

รายงานวิจัยฉบับสมบูรณ์

Project title: Outcome of Emergency Department Patients with Non-Traumatic Hypotension: A comparison between Thailand and Australia

คณะนักวิจัย

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1. **Project title:** Outcome of Emergency Department Patients with Non-Traumatic Hypotension: A comparison between Thailand and Australia

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4. กิตติกรรมประกาศ

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5. บทคัดย่อ

Introduction: Hypotension is a known indicator of mortality and morbidity in emergency department (ED) patients. The aim of this study was to identify the in-hospital mortality, intensive care unit admission, and length of hospital stay in ED Thai patients with non-traumatic hypotension (NTH).

Methods: A retrospective review of 824 patients' record in ED with NTH was conducted in two tertiary hospitals. Patients' records included in the study were those of patients' records over 18 years old with NTH (systolic blood pressure below 100 mmHg) retrieved from ED medical record. The main outcome measures were patient mortality rate, ICU admission, and length of stay.

Results: A total of 318 (38.59%) ED records of patients with NTH were retrieved. The mortality rate was 5.7%. The mean hospital length of stay was 7.01 days (SD = 12.80), and patients admitted in intensive care unit mean days were 4.24 days (SD = 12.71).

Conclusion: Although the mortality rate, ICU admission, and length of stay in this study were lower than published studies, due to limitation of a retrospective review, the results of this study reviewed that hypotension in ED influenced in-patient mortality and morbidity. These findings suggest nurses working in the ED to provide effective care to restore hypotensive conditions in the non-traumatic patients in order to reduce mortality rate, ICU admission, and hospital length of stay.

Keywords: *Hypotension, emergency department, outcomes, non- traumatic injury*

บทนำ: ภาวะความดันโลหิตต่ำเป็นดัชนีชี้วัดอัตราการตายและความพิการของผู้ป่วยที่เข้ารับการรักษาที่แผนกฉุกเฉิน การศึกษาครั้งนี้มีวัตถุประสงค์เพื่อศึกษาอัตราการตาย ระยะเวลาการเข้ารับการรักษาในหออภิบาลผู้ป่วยหนัก และระยะเวลาในการนอนในโรงพยาบาล

วิธีการ: ภาวะความดันโลหิตต่ำที่มีความดันซิสโตลิกน้อยกว่า 100 มิลลิเมตรปรอท จากแฟ้มประวัติผู้ป่วยที่อายุมากกว่า 18 ปี จำนวน 824 รายที่เข้ารับการรักษาในแผนกฉุกเฉินจากโรงพยาบาล 2 แห่ง เพื่อวิเคราะห์อัตราการตาย ระยะเวลาการเข้ารับการรักษาในหออภิบาลผู้ป่วยหนัก และระยะเวลาในการนอนในโรงพยาบาล

ผลการวิจัย: ผู้ป่วยจำนวน 318 ราย (38.59%) มีภาวะความดันโลหิตต่ำ โดยพบอัตราการตายร้อยละ 5.7 มีค่าเฉลี่ยวันนอนโรงพยาบาลเท่ากับ 7.01 วัน (SD = 12.80) และมีค่าเฉลี่ยวันนอนในหออภิบาลผู้ป่วยหนักเท่ากับ 4.24 วัน (SD = 12.71)

สรุป: แม้ว่าอัตราการตาย ระยะเวลาการเข้ารับการรักษาในหออภิบาลผู้ป่วยหนัก และระยะเวลาในการนอนในโรงพยาบาลในการศึกษานี้ จะต่ำกว่าการศึกษาที่ผ่านมา แต่ผลการวิจัยแสดงให้เห็นว่าภาวะความดันโลหิตต่ำมีความเกี่ยวข้องกับอัตราการตาย ระยะเวลาการเข้ารับการรักษาในหออภิบาลผู้ป่วยหนัก และระยะเวลาในการนอนในโรงพยาบาล ดังนั้นผู้ป่วยกลุ่มนี้ควรได้รับการดูแลที่มีประสิทธิภาพจากพยาบาลผู้ปฏิบัติงานในแผนกฉุกเฉินเพื่อลดอัตราการตาย ระยะเวลาการเข้ารับการรักษาในหออภิบาลผู้ป่วยหนัก และระยะเวลาในการนอนในโรงพยาบาล

