American Journal of Emergency Medicine 37 (2019) 1307–1312

Contents lists available at ScienceDirect

American Journal of Emergency Medicine

journal homepage: www.elsevier.com/locate/ajem

Original Contribution

Comparison of critically ill patients from three freestanding ED's compared to a tertiary care hospital based ED

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ARTICLE INFO

Article history:
Received 17 June 2018
Received in revised form 5 October 2018
Accepted 10 October 2018

Keywords:
Freestanding emergency department
Critical care
Emergency department

ABSTRACT

Background: Freestanding emergency departments (FEDs) care for all patients, including critically ill, 24/7/365. We characterized patients from three FEDs transferred to intensive care units (ICU) at a tertiary care hospital, and compared hospital length of stay(LOS) between patients admitted to ICUs from FEDs versus a hospital-based ED (HBED).

Methods: We performed a retrospective, observational cohort study from January 2014 to December 2016. Demographic and clinical information was compared between FED and HBED patients with chi-square and fisher's exact tests for categorical variables and Student's *t*-test for continuous variables. The main outcome of interest was hospital LOS. Multi-variable linear regression was performed to estimate association between LOS and emergency facility type, while adjusting for potential confounders.

Results: We included 500 critically ill patients (FED = 250 and HBED = 250). Patients did not differ by age, gender, or BMI. FED patients were more likely to be white (89.6% vs. 70.8%, $p < 0.001$) and have higher Charlson Comorbidity Index scores (3.5 vs. 2.4, $p < 0.001$). Average LOS for FED patients was 5 days, compared to 7 days for HBED patients ($p < 0.001$). After adjusting for demographic and clinical confounders, there was significant correlation between ED facility type and LOS in hospital ($p < 0.001$).

Conclusion: Patients transferred from FEDs to an ICU were similar in age and gender, but more likely to be white with a higher Charlson Comorbidity Index score. FED patients experienced shorter hospital length of stay compared to patients admitted from a HBED.

1. Introduction

The number of freestanding emergency departments (FEDs) has grown rapidly across the U.S. in the past decade [1]. These centers have emerged as an alternative to traditional hospital-based emergency care. They provide closer proximity emergency care to a greater number of patients and potentially increase access through reduced travel time to an emergency facility [2]. In the first published analysis of the impact of two new FEDs on a main campus tertiary care center hospital-based ED (HBED), we found combined patient volumes at all three facilities increased by 45% [3]. The observed substantial increase in patient volume suggests that the presence of FEDs potentially increased access and market presence for ED services.

FEDs offer a potential solution to many factors contributing to ED crowding. They introduce new dynamics into patient care, specifically for patients presenting with disease processes that are highly time-dependent. Prompt stabilization and initiation of treatment is the cornerstone of high-quality care, as the risk of mortality increases with delay [4] for many conditions.

FED facilities have the potential to greatly reduce time to emergent medical intervention for patients, especially when coupled with decreased wait times and local access to emergency services for patients who would otherwise have to travel longer distances. FEDs may have an impact on morbidity and mortality for patients seeking emergency care, further accentuating the importance and need for FED care within communities.

While FEDs have become more common, the characterization of certain patient populations has yet to be undertaken to determine areas of potential improvement. Patients presenting with illnesses requiring an intensive care unit (ICU) – such as severe sepsis – require timely intervention to optimize outcomes. This study was the first to look at

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https://doi.org/10.1016/j.ajem.2018.10.006
0735-6757/

critically ill patients initially seen at a FED and compares them to patients initially seen at a HBED.

No studies have previously described patient populations and outcomes among patients presenting to FEDs who require transfer to an ICU.

The primary goal of our study was to evaluate hospital LOS for patients admitted from a FED to those admitted from a HBED. We also characterized the patient population transferred from FEDs to ICUs at a tertiary care hospital, and compared their clinical course and outcomes to patients admitted to an ICU from a HBED.

2. Methods

2.1. Study design and setting

We performed a retrospective, observational cohort study of patients admitted to a ICU from our HBED or one of three associated FEDs between January 2014 to December 2016. A random sample of patients transferred from three FEDs to ICUs at a tertiary care hospital was compared to a random sample of patients admitted from the HBED. The Institutional Research Review Board approved the study protocol.

