyme inhibitors (ACEIs) or angiotensin receptor blockers (ARBs) (53.8%).

The mean SBP values of Site 1, Site 2, Site 3 and Site 4 were 138±13.9, 131±13.5, 143±16.7, and 149±15.1 mmHg, respectively. Meanwhile, the mean DBP values were 76±10.2, 77±9.8, 76±12.2, and 84±10.1 mmHg. The main sociodemographic

characteristics and clinical baseline parameters are summarized in Table 1.

The results of the adjusted multivariate analyses are shown in Table 2. The odds of having uncontrolled blood pressure were about 1.25 times higher in participants with diabetes mellitus, almost five times higher in those having cardiovascular disease, and 1.31 times higher in those using ACEIs or ARBs compared to participants with controlled blood pressure in Site 1. Furthermore, the odds of having uncontrolled blood pressure were lower in participants of an older age, who were female, had dyslipidemia, and used beta blockers, CCBs, or diuretics. The adjusted odds ratios, the 95% CIs, and the p-values for these are shown in Table 2.

The present study found the patients from Site 2 were more likely to control their blood pressure well when compared with those from Site 1, yet no statistical significance was observed (p=0.08). Meanwhile, patients from both Site 3 and Site 4 were significantly less likely to control their blood pressure when compared with those from Site 1 (p<0.05).



**Figure 1.** Forest plot of proportion of participants with controlled blood pressure by PCU site: logistic regression analyses.

The results of the adjusted multivariate analyses are shown in Figure 1. The proportions of participants with controlled blood pressure from each PCU were 0.92 (95% CI 0.91 to 0.94,  $p=1.00$ ), 0.96 (95% CI 0.91 to 0.99,  $p=0.12$ ), 0.88 (95% CI 0.84 to 0.91,  $p=0.009$ ), and 0.74 (95% CI 0.67 to 0.81,  $p<0.05$ ) in Site 1, Site 2, Site 3, and Site 4, respectively (Figure 1).

## Discussion

The present study found the proportion of participants with controlled blood pressure was higher in the PCU of Site 2 than in Site 1. Furthermore, the proportion of participants with controlled blood pressure was lower in the PCU of Site 3 and Site 4 compared with the other two PCUs. The factors associated with HT control in the present study were location of PCU, age, gender, comorbidities, and types of antihypertensive drug prescription.

Even though the number of hypertensive patients in Thailand is on the rise, HT can be avoidable, thus prevent a cause of cardiovascular disease and renal failure<sup>(6)</sup>. There are more than nine thousand PCUs in Thailand<sup>(7)</sup>. The eminent roles of the primary healthcare are to be the point of first contact for patients seeking medical attention as well as ensure the provision of continuous, comprehensive, and coordinated care to anyone. A good primary healthcare system improves the quality of life and reduces the morbid conditions of the population it reaches<sup>(8)</sup>. Consequently, the control of HT at the primary healthcare level is essential.

To reduce the blood pressure level in hypertensive patients, physicians need to know the exact size of the problem to properly plan, provision, and evaluate the hypertensive management offered at the primary healthcare units. Regardless of its importance, the

precise proportion of participants with controlled blood pressure in the PCUs of Songklanagarind Hospital, Municipal School 4, Banpru Municipality, and Kho Hong Municipality is not known. Hence, the present study aimed to evaluate the proportion of patients with well-controlled HT that receive care at these four PCUs in Hat Yai District of Songkhla Province as well as determine the factors that associate with good HT control.

To ensure the most standardized and efficient blood pressure measurement, blood pressure in the present study was measured using an automatic blood pressure measurement device in accordance with the protocol recommended by the 2012 Guideline on the Treatment of Hypertension in Thailand and the 2015 update. The hypertensive patients at these four PCUs were served by the same group of physicians that worked there. This would have minimized the bias related to care provided by physicians. Moreover, the authors used systematic random sampling methods to select the time period for the study, which would have enhanced the possibility of having an evenly sampled population.