คำสำคัญ: 8วามดันโลหิตสูง, แผนกฉุกเฉิน, ผลลัพธ์, ผู้ป่วยฉุกเฉิน

6. บทนำ

Hypotension is a known predictor of mortality and morbidity of patients in the Emergency Department (ED)^{1,2,3,4,5} 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 injuries¹ less than 100 mmHg for non-traumatic patients^{3,4,5} and less than 110 mmHg for penetrating major trauma patients² 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%)^{4,5,6,7}

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 admissions⁸ 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.

7. วัตถุประสงค์

7.1 The aims of this study were:

7.1.1 To compare in-hospital mortality, intensive care unit admission, and length of hospital stay between ED Thai patients with non-trauma hypotension and ED Australian patients with non-trauma hypotension.

7.1.2 To compare in-hospital mortality, intensive care unit (ICU) admission, and length of hospital stay between ED Thai patients with non-trauma hypotension and ED Thai patients with normal blood pressure.

7.1.3 To compare in-hospital mortality, ICU admission, and length of hospital stay between ED Australian patients with non-trauma hypotension and ED Australian patients with normal blood pressure.

7.1.4 To compare in-hospital mortality, ICU admission, and length of hospital stay between ED Thai patients with normative blood pressure and ED Australian patients with normal blood pressure.

7.2 The rationale of collaboration with foreign expert/ institution

To share and gain experience of conducting research with the researcher who is expert both in the clinical practice and research methodology in an area of

emergency nursing care in Northern Health and Deakin University, School of Nursing and Midwifery, Australia. Also, to build the future collaboration between PSU and Deakin University in terms of exchange researchers and students between these two institutes.

8. การตรวจเอกสาร

Hypotension is a known predictor of mortality and mobility of patients in Emergency Department (ED)^{3,4,5} 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%) as compared to those with systolic blood pressure of > 100 mmHg (0.2%)⁵ In addition, hypotension was found to be an independent predictor of in-hospital mortality (OR = 2.0). Non-traumatic ED patients with systolic blood pressure of less than 100 mmHg were significantly more likely to die in the hospital than those with blood pressures greater than 100 mmHg (19.9% vs. 3.1%)⁷ Moreover, it was also found that the relationship between duration of ED hypotension and adverse hospital outcomes including in-hospital mortality, need for intensive care unit services, and acute organ failure³ Therefore, patients in ED with symptomatic hypotension in the absence of trauma had a high mortality rate, needs intensive care unit services, and/or acute organ failure.

In 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 in-patient mortality rate with this group of patients was 12.5%, while all patients who died had sustained prolonged hypotension, increased length of stay, and prolonged ICU admissions.⁸ However, there is no evidence reported of the incidence and significance of ED patients with non-traumatic hypotension, especially in Thai hospitals at the urban area. In addition, no known published study in Thailand compared the outcomes of hypotension and normative blood pressure in patients with non-trauma admitted to ED. Moreover, concern about prolonged hypotension at ED has led to the adverse consequences.^{5,11} Quality of nursing care is needed to reduce mortality rate and other adverse outcomes.

9. วิธีการดำเนินการวิจัย

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. Of the 796 patients included in the study, 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 sufficient 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 $p < .05$.

10. ผลการทดลองและวิจารณ์

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.

Table 1

Demographic data and relevant characteristics of patients with non-traumatic hypotension (N = 318)

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)

Variables	n (%)
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

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 = 15.07) with median of 7.5 days (IQR = 13) (Table 2).

Table 2

Blood pressure and other relevant data on ED admission with non-traumatic hypotension (N = 318)

Variables	M (SD)	Mdn (IQR)
Blood pressure (mmHg)		
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)

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%) ($\chi^2 = 9.63$, $p = .002$) and the hospital admission rate was significantly lower than those with NTH (22.85% vs. 49.06%) ($\chi^2 = 60.80$, $p < .001$). In addition, the length of ICU stay trend to be lower than that with NTH (Table 3 and Table 4).