Patients seen in the FEDs or HBED and then transferred/admitted to the Medical ICU (MICU), surgical ICU (SICU), Neurological ICU (NICU) or Cardiovascular ICU (CVICU) were included in the study. Patients were excluded if they were under 18 years of age, pregnant, or admitted to the floor prior to the ICU.

Our healthcare system operates three FEDs in neighboring communities located 9.6, 11.4, and 11.8 miles from the HBED, respectively. These FEDs are open 24/7/365 and are staffed by board eligible or board-certified emergency physicians and have resident coverage 10 h per day. The FEDs treat all illnesses and injuries that arrive by private vehicle, as well as a large portion of ambulance traffic in the area. Each FED has two rooms designated as trauma rooms, a resuscitation room, and a fully equipped radiology suite on site for x-ray, CT, ultrasound, and MRI. Ultrasound and MRI hours are limited to weekday business hours and Saturday mornings. Local emergency medical services (EMS) within the study region have been instructed to take all trauma meeting state triage criteria for trauma team activation, ST-elevation myocardial infarctions (STEMI), and strokes to the HBED. All other ambulance traffic may be transported to the FEDs. Patients coming via private vehicle to the FED with a STEMI, stroke or who meet criteria for trauma team activation are evaluated in the FED and transferred to the HBED for definitive care. Our HBED is a Level 1 Trauma, stroke and primary percutaneous coronary intervention center and has an emergency medicine residency program.

2.2. Data collection

Data was abstracted from the electronic medical record systems by trained co-investigators performing chart review. Study variables included demographic information, health insurance, code status, comorbidities, and clinical data. To quantify differences in the presence of comorbid conditions and adjust for these differences in analysis, the Charlson Comorbidity Index (CCI) was calculated for each patient visit [5]. Data on type of ED the patient was admitted from, mode of transportation to ED, length of stay in hospital (ED and ICU), time spent on a ventilator, and discharge locations were also recorded. Admission source and transportation data were abstracted from the ED nursing note.

To compare patient flow between the FEDs and HBED, we measured the time from ED arrival to ED provider evaluation, time from provider evaluation to ICU consult placement, time from ICU consult placement to ambulance arrival (FED only), time from ambulance arrival to arrival in the ICU (FED only), and time from ICU consult placement to arrival in the ICU.

2.3. Outcome and exposure variables

The primary outcome was the in-hospital length of stay (LOS). The primary exposure variable was the facility type where the visit was initiated (FED versus HBED). The confounding variables were demographic characteristics of the patient (age, race, gender, insurance type and Do-not-Resuscitate (DNR) status), clinical outcomes, and Charlson Comorbidity Index (CCI)).

2.4. Statistical analysis

All analyses were conducted using SAS® 9.4 (SAS Institute Inc., Cary, NC, USA). We compared two different groups of patients: those admitted to the ICU from a FED and those admitted to the ICU from the HBED. Variables such as age, in-hospital LOS and CCI were reported both in continuous and categorical scale to have better understanding of the distribution. Variables were analyzed using descriptive statistics and reported as a proportion or mean [standard deviation (SD)]. To examine differences between FEDs and HBED visit characteristics, statistical significance of categorical variables was analyzed using chi-square test or Fisher's exact test (when the cell frequency was less than 5). Continuous variables were compared using two-tailed *t*-test. Adjustments for potential confounders (demographics and clinical co-morbidities) were performed in multivariable linear regression.

2.5. Log-transformed dependent variable

Hospital length of stay is the dependent variable of this study and it was positively skewed (Skewness = 1.98). Thus, for the outcome variable to better fit the assumptions underlying regression analysis, the hospital length of stay variable was log-transformed. Similarly, length of stay in ICU variable was also log-transformed.

Simple linear regression analysis was used to estimate correlation between exposure variables and length of stay in hospital. Multiple linear regression models were performed to obtain adjusted parameter estimates in assessing the relationship between the type of emergency facility used and the length of stay in the hospital. Potential confounders tested included demographics and clinical co-morbidities.

3. Results

This study included a total of 500 critically ill patients (FEDs = 250 and HBED = 250) who visited either a FED or HBED.

3.1. Demographic characteristics

The mean age, gender, and racial distribution was 61 years (SD: ± 18), female (48.8%), and white (80.2%). Age and gender distribution were similar between FEDs and HBED; however, racial distribution differed with FEDs seeing 89.6% white patients, compared to HBED seeing 70.8% ($p < 0.001$).