Regarding the sociodemographic characteristics and factors associated with HT control, the authors found that CCBs exhibited a higher level of association with good control than the other types of medicine. In addition, dyslipidemia was the most common comorbidity among the present study participants. The mean age of the participants was  $64.27\pm 10.78$  years, the mean SBP value was  $139.5\pm 15.15$  mmHg, and the mean DBP value was  $77.2\pm 10.81$  mmHg. These findings can be explained by the importance of patient frailty in this matter. Older age together with comorbidities could also be associated with the need for antihypertensive medicine as well as higher

blood pressure values.

The population in the four PCUs are different in many ways. Most of participants in Site 4 are employees of companies and factories, which can explain the younger mean age of the population compared to other PCUs. They usually spend most of their times working as a shift in the factories. Their occupations might affect their adherence to medication and cause them to have poorer control of blood pressure. Secondly, dyslipidemia in Site 4 is found to be the lowest percentage among the four PCUs, which might be due to more difficult access to laboratory assessments compared to others. Therefore, the prevalence of dyslipidemia could be underestimated. Thirdly, the distance between Site 4 and Site 1 is short, thus, patients can go to the PCU of Site 1 if they have health insurance that can cover the costs.

The present study found that the proportions of hypertensive patients from all the groups who received antihypertensive drugs were highest in Site 1. Only the proportion of the CCB group was higher in Site 4 than in the other sites. The comorbidities in Site 1 were proportionally higher than those in the other sites as well. The controlled blood pressure rates compared to the uncontrolled in Site 1 and Site 2 were higher than those in Site 3 and Site 4, especially when other factors were controlled in the multiple regression models. Although, the controlled blood pressure rates in the present study showed no meaningful differences between Site 1, Site 2, and Site 3, a statistically significant difference was detected between the rate of Site 4 and those of the other sites.

The controlled versus the uncontrolled blood pressure ratio was lowest in Site 4. This finding can be explained by this site's small sample size and the short period of time for data collection. Besides, Site 4 employs fewer staffs, and most of them are public health officers. There is only one registered nurse. This shortage in personnel might be a barrier to the thorough compliance with the guidelines. During the study, it was observed that, although available in all of the PCU at hand, the standard management guidelines for HT are often impractical in real-life practice<sup>(9)</sup>.

The better control rate in Site 1 might be due to the availability of more types of antihypertensive drugs in that PCU compared to the other PCUs. The present study found that the patients' mean age in three out of four PCUs was higher than 60 years. In one PCU, it was older than 55 years. The authors noticed that the statistically significant differences

in the blood pressure control rates among these four PCUs declined with age.

The patients received more antihypertensive drugs in Site 1 than in the others. This is possibly because a greater variety of drugs is available in Site 1. All PCUs in Thailand are obliged to prescribe only drugs that are in the list of the essential medicines available to each PCU. The local government can adjust the list by adding more drugs to it. More than 20 kinds of antihypertensive drugs were available in Site 1, whereas only 15, 14, and 12 types were available in Site 2, Site 3, and Site 4, respectively. Finally, the fact that the PCU of Site 1 provides care for an older population (mean age of  $65.5 \pm 10.8$  years) could indicate that, its medicine list comprises more kinds of antihypertensive drugs and it requires a non-stop access to laboratory investigations.

## Conclusion

In summary, there was no difference in blood pressure control rates among patients in the PCU of university hospital and community. Only the PCU of Site 4 had a significantly lower rate of adequate HT control compared to the other sites. These community based PCUs were generally capable of managing HT, even though the quality of the facilities differed significantly among the sites.

## What is already known on this topic?

HT is the biggest determinant for cardiovascular disease and causes many morbidities and mortalities worldwide including in Songkhla province. To know the quality of hypertensive care that is not yet ideally controlled among the PCUs, the proportion of patients with well-controlled HT could be studied further.

## What this study adds?

This research described the proportion of blood pressure control in hypertensive patients, which there was mostly no difference in blood pressure control rates among patients in the PCUs of university hospital and community. This could reflect the quality of hypertensive care.

## Acknowledgement

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## Conflicts of interest

The authors declare no conflict of interest.

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