

# Outcomes of Thai Emergency Department Patients with Non-traumatic Hypotension

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## Abstract

**Background:** The expeditious management of hypotension of emergency department (ED) patients is crucial to prevent hypoxia and in-hospital mortality. This study aimed to identify in-hospital mortality rate, hospital admission rate, and intensive care unit admission rate in Thai ED patients with Non-Traumatic Hypotension (NTH).

**Methods:** Retrospective chart review of 796 patients with non-traumatic injuries admitted in ED within 3 months in two tertiary hospitals was conducted. A systolic blood pressure less than or equal to 100 mmHg was defined as NTH. A total of 318 (39.95%) ED records of patients with NTH were retrieved. The main outcome measures were mortality rate, length of intensive care unit stay, and hospital admission rate.

**Results:** The mortality rate and hospital admission rate were significantly higher in NTH patients than in those patients with normative systolic blood pressure. The results of this review study showed that hypotension in ED significantly influenced in-patient mortality ( $p=0.002$ ) and hospital admission rate ( $p<0.001$ ).

**Conclusion:** These findings suggest nurse's work in the ED to provide effective care to restore hypotensive conditions in non-traumatic patients in order to prevent further adverse effects and also reduce the mortality rate.

**Keywords:** Hypotension; Emergency department; Outcomes; Non-traumatic injury

## Introduction

Hypotension is a known predictor of mortality and morbidity of patients in the Emergency Department (ED) [1-5]. The definition of hypotension varies depending on the diagnosis of the patients. For example, hypotension was defined as systolic blood pressure less than 90 mmHg for patients with trauma injuries [1], less than 100 mmHg for non-traumatic patients [3-5], and less than 110 mmHg for penetrating major trauma patients [2]. It was evidenced that non-traumatic patients attended at the ED with hypotensive conditions in which systolic blood pressure <100 mmHg were more likely to have sudden and unexpected death (2%) and intensive care unit admission as compared to those with systolic blood pressure of >100 mmHg (0.2%) [4-7].

In the retrospective pilot study, conducted at an urban hospital in Melbourne, Australia, ninety-one ED patients with non-traumatic hypotension were recruited. The results showed that the in-patient mortality rate within this group of patients was 12.5%, and all patients who died had sustained prolonged hypotension, increased length of stay, and prolonged ICU admissions [8]. However, there is no evidence reporting the incidence and significance of ED patients with non-traumatic hypotension, especially in Thai hospitals in urban areas. In addition, it is required to review hypotension in ED patients in Thai

hospitals, as no known published study has been found. Such a study can serve as guide to reduce the mortality rate and other adverse outcomes due to hypotension and raise the quality of nursing care.

The purpose of this study was to identify in-hospital mortality, intensive care unit admission, length of hospitalization in ED Thai patients with Non-Traumatic Hypotension (NTH), and to compare those outcomes between NTH and non-traumatic patients with normative systolic blood pressure.

## Materials and Methods

The retrospective study was conducted using two tertiary hospital databases: one from a regional hospital and another from a university hospital in southern Thailand. Approval was obtained from the relevant Ethics Committee before undertaking this study. All patients' records in the ED with NTH were identified as "exposures" whose systolic blood pressure <100 mmHg on ED arrival [9,10]. In this study, normal blood pressure was defined as systolic blood pressure greater than 100 mmHg on ED arrival.

## Study settings

Patients' records from two hospitals were investigated for hypotension status. The first hospital is a regional hospital under the Ministry of Public Health. It is a 700-bed hospital providing care for a large urban population in Songkhla province which also accepts a large number of referrals from nearby secondary and primary hospitals. The

ED in this regional hospital serves approximately 150-160 patients per day with trauma and non-trauma conditions. The second is an 800-bed university hospital providing care for both walk-ins and referred patients from hospitals throughout southern Thailand. It is the largest teaching hospital where approximately 180-200 patients visit the ED per day.

**Sample size calculation**

Sample size calculation was calculated based on the percentage of patients admitted to the ED of both hospitals. The average number of admitted patients was 150-160 patients per day or 4500-4600 patients per month. Approximately, 60%-70% of them were patients with non-trauma related problems. However, approximately 20% of non-trauma related patients were exposed to systolic BP of <100 mmHg during their ED care [4]. Essentially, 550 patients were found minimum sample size to serve as a sample of the study.

**Data collection and processing**

Data were obtained from the medical records of the patients admitted to the ED every morning. Patients with a blood pressure of <100 mmHg on admission who were recruited during the previous 24 hours were used for data analysis. Patients also were tracked for hospital admission, intensive care unit (ICU) or ward admission and were followed up until discharge to determine mortality rate and length of ICU stay.

