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Evaluation of a Hospital-based Hypertension Screening Program in Seven Hospitals in Thailand

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Abstract

The Department of Disease Control in Thailand piloted an intervention program at seven hospitals around the country for screening hypertension during May–September 2019. The intervention focused on implementing a guideline for managing patients with raised blood pressure. The guideline included provision of a blood pressure notification and follow-up book and conducting meetings to communicate them to the hospital representative, aim for enhancing patient coverage and reducing the risks from persistent hypertension. An evaluation was conducted to assess the effectiveness of the program and identify weaknesses. The evaluation consisted of quantitative and qualitative methods. A comparison of the proportion of newly diagnosed hypertensive patients among patients who had raised blood pressure before and after implementation of the intervention was performed. Healthcare workers in each hospital were interviewed about the work process of the program. The overall proportion of newly diagnosed hypertensive patients increased by 1.1% after the intervention (range: -11.7 to 2.9%). The practice compared between pre- and post-intervention did not have difference as expected. From the qualitative interviews, healthcare workers believed that the decision to make a follow-up appointment rested solely with the physician. Physicians tended to make appointments at one month because of their high workload. Adequate orientation of the guideline and providing robust and feasible processes were essential for the program's success. Monitoring and evaluation should be done periodically to ensure protocol adherence.

Keywords: hospital-based screening, hypertension screening, hypertension diagnosis, program evaluation

Introduction

Hypertension is a condition in which blood vessels have persistently raised pressure. Raised blood pressure (RBP) is defined as a systolic blood pressure (SBP) ≥140 millimetres of mercury (mmHg) or a diastolic blood pressure (DBP) ≥90 mmHg.[1,2] Globally, 1.4 billion adults have raised blood pressure; however, less than 21% of them have blood pressure controlled within normal range after the treatment.[3] From a couple of survey globally, undiagnosed hypertension patients were account for 5.3–50% and left untreated.[4–8] Persistent RBP or hypertension can increase the risk of cardiovascular diseases (CVDs), which are a leading cause of death. It is estimated that 17.9 million people died from CVDs in 2016, representing 31% of all global deaths, mainly due to heart attack and stroke.[3]

In 2016, the fifth Thai National Health Examination Survey revealed that the number of RBP patients (aged above 15 years) was around 13.3 million, which is a prevalence of 24.7%.[9] Among this group, 5.9 million (44.7%) had undiagnosed hypertension. According to the Thai Ministry of Public Health in the 2018 fiscal year, approximately 44 million people in Thailand visited hospitals and had their blood pressure measured, of which about 11 million had RBP and 65% had not yet been diagnosed as hypertension.[10] This vulnerable group tends to experience inappropriate management (including diagnosis), follow up, and treatment.