Cardiovascular issues were the most frequently reported health condition for all ICU transfers and admissions (26.3%), followed by respiratory health conditions (18.8%). FEDs transferred more patients to the ICU for cardiovascular issues (32.5%) and fewer for gastrointestinal, neurologic, pulmonary, and trauma related complaints [Table 1].

Average CCI score reported by all patients was 3 (SD: ±2.6). Patients visiting FEDs had statistically significantly higher mean CCI scores of 3.5(SD: ±2.7) when compared to patients visiting HBED with mean CCI score of 2.4 (SD: ±2.4). Nearly 50% of patients had a CCI score range of 1 to 3. FEDs had a higher proportion of patients who were obese (36.8%) compared to patients visiting HBED (31.6%). However, this was not statistically significant ($p = 0.5246$) (Table 1).

There was a significant difference between the methods of transportation to ED facility visited ($p < 0.001$). Sixty-six percent of patients who came to the FEDs and 21.2% of patients who came to the HBED from

Table 1
Socio demographic characteristics and co-morbidities of critically ill patients visiting Emergency Department (ED) stratified by type of facility visited (FED versus HBED) (N = 500).

Variables	Overall	Type of ED facility (N = 500)		p Value
		FEDs(N = 250)	HBEDs (N = 250)	
Age (in minutes), Mean (±SD)	61 (±18)	59 (±19)	62 (±17)	0.1009
Charlson co-morbidity index (CCI), mean (±SD)	3.0 (±2.6)	3.5(±2.7)	2.4(±2.4)	<0.001*
Race, N (%)				<0.001*
Whites	104 (80.2)	224 (89.6)	177 (70.8)	
Blacks	88 (17.6)	20 (8.0)	68 (27.2)	
Others	11 (2.2)	6 (2.4)	5 (2.0)	
Gender, N (%)				0.5914
Female	244 (48.8)	119 (47.6)	125 (50.0)	
Male	256 (51.2)	131 (52.4)	125 (50.0)	
Age group (years), N (%)				0.0683
18–35	54 (10.8)	35 (14.0)	19 (7.6)	
36–55	129 (25.8)	64 (25.6)	65 (26.1)	
56 or above	316 (63.6)	151 (60.4)	165 (66.3)	
Insurance types				<0.001
Self-pay	59 (11.8)	29 (11.6)	30 (12.0)	
Private	122 (24.4)	89 (35.6)	33 (13.2)	
Medicare	245 (49.0)	104 (41.6)	141 (56.4)	
Medicaid	72 (14.4)	27 (10.8)	45 (18.0)	
VA/Tricare	2 (0.4)	1 (0.4)	1 (0.4)	
Diagnosis Category, N (%)				0.0429*
Cardio-vascular	130 (26.3)	80 (32.5)	50 (20.1)	
Eyes, Nose and Throat (ENT)	23 (4.65)	13 (5.28)	10 (4.0)	
Gastrointestinal	28 (5.7)	10 (4.1)	18 (7.2)	
Genital and Renal	13 (2.6)	6 (2.4)	7 (2.8)	
Hematology	7 (1.4)	4 (1.6)	3 (1.2)	
Infectious Disease	32 (6.5)	16 (6.5)	16 (6.4)	
Metabolic and Endocrine	56 (11.3)	31 (12.6)	25 (10.0)	
Neurologic	64 (12.9)	27 (10.9)	37 (14.9)	
Psychiatric	2 (0.4)	2 (0.8)	0 (0.0)	
Respiratory	93 (18.8)	41 (16.7)	52 (20.9)	
Trauma	25 (5.0)	8 (3.2)	17 (6.8)	
Others	22 (4.4)	8 (3.2)	14 (5.6)	
Body Mass Index (BMI), N (%)				0.5246
Under weight	40 (8.0)	19 (7.6)	21 (8.5)	
Healthy weight	133 (26.8)	68 (27.2)	65 (26.3)	
Over weight	154 (30.9)	71 (28.4)	83 (33.6)	
Obese	170 (34.2)	92 (36.8)	78 (31.6)	
Charlson co-morbidity index (CCI), N (%)				<0.001*
0	98 (19.6)	32 (12.8)	66 (26.4)	
1–3	224 (44.8)	110 (44.0)	114 (45.6)	
4–6	127 (25.4)	71 (28.4)	56 (22.4)	
7–12	51 (10.2)	37 (14.8)	14 (5.6)	
Do-not-resuscitate (DNR) status				0.1933
Full-code	400 (80.0)	208 (83.2)	192 (76.8)	
DNR-CC	18 (3.6)	7 (2.8)	11 (4.4)	
DNR-CCA	82 (16.4)	35 (14.0)	192 (76.8)	