Table 3

Blood pressure and other vital signs on ED admission without hypotension (N = 478)

Variables	M (SD)	Mdn (IQR)
Blood pressure (mmHg)		
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)

Variables	M (SD)	Mdn (IQR)
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 4

Comparison of hospital length of stay and intensive care unit length of stay between patients with non-traumatic hypotension and those without hypotension

Group	With Hypotension	Without hypotension	Statistics
ICU length of stay (Mdn/IQR)	7.5 (13)	6 (7)	-1.08 ^a
Hospital admission (n/%)	156 (49.06)	109 (22.85)	60.80 ^{b***}
Mortality (n/%)	18 (5.7)	8 (1.7)	9.63 ^{b**}

** $p = .002$, *** $p < .001$; ICU = intensive care unit, a = Mann Whitney U test, b = Chi-square test

11. อภิปราย

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 ≤ 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 colleagues¹¹ 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.

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 <100mmHg 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.

12. อ้างอิง

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13. ข้อคิดเห็นและข้อเสนอแนะสำหรับการวิจัยต่อไป

Limitations

Several limitations should be considered. First, some missing data occurred due to the retrospective design. Second, the outcomes of hypotension and non-hypotension (normal blood pressure) in ED patients do not compare due to the limited accessing data of non-hypotension ED patients; then, the objective as proposed to compare hypotensive outcomes and non-hypotensive outcomes was not investigated. Third, duration of hypotension in ED admission did not explore; thus, outcomes of each subscale of ED hypotension cannot be in-depth explored. Finally, the comparison of hypotensive outcomes between Thai and Australian patients admitted in ED did not conduct as prospective design because one of investigators resigned from the study hospital in Australia prior starting data collection; then, it was inaccessible to collect data of Australian patients admitted in the ED as planned; then, the objective as proposed to compare hypotensive and

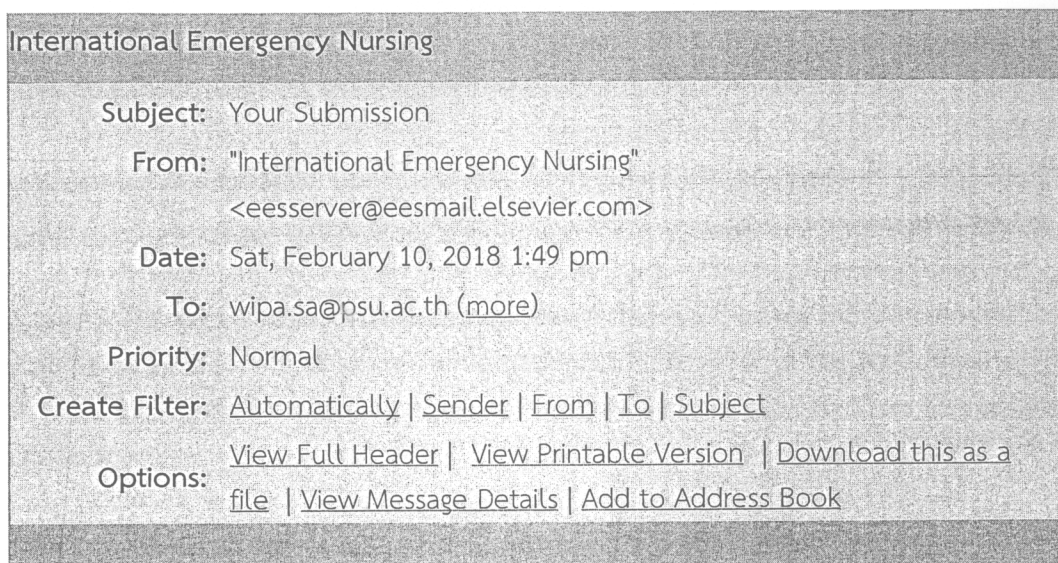
non-hypotensive outcomes between Australian patients could not be investigated and also the objective of current study to compare hypotensive outcomes between Thai and Australian patients could not be investigated. However, the non-traumatic hypotensive outcomes in this current study were compared with the hypotensive outcomes of published study of Australian patients admitted in Australian ED⁸ as conducted by one of investigators of this current study.

