

Factors Associated with Uncontrolled Hypertension among Adults

Aged 35 Years and Older in Narathiwat Province

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Abstract

Uncontrolled hypertension is an important public health issue and a leading contributor to global disease and mortality. The objective of this study is to determine the factors associated with uncontrolled hypertension among adults aged 35 years or older in Narathiwat province who had undergone hypertension screening for at least one year. Data were obtained from the Health Data Center of the national health database system from October 2012 to September 2022. A total of 43,015 adults were diagnosed with hypertension. Among them, 14,696 adults had uncontrolled hypertension, while 28,319 had achieved controlled blood pressure. Descriptive statistics and multiple logistic regression were employed to analyze the data. The overall prevalence of uncontrolled hypertension was 65.84%. Results show that an uncontrolled hypertension was prevalent among older adults aged more than 55 years, those who were single, those with no formal education, the unemployed, smokers, underweight adults, those who had been under care for a longer period, and those who had complications of diabetes mellitus. These results should raise awareness and encourage a healthy lifestyle to prevent or control hypertension.

Keywords: Uncontrolled hypertension, Blood pressure, Associated factors, Southern Thailand

Introduction

Uncontrolled hypertension is a significant contributor to cardiovascular-related morbidity and mortality, often resulting in illnesses (Iyer et al., 2010). Globally, hypertension ranks as the third leading cause of cardiovascular disease (Meher et al., 2023). It is also a significant factor in serious health problems, including cardiovascular, renal, and cerebrovascular complications (Gansevoort et al., 2013; Jafar et al., 2018).

Worldwide, approximately 1.28 billion persons between the ages of 30 and 79 have high blood pressure. However, only about 21% of these individuals have their condition under control (WHO, 2022). Despite the availability of medical interventions, hypertension frequently remains uncontrolled in primary care, contributing to 40% of ischemic heart disease deaths and 51% of stroke-related deaths globally (Böhm et al., 2015). Uncontrolled hypertension poses a significant public health challenge across both high- and low-income countries (Dzudie et al., 2012). In 2019, the global prevalence of hypertension is 33%. Regionally, prevalences are 35% in the Americas, 37% in Europe, 36% in Africa, 38% in the Eastern Mediterranean, 28% in the Western Pacific, and 37% in South-East Asia (WHO, 2023).

The prevalence of uncontrolled hypertension varies across countries. In northern Ethiopia, 48.6% of adult hypertensive patients under follow-up care had uncontrolled blood pressure (Aberhe et al., 2020). In Malaysia, a study among older adults reported that 45.9% experienced uncontrolled hypertension (Ghazali et al., 2020). Similarly, in Indonesia, 52.6% of the elderly with hypertension were found to have uncontrolled blood pressure (Mitra & Wulandari, 2019).

Several factors have been identified as contributing to uncontrolled hypertension, including demographic, socio-economic, and behavioral factors. High body mass index, male gender, older age, living alone, alcohol consumption, the presence of diabetes, elevated blood cholesterol levels, non-adherence to medical advice, and a physically inactive lifestyle have all been associated with uncontrolled hypertension (Mills et al., 2020; Kapoor, 2021; Katatwire & Meremo, 2023; Gobezie, 2024). Hypertension rates are higher in men than in women, as well as in older age groups (Cherfane, et al., 2024; Fryar et al., 2024). Additionally, having a university degree was found to be associated with a lower risk of uncontrolled hypertension (Meyer et al., 2025).