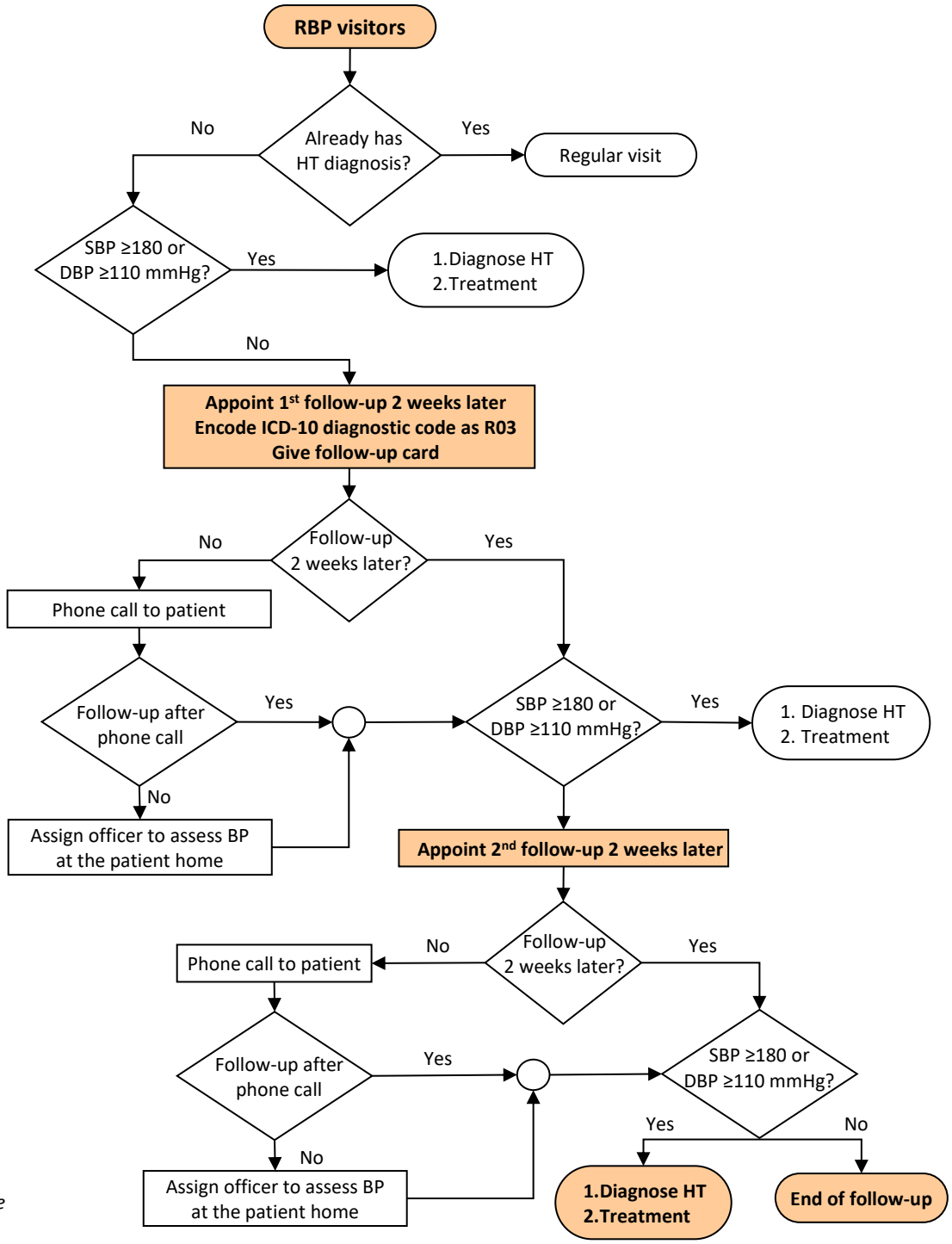
A previous study from Thailand was able to increase hypertension diagnoses during hospital visits using interventions such as notification of RBP through

healthcare personnel's interface to reduce unrecognised RBP visitors, and the introduction of a "follow up book" to reduce the loss to follow-up rate.[11] The rate of newly diagnosis hypertension increased by 15.4% after the intervention.

Subsequently, a hospital-based hypertension screening program was established by the Department of Disease Control for enhancing RBP patient coverage and reducing the risks from persistent hypertension.[12]

The major intervention of this program is the developing of management guideline for RBP visitors. The management flowchart is shown in Figure 1.

The program was started since May 2019 in many hospitals in the central region of Thailand.[12] Along with the program implementation, to assess the effectiveness of this guideline and find opportunities for improvement, the program required a post-implementation evaluation.



HT: hypertension
RBP: raised blood pressure
SBP: systolic blood pressure
DBP: diastolic blood pressure
BP: blood pressure
ICD-10: International Classification of Diseases, tenth revision
R03: ICD-10 code R03 for abnormal blood-pressure reading, without diagnosis

Figure 1. RBP management flowchart (adapted from guideline for raised blood pressure visitor management for healthcare personnel, Division of Non-communicable Diseases, Department of Disease Control, 2019)

Methods

Study Design

This evaluation was a cross-sectional study consisting of two parts: a quantitative analysis and qualitative interviews. In the quantitative part, we compared the proportions of newly diagnosed hypertension patients among all raised blood pressure patients between pre- and post-program implementation. The period of data collection was from the start of the program in May 2019 until the program evaluation. We also collected data in the same period in 2018 (before the program started), for comparative purposes. The data collection period for each hospital differed depending on the starting of program implementation and we evaluated the program one month after the implementation.

