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Published in:
Journal of the Medical Association of Thailand

Published: 01/11/2017

Document Version
Publisher's PDF, also known as Version of record

Factors Associated with Length of Stay of Non-Trauma Patients in the Emergency Department: A Cross-Sectional Study in Thai Healthcare Setting

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Background: *Many previous studies demonstrate that overcrowding is a major problem in Emergency Department (ED) around the world. There is no definition in Thailand hospitals to describe prolonged length of stay in EDs. A study is needed to understand which factors impact ED patients and to what extent this occurs.*

Objective: *To determine the factors associated with prolonged length of stay in Public Tertiary Military Royal Thai Air Force Hospital.*

Material and Method: *A cross-sectional study using routinely collected data involving non-traumatic patients presenting to the ED of Bhumibol Adulyadej Hospital, Bangkok over the 6-month period between March and August 2015. The medical records of 2,079 patients were reviewed. Key data were recorded, including patient characteristics, types of health insurance, times of presenting to emergency room, day (weekday/weekend), triage categories, and underlying disease and disease complexity using the Charlson comorbidity index (CCI) along with diagnosis categories.*

Results: *Univariate analysis revealed several factors that affect ED length of stay. Age, type of health insurance, times of presenting to emergency room, weekend, triage categories, and CCI were all identified as potentially important ($p<0.2$) and subsequently entered into the multivariable cox regression model. The multivariate model identified age, weekend, underlying disease, and disease complexity, and time of day as all significant predictors of ED length of stay. For every 10 years older a patient is, the chance of discharge is 10% less (HR = 0.90, 95% CI 0.88 to 0.92, $p<0.001$). Those admitted on the weekend had 1.18 times the chance of discharge (at any given time) compared to those presenting on weekdays (HR = 1.18, 95% CI 1.07 to 1.29, $p<0.001$), and those in the evening shift had a lower chance of discharge compared to those in day shift (Evening shift HR = 0.83, 95% CI 0.75 to 0.92, $p<0.001$) Finally, patients with CCI of 3 or more had a 9% less chance of discharge, compare to patients with CCI of 0 to 2 (HR = 0.91, 95% CI 0.88 to 0.94, $p<0.001$). The Kaplan-Meier curves found that triage categories ESI1, ESI2, ESI3 have similar discharge times (a median of approximated 400 minutes), whereas ESI4 and ESI5 patients had a considerably lower median discharge time (340 and 200 minutes, respectively).*

Conclusion: *The majority of patients spent long length of stay in the emergency room and almost all factors in the present study were shown to be associated with prolonged length of stay in the ED. However, the downstream effect of extended ED stay on patient safety and mortality needs further research.*

Keywords: *Factors, Length of stay, Non-trauma patients, Emergency Department*

J Med Assoc Thai 2017; 100 (11): 1232-40
Website: http://www.jmatonline.com

Length of stay (LOS) is a key measure of emergency department (ED) throughput and an established measurement of ED overcrowding[1]. EDs are traditionally designed to provide rapid evaluation and stabilization of the patients, and are neither staffed nor equipped to provide prolonged care. Extended ED LOS may compromise quality of care and contribute to delay in the emergency evaluation of other patient. In the US, median ED LOS has been shown to be increasing approximately 3.5% per year and is even more pronounced in critically ill patients for whom ED LOS has been increasing 7.0% annually[2]. ED overcrowding is an ongoing and worsening worldwide crisis for over 20 years, with most evidence of this trend coming from developed countries. To date, few studies have considered the extent, impact, and factors associated with ED overcrowding in developing countries, like Thailand[3]. Results from studies of developed countries ED overcrowding may not reflect the conditions in countries with different health systems

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and levels of development. Thus far, there have been few reports describing ED overcrowding in Thailand.

Several studies have considered the factors contributing to prolonged length of stay in the emergency room (ED-LOS). These factors include boarding block, shortage of inpatient beds, reluctance of the wards to admit[4], testing (particularly blood testing and advanced imaging), less substantial treatment, consultation decision time[5], outside of dayshift working hours, decision to admit[6], type of health insurance, and inappropriate investigations[7]. All factors have been reported to be associated with ED overcrowding. Prolonged ED stay also increases risk of older adults as a high-risk group for adverse events (AEs)[8] and higher in-hospital mortality[9,10].

After patients pass crisis condition, many still remain in the hospital for observation. Often, patients will spend this time in the emergency room, and this stay can be extended, especially for elder patients, or those with comorbidity. Patients and their relatives often feel inconvenienced or unsatisfied due to delays in service. To understand the problem, and identify solution to further develop services that may reduce ED congestion, we investigate factors potentially contributing to prolonged ED stays in a Thai healthcare setting.

Material and Method

Setting

The present study was conducted at Bhumibol Adulyadej Hospital (BAH), Royal Thai Air Force, Affiliated Hospital, Faculty of Medicine, Chulalongkorn University. This hospital has 700 in-patient beds and its 60 ED observation beds, which serve over 70,000 attendants a year. In response to the overcrowding caused by approximately 200 patients per day, the ED is divided into two sections. The first section is for non-traumatic patients who walk in to the emergency room, the other section is for traumatic patients, which are attended in the accident room. During the day shift (8:00 to 15:59) there are two emergency staff and two attending emergency residents, prioritize and closely care patients. During the evening shift (16:00 to 23:59), five doctors are present, one emergency staff, two emergency residents, and two residents from other departments. For the night shift (24:00 to 7:59), the emergency room is typically staffed by one emergency physician (EP), and two emergency residents. The present study received ethical approval from the Institutional Review Boards of both BAH and the Faculty of Medicine, Chulalongkorn University.