In Thailand, hypertension remains a public health concern, with its prevalence steadily increasing. The National Health Examination Survey conducted in 2009 reported a hypertension prevalence of 27.9% among Thai adults aged 15 years and above (Aekplakorn et al., 2011). During 2019–2020, the prevalence of age-standardized hypertension was 25.7%, with 51.5% diagnosed with hypertension, 47.9% receiving treatment, and only 22.7% able to control their blood pressure (Aekplakorn et al., 2024). The prevalence of uncontrolled hypertension patients in the rural communities in the central areas was 54.4% (Meelab et al., 2019). In the southern region, 48.1% of older adults were diagnosed with hypertension, and 59.9% were unaware of their blood pressure status. Among those affected, 19.9% had uncontrolled hypertension, while only 14.1% had their condition under control (Porapakkham et al., 2008). The primary objective of this study is to investigate the factors associated with uncontrolled hypertension among adults aged 35 years or older in Narathiwat province. In this province, 82.0% of the population is Muslim and 18.0% is Buddhist (Shobron et al., 2020). The patients' beliefs and perceptions about hypertension are associated with barriers to hypertension control (Panpakdee et al., 2003).

Materials and Methods

The study was conducted in Narathiwat Province, located in the southernmost part of Thailand, comprising 13 districts as shown in Fig. 1.

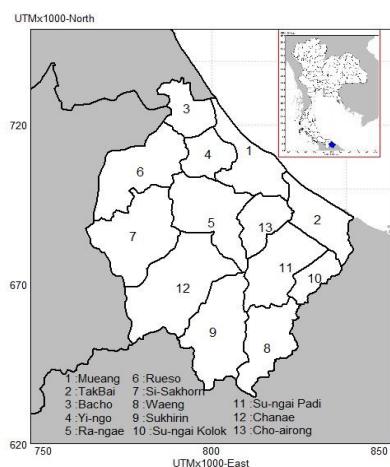


Figure 1 Map of Narathiwat

This study used secondary data sourced from the Health Data Center (HDC), the nation's primary health database system. The dataset covered the period from October 1, 2012, to September 30, 2022. The target population comprises adults aged 35 years or above in Narathiwat who had undergone hypertension screening.

A comprehensive hypertension screening was conducted on a total of 286,656 adults from 2012 until 2022. Among them, 49,261 adults were diagnosed with hypertension based on the International Classification of Diseases from the Tenth Revision (ICD-10) of the code for essential (primary) hypertension (I10–I15). Of the total, 47,733 adults had at least one year of follow-up. An additional 1,528 new cases identified in 2022 were excluded from the study. Among the follow-up group, 14,696 adults were identified with uncontrolled hypertension, 28,319 had achieved blood pressure control, and 4,718 were lost to follow-up. To be included in the study, all cases were required to have a documented diagnosis of hypertension for at least one year.

For this study the sample size is 43,015 adults, as shown in Fig. 2. The classification of uncontrolled hypertension is based on the criterion of not achieving optimal blood pressure control, defined as a last recorded systolic blood pressure of ≥ 140 mmHg or diastolic blood pressure of ≥ 90 mmHg.