In the qualitative part, healthcare personnel including physicians, screening nurses, non-communicable disease (NCD)-care team leaders, public health officers or NCD-related job titles were interviewed with open-ended questionnaires. Topics discussed consisted of orientation and distribution of the guideline in the workplace, recognition of RBP patients during hospital visits, follow-up practices and management, and diagnosis practices.

Program evaluation purposely selected in seven hospitals and across four provinces in the central region of Thailand. The selected hospitals included small-sized hospitals (fewer than 50 beds), medium-sized hospitals (60–100 beds) and large-sized hospitals (greater than 100 beds). In this study, only one large hospital, hospital "A" (328 beds), and one medium hospital, hospital "B1" (65 beds), were selected. The rest of the selected hospitals, namely hospital "S" (48 beds), hospital "BS" (30 beds), hospital "B2" (27 beds), hospital "BB" (26 beds), and hospital "P" (18 beds) were classified as small-sized. The study population for the quantitative study included all hospital visitors who had a blood pressure equal to or greater than 140/90 mmHg at their visit. We excluded visitors who had already been diagnosed with hypertension before the study period. Pregnant women and those aged less than 15 years were also excluded.

Operational Definitions

A hypertensive patient in this study included any patient with one of the following: the international classification of diseases, tenth revision (ICD-10) diagnostic codes recorded in the hospital database: I10 (Essential hypertension), I11 (Hypertensive heart disease), I12 (Hypertensive chronic kidney disease), I13 (Hypertensive heart and chronic kidney disease), and I15 (Secondary hypertension).[13]

Blood pressure status in this study was divided into four levels based on the 2019 Thai guideline on the treatment and diagnosis of hypertension: (1) isolated systolic hypertension; SBP ≥140 mmHg and DBP <90 mmHg, (2) stage 1 hypertension; SBP 140–159 or DBP 90–99 mmHg, (3) stage 2 hypertension; SBP 160–179 or DBP 100–109 mmHg, and (4) stage 3 hypertension; SBP ≥180 or DBP ≥110 mmHg.[14]

A newly diagnosed hypertensive patient was defined as a hypertensive patient who was first diagnosed with an ICD-10 code I10 to I15 (Hypertension and related condition) in the hospital database during the study period.

Data Collection and Variables

All data were extracted from electronic medical records in each hospital database. Selected variables included hospital number, gender, date of birth, weight, height, visit date, underlying disease, and residential address. Data were collected once in the evaluation period and separated into a pre-implementation and post-implementation dataset. The data of patients with multiple visits should be treated by selecting the latest date of patient visit. In the process of data cleaning, weight, height and blood pressure were verified for validity. A weight in the range of 30–130 kilograms, height in the range of 100–200 centimetres, systolic blood pressure level in the range of 60–220 mmHg and diastolic blood pressure in the range of 40–120 mmHg were defined as valid. A patient with any level outside these valid ranges were excluded from the analysis.

Data Analysis

Continuous variables were presented descriptively using medians with interquartile ranges. Categorical variables were presented using proportions. The main outcome of the program was calculated as the proportion of newly diagnosed hypertensive patients among all RBP patients. We compared the proportions between pre- and post-implementation using a chi-square test. The statistically significant level (α) was set as 0.05. Python version 3.8.5 was used for data analysis.

Results

Characteristics of Study Population

The medical records of 123,552 patients with RBP were identified and extracted from the seven study hospitals. After data were cleaned and duplications were deleted, 36,324 patients were identified as RBP, of which 17,650 (48.6%) and 18,674 (51.4%) were reported in 2018 (pre-implementation) and 2019 (post-implementation), respectively.