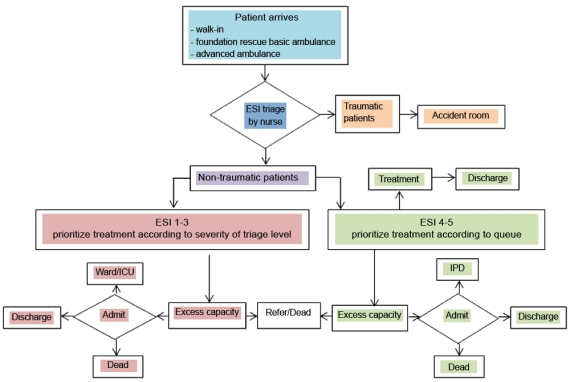

Fig. 1 Emergency Department related system: flow chart (ESI: emergency severity index; IPD: in-patient department; ICU: intensive care unit).

Data collection

Study sample comprised of patients presenting to the ED and staying in the in-patient ward and intensive care unit (ICU) in BAH during the 6-month period between March and August 2015. In the present study, patients were identified through the electronic ED Information System and linked to data on hospital admissions. ED data included presenting chief complaints, ED diagnosis, disposition, and LOS (in-hospital and ICU). A process flow chart illustrating the patient pathway is presented in Fig. 1.

We included ED visits by adult patients 18 years of age and older, non-traumatic patients, patients presenting to an emergency room and stay in emergency room more than two hours in the present study. Patients who refused ED care or treatment and patients referred to other hospital before completion of ED care or treatment were excluded from our study.

The present study conducted in the adult ED at a tertiary government emergency medical training hospital. Patients presenting to the ED were triaged by experienced nurses according to rules based on the Emergency Severity Index (ESI) in Table 1. The initial triage nurse evaluates each patient and assign triage acuity using five levels of immediacy that patient should be seen, high-acuity patients (levels 1-resuscitation, immediately, and levels 2-emergency, less than 10 minutes) were triaged to the resuscitation room, levels 3-urgent (less than 30 minutes) wait in the observation area of the emergency room, whereas low-acuity patients (levels 4-semi-urgent, less than 60 minutes and levels 5-non-urgent, less than 120 minutes) were treated in the emergency outpatient room. In cases where the ED physician examines the patient and decides the condition of disease or diagnosis

Table 1. Emergency Severity Index (ESI)

ESI level	Definition	Clinical manifestations	Medical intervention within
1	Resuscitation	Require immediate life-saving intervention	Immediately (zero-minute response)
2	Emergency	High-risk situation or confused or lethargic or severe pain or distress or disoriented or dangerous vital signs	10 minutes
3	Urgent	Need many types of resource†	30 minutes
4	Semi-urgent	Need only one types of resource	60 minutes
5	Non-urgent	No resource is needed	120 minutes

† Types of resources, including accessory examinations (labs, electrocardiography, radiological examinations) or intravenous fluids or specialist consultations or procedures (such as Foley catheterization)

exceed capacity for treatment, they consult the appropriate specialists who subsequently visit patients in the emergency room.

Outcome and potential predictors

In the present study, factors predicting LOS for emergency patients were classified according to the patient pathway in the ED. Variables represented the 'quality' and 'quantity' of the presenting patients in addition to the characteristics and daily numbers of emergency patients. Characteristic variables included demographic information (e.g., patient's sex, age), time of presenting to emergency room including work shift where day shift (08.00 to 15.59), evening shift (16.00 to 23.59), and night shift (24.00 to 7.59), and day of the week (weekday and weekend), types of health insurance, divided into six categories, self-payment, government insurance, social security insurance, universal coverage, air force insurance, and company parties, triage categories, underlying disease and disease complexity using the CCI[11,12], and diagnosis categories. Destination after transfer from the emergency room was divided into hospital admission, and discharge from the ED after recovery or death. The primary outcome variable was ED-LOS, which was expressed in terms of minutes and represents the interval between the patient's arrival and departure from the emergency room.

Statistical analysis

As the outcome variable, ED-LOS is a time to event variable, survival analysis methods were used to analyze this outcome. Kaplan-Meier curves were generated to examine the effects of the individual predictors on ED-LOS, and Cox proportional hazard regression was used to formally model this outcome. Both crude and adjusted hazard ratios were generated, with all candidate predictors whose $p<0.2$ entering the multivariable Cox regression model. A two-tailed $p<0.05$ was considered statistically significant and all analyses were performed using the statistical package R (v3.2.4; R core team, 2016).

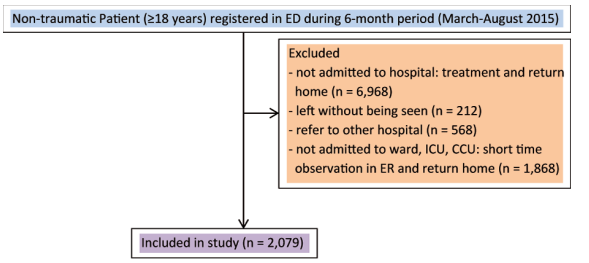

Fig. 2 Data collection of ED patients during the study period (ED: emergency department).