Future study is suggested to compare outcomes of patients with hypotension outcomes and those with non-hypotension with a mass sample size, such as multi-sites data in Thailand.

14. ภาคผนวก

This study was submitted to be published in three nursing journals of Australasian Emergency Nursing Journal, Catalyst Journal, and International Emergency Nursing, respectively since January, 2017 through February, 2018. However, those three journals rejected this manuscript. The rationales of rejection of each journal were as reported in the next section. Currently, the principle investigator make a revision based on the recommendation of the reviewers from those three journals, and submit to the Journal of Nursing & Care since May 2018; however, right now the principle investigator still has not received response from the journal yet. Below is the last version of manuscript that has been submitted to the Journal of Nursing & Care.

Responses from the rejected journals



Ms. Ref. No.: YAAEN-D-17-00118

Title: Outcomes of Thai emergency department patients with non-traumatic hypotension

International Emergency Nursing

Dear Ms. wipa saesia,

I regret to inform you that the reviewers of your manuscript have advised against publication, and I must therefore reject it.

For your guidance, the reviewers' comments are included below.

Thank you for giving us the opportunity to consider your work.

Yours sincerely,

Petra Brysiewicz, PhD

Editor

International Emergency Nursing

Reviewers' comments:

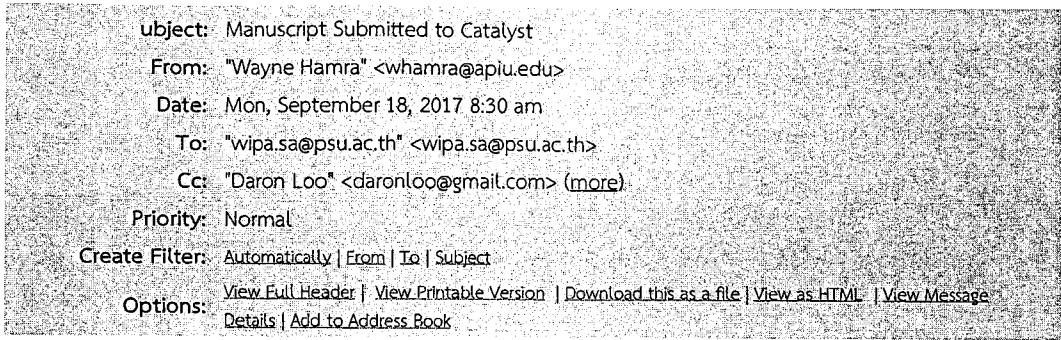
Dear authors,

Thank you for submitting your paper to International Emergency Nursing.

We have completed our initial assessment of your manuscript, and, after a review by our editors, have decided not to consider it further for publication in International Emergency Nursing. Regrettably, limitations on the number of manuscripts we can publish in a year and the numerous high quality submissions we receive force us to accept a limited number of manuscripts submitted for publication. Given such a competitive field for submissions to International Emergency Nursing, we often notify authors quickly when we decline to publish papers without sending them to outside reviewers.

Although the outcome may seem less than ideal, a quick rejection gives the submitting authors a chance to submit their work elsewhere - possibly to a more suitable journal - with little time lost. Additionally, it allows us to focus our limited resources on papers that will have a better chance at acceptance.

We appreciate that you provided International Emergency Nursing the opportunity to review your work and to consider it for publication in our journal. We can think of no higher sign of respect from authors and hope that you will consider International Emergency Nursing for your next manuscript.



Dear Dr Wipa,

Thank you for the manuscript entitled "Outcomes of Thai Emergency Department Patients with Non-Traumatic Hypotension" that you recently submitted to Catalyst. I have briefly looked at the manuscript, and it looks like a fine paper. However, there are several comments and concerns that need to be expressed.