The demographic characteristics of the pre- and post-implementation study population is shown on Table 1. Males accounted for 48.0–48.2% of the RBP patients. The median age was 56 years (Q1–Q3: 34–78) and 57 years (Q1–Q3: 35–79) in 2018 and 2019, respectively. Most were aged 60 years and older. At the hospital visit, 69% of the patients were diagnosed with isolated systolic hypertension, followed by stage 1 hypertension (27.6–27.7%) and stage 2 hypertension (2.6–2.7%) whereas stage 3 hypertension was detected in 0.5–0.6%. Approximately 5% had diabetes and dyslipidemia. When comparing between 2018 and 2019, there were no differences in the distribution of RBP patients by age, gender, body mass index, blood pressure level, and comorbidities.

Table 1. A comparison of characteristics of RBP patients between pre- and post-implementation of a hospital-based intervention program

Characteristics	Pre-implementation (n=17,650)		Post-implementation (n=18,674)	
	Number of patients	Percent	Number of patients	Percent
Age				
Median	56		57	
Interquartile range (Q1–Q3)	22 (34–78)		22 (35–79)	
Age group (years)				
15–44	4,810	27.3	4,863	26.0
45–60	5,705	32.3	5,924	31.7
>60	7,135	40.4	7,887	42.2
Gender				
Male (%)	8,479	48.0	8,995	48.2
BMI				
Median	25		25	
Interquartile range (Q1–Q3)	6.2 (22.2–28.4)		6.2 (22.1–28.3)	
BMI categories				
Underweight	1,002	5.7	1,022	5.5
Normal	4,568	25.9	4,932	26.4
Pre-obese	3,213	18.2	3,407	18.2
Obesity level 1	5,826	33.0	6,127	32.8
Obesity level 2	3,041	17.2	3,186	17.1
Blood pressure status at visit				
Isolated systolic hypertension	12,231	69.3	12,895	69.1
Stage 1	4,881	27.7	5,156	27.6
Stage 2	453	2.6	510	2.7
Stage 3	85	0.5	113	0.6
Comorbidities				
Diabetes	943	5.3	988	5.3
Dyslipidemia	1,031	5.8	1,088	5.8

BMI: body mass index

Main Outcome: Newly Diagnosed Hypertension among RBP Patients

Overall, the proportion of newly diagnosed hypertensive patients across all seven hospitals increased significantly from 8.5% (1,389/16,261) in 2018 to 9.6% (1,637/17,037) in 2019 (p <0.01). As shown in Table 2, four of the seven selected hospitals demonstrated an increase, of which one was statistically significant. In contrast, three hospitals demonstrated a decrease, of which one was statistically significant.

Table 2. Comparison of the proportion of newly diagnosed hypertension patients among RBP patients by selected hospitals

Hospitals	No. of beds	Period of data collection	Pre-implementation (2018)			Post-implementation (2019)			Difference (%)	*P*-value
			No. of RBP patients	No. of diagnosis	Percent (%)	No. of RBP patients	No. of diagnosis	Percent (%)		
B1	65	June–September	4,591	561	12.2	5,467	826	15.1	2.9	<0.001
BS	30	June–September	2,242	184	8.2	2,335	216	9.3	1.0	0.125
S	48	June–September	1,005	79	7.9	1,166	100	8.6	0.7	0.578
A	328	July–September	2,305	104	4.5	2,009	95	4.7	0.2	0.747
P	18	June–September	4,434	208	4.7	4,283	190	4.4	-0.3	0.586
B2	27	August–September	1,310	150	11.5	1,430	155	10.8	-0.6	0.650
BB	26	August–September	374	103	27.5	347	55	15.9	-11.7	<0.001
Totals			**16,261**	**1,389**	**8.5**	**17,037**	**1,637**	**9.6**	**1.1**	**0.002**

Stage 3 Hypertension

Based on the 2019 Thai guideline on the treatment and diagnosis of hypertension, undiagnosed stage 3 hypertension patients needed to get hypertension diagnosis and treatment at visit. As shown in Table 3, 36–37% of patients who were classified as stage 3 hypertension received a diagnosis as hypertension and received treatment to control their blood pressure (31/85 in 2018 versus 42/113 in 2019). However, the proportions among patients with stage 3 hypertension and received diagnosis ranged from 14.3–60.0% versus 21.4–50.0% in 2018 and 2019, respectively.