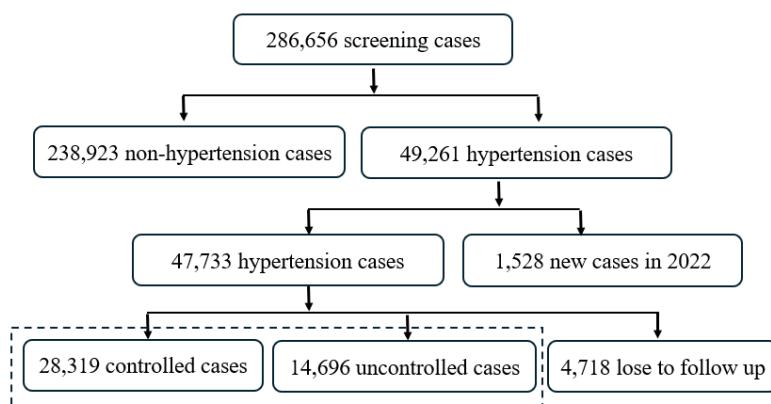


Figure 2 Data flow diagram

The outcome variable is binary, namely uncontrolled hypertension versus controlled hypertension. The factors considered are gender, the four age groups 35–44, 45–54, 55–64 and 65+, marital status classified as single, married, widowed and unknown, occupation classified as no occupation, agriculture, employee, government officer and other, education level (uneducated, primary school, secondary school, Bachelor or higher), current district of residence (13 districts in Narathiwat), smoking status, presence of diabetes mellitus complications, body mass index, family history of diabetes mellitus, and duration of time under care. The duration of time is calculated as the difference between the initial hypertension diagnosis and the most recent blood pressure record, categorized into five groups: 1–2 years, 3–4 years, 5–6 years, 7–8 years, and 9–10 years. However, some data were missing for marital status, smoking status, presence of diabetes mellitus complications, body mass index, and family history of diabetes mellitus. These missing values were categorized as an 'unknown' group for each variable.

This research obtained ethical approval from the Research Committee of Prince of Songkla University with approval ID: PSU.PN.1-012/67.

Sample characteristics are presented using descriptive statistics. Tabulations and cross-tabulations are used to characterize the sample, including counts and percentages for categorical variables. The chi-squared test of independence is used to examine the association between the categorical variables of both the outcome and risk

factors. This study employed multiple logistic regression to investigate the association between outcome and all determinants, namely

$$\ln\left(\frac{p}{1-p}\right) = \alpha + \sum_{i=1}^n \beta_i x_i$$

where p denotes the probability of occurrence of outcome, α is a constant, β_i are regression coefficients, and x_i denote risk factors. A 95% confidence interval shows the effect of each factor group on uncontrolled hypertension based on the model. A receiver operating characteristic (ROC) curve shows how well the model fits the data. All graphical and statistical analyses were performed using R language and environment (R Core Team, 2020).

Results

Of the 43,015 patients included in this study, 14,696 (34.16%) had controlled hypertension, while the majority, 28,319 (65.84%) had uncontrolled hypertension. Descriptive and bivariate analyses of controlled and uncontrolled hypertension in association to each characteristic factor are shown in Table 1. Most of the hypertension screening adults were female (63.5%) and older than 50 years old (71.42%). The majority were married (74.55%) and worked in agriculture or as employed (64.18%). Regarding education, 39.73% were uneducated, and 13.23% lived in Muang district. Body mass index distribution showed that 42.29% had a normal BMI, compared to 40.18% were overweight. Clinically, most adults (56.1%) did not have complications from diabetes mellitus. The percentages of adults who underwent continuous hypertension screening were similar across all time groups.

The crosstabulation between controlled and uncontrolled hypertension for each factor shows that males (66.7%) had a slightly higher rate of uncontrolled hypertension compared to females (65.3%). There is no evidence of a difference in the percentage of uncontrolled hypertension across age groups. Higher rates of uncontrolled hypertension were observed among single patients (70.0%), those unemployed (73.8%), and those with no education (69.2%). Patients residing in the districts of Ra-ngae (71.1%), Rueso (73.9%), Sukhirin (97.1%), Su-ngai Padi (75.5%), and Cho-airong (91.0%) had the highest rates of uncontrolled hypertension. Additionally, adults with complications from diabetes mellitus (79.9%) and those who had been advised and were under care for more than six years exhibited the highest rates of uncontrolled hypertension. The bivariate analysis revealed that all factors were significantly associated with uncontrolled hypertension (p -value < 0.05).

Table 1 Characteristics of hypertension patients and their association with uncontrolled hypertension