1. First of all, it will be quite a long time before any new manuscripts can be published in Catalyst. The December 2017 issue is full at this point, and the university has dedicated the April 2018 issue to selected articles from the upcoming International Research Conference that it will be hosting next month. So the next available issue will be in August 2018; this long waiting period is a bit of an unusual situation because of this research conference that is hosted at AIU once every four years.
2. Catalyst is considered a social sciences and humanities journal, and some feedback from TCI has recently been received regarding the types of articles that may be published. While nursing articles have been occasionally published, they have had an educational or public health component, and have frequently been based on survey research findings. We have noted that this most recent study is a nursing science topic that was conducted in a hospital setting.
3. TCI has invited Catalyst to apply for listing in the SCOPUS database in 2018, and so the articles published in the next few issues will be subject to a heightened level of scrutiny. Since counsel has been received from TCI regarding the need to select appropriate topics that fit within the journal's scope, the Editorial Board has decided that the journal cannot accept some articles that are outside of the given scope.

May we kindly suggest that perhaps another journal would be more suitable to publish this article? My sincere apologies that we are unable to be of service.

Regretfully yours,

Wayne

Dr Wayne A Hamra

Principal Lecturer, Faculty of Business Administration

Managing Editor, Catalyst Journal

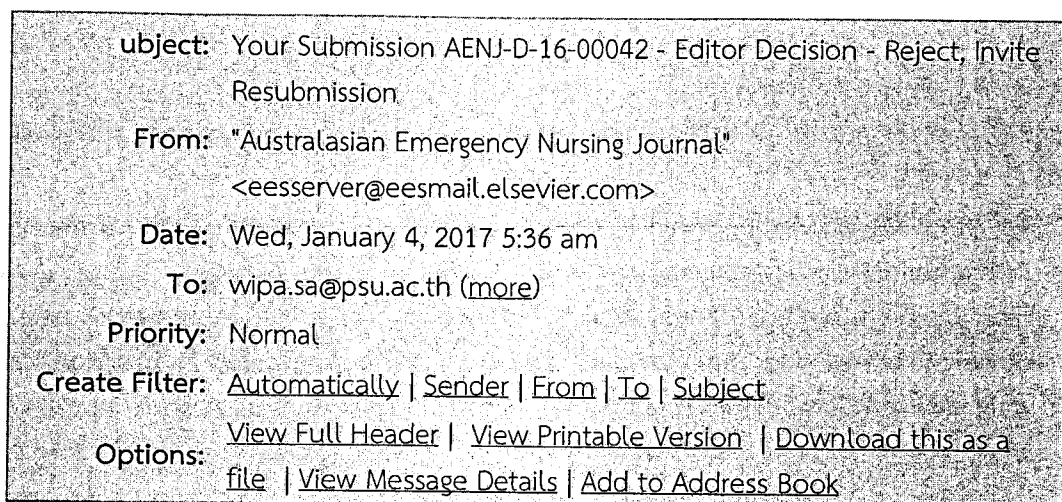
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Australasian Emergency Nursing Journal



Ms. Ref. No.: AENJ-D-16-00042

Title: Outcomes of Thai Emergency Department Patients with Non-Traumatic Hypotension

Australasian Emergency Nursing Journal

Editor Decision - Reject, Invite Resubmission

Dear Dr. saesia,

Thank you for submitting your paper for publication. Regrettably our reviewers have found it unsuitable for publication in Australasian Emergency Nursing Journal (AENJ).

I realise how much work has gone into the preparation of this paper. Listed below are some of the comments made by the reviewers which may help to explain why your paper has been rejected. These comments are sent to you in the hope that you will find them instructive rather than destructive.

I will consider a submission of a revised paper, but this would be considered as a new submission and would be re-reviewed accordingly and therefore acceptance would still not be guaranteed. I would ask that you confirm by email if you intend to resubmit your paper.

Yours sincerely,

Prof Ramon Z Shaban, RN CICP-E PhD FACN FFCENA
Editor-in-Chief
Australasian Emergency Nursing Journal

Reviewers' comments:

Thank you for submitting your work to Australasian Emergency Nursing Journal. Your manuscript is titled AENJ-D-16-00042 "Outcomes of Thai Emergency Department Patients with Non-Traumatic Hypotension ". Unfortunately, the paper is not suitable for publication. However, we have provided reviewers comments below should you wish to pursue resubmission or publication in an alternative journal. You may also download and access an attachment from the EES, which provides Reviewer's 1 comments.