Results

Overall, 11,695 non-trauma patients (18 years or older) were registered in the ED during the six-month study period. Of these, 6,968 patients (59.6%) were not admitted to hospital, 212 (1.8%) left without being seen, and 568 (4.9%) were referred to other hospitals. However, the 1,868 patients not requiring admission to ward or ICU/coronary care unit (CCU) were excluded from our analysis. Eventually, 2,079 were patients who met the eligibility criteria were included in our study. The data collection flow was provided in Fig. 2.

Sample characteristics

Data collection forms included characteristics of the patients in the present study and these characteristics were described in Table 2. Of the 2,079 patients, 1,076 (51.8%) were male, the average age was 58.36 (SD = 20.08) with 839 (40.3%) patients aged above 65 years, and 1,235 (59.4%) patients had universal coverage health insurance. The number of patients presenting in emergency room was similar between the day and evening shift (793 patients (38.2%) vs. 911 patients (43.8%), respectively), and patients were more likely to come to hospital during the weekend (average number on weekday = 274 vs.

average number of weekend = 354). Most patients were triaged into categories under level 3 (1,025 or 49.3% of patients). A majority of patients (1,904 or 91.6%)

Table 2. Characteristics of patients and median ED LOS (n = 2,079) during the study period

Variables	n (%)	ED LOS (years) median (IQR)
All patients	2,079 (100)	6.1 (3.5 to 10.5)
Gender		
Male	1,076 (51.8)	6.4 (3.7 to 10.7)
Female	1,003 (48.2)	5.8 (3.3 to 10.2)
Age (year) (mean age = 58.36, SD = 20.08)		
18 to 35	345 (16.6)	4.9 (2.8 to 8.3)
36 to 50	347 (16.7)	5.4 (3.5 to 8.9)
51 to 65	548 (26.4)	5.9 (3.5 to 10.7)
66 and older	839 (40.3)	7.1 (3.9 to 12.1)
Type of health insurance		
Self-payment	126 (6.1)	6.7 (2.9 to 10.8)
Government insurance	354 (17.0)	6.3 (3.9 to 10.6)
Social security insurance	250 (12.0)	5.8 (3.6 to 9.3)
Universal coverage	1,235 (59.4)	5.8 (3.3 to 10.6)
Air force insurance	114 (5.5)	5.9 (3.4 to 10.6)
Times of presenting to ER		
Day shift (8:00 to 15:59)	793 (38.2)	5.9 (3.6 to 9.2)
Evening shift (16:00 to 23:59)	911 (43.8)	6.3 (3.4 to 11.7)
Night shift (24:00 to 7:59)	375 (18.0)	6.2 (3.6 to 10.9)
Day		
Weekday	1,372 (66.0)	6.4 (3.7 to 10.9)
Weekend	707 (34.0)	5.6 (3.1 to 9.4)
Triage categories		
ESI 1	413 (19.9)	5.5 (3.5 to 9.3)
ESI 2	470 (22.6)	6.5 (3.6 to 11.3)
ESI 3	1,025 (49.3)	6.3 (3.5 to 11.1)
ESI 4	166 (8.0)	5.7 (3.2 to 9.1)
ESI 5	5 (0.2)	3.5 (3.0 to 5.2)
Underlying disease and disease complexity (CCI)		
CCI 0 to 2	1,904 (91.6)	6.0 (3.2 to 9.2)
CCI ≥3	175 (8.4)	7.2 (3.7 to 12.1)
Diagnosis categories		
Gastroenterology	345 (16.6)	5.1 (2.7 to 9.2)
Cardiology	317 (15.2)	5.4 (3.2 to 8.3)
Neurology	310 (14.9)	6.2 (3.6 to 10.5)
Ophthalmology/Otology	284 (13.6)	6.9 (3.9 to 11.8)
Infectious disease	282 (13.6)	6.1 (3.6 to 9.3)
Pulmonary	151 (7.3)	7.1 (3.4 to 13.7)
Obstetrics/Gynecology	127 (6.1)	5.8 (3.1 to 11.9)
Malignancy	99 (4.8)	8.4 (4.1 to 14.0)
Nephrology	78 (3.8)	6.8 (3.7 to 12.6)
Endocrinology	75 (3.6)	6.1 (4.1 to 8.9)
Psychiatry	11 (0.5)	7.2 (5.5 to 13.7)
In-hospital mortality		
Dead	212 (10.2)	5.7 (3.2 to 9.7)
Survive	1,877 (89.8)	6.2 (3.5 to 10.6)

CCI = Charlson comorbidity index; ER = emergency room; ED = Emergency Department; LOS = length of stay; IQR = interquartile range

