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Can different physicians providing urgent and non-urgent treatment improve patient flow in emergency department?

Flora Fei-Fei Yau, MD [a,1], Tsung-Cheng Tsai, MD [a,1], Yan-Ren Lin, MD, PhD [b,c,d], Kuan-Han Wu, MD [a], Yuan-Jhen Syue, MD [e], Chao-Jui Li, MD, PhD [a,*]

[a] Department of Emergency Medicine, Kaohsiung Chang Gung Memorial Hospital, Chang Gung University College of Medicine, Kaohsiung, Taiwan
[b] Department of Emergency Medicine, Changhua Christian Hospital, Changhua, Taiwan
[c] School of Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan
[d] School of Medicine, Chung Shan Medical University, Taichung, Taiwan
[e] Department of Anaesthesiology, Kaohsiung Chang Gung Memorial Hospital, Chang Gung University College of Medicine, Kaohsiung, Taiwan

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ABSTRACT

Background: Emergency Department (ED) overcrowding is a worldwide problem, and it might be caused by prolonged patient stay in the ED. This study tried to analyze if different practice models influence patient flow in the ED.
Materials and methods: A retrospective, 1-year cohort study was conducted across two EDs in the largest healthcare system in Taiwan. A total of 37,580 adult non-trauma patients were involved in the study. The clinical practice between two ED practice models was compared. In one model, urgent and non-urgent patients were treated by different emergency physicians (EPs) separately (separated model). In the other, EPs treated all patients assigned randomly (merged model). The ED length of stay (LOS), diagnostic tool use (including laboratory examinations and computed tomography scans), and patient dispositions (including discharge, general ward admission, intensive care unit (ICU) admissions, and ED mortality) were selected as outcome indicators.
Result: Patients discharged from ED had 0.4 h shorter ED LOS in the separated model than in merged model. After adjusting for the potential confounding factors through regression model, there was no difference of patient disposition of the two practice models. However, the separated model showed a slight decrease in laboratory examination use (adjusted odds ratio, 0.9; 95% confidence interval, 0.83–0.96) compared with the merged model.
Conclusion: The separated model had better patient flow than the merged model did. It decreased the ED LOS in ED discharge patients and laboratory examination use.

1. Introduction

Emergency Department (ED) overcrowding is not a new topic; it has been identified as a problem for over 20 years [1]. Many researchers had proven its negative effect on quality of patient care outcomes and even psychological outcomes, such as increased ED mortality and revisit rates, worsening perceived clinician-patient communication, prolonged hospital stays, and increased costs for admitted patients [2-5]. Numerous strategies had been implemented to address the issue, yet the problem remains unsolved and threatens to become worse. Causes of ED overcrowding are complicated. Robert W. Derlet et al. listed some of the major causes including increased complexity and acuity of patients presenting to the ED, overall increase in patient volume, lack of beds for patients admitted to the hospital, and shortage of ED staff [6]. Some of these issues require more medical resources despite budget limitations. We studied different models of ED practice that might influence patient flow during an ED visit.

Chang Gung Medical Foundation consists of several hospitals located throughout Taiwan. One of the largest hospitals in northern Taiwan, the Chang Gung Memorial Hospital (CGMH) based in Linkou County handles >180,000 ED visits annually. Similarly, CGMH based in Kaohsiung City manages a large portion of ED patients in southern Taiwan. Both hospitals need an efficient, high-functioning ED. Although they shared the same system, the two ED adopted different approaches for managing patients. At both EDs, patients are triaged upon entry using the standard Taiwan Triage and Acuity Scale (TTAS) developed by the Ministry of Health and Welfare [7]. At Linkou CGMH, patients are assigned to different examination areas according to the severity of their complaints. An ED physician specifically responsible for critical area will treat patients categorized as level 1 (resuscitation) and level 2 (emergency). Patients ranging from level 3 to level 5 (urgent to non-urgent) will be

* Corresponding author at: No. 123, Dapi Rd., Niaosong Dist., Kaohsiung City 833, Taiwan.
E-mail address: chaojui@cgmh.org.tw (C.-J. Li).
[1] Fei-Fei Yau and Tsung-Cheng Tsai contributed equally to this work.

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assigned to a non-critical area where they will wait for treatment by other ED physicians. As for CGMH based in Kaohsiung City, after triaged, all patients are randomly assigned to an ED physician. That physician will be solely responsible for the patients despite their severity level.

The purpose of this study is to compare the two models in terms of clinical efficiency, diagnostic tool use, and patient dispositions. The aim is to determine whether one approach is superior and whether it helps to facilitate patient flow in the ED.

2. Materials and methods

2.1. Study design

This was a retrospective, 1-year cohort study approved by the institutional review board of the Chang Gung Medical Foundation. All patients' and physicians' records and information were anonymized and de-identified before analysis.

2.2. Study setting and participants

This study was conducted in two ED of the tertiary referral medical centers located in northern and southern Taiwan separately. Beds of these two EDs were 80 and 60, and total beds in observation rooms were 160 and 148, respectively. Observation rooms are designed for short stays to follow clinical changes or waiting for hospital admission. There are over 3500 and 2500 inpatient beds in the two hospitals.

From 1 July 2011 to 30 June 2012, all adult non-trauma patients who presented to the two EDs from 10:00 to 14:00 were included in the analysis. Overall, 76 full-time attending physicians were involved in this study; 59 worked in the northern ED, and 17 worked in the southern one. All 76 attending physicians were qualified emergency physicians and received the same residency training program developed by the Taiwan Society of Emergency Medicine. On the other hand, the nursing levels are the same for both EDs. All nurses in the two EDs have a college degree in nursing, and through the national examination.