**Analysis**

Demographic data of the patients were presented with descriptive statistics. Analyses were performed in SPSS software. The assumption of normality for the length of ICU stay and intensive care unit admission was not met; then, Mann-Whitney U test and Chi-square test were used to examine the differences in outcomes between NTH and normal systolic blood pressure groups. Significant level was set at p <0.05.

**Results**

796 cases of patients who met the inclusion criteria within the 3 month study period were recruited. Among the 796 patients, 478 (60.05%) had systolic blood pressures greater than 100 mmHg and 318 (39.95%) presented with systolic blood pressures on admission less than or equal to 100 mmHg. The etiology of hypotension was highly related to sepsis or septic shock (n=78, 24.53%). Patients' characteristics and relevant clinical data with hypotension are shown in Table 1.

Variables	n (%)
Age (yr) Min=17, Max=93	
M (SD)=52.69 (20.72)	
Mdn (IQR)=52.96 (32.04)	
Gender	
Male	154 (48.4)
Female	164 (51.6)
Religion	

Buddhism	289 (90.9)
Islamic	29 (9.1)
Causes of hypotension	
Sepsis/septic shock	78 (24.53)
Cardiovascular/Circulatory system	58 (18.24)
Digestive/ Excretory system	23 (7.65)
Respiratory system	13 (4.50)
Lymphatic/ Immune system	12 (3.78)
Reproductive system	10 (3.14)
Nervous system	10 (3.14)
Alteration of conscious	9 (2.83)
Renal/Urinary system	8 (2.53)
Endocrine system	6 (1.89)
Pain	5 (1.57)
Muscular/Skeletal system	3 (0.09)
Missing diagnosis	83 (26.10)
Destination after ED admission	
Discharged	162 (50.94)
Admitted	138 (43.40)
ICU admitted	48 (34.78)
Ward admitted	90 (65.22)
Dead	18 (5.70)
ICU = Intensive care unit	

**Table 1:** Demographic data and relevant characteristics of patients with non-traumatic hypotension (N=318).

Overall, the mean systolic blood pressure of the sample with NIH was 92.04 mmHg (SD=9.21) with a median of 95 mmHg (IQR=11). Other vital signs are shown in Table 2. Considering the mean systolic blood pressure of patients with sepsis, septic shock, cardiogenic shock, or circulatory problems (n=138, 42.77%), it was found that the mean systolic blood pressure of both septic and cardiogenic shock was 88.52 mmHg (SD=11.01) with a median of 92 mmHg (IQR=15). Most of the septic shocks were caused by urinary tract infection or respiratory tract infection (n=65, 20.4%). The hospital admission rate was 43.40% (n=138) and intensive care unit (ICU) length of stay was 12.92 days (SD=5.07) with median of 7.5 days (IQR=13) (Table 2).

Variables	M (SD)	Mdn(IQR)
<b>Blood pressure (mmHg)</b>		
Systolic (Min=45, Max=100)	91.94 (9.41)	95 (11)
Diastolic (Min=22, Max=86)	56.83 (9.96)	57 (13)
Pulse rate (beat/min) (Min 42, Max=177)	94.42 (23.12)	94 (32)

Respiratory rate (beat/min) (Min=18, Max=56)	25.78 (6.38)	24 (6)
Temperature (°C) (Min=35, Max=39.90)	37.15 (0.97)	37 (1)
ICU length of stay (days) (Min=1, Max=71)	12.92 (15.07)	7.50 (13)

**Table 2:** Blood pressure and other relevant data on ED admission with non-traumatic hypotension (N=318).

As compared to patients without hypotension whose systolic blood pressure >100 mmHg, it was found that the mortality rate of those without NTH was significantly lower than NTH (1.7% vs. 5.7%) ( $\chi^2=9.63$ ,  $p=0.002$ ) and the hospital admission rate was significantly lower than those with NTH (22.85% vs. 49.06%) ( $\chi^2=60.80$ ,  $p<0.001$ ). In addition, the length of ICU stay was lower than that with NTH (Table 3 and Table 4).