Demographic factors	Frequency (%) 43,015	Frequency Percent (%)		Test statistics Chisq (df)	p-value
		controlled 14,696 (34.2)	uncontrolled 28,319 (65.8)		
Gender				8.1 (1df)	0.004
Male	15,694 (36.5)	5,227 (33.3)	10,467 (66.7)		
Female	27,321 (63.5)	9,469 (34.7)	17,852 (65.3)	57.8 (3df)	<0.001
Age group					
35-44	3,284 (7.7)	1,287 (39.2)	1,997 (60.8)		
45-54	9,009 (20.9)	3,201 (35.5)	5,808 (64.5)		
55-64	13,469 (31.3)	4,525 (33.6)	8,944 (66.4)		
65+	17,253 (40.1)	5,683 (32.9)	11,570 (67.1)		
Status				55.7 (3df)	<0.001
Single	3,548 (7.2)	1,042 (29.4)	2,506 (70.6)		
Married	32,066 (70.6)	11,117 (34.7)	20,949 (65.3)		
Widowed	3,901 (9.1)	1,418 (36.3)	2,483 (63.7)		
Unknown	3,500 (8.1)	1,119 (32.0)	2,381 (68.0)		
Occupation				236.2 (4df)	<0.001
No occupation	6,522 (15.1)	1,709 (26.2)	4,813 (73.8)		
Agriculture	13,283 (30.9)	4,635 (34.9)	8,648 (65.1)		
Employee	14,325 (33.3)	5,291 (36.9)	9,034 (63.1)		
Government	2,445 (5.7)	845 (34.6)	1,600 (65.4)		
Other	6,440 (15.0)	2,216 (34.4)	4,224 (65.6)		
Education				330.6 (3df)	<0.001
Uneducated	17,090 (39.7)	5,270 (30.8)	11,820 (69.2)		
Primary	18,025 (41.9)	6,074 (33.7)	11,951 (66.3)		
Secondary	5,310 (12.4)	2,210 (41.6)	3,100 (58.4)		
Bachelor or higher	2,590 (6.0)	1,142 (44.1)	1,448 (55.9)		
District				3942.3 (12df)	<0.001
Mueang	5,693 (13.2)	2,160 (37.9)	3,533 (62.1)		
TakBai	3,802 (8.8)	1,292 (34.0)	2,510 (66.0)		
Bacho	3,567 (8.3)	1,594 (44.7)	1,973 (55.3)		
Yi-ngo	2,769 (6.4)	1,441 (52.0)	1,328 (48.0)		
Ra-ngae	4,861 (11.3)	1,403 (28.9)	3,458 (71.1)		
Rueso	2,548 (5.9)	665 (26.1)	1,883 (73.9)		
Si Sakhon	1,725 (4.0)	875 (50.7)	850 (49.3)		
Waeng	2,897 (6.7)	1,563 (54.0)	1,334 (46.0)		
Sukhirin	3,051 (7.1)	89 (2.9)	2,962 (97.1)		
Su-ngai Kolok	4,869 (11.3)	1,610 (33.1)	3,259 (66.9)		
Su-ngai Padi	2,981 (6.9)	729 (24.5)	2,252 (75.5)		
Chanae	1,932 (4.5)	1,067 (55.2)	865 (44.8)		
Cho-airong	2,320 (5.4)	208 (9.0)	2,112 (91.0)		
Smoke				1993.4 (2df)	< 0.001
Yes	1,922 (4.4)	578 (30.1)	1,344 (69.9)		
No	35,128 (81.7)	13,575 (38.6)	21,553 (61.4)		
Unknown	5,965 (13.9)	543 (9.1)	5,422 (90.9)		
Family with diabetes mellitus				552.8 (2df)	< 0.001
Yes	375 (0.9)	186 (49.6)	189 (50.4)		
No	31,294 (72.7)	11,629 (37.2)	19,665 (62.8)		
Unknown	11,346 (26.4)	2,881 (25.4)	8,465 (74.6)		
Body mass index (BMI)				1854.6 (3df)	< 0.001
Underweight	7,006 (16.3)	7,535 (41.4)	10,655 (58.6)		
Normal weight	18,190 (42.3)	5,974 (34.6)	11,310 (65.4)		
Overweight	17,284 (40.2)	264 (49.3)	271 (50.7)		
Unknown	535 (1.2)	923 (13.2)	6083 (86.8)		
Complication of diabetes mellitus				1548.1 (2df)	< 0.001
Yes	8,771 (20.4)	1,764 (20.1)	7,007 (79.9)		
No	24,129 (56.1)	10,077 (41.8)	14,052 (58.2)		
Unknown	10,115 (23.5)	2,855 (28.2)	7,260 (71.8)		
Length of screening time (year)				223.9 (4df)	< 0.001
1-2	8,405 (19.5)	3,328 (39.6)	5,077 (60.4)		
3-4	8,224 (19.1)	2,769 (33.7)	5,455 (66.3)		
5-6	9,747 (22.7)	3,506 (36.0)	6,241 (64.0)		
7-8	6,935 (16.1)	2,191 (31.6)	4,744 (68.4)		
9-10	9,704 (22.6)	2,902 (29.9)	6,802 (70.1)		