Regards Marg

Reviewer #1:

Thank you for your manuscript. It does identify an important emergency nursing care concept. However, it is important to make papers as clear as possible as well as follow a well defined format for presentation. I would strongly encourage you to select a research journal in this paper that you may use as a guideline to help revise your paper. It is also important to include a more extensive review of the current literature.

There are multiple resources and international guidelines that have defined hypotension. I would also include a range since there are many things that may influence hypotension such as the basic health of the patient. I am including a copy of comments that I added to the manuscript that I hope will help. Thank you

Reviewer 2:

Overall Quality and Importance of the Content: Overall, this topic is interesting for preventing negative outcomes of non-traumatic hypotension in Thai patients.

2. Overall Quality and Presentation of the Paper: Quality and presentation of this manuscript are a slightly low level because of limitations of methodology design, findings and discussion.

PART C - SPECIFIC COMMENTS: Please comment of the areas as relevant:

INTRODUCTION, LITERATURE, AIMS, PURPOSES:

1. Is the work original?

Yes. This work is original in Thailand.

2. Is there a clear overall message conveyed by the paper?

Yes.

3. How important are the findings?

These findings will provide basic information for healthcare providers to concern how to improve negative outcomes of patients with non-traumatic hypotension who are arrived at ED.

4. Does the paper cater for an international readership by explaining contextual concepts clearly?

Yes

5. Do the authors make the purpose and aims of the study clear?

The purpose of this study is clear.

6. Is there a hypothesis (if appropriate)?

It is unnecessary for this study.

7. Paper is logically and clearly written?

This manuscript should be needed to write logically and clearly. For example, gap of existing knowledge how the adverse outcomes are related to quality, presentation of findings, and discussion related to data.

STUDY DESIGN, METHODS, ANALYTIC TECHNIQUES:

8. Have the methods been adequately described?

The methods should be clearly described about the rationale of settings selection, validity of questionnaire, and the characteristics of researcher assistant and how to train them for collecting data (If have).

9. Has there use been appropriately justified or warranted?

Yes.

10. Is the statistical analysis valid?

The statistical analysis used may be questionable because the SD values of hospital length of stay and intensive care length of stay are higher than their mean values. (M = 7.01, SD = 12.80; M = 4.24, SD = 12.71). Therefore, it should be rechecked about normal distribution of these data and the selection appropriate statistics should be concerned.

FINDINGS, RESULTS, DISCUSSION, CONCLUSIONS:

11. Are the results relevant to the aims of the study?

Yes.

12. Are all claims made suitably substantiated by data?

Some findings are problematic or unclear in Table 2.

1)A number of patients with non-traumatic hypotension should be showed in the title of this table.

2)The systolic BP (Max) showed equal 100 whereas the researcher identified hypotension (SBP < 100) in a part of methods and the patients with hypotension should not have DBP (Max =95).

3)The presentation of values of Hospital length of stay and ICU length of stay may be reconsidered if their data have non-normal distributions. For example, presenting in terms of Median, IQR.

13. Is the discussion coherent and of an appropriate length?

The discussion is unclear about the rationales of length of stay in hospital and ICU that are main findings in this study.

14.Is there undue repetition of the results?

No.

15.Are data referred to which should have been mentioned in the results section?

No.

16.Does it lead to conclusions warranted by the data?

Instead of summary in general, the finding data regarding the etiology of hypotension caused from septic shock/ cardiovascular problems lead to mortality should be used into conclusions to suggest health care providers to be aware of early detection and rapid response for patients with hypotension from septic/ cardiogenic shock.

17. Are all the tables and figures essential?

Yes.

18. Is each table and figure clearly presented and appropriately labeled?

Yes.

19. Are the references relevant, necessary and up to date?

Yes. Bust some references will be needed to complete.

20. Does the referencing meet with the Vancouver Uniform Requirements?

No. Some references should be revised relating to the Vancouver Style requirements.