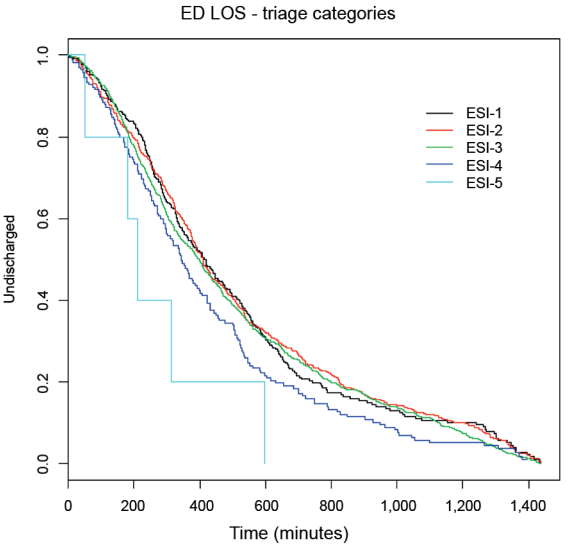

Fig. 3 Kaplan-Meier curves estimates of the probability of discharge among non-trauma patients identified by triage category.

had a CCI of 0 to 2. In the present study, 212 (10.2%) patients died in hospital.

Analysis revealed the average total ED median ED LOS to be 6.1 hours (IQR 3.5 to 10.5 hours). Exploratory analysis of the data suggested that the older the patient, the longer their duration of stay. Patients aged 36 to 50 had a median ED LOS of 5.4 hours (IQR 3.5 to 8.9 hours), and those aged 51 to 65 had a median ED LOS of 5.9 hours (IQR 3.5 to 10.7 hours), and those older than 66 years had a median ED LOS of 7.1 hours (IQR, 3.9 to 12.1 hours). The most frequent triage category was ESI 3, and this category was particularly high in the night shift and on weekends. In addition, most ED patients were CCI 0 to 2 (92% of patients). The 8% of patients who were CCI 3 or greater were mostly represented by malignancy or HIV complications. The top three diagnosis categories were gastroenterology (345 patients, or 16.6%) often accompanied with abdominal pain, cardiology (317 patients or 15.2%), patients complaining about their chest pain, and neurology (310 patients or 14.9%), respectively.

The Kaplan-Meier curves provided in Fig. 3 estimated the probability of discharge for non-trauma patients remaining undischarged, by triage categories. The Kaplan-Meier curves suggested that triage categories ESI 1, ESI 2, and ESI 3 had similar discharge times (a median of approximated 400 minutes), whereas ESI 4 and ESI 5 patents had a considerably lower median discharge time (340 and 200 minutes, respectively).

Table 3. Length of stay in ED and non-trauma patient-related factors in patients ≥18 years of age admitted in tertiary hospital from the ED in an 6-month period by univariate and multivariate logistic analyses

Covariates	Crude HR (95% CI)	Adjusted HR (95% CI)
Gender (refs = males)		
Female	1.05 (0.96, 1.15)	-
Age (10 years)	0.90*** (0.88, 0.92)	0.90** (0.88, 0.92)
Type of health insurance (refs = self-payment)	x^2_{LRT} = 18.17, p = 0.003	x^2_{LRT} = 6.48, p = 0.262
Government insurance	0.88 (0.70, 1.09)	0.94 (0.75, 1.18)
Social security insurance	1.22 (0.97, 1.53)	1.03 (0.82, 1.29)
Universal coverage	1.07 (0.88, 1.30)	1.09 (0.89, 1.32)
Air force insurance	1.06 (0.82, 1.39)	1.05 (0.80, 1.37)
Times of presenting to ER (ref = day shift)	x^2_{LRT} = 10.84, p = 0.004	x^2_{LRT} = 13.48, p = 0.001
Evening shift	0.84***(0.76, 0.93)	0.83*** (0.75, 0.92)
Night shift	0.90* (0.79, 1.02)	0.89 (0.78, 0.99)
Day (refs = weekday)		
Weekend	1.18*** (1.08, 1.30)	1.18*** (1.07, 1.29)
Triage categories (ref = ESI 1)	x^2_{LRT} = 987, p = 0.042	x^2_{LRT} = 7.31, p = 0.12
ESI 2	0.98 (0.85, 1.14)	0.96 (0.83, 1.11)
ESI 3	1.06 (0.93, 1.20)	0.92 (0.81, 1.05)
ESI 4	1.25* (1.03, 1.51)	1.08 (0.89, 1.31)
ESI 5	2.41 (0.99, 5.82)	2.43* (1.00, 5.91)
Underlying disease and disease complexity (CCI ≥3)	0.91*** (0.87,0.94)	0.91*** (0.88, 0.94)

HR = hazard ratio
Significant at: * p<0.05, ** p<0.01, *** p<0.001

The crude and adjusted hazard ratios from Cox regression analysis are given in Table 3. Univariate analysis revealed several factors that may affect ED LOS. Age (in 10 years), type of health insurance, times of presenting to emergency room, weekend, triage categories, and CCI were all identified as potentially important (p<0.2) and subsequently entered into the multivariable Cox regression model. The multivariate model identified age, weekend, underlying disease and disease complexity and time of presentation as all significant predictors of ED LOS. For every 10 years older a patient, the chance of discharge is 10% less (HR = 0.90, 95% CI 0.88 to 0.92, p<0.001). Those admitted on the weekend had 1.18 times chance of discharge (at any given time) compared to those presenting on weekdays (HR = 1.18, 95% CI 1.07 to 1.29, p<0.001), and those in the evening shift had a lower chance of discharge compared to those in day shift (evening shift HR = 0.83, 95% CI 0.75 to 0.92, p<0.001). Finally, patients with CCI 3 or greater had a 9% less chance of discharge, compare to patients with CCI 0 to 2 (HR = 0.91, 95% CI 0.88 to 0.94, p<0.001).