The results of the multiple logistic regression are presented in Fig. 3, where hollow circles denote the crude prevalence, dark solid circles denote the adjusted prevalence, and the horizontal lines mark the overall average prevalence of uncontrolled hypertension (65.8%). Factors found to be associated with uncontrolled hypertension were age group, marital status, occupation, education level, current district of residence, smoking status, presence

of diabetes mellitus complications, body mass index, family history of diabetes mellitus and length of time under care.

The prevalence of adjusted uncontrolled hypertension is higher than the overall prevalence rate among adults between the ages of 55–65, while lower in adults under the age of 45. Single or unemployed adults had a higher prevalence of uncontrolled hypertension than the overall prevalence.

Among this sample, single, low-educated, or unemployed adults had a higher adjusted prevalence of uncontrolled hypertension than the overall prevalence rate. Similarly, residents of Ragae, Rueso, Sukirin, Sungai Padi and Pang Iront districts also had an adjusted prevalence rate higher than the overall prevalence. Sukirin has the highest prevalence of uncontrolled hypertension. It could be due to the geography, as most of the area is forested and mountainous. Distance, terrain, and other factors might limit access to infrastructure and public health services.

In terms of health-related factors, adults who smoke, are underweight, or have a family history of diabetes have a higher adjusted prevalence of uncontrolled hypertension than overall prevalence. Additionally, adults who have been in care for more than 7 years have a higher adjusted prevalence rate compared to the overall prevalence rate.

The ROC curve for the multiple logistic regression model of uncontrolled hypertension was shown in Fig. 4. The model is reasonably good, with an AUC of 0.758.

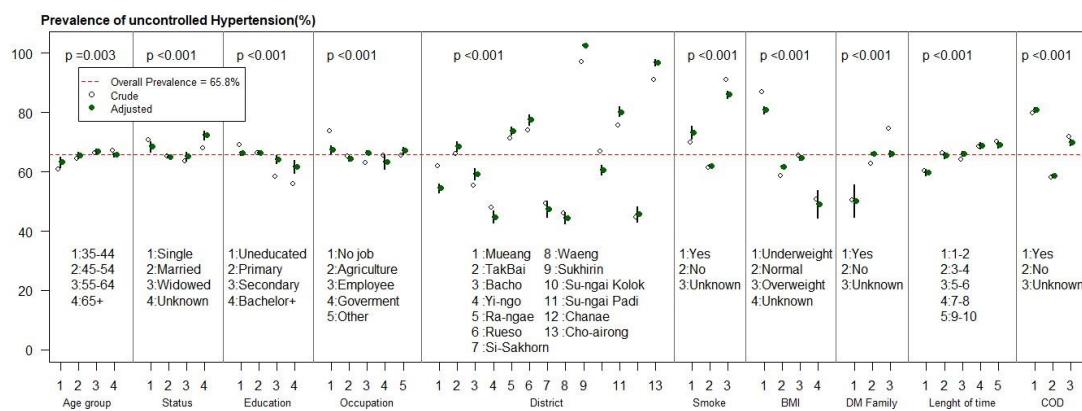


Figure 3 The 95% CI of uncontrolled hypertension prevalence from the logistic model