Reviewer #3: Thank you for the opportunity to review this manuscript which examines non-traumatic hypotension in the ED setting in Thailand. Minor grammatical errors are evident, which makes meaning sometimes difficult to understand, but these could be addressed by an editor. In addition, some of the language used needs defining:

* Page 2, Line 14 non-traumatic ED patient,

* Page 4, line 19 non-traumatic injury, (is this different than a non-traumatic ED patient?)

The results presented in this manuscript do not support the discussion and conclusions made. The following collegial comments are provided to enable the authors to strengthen this manuscript.

Abstract

The abstract indicates that "824 patients record in ED with NTH" were reviewed, but this does not match the method. I think 824 histories were reviewed, but only 318 had NTH?

Consider including the time frame for data collection (ie 3 months) in the abstract
The authors conclude that hypotension in ED influenced mortality and morbidity, but this has not been demonstrated in the paper. There was no comparison to patients who did not have NTH, and no consideration of either the diagnoses (eg sepsis has a high mortality rate, whether the BP is > or < than 100) or of any interventions undertaken in the ED

Introduction

The introduction is unclear, and seems repetitive. The authors are making a case that non-traumatic hypotension in ED has poor patient outcomes, with similar examples provided in each paragraph. I suggest synthesising the literature more, to make a stronger and clearer argument.

There are several examples where the meaning is unclear, or sentences seem incomplete:

* Page 1, Line 6 - I believe this should read Hypotension is a known predictor of mortality and morbidity (not mobility)

* Page 1, Line 11-12: hypotension was found to be an independent predictor of in-hospital mortality (OR = 2.0). - needs a reference added please

* Page 1, Line 18-23 meaning is unclear / sentence may be incomplete: "Moreover, it was also found that the relationship between duration of ED hypotension and

adverse hospital outcomes including in-hospital mortality, need for intensive care unit services, and acute organ failure"

* Page 1, Line 53: Sentence meaning unclear: "Moreover, concern about prolonged hypotension at ED has led to the adverse consequences" (what adverse consequences, for whom?)

Method:

There is repetition in the method. For example, in the Settings section, the number of patients seen in ED per day is reported. This is then repeated in the sample size calculation section.

Page 3, Line 41: The following sentence is unclear: "Of these patients, 30-40% of them were trauma patients and of these 60-70% of them were patients with nontrauma related problems". This reads like 60-70% of the trauma patients had non-trauma related problems. Is that the intended meaning, or should it read that 60-70% of all patients presenting to ED had non-trauma related problems? If it is that trauma patients had non-trauma related problems, how was this defined?

It is unclear how the sample size were calculated. If I understand this, 20% of 4500 patients per month had non-trauma related hypotension. That would make 900 patients / month. How did the authors determine that 550 was the amount to sample?

The identification of the sample, and data collection method is unclear.

The authors have used mean and SD to report findings, but the sample does not appear to be evenly distributed, e.g. Systolic BP ranged from 45-100. I think using Median and IQR might be a more accurate way to report data that are spread so widely

Results

The authors identified that a sample of 550 was appropriate, but it appears that the sample was only 318. This difference has not been discussed / addressed

P4, line 19 - were there only 824 patients with non-traumatic injuries: As above, I am not clear what a non-traumatic injury is, but I am also not clear here if the authors are describing non-traumatic hypotension, or simply patients who present due to

illness rather than injury? 824 seems low for a 3 month period, as the proportion of 4,500 patients per month

Page 4, Line 28, What does "accessible etiology of hypotension" mean?

Table 1 - it might be easier for the reader to interpret the table if the diagnoses were presented from most frequent to least, or vice versa. There is no discernible pattern to the current order.

The authors have identified that sepsis and shock were a common cause of hypotension, and described the length of stay in hospital. Given the diagnoses, I think the length of stay is appropriate. They have not commented on whether the hypotension was managed in ED (eg what interventions were undertaken to address the hypotension). Conclusions cannot be made about the hypotension and subsequent length of stay. Further, the aim set out re mortality and these results are presented in a Table, but with no context - there are times when mortality will be the only outcome, regardless of intervention.