Discussion

Overcrowding is a major issue in EDs around the world and has a substantial effect on patient outcomes and satisfaction. In resource-limited health care settings, such as Thailand, the problem of ED overcrowding is particularly important. The problem is critical in developing countries where manpower and/or equipment resources are limited. In the present study, we investigated the patient characteristics associated with extended LOS to identify likely determinates of ED overcrowding and to identify patients at risk, so we might consider interventions that might alleviate the problem. In our study, we found that the median ED LOS was 6.1 hours (IQR 3.5 to 10.5 hours), which compared favorably to other EDs in the similar healthcare setting. For example, a recent study of a Chinese tertiary hospital ED, found a median LOS of 10.6 hours (IQR 3.1 to 23.1 hours)[4].

We identified several important factors that may lead to ED overcrowding. First, most patients who stayed in our emergency room for extended periods were older patients (aged more than 50 years old comprising 66.7% of total 2,079 patients) in our sample. Compared to younger patients, multi-morbidity, and related-disabilities leading to a high disease burden characterized older patient groups[13,14]. Elderly patients are more likely to have more than one disease as well as disease complications, require more detailed diagnosis and/or treatment, and often need greater input from medical specialist. Second, most of our ED patients had universal coverage insurance (60% of patients). Universal coverage provides inexpensive access to healthcare in the ED setting, which may result

in an over-utilization of medical care via the ED for patient in higher ESI categories, leading to downstream increased LOS in more severe patients. This problem is likely to be compounded by the fact that our hospital is the only government hospital in the district. Health insurance type is an important issue in the Thai setting, as certain hospitals are obliged to admit patients with certain types of health coverage. Another study of ED LOS conducted in Thailand[7] found that number of rounds of blood testing and type of insurance were associated with ED LOS. A third factor, we identified as associated with ED LOS was time (time of day, time of week). We found that ED LOS was significantly higher in the evening (16.00 to 23.59), and on weekends compared to other times.

Prolonged ED stays make a disproportionate contribution to ED overcrowding and there are further implications of prolonged LOS such as patient dissatisfaction[15], poor patient outcomes[16], increased inpatient stay[17], and increased mortality[18-20]. Previous studies have shown that overcrowding, prolonged waiting times, and protracted lengths of stay increase the proportion of patients who leave without being seen by physicians[21]. However, improved ED management processes, such as protocol-driven evaluation systems and reorganized clinical teams can significantly decrease LOS[22]. High LOS may lead to crucial expenditures and may have implications on patient safety.

Many studies conducted across a wide variety of countries and/or healthcare settings have established that ED LOS is strongly associated with patient characteristics. The most commonly identified as a major risk factor for extended LOS is patient age. Age has been shown to be a risk factor in many countries including the United States of America, Canada, Europe, Australia, Turkey, and Japan[23-29]. However, there remains a paucity of information about ED overcrowding in Asian countries, especially developing Asian countries. In addition, there are much disparity in the results of studies from different countries, which may reflect differences in practice patterns among hospital health systems, or patient characteristics[30].

We demonstrated that increased hospital occupancy contributes to increased LOS for admitted patients in the ED. Because it is widely believed that prolonged ED LOS for admitted patients is an important determinant of ED overcrowding, it is possible that increased hospital occupancy also contributes to ED congestion. Although we cannot assume LOS is a surrogate measure of patient safety or mortality, other studies have shown preoccupation with ED overcrowding alone potentially leads to problems such as inappropriate admission, or discharge and treatment which will in turn lead to poor patient outcomes and unnecessary strain on other department of the hospital[31]. We cannot conclude that prolonged LOS in the ED leads to poor patient safety or increased mortality, but we do know ED overcrowding causes difficulties in adequately resourcing EDs for optimal patient care. The implementation of good fast track management in the ED such as ST elevated myocardial infarction (MI), stroke, emergency delivery from birth before arrival, and cardiac arrest may help to decrease the mortality rate. In addition, effective triaging, systems for monitoring potentially severe or high-risk patients, warning system of signal pulse changing, room in proportion to each triage categories, sufficient number of staff to treat patients, and adequate ED training of doctors, nurses, and staff are all important components of ED management.

Our study had a number of limitations. First, our sample was retrospectively collected and restricted to non-trauma patients admitted to the wards or the ICU. Second, our study was conducted in a single tertiary, government emergency medical training hospital in Thailand, which has a very high annual ED volume. The generalizability of our findings to other types of hospitals in Thailand (e.g., community hospitals) or publicly funded hospitals in countries at a similar level of economic development or in the same regions is unknown. However, it is unlikely that our conclusions are relevant to hospitals with low bed occupancy. The reason, we recruited only non-trauma patients in our study is because trauma patients in our hospital are typically processed and treated in the accident room, a distinct department. Third, we only considered a six month study period, and cannot assume the extent of ED overcrowding is uniform over the whole year, or that our study even represented a typical period. Finally, the generalizability of our finding may be limited because ED work processes, ED management structures, emergency medical services (EMS) characteristics, availability, and/or nature of specialty consultation, such as the staff-to-resident physician consultation model, used in one study center may not be used in other centers, resulting in different consultation approaches (e.g., staff-to-staff). For example, EP staff may not be able to admit a patient without the input of another specialist and inpatient services, something likely to influence ED LOS.