Table 3. Comparison of the proportion of newly diagnosed hypertension patients among RBP patients with stage 3 hypertension by selected hospitals

Hospitals	Pre-implementation			Post-implementation		
	No. of RBP patients with stage 3 hypertension	No. of diagnosis	Percent (%)	No. of RBP patients with stage 3 hypertension	No. of diagnosis	Percent (%)
A	14	2	14.3	14	5	35.7
BB	4	1	25.0	2	1	50.0
B1	20	12	60.0	51	24	47.1
B2	9	4	44.4	14	3	21.4
BS	21	6	28.6	12	3	25.0
P	5	3	60.0	8	3	37.5
S	12	3	25.0	12	3	25.0
Total	**85**	**31**	**36.5**	**113**	**42**	**37.2**

Assessment of RBP Practices among Healthcare Personnel

Orientation of the guideline

The RBP management guideline was distributed to all seven selected hospitals. However, only three could participate in the orientation meeting held by the Division of Non-communicable Diseases, Department of Disease Control in May 2019. During implementation, influenced by NCD-care team leaders of each hospital, the management of RBP patients varied among the selected hospitals. This issue also affected the time at the commencement of program implementation. Thus, "B1" gained the highest increase in diagnosis, the staff from hospital "B1" said they had communicated with the program manager about the guideline and management protocol.

Recognition of RBP during visits

Patients' blood pressure levels were measured by the screening officers. Four of the seven hospitals had some notification methods when RBP patients were

detected. For example, a small sticky note was used as a notification by being written down and attached with the patients' medical records. "Blood pressure" box was highlighted on the computer screen for the screening staff when blood pressure values were above 160/90 mmHg. However, no notification pop up was shown on the screen for physicians in all the selected hospitals. When the blood pressure of RBP visitors reached 180/110 mmHg, all hospitals had a special "fast track" to send them to the emergency room immediately after detection.

Follow-up practices

Physicians played a key role to determine whether patients needed to be followed up. Because of their high daily workload, most physicians tended to follow up RBP patients with a blood pressure ≥160/90 mmHg and set a follow-up period as around one month. Officers from hospital "B1" stated that they had separate records for the enrolled RBP patients who needed to be followed up and gave them special appointment cards. The special card includes the patient's information so that the RBP patients were able to follow up their blood pressure at other health facilities. Furthermore, the card provided useful advice for the patients in case their blood pressure became elevated or if they developed other suspicious symptoms. When patients with RBP were detected, the responsible staff from all seven hospitals did not use the ICD-10 code R03: "Abnormal blood-pressure reading, without diagnosis", to track down the patients. However, all seven hospitals worked in collaboration with village health volunteers to follow up patients, assess blood pressure and report the results to the hospital.

Diagnosis practices

Physicians from all the hospitals have a crucial role for making the definite hypertension diagnosis for the incoming visitors. All interviewed physicians also stated that they followed the 2019 Thai guideline on the treatment and diagnosis of hypertension, announced by Thai Hypertension Society.[14]

Discussion

It was found that the proportion of newly diagnosed hypertension significantly increased after implementation of a hospital-based intervention program, although the increase was small (1.1%). This indicates that this intervention involving only guideline distribution and one meeting could not yield impressive results. Therefore, the success of intervention required good communication and coordination as well as support from the policy level.[8,15] However, in one hospital ("B1"), the increase was 2.9%, which was statistically significant, and suggests that the implementation of the guideline into RBP management practices was partially successful. This particular hospital has good internal communication and collaboration and has meticulous RBP case recognition and detection methods.[15] Moreover, systems developed for RBP registration using separate records and case follow-up were effectively conducted. A special appointment card would be one of the practical ways to help adherence to the follow-up process.