Variables	M (SD)	Mdn (IQR)
<b>Blood pressure (mmHg)</b>		
Systolic (Min=101, Max=112)	105.81 (2.59)	107 (5)
Diastolic (Min=36, Max=96)	65.94 (7.34)	64.5 (12)
Pulse rate (beat/min) (Min 64, Max=172)	91.43 (20.95)	88 (30)
Respiratory rate (beat/min) (Min=12, Max=60)	23.89 (5.87)	22 (4)
Temperature (°C) (Min=30.80, Max=42.40)	37.10 (1.14)	36.8 (0.90)
ICU length of stay (days) (Min=1,Max=63)	10.05 (13.72)	6.0 (7)
Destination after ED admission	N (%)	
Discharged	368 (77.15)	
Admitted	109 (22.85)	
ICU admitted	43 (39.45)	
Ward admitted	66 (60.55)	
Dead	8 (1.7)	
ICU=Intensive care unit		

**Table 3:** Blood pressure and other vital signs on ED admission without hypotension (N=478).

Group	With Hypotension	Without hypotension	Statistics
ICU length of stay (Mdn/IQR)	7.5 (13)	6 (7)	-1.08 <sup>a</sup>
Hospital admission (n/%)	156 (49.06)	109 (22.85)	60.80 <sup>b***</sup>
Mortality (n/%)	18 (5.7)	8 (1.7)	9.63 <sup>b**</sup>
**p=0.002, ***p<0.001; ICU=Intensive Care Unit, a=Mann Whitney U test, b=Chi-square test			

**Table 4:** Comparison of hospital length of stay and intensive care unit length of stay between patients with non-traumatic hypotension and those without hypotension.

## Discussion

This study provides the characteristics of 39.95% adult hypotensive patients who arrived at the ED in two tertiary care hospitals in Southern Thailand. If compared with others who used the same definition of hypotension (systolic blood pressures of  $\leq 100$  mmHg), the prevalence of hypotension was higher (39.95%) than that of the previous studies (19%-20%) [4,9]. In this study, the ED patients with hypotension had no history of trauma. As per the etiology of hypotension, sepsis or septic shock was most prevalent (24.53%) in patients with non-trauma injuries followed by cardiogenic shock or cardiovascular problems (18.24%). However, the prevalence of hypotensive shock in this study was higher than that in a previous study by Holler and colleagues [11] which showed that the ED prevalence of a subgroup of hypotensive shock was between 0.95%-1.9%. The difference in prevalence may be because of the difference in the definition of hypotension (using the definition of systolic blood pressure less than 90 mmHg in non-traumatic patients), and of the different etiologies of hypotension.

The mean systolic blood pressure for patients with shock either from sepsis or cardiovascular problems was less than 100 mmHg, similar to previous studies [4,11]. In addition, it was consistent with another study which showed that hypotensive sepsis of systolic blood pressure <100 mmHg in the ED patients was associated with higher in-hospital mortality compared to patients with sepsis and without hypotension [5].

Similar to the previous study, 18.24% of NTH had cardiovascular or circulation problems. This study showed that 15% of ED patients with hemodynamic problems, especially cardiac tamponade, were hypotensive often with systolic blood pressures of <90 mmHg upon ED arrival [12]. In addition, when comparing the same definition of hypotension with systolic blood pressure of <100 mmHg, it was found that there were 5.7% of patients with NTH in this current study that died during their ED admission and/or in-hospital admission. This percentage was less than that found in previous cohort studies in which the mortality rate was between 12.5% [8] to 26% [3]. These data illustrate that different settings, small sample size, and different patient diagnosis and treatment protocol might influence different mortality rates.

Furthermore, the results of this study showed that nearly half of the patients with NTH were admitted to the ICU (43.40%) which is similar to a previous Australian study [8]. Additional analysis also showed that the mortality rate and hospitalization admission rate in patients with hypotension were greater than those in patients with normative blood pressure.

## Limitations

This study has some limitations. First, some missing data were encountered because this was a retrospective study. Second, the outcomes of hypotension and non-hypotension in ED patients with traumatic and non-traumatic problems were not compared because of the data of non-hypotension ED patients with traumatic problems of the study hospitals were not explored. Third, duration of hypotension in ED admission was not explored; therefore, outcomes of each subscale of ED hypotension could not be explored in-depth.

## Conclusions

This study suggests that hypotension in ED impacts in-patient mortality and length of ICU stay. These findings suggest nurses working in the ED should triage non-traumatic patients with a systolic blood pressure <100 mmHg to resuscitation areas and within appropriately special healthcare providers. Effective triage and management would then restore hypotensive conditions and contribute to reducing mortality rate, hospital admission, and ICU admission. Further prospective studies are needed to provide a better understanding of the duration of ED hypotension and its outcomes, including examining nursing management in ED and care outcomes after discharge from the ED.

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