Conclusion

We identified age, type of health insurance, time of presentation to ED (time of day, and day of week), triage categories, underlying disease and disease complexity (CCI) as all representing risk factors for extended ED LOS. Most patients spent too long in the emergency room and most factors in the present study were shown to be associated with prolonged LOS in the ED. The downstream effect of extended ED stay on patient safety and mortality needs further research. Perusal of the literature demonstrates that, in different countries and/or healthcare setting, there exist a large disparity in the determinants, extent, and impact of ED overcrowding in different situation. Increase hospital bed availability, segregation based on triage categories and diagnosis categories, and specialized emergency department intensive care unit (EDICU)[32] may all be important strategies for reducing ED overcrowding. However, the feasibility of such an approach in Thai EDs, and similarly resourced EDs around the world needs further investigation.

What is already known on this topic?

Although the factors that contribute to prolong ED LOS have been analyzed in many studies, most data were derived from the same US database (National Hospital Ambulatory Medical Care Survey, NHAMCS), a nationwide study of ED services. These results might not reflect the conditions in countries with different health systems. So far, there have been few reports describing ED overcrowding in Thailand.

In reviewing some of the research, it showed significant factors contributing to prolonged LOS in the emergency room such as boarding block, shortage of inpatient beds, reluctance of the wards to admit, testing particularly for blood testing and advanced imaging, less substantially treatment, consultation decision time, outside of working hours, decision to admit, type of health insurance, and inappropriate investigations. All factors have been reported to be associated with overcrowded ED. Patients with prolonged ED stay also increase the risk for older adults as a high-risk group for AEs and higher in-hospital mortality.

What this study adds?

The present study has demonstrated that increased hospital occupancy contributes to increased LOS for admitted patients in the ED. As it is widely believed that prolonged ED LOS for admitted patients is one of the important determinants of ED overcrowding. It is possible that increased hospital occupancy also contributes to the congestion in the ED. However, good fast track management in the ED such as ST elevate MI, stroke, emergency delivery from birth before arrival, and cardiac arrest help to decrease mortality rate. Therefore, ED system service should be highly focused. The service includes triage, monitoring system of potential severe patients, warning system to signal pulse changing, divided room in proportional to each triage patients, sufficient number of staffs to treat patients, training provided to doctors, nurses, and residents in the ED.

Acknowledgement

This study was supported by the Thai CERTC consortium and The BAH Research Fund. The authors thank all teachers in the Thai CERTC, the ED attending physicians, residents, medical students, nursing staff, unit clerks, and statistician in the hospital for extraction of data participating in the present study.

Potential conflicts of interest

None.

References

1. Yoon P, Steiner I, Reinhardt G. Analysis of factors influencing length of stay in the emergency department. CJEM 2003; 5: 155-61.
2. Herring A, Wilper A, Himmelstein DU, Woolhandler S, Espinola JA, Brown DF, et al. Increasing length of stay among adult visits to U.S. Emergency departments, 2001-2005. Acad Emerg Med 2009; 16: 609-16.
3. Kocher KE, Meurer WJ, Desmond JS, Nallamothu BK. Effect of testing and treatment on emergency department length of stay using a national database. Acad Emerg Med 2012; 19: 525-34.
4. Ye L, Zhou G, He X, Shen W, Gan J, Zhang M. Prolonged length of stay in the emergency department in high-acuity patients at a Chinese tertiary hospital. Emerg Med Australas 2012; 24: 634-40.
5. Brick C, Lowes J, Lovstrom L, Kokotilo A, Villa-Roel C, Lee P, et al. The impact of consultation on length of stay in tertiary care emergency departments. Emerg Med J 2014; 31: 134-8.
6. Perimal-Lewis L, Ben Tovim DI, Li JY, Hakendorf PH, Thompson CH. Emergency department lengths of stay: characteristics favouring a delay to the admission decision as distinct from a delay while awaiting an inpatient bed. Intern Med J