According to the result, RBP patients were recognized manually by responsible staff using sticky notes. Meanwhile, hospital information software only provided minimal highlights in exceeding blood pressure value but did not have recognition aid like automatic label or notification pop up box. So, a computer-based recognition support system could be beneficial in this situation. From the result, almost all the selected hospitals did not have effective ways to detect and register high number of RBP patients which visited the hospital. Integration of clinical decision support system (CDSS) in hospital information systems might improve recognition and detection of raised blood pressure patients on visits by establishing visual-aid pop-up when RBP patient was found, or automatically label 1st visit of RBP patient as R03 for further follow-up and assessment. From the systematic review, CDSS provides diagnostic support based on patient data, and automating output from history taking and physical examination.[13,16] Moreover, CDSS lead to automated workflow improvement; they could deliver solutions for detection, recognition, and diagnosis.

Due to their high workload, physicians usually make an appointment with the patients with stage 2 and 3 hypertension (blood pressure ≥160/90 mmHg) to follow up the blood pressure level. Therefore, stage 1 or isolated systolic hypertension patients tended to be ignored by the healthcare staff to reassess the blood pressure. Since these patients account for about 90% of all RBP patients, this could affect the actual number of newly diagnosed hypertension patients. From a couple of studies, isolated systolic hypertension and stage 1 hypertension accounted for morbidity and mortality from cardiovascular disease or cerebrovascular disease latterly.[17–20]

This study has some limitations. We relied on the diagnosis based on electronic hospital medical records. We could have missed some of the RBP patients who follow up their blood pressure at health facilities outside the hospital. Secondly, all hospitals did not start the intervention in the same period, which means we could not compare the results from each hospital directly. Moreover, this could result in a slightly lower number of newly diagnosed hypertension patients.

Recommendations

We recommend hospitals develop a "Raised Blood Pressure" recognition system, e.g., a pop-up notification on the physician's computer screen, or highlight blood pressure notification, to increase RBP recognition and detection in the hospital setting. RBP patients who need follow up should be systematically labelled in hospital databases, such as ICD-10 encoding as R03 or registered in separate records. At the policy level, feasible tools or specific interventions should be provided along with the guideline. The monitoring and evaluation should be periodically conducted to ensure all implemented hospital practices adhere to the guideline and remove barriers or obstacles of program success.