Discussion

Some statements in the discussion are not supported by the results, e.g. Page6, line 55 "These characteristics showed that 38.59% of patients admitted in the ED had hypotension". This does not reflected the reported results. The results indicate that 318 patients over 3 months had non-traumatic hypotension. In the method, the authors reported the EDs received 4,500 pts per month (13,500 in 3 months). Therefore, $318/13,500 = 2.3\%$. Thus the following comparisons made in the discussion (compared against hypotension rates in other studies) are incorrect.

Conclusion

The authors conclude that this study shows that hypotension in ED impacts on mortality and morbidity, but neither of these were shown with the results presented.

Highlights

The authors have not described any of the ED management, and therefore the highlight, which recommends provision of effective care in ED to manage hypotension, is not based on the study findings.

References

In the following reference, part of the journal name has not been italicised:

Holler JG, Henriksen DP, Mikkelsen S, Pedersen C, Lassen AT. Increasing incidence of hypotension in the emergency department: a 12 year population-based cohort study. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine* 2016;24(1):20.

<http://ees.elsevier.com/aenj/L.asp?i=7827&l=9T8U6AUN>

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Alternatively, you may log in to the system and click the 'View Review Attachments' link in the Action column.

Manuscript submitted to Journal of Nursing & Care

Outcomes of Thai Emergency Department Patients with Non-Traumatic Hypotension

Running Head: Non-Traumatic Hypotension in Emergency Department

Authors: Wipa Sae-Sia*, Praneed Songwatthanaa, Tanormsri Pibansakb, Waeyoh Wahamacab

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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 influenced in-patient mortality and prolonged intensive care unit stay.

Conclusion: These findings suggest nurses work in the ED to provide effective care to restore hypotensive conditions in non-traumatic patients in order to prevent further adverse effects.

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. Of the 796 patients included in the study, 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 sufficient 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 $p < .05$.

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.

[insert Table 1]

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 = 15.07) with median of 7.5 days (IQR = 13)

(Table 2)

[insert Table 2]

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%) ($\chi^2 = 9.63, p = .002$) and the hospital admission rate was significantly lower than those with NTH (22.85% vs. 49.06%) ($\chi^2 = 60.80, p < .001$). In addition, the length of ICU stay was lower than that with NTH (Table 3 and Table 4).

[Insert Table 3 and Table 4]

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 ≤ 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 were not compared because of the limited data of non-hypotension ED patients. 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.

Disclosure

The authors declare no conflict of interest.

Acknowledgement

The authors would like to thank Prince of Songkla University for providing research funding and also the Research Center for Caring and Healing System for People with Trauma, Emergency, and Disaster, Faculty of Nursing, Prince of Songkla University, Thailand for supporting research assistants for data collection. A special thank is also acknowledged to Publication Clinic, Prince of Songkla University, for editing this manuscript.

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Table 1

Demographic data and relevant characteristics of patients with non-traumatic hypotension (N = 318)

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

ICU = Intensive care unit

Table 2

Blood pressure and other relevant data on ED admission with non-traumatic hypotension (N = 318)

Variables	M (SD)	Mdn (IQR)
Blood pressure (mmHg)		
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 3

Blood pressure and other vital signs on ED admission without hypotension (N = 478)

Variables	M (SD)	Mdn (IQR)
Blood pressure (mmHg)		
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	6.0 (7)
Destination after ED admission	(13.72)	
Discharged	n(%)	
Admitted	368 (77.15)	
ICU admitted	109 (22.85)	
Ward admitted	43 (39.45)	
Dead	66 (60.55)	
	8 (1.7)	

ICU = Intensive care unit

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

Group	With Hypotension	Without hypotension	Statistics
ICU length of stay	7.5 (13)	6 (7)	-1.08 ^a
(Mdn/IQR)	156 (49.06)	109 (22.85)	60.80 ^{b***}
Hospital admission (n/%)	18 (5.7)	8 (1.7)	9.63 ^{b**}
Mortality (n/%)			

** $p = .002$, *** $p < .001$; ICU = intensive care unit, a = Mann Whitney U test, b = Chi-square test