2014; 44: 384-9.
7. Wibulpolprasert A, Sittichanbuncha Y, Sricharoen P, Borwornsrisuk S, Sawanyawisuth K. Factors associated with overcrowded emergency rooms in Thailand: a medical school setting. Emerg Med Int 2014; 2014: 576259.
8. Ackroyd-Stolarz S, Read GJ, Mackinnon NJ, Kovacs G. The association between a prolonged stay in the emergency department and adverse events in older patients admitted to hospital: a retrospective cohort study. BMJ Qual Saf 2011; 20: 564-9.
9. Hsu NC, Shu CC, Lin YF, Yang MC, Su S, Ko WJ. Why do general medical patients have a lengthy wait in the emergency department before admission? J Formos Med Assoc 2014; 113: 557-61.
10. Mitra B, Cameron PA, Archer P, Bailey M, Pielage P, Mele G, et al. The association between time to disposition plan in the emergency department and in-hospital mortality of general medical patients. Intern Med J 2012; 42: 444-50.
11. Sundararajan V, Henderson T, Perry C, Muggivan A, Quan H, Ghali WA. New ICD-10 version of the Charlson comorbidity index predicted in-hospital mortality. J Clin Epidemiol 2004; 57: 1288-94.
12. Needham DM, Scales DC, Laupacis A, Pronovost PJ. A systematic review of the Charlson comorbidity index using Canadian administrative databases: a perspective on risk adjustment in critical care research. J Crit Care 2005; 20: 12-9.
13. Stuck AE, Iliffe S. Comprehensive geriatric assessment for older adults. BMJ 2011; 343: d6799.
14. Conroy SP, Ansari K, Williams M, Laithwaite E, Teasdale B, Dawson J, et al. A controlled evaluation of comprehensive geriatric assessment in the emergency department: the 'Emergency Frailty Unit'. Age Ageing 2014; 43: 109-14.
15. Vieth TL, Rhodes KV. The effect of crowding on access and quality in an academic ED. Am J Emerg Med 2006; 24: 787-94.
16. Rowe BH, Channan P, Bullard M, Blitz S, Saunders LD, Rosychuk RJ, et al. Characteristics of patients who leave emergency departments without being seen. Acad Emerg Med 2006; 13: 848-52.
17. Higgins TL, McGee WT, Steingrub JS, Rapoport J, Lemeshow S, Teres D. Early indicators of prolonged intensive care unit stay: impact of illness severity, physician staffing, and pre-intensive care unit length of stay. Crit Care Med 2003; 31: 45-51.
18. Chalfin DB, Trzeciak S, Likourezos A, Baumann BM, Dellinger RP. Impact of delayed transfer of critically ill patients from the emergency department to the intensive care unit. Crit Care Med 2007; 35: 1477-83.
19. Richardson DB. Increase in patient mortality at 10 days associated with emergency department overcrowding. Med J Aust 2006; 184: 213-6.
20. Miro O, Antonio MT, Jimenez S, De Dios A, Sanchez M, Borras A, et al. Decreased health care quality associated with emergency department overcrowding. Eur J Emerg Med 1999; 6: 105-7.
21. Stock LM, Bradley GE, Lewis RJ, Baker DW, Sipsey J, Stevens CD. Patients who leave emergency departments without being seen by a physician: magnitude of the problem in Los Angeles County. Ann Emerg Med 1994; 23: 294-8.
22. Lau FL, Leung KP. Waiting time in an urban accident and emergency department--a way to improve it. J Accid Emerg Med 1997; 14: 299-301.
23. Baum SA, Rubenstein LZ. Old people in the emergency room: age-related differences in emergency department use and care. J Am Geriatr Soc 1987; 35: 398-404.
24. Nippak PM, Isaac WW, Ikeda-Douglas CJ, Marion AM, VandenBroek M. Is there a relation between emergency department and inpatient lengths of stay? Can J Rural Med 2014; 19: 12-20.
25. Biber R, Bail HJ, Sieber C, Weis P, Christ M, Singler K. Correlation between age, emergency department length of stay and hospital admission rate in emergency department patients aged ≥70 years. Gerontology 2013; 59: 17-22.
26. Casalino E, Wargon M, Peroziello A, Choquet C, Leroy C, Beaune S, et al. Predictive factors for longer length of stay in an emergency department: a prospective multicentre study evaluating the impact of age, patient's clinical acuity and complexity, and care pathways. Emerg Med J 2014; 31: 361-8.
27. Lowthian JA, Curtis AJ, Jolley DJ, Stoelwinder JU, McNeil JJ, Cameron PA. Demand at the emergency department front door: 10-year trends in presentations. Med J Aust 2012; 196: 128-32.
28. Serinken M, Karcioglu O, Turkcuer I, Ozkan HI, Keysan MK, Bukiran A. Analysis of clinical and demographic characteristics of patients presenting with renal colic in the emergency department. BMC Res Notes 2008; 1: 79.

29. Kawano T, Nishiyama K, Anan H, Tujimura Y. Direct relationship between aging and overcrowding in the ED, and a calculation formula for demand projection: a cross-sectional study. Emerg Med J 2014; 31: 19-23.
30. Kreindler SA, Cui Y, Metge CJ, Raynard M. Patient characteristics associated with longer emergency department stay: a rapid review. Emerg Med J 2016; 33: 194-9.
31. Goh SL. Emergency department overcrowding and mortality after the introduction of the 4-hour rule in Western Australia. Med J Aust 2012; 197: 148.
32. Tseng JC, Li CH, Chen KF, Chan YL, Chang SS, Wang FL, et al. Outcomes of an emergency department intensive care unit in a tertiary medical center in Taiwan: An observational study. J Crit Care 2015; 30: 444-8.