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References

1. World Health Organization. Hypertension: overview [Internet]. Geneva: World Health Organization; [cited 2022 May 16]. <https://www.who.int/health-topics/hypertension#tab=tab_1>
2. World Health Organization. High blood pressure-measure accurately, control it and live longer [Internet]. Geneva: World Health Organization; 2022 May 16 [cited 2022 Sep 15]. <https://www.who.int/srilanka/news/detail/16-05-2022-high-blood-pressure---measure-accurately--control-it-and-live-longer>
3. World Health Organization. Cardiovascular diseases (CVDs) [Internet]. Geneva: World Health Organization; 2021 Jun 11 [cited 2022 Sep 15]. <https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)>
4. Chow CK. Prevalence, awareness, treatment, and control of hypertension in rural and urban communities in high-, middle-, and low-income countries. JAMA. 2013;310(9):959. doi:10.1001/jama.2013.184182.
5. Nwankwo T, Yoon SS, Burt V, Gu Q. Hypertension among adults in the United States: national health and nutrition examination survey, 2011–2012. NCHS data brief. 2013 Oct;133:1–8.
6. Islam FMA, Bhuiyan A, Chakrabarti R, Rahman MA, Kanagasingam Y, Hiller JE. Undiagnosed hypertension in a rural district in Bangladesh: The Bangladesh population-based diabetes and Eye Study (BPDES). J Hum Hypertens. 2016 Apr;30(4):252–9. doi:10.1038/jhh.2015.65.
7. Najafipour H, Nasri HR, Rostamzadeh F, Amirzadeh R, Shadkam M, Mirzazadeh A. Prevalence and incidence of pre-hypertension and hypertension (awareness/control) in Iran: Findings from Kerman Coronary Artery Diseases Risk Factors Study 2 (KERCADRS). J Hum Hypertens. 2020 May;36(5):461–72. doi:10.1038/s41371-020-00392-5.
8. Huguet N, Larson A, Angier H, Marino M, Green BB, Moreno L, et al. Rates of undiagnosed hypertension and diagnosed hypertension without anti-hypertensive medication following the Affordable Care Act. Am J Hypertens. 2021 Sep 22;34(9):989–98. doi:10.1093/ajh/hpab069.
9. Aekplakorn W, editor. 5th Thai national health examination survey. Nonthaburi: Health System Research Institute; 2016 Nov 1. 283 p. Thai.
10. Health data center database [Internet]. Nonthaburi: Ministry of Public Health; 2018 [cited 2022 May 16]. <https://hdcservice.moph.go.th/hdc/main/index.php>. Thai.
11. Yueayai, K, Moran, AE, Pratipanwat, P, Chaisongkram, S, Anosri, L, Thitichai, P. Hospital-based intervention to enhance hypertension diagnosis in hospital K, Thailand, 2017-2019: A pre-post pilot intervention study. J Clin Hypertens. 2020 Aug;22(8):1310–20. doi:10.1111/jch.13953.
12. Guideline for raised blood pressure visitor management for healthcare personnel. Nonthaburi: Division of Non-communicable diseases, Department of Disease Control; 2019. 12 p. Thai.
13. World Health Organization. (2004). ICD-10: international statistical classification of diseases and related health problems: tenth revision, 2nd ed. Geneva: World Health Organization; 2004.

14. Thai Hypertension Society. 2019 Thai guidelines on the treatment of hypertension [Internet]. Bangkok: Thai Hypertension Society; 2022 Apr [cited 2022 May 16]. 78 p. <http://www.thaihypertension.org/files/HT%20guideline%202019.with%20watermark.pdf>. Thai.

15. Meador M, Osheroff JA, Reisler B. Improving identification and diagnosis of hypertensive patients hiding in plain sight (HIPS) in health centers. Jt Comm J Qual Patient Saf. 2018 Mar;44(3):117–29. doi:10.1016/j.jcjq.2017.09.003.

16. Sutton RT, Pincock D, Baumgart DC, Sadowski DC, Fedorak RN, Kroeker KI. An overview of clinical decision support systems: Benefits, risks, and strategies for success. NPJ Dig Med. 2020;3(1):17. doi:10.1038/s41746-020-0221-y.

17. Atasoy S, Middeke M, Johar H, Peters A, Heier M, Ladwig KH. Cardiovascular mortality risk in young adults with isolated systolic hypertension: findings from population-based Monica/Kora cohort study. J Hum Hypertens. 2021 Dec;36(12):1059–65. doi:10.1038/s41371-021-00619-z.

18. Yano Y, Stamler J, Garside DB, Daviglus ML, Franklin SS, Carnethon MR, et al. Isolated systolic hypertension in young and middle-aged adults and 31-year risk for cardiovascular mortality. J Am Coll Cardiol. 2015;65(4):327–35. doi:10.1016/j.jacc.2014.10.060.

19. Peng X, Jin C, Song Q, Wu S, Cai J. Stage 1 hypertension and the 10-year and lifetime risk of cardiovascular disease: A prospective real-world study. J Am Heart Assoc. 2023 Apr 4;12(7):e028762. doi:10.1161/jaha.122.028762.

20. Antikainen R, Jousilahti P, Tuomilehto J. Systolic blood pressure, isolated systolic hypertension and risk of coronary heart disease, strokes, cardiovascular disease and all-cause mortality in the middle-aged population. J Hypertens. 1998 May;16(5):577–83. doi:10.1097/00004872-199816050-00004.