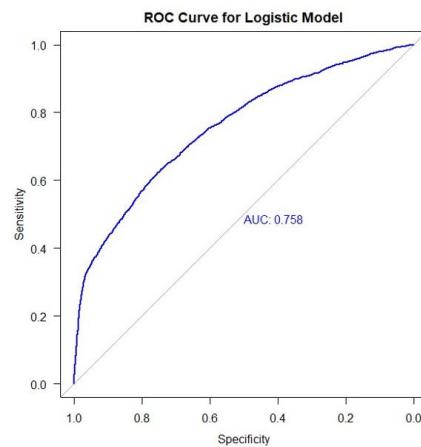


Figure 4 ROC curve of logistic regression model

Discussion

The findings of this study show uncontrolled hypertension to be significantly associated with several factors, including age, marital status, occupation, education level, current district of residence, smoking status, body mass index, family history of diabetes mellitus, complications of diabetes, and length of time under care.

The prevalence of uncontrolled hypertension increases with age. This result is consistent with the several studies (Farhadi et al., 2023; Cherfane et al., 2024; Fryar et al., 2024). Marital status is associated with hypertension. Single adults have a higher prevalence of uncontrolled hypertension, in agreement with the study of Ramezankhani et al. (2019). However, some studies have shown no significant association between marital status and hypertension control (Liew et al., 2019).

Adults with no education and unemployment were found to be significantly associated with uncontrolled hypertension. Adults with lower levels of education were found to be at higher risk for hypertension (Zacher, 2023). This may be because low educational attainment is linked to lower health literacy, which can affect individuals' understanding of their health concerns (McNaughton et al., 2015). Unemployed adults had a higher frequency of uncontrolled hypertension than those who were employed. This association could be related to the stress and financial uncertainty that come with being unemployed, which can have a negative impact on health behaviors and access to healthcare.

Adults who smoked were more likely to have uncontrolled hypertension than nonsmokers. Smoking was related to other negative behaviors, including a poor diet and a lack of exercise, all of which can lead to hypertension. Smokers may also be less likely to take antihypertensive drugs, which contributes to uncontrolled blood pressure (McNagny et al., 1997; Kaplan et al., 2020).

Adults with underweight were more likely to have uncontrolled hypertension, with an adjusted prevalence rate higher than the overall prevalence. This may be due to a lack of awareness, which can lead to lower rates of blood pressure control in adults who are underweight. They may also receive inadequate monitoring or treatment for high blood pressure. Adults with diabetes mellitus complications were more likely to have uncontrolled hypertension than those without complications. Complications were significantly more common in patients with uncontrolled blood pressure (Rabizadeh et al., 2021).

Among adults receiving care for hypertension, longer duration of care was related to a higher prevalence of uncontrolled hypertension. This suggests that longer periods of care may not necessarily indicate improved blood pressure control. This outcome is likely attributable to underlying factor such as medication non-adherence, insufficient treatment strategies, or the inherent complexity of managing multiple comorbidities (Aberhe et al., 2020).

Conclusion and Suggestions

The findings imply that extended hypertension treatment durations are theoretically expected to improve blood pressure control, they may not always lead to improved outcomes. This disparity suggests the need for healthcare practitioners to prioritize patient education and engagement, ensuring individuals are fully aware of their condition and are actively encouraged to adopt healthy behaviors as part of their daily routine. This information is crucial

for implementing enhanced, patient-centered strategies designed to ensure individuals achieve and maintain regulated blood pressure effectively.

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Author Contributions

Areefan Mahmud: Conceptualization, methodology design, data collection and analysis, manuscript writing

Rhysa McNeil: Conceptualization, methodology design, data interpretation, manuscript writing and editing

Kriangsak Damchoom: Conceptualization, methodology design, manuscript review and editing

Conflict of Interests

All authors declare that they have no conflicts of interest.

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