ปัจจัยที่มีความสัมพันธ์กับระยะเวลาสังเกตอาการที่นานของผู้ป่วยที่ไม่ได้เกิดจากอุบัติเหตุในห้องฉุกเฉิน: การวิจัยเชิงวิเคราะห์แบบย้อนหลังในบริการทางด้านสุขภาพของไทย

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ภูมิหลัง: *หลายการศึกษาในต่างประเทศ พบว่าการคั่งค้างของผู้ป่วยเป็นเวลานาน ส่งผลต่อความแออัดของผู้ป่วยในห้องฉุกเฉิน จึงได้ทำการศึกษาวิจัยเพื่อให้เกิดเข้าใจถึงปัจจัยต่าง ๆ ที่มีผลกระทบต่อผู้ป่วยที่อยู่ในห้องฉุกเฉิน*

วัตถุประสงค์: *เพื่อศึกษาปัจจัยที่มีผลกระทบต่อระยะเวลาสังเกตอาการที่นานในห้องฉุกเฉินของโรงพยาบาลรัฐ ระดับตติยภูมิ ในประเทศไทย*

วัสดุและวิธีการ: *เก็บข้อมูลผู้ป่วยที่ไม่ได้เกิดจากอุบัติเหตุซึ่งเข้ามารับการรักษาในห้องฉุกเฉินของโรงพยาบาลภูมิพลอดุลยเดช ในกรุงเทพฯ เป็นเวลา 6 เดือน ตั้งแต่เดือนมีนาคม พ.ศ. 2558 ถึง สิงหาคม พ.ศ. 2558 จำนวน 2,079 ราย ข้อมูลสำคัญที่บันทึกได้แก่ ลักษณะของผู้ป่วย ชนิดของสิทธิ์การรักษา เวลาเริ่มต้นที่เข้ามาในห้องฉุกเฉิน วันประจำสัปดาห์ (วันธรรมดา/วันหยุดนักขัตฤกษ์) ประเภทการคัดแยกผู้ป่วย โรคประจำตัว และโรคแทรกซ้อน โดยใช้ Charlson comorbidity index (CCI) ในการวินิจฉัยโรค*

ผลการศึกษา: *จากการวิเคราะห์ตัวแปรเดี่ยวพบว่ามีปัจจัยต่าง ๆ ที่มีความสัมพันธ์กับระยะเวลาสังเกตอาการในห้องฉุกเฉิน ได้แก่ อายุ ชนิดของสิทธิ์การรักษา เวลาเริ่มต้นที่เข้ามาในห้องฉุกเฉิน วันหยุดนักขัตฤกษ์ ประเภทการคัดแยกผู้ป่วย และโรคประจำตัวและโรคแทรกซ้อน ทำการวิเคราะห์แบบหลายตัวแปรโดยใช้ Cox regression analysis ในการวิเคราะห์แบบหลายตัวแปรแยกตามอายุ วันหยุดนักขัตฤกษ์ โรคประจำตัว และโรคแทรกซ้อน และเวลาในแต่ละวันมีนัยสำคัญทางสถิติในการทำนายระยะเวลาในการสังเกตอาการในห้องฉุกเฉิน ทุกช่วงอายุของผู้ป่วยที่เพิ่มขึ้นทุก 10 ปี จะมีโอกาสการจำหน่ายน้อยลง 10% (HR = 0.90, 95% CI 0.88-0.92, p<0.001) ผู้ป่วยที่ได้รับการรักษาแบบผู้ป่วยใน ในช่วงวันหยุดมีโอกาสจำหน่ายเป็น 1.18 เท่า เมื่อเทียบกับผู้ป่วยที่มาในช่วงวันธรรมดา (HR = 1.18, 95% CI 1.07-1.29, p<0.001) และผู้ป่วยที่มาในช่วงเวลาบ่ายจะมีโอกาสจำหน่ายต่ำกว่าในช่วงเวลาเช้า (evening shift HR = 0.83, 95% CI 0.75-0.92, p<0.001) และสุดท้ายผู้ป่วยที่มี CCI มากกว่าหรือเท่ากับ 3 จะมีโอกาสจำหน่ายน้อยกว่า 9% เมื่อเปรียบเทียบกับผู้ป่วยที่มี CCI 0-2 (HR = 0.91, 95% CI 0.88-0.94, p<0.001) ผลการวิเคราะห์โดย Kaplan-Meier curves พบว่าประเภทการคัดแยกผู้ป่วยแบบ ESI 1, ESI 2, ESI 3 มีเวลาในการจำหน่ายใกล้เคียงกัน (ค่าเฉลี่ยประมาณ 400 นาที) ในขณะที่การคัดแยกผู้ป่วยแบบ ESI 4 และ ESI 5 จะมีค่าเฉลี่ยในการจำหน่ายน้อยกว่า (ค่าเฉลี่ยประมาณ 340 และ 200 นาที ตามลำดับ)*

สรุป: *ผู้ป่วยส่วนใหญ่ใช้เวลาในห้องฉุกเฉินนาน จากการศึกษานี้พบมีปัจจัยต่าง ๆ มีความสัมพันธ์กับระยะเวลาสังเกตอาการนานของผู้ป่วย การบริหารจัดการปัจจัยต่าง ๆ เหล่านี้ อาจช่วยลดระยะเวลาการอยู่ในห้องฉุกเฉิน นอกจากนี้การศึกษาถึงความสำคัญของผลกระทบจากการอยู่ในห้องฉุกเฉินนานต่อภาวะความแออัด ความปลอดภัยของผู้ป่วย และการเสียชีวิตนั้น ควรจะต้องมีการศึกษาเพิ่มเติมต่อไป*