The ED visits were classified into different disease acuities based on the five-level Taiwan Triage and Acuity Scale (TTAS), a commonly used triage system formulated by the Ministry of Health and Welfare in Taiwan [7]. Based on TTAS, patient acuity was determined according to presenting vital signs (heart rate, blood pressure, respiration rate, oxygen saturation) and the main problem. For example, a patient presenting with dyspnea and unstable vital signs would be determined as triage II, or even triage I if immediate resuscitation is needed. According to these criteria, patients identified as triage levels 1 and 2 should be seen immediately or within 10 min, respectively, and are defined as urgent. Patients with triage levels 3, 4, and 5 should be assessed within 30, 60, or 120 min, respectively, and are classified as non-urgent.

In the northern ED, where three attending physicians worked at the same time, patients were assigned to different attending physicians according to their disease acuity according to the TTAS. One physician treated level 1 and 2 triage patients (urgent ones); the other two EPs treated level 3, 4, and 5 patients (non-urgent ones). In the southern ED, three attending physicians worked at the same time, and a computer assigned presenting patients in rotation to attending physicians. As all study sites were teaching medical units, residents assisted in the treatment of ED patients under an attending physician's supervision. In the northern ED, there were 7 nurses working together, and in the southern one were 6. The northern ED practice was defined as a separated model, and the southern one was defined as a merged model.

2.3. Measures

Variables were extracted from the ED administrative database and included patients' age, sex, triage, diagnosis, visit type (seen by attending alone or resident under attending supervision), occupancy status upon ED arrival, patient disposition, diagnostic tool use, and ED LOS. Patients' diagnoses were categorized into 7 groups according to the International Classification of Diseases-9 (ICD-9) including nervous system disease (ICD-9-CM: 320–389 and 430–438), gastrointestinal disease (ICD-9-CM: 520–579), genitourinary disease (ICD-9-CM: 580–629), pulmonary disease (ICD-9-CM: 460–519), cardiovascular disease (ICD-9-CM: 390–429 and 439–459), neoplasms (ICD-9-CM: 140–239), and others. Because the two study hospitals were teaching medical units, residents assisted in the treatment of ED patients under an attending physician's supervision, so the visits were divided into supervised visits and attending-alone visits. All supervised visits were initially evaluated and treated by residents; attending physician consults were always required. Considering the difference of visit numbers in the two EDs, the ED occupancy status, determined by the number of patients staying during their time of visit, was used to control the influence of the ED crowding. The occupancy status was grouped into four levels according to the number of patients staying in ED, divided into quartiles [8,9]. The ED LOS, diagnostic tool use, and patient disposition were treated as outcome variables. The ED LOS was defined from the initial time that the patient presented to the ED as documented by the triage nurse to the final time that the patient left the ED. ED LOS were calculated using the following four points: EP completing initial patient evaluation (the timing of first order or prescription), discharge from ED, admission to general ward, and admission to ICU. As diagnostic-tool use outcomes, we included computed tomography (CT) and any laboratory examinations (e.g., complete blood count, blood chemistry, urine analysis, stool analysis, or influenza screen test). The patient dispositions were classified into discharge, hospital admission (including general ward and ICU), and ED mortality [10].

2.4. Data analysis

For continuous variable (age), the data were summarized as means and standard deviations (SD). Because the distributions of ED LOS were not normal, we used medians with interquartile ranges (IQRs). The distributions of categorical variables including sex, triage, diagnosis, visit type, crowding status, patient disposition, and diagnostic tool use were presented with numbers and percentages. Student's *t*-test, Mann-Whitney *U* test, and chi-square tests were used to evaluate the associations among these variables and the two ED practice models. To analyze the associations of the outcome variables with the two practice models adjusting for the potential confounding factors, multinomial logistic regression was selected for patient disposition, and binomial logistic regression for diagnostic tool use. Effects were estimated in terms of odds ratios (ORs) and corresponding 95% confidence intervals (CIs).

Table 1
Demographics and diagnosis of the patients and occupancy status in the emergency departments.

	Separated model $N = 21{,}630$	Merged model $N = 15{,}950$	*p*-Value
Age	56.3 ± 19.36	57.9 ± 18.66	<0.001
Male	11,264 (52.1%)	7908 (49.6%)	<0.001
Urgent	5776 (26.7%)	3296 (20.7%)	<0.001
Diagnostic category			<0.001
Nervous	2992 (13.8%)	2437 (15.3%)	
Gastrointestinal	4398 (20.3%)	2971 (18.6%)	
Genitourinary	2256 (10.4%)	1363 (8.5%)	
Pulmonary	3209 (14.8%)	2279 (14.3%)	
Cardiovascular	1621 (7.5%)	1274 (5.0%)	
Neoplasm	1551 (7.2%)	1169 (7.3%)	
Other	5603 (25.9%)	4457 (27.9%)	
Supervised visits	4298 (19.9%)	7079 (44.4%)	<0.001
ED occupancy status (stand-by patient number)			<0.001
1st quartile (<29)	994 (4.6%)	8655 (54.3%)	
2nd quartile (29–43)	3554 (16.4%)	5641 (35.4%)	
3rd quartile (43–67)	8177 (37.8%)	1636 (10.3%)	
4th quartile (>67)	8905 (41.2%)	18 (0.1%)	