Note: SD: Standard Deviation; HBED: Hospital-Based Emergency Department; FED: Free standing Emergency Department.
* Significant p-values < 0.05.

home arrived via car. Thirty-one percent of patients who came to the FEDs and 75.6% of the patients who came to the HBED from home arrived via EMS. Of the patients first admitted to the FEDs, 85.3% originally came to the FEDs from home and 74% were later discharged back home. Of the patients first admitted to the HBED, 74.2% originally came from home and 57.6% were later discharged back home (Table 2).

3.2. Clinical outcome

Average in-hospital length of stay (LOS) was significantly different between ED facility types (mean FED LOS = 5 days, mean HBED LOS = 7 days, $p < 0.001$). Four percent of patients visiting either FED or HBED had hospital length of stay of 15 or more days. For those patients who required mechanical ventilation, the mean duration of ventilation was 1.3 (SD: ±4.8) days, which was not significantly different between the two groups. There was a significant difference between the FEDs and HBED in average length of time from ED arrival to ED provider evaluation as well as average time from ED provider evaluation to ICU consult placement (Table 2). The number of deaths in patients without "do-not-resuscitate restrictions" was very small in both groups; therefore, mortality rates were not used to assess quality of care. Of the 250 patients seen at the FEDs, 15 died, and of those, 11 had a DNR. Of the 250 patients seen at the HBEDs, 7 died, and of those, 5 had DNRs.

3.3. Multiple linear regressions model analysis

3.3.1. In-hospital length of stay

Table 3 summarizes the multivariable linear regression model between type of ED facility and in-hospital LOS of patients adjusting for potential confounding variables (age, race, gender, Insurance type, DNR status, BMI of patients, Time between arrival to ED and finished consultation with ER doctor, Time between consult to ambulance call by ER to arrival in ICU, CCI, time spent in ventilator, and patient disposition). We found 31.4% of the variance in total in-hospital LOS of critically ill patients (R square: 0.3136) was explained by the variables accounted in the model. After adjusting for potential confounders, on average, critically ill patients who visited FEDs had an approximately 31% shorter total in-hospital LOS ($\exp \beta = 0.694$) when compared to patients visiting HBED. However, the correlation between ED facility type and in-hospital LOS was not significant [Confidence Interval (CI): −0.75–0.02].

Table 2
Clinical Outcomes of critically ill patients visiting Emergency Department (ED) stratified by type of facility visited (FED versus HBED) (N = 500).

Variables	Overall	Type of ED facility (N = 500)		p Value
		FEDs (n = 250) n (%)	HBEDs (n = 250) n (%)	
Hospital length of stay (LOS) (in days), Mean (±SD)	6 (±5)	5 (±4)	7 (±5)	<0.001*
Length of stay in ICU, Mean (±SD)	3.3 (±3)	3.4 (±3)	3.3 (±3)	0.8135
Time spent in ventilator (in days), Mean (±SD)	1.3 (±4.8)	1.7 (±6.1)	0.9 (±3.1)	0.0630
Time between patient arrival to the doctor evaluating patient (in minutes), Mean (±SD)	27.0 (±35.1)	14.6 (±16.7)	39.4 (±43.3)	<0.001*
Time between patient seen by provider to determine need of ICU (in minutes), Mean (±SD)	139.7 (±98.8)	104 (±71.4)	175.5 (±109.0)	<0.001*
Consult placed to ambulance arrival (in minutes), Mean (±SD)	62.9 (±61.1)	62.9 (±61.1)	N/A	–
Ambulance arrival to arrival in ICU (in minutes), Mean (±SD)	39.8 (±11.2)	39.8 (±11.2)	N/A	–
Time between consult by ED to arrival in ICU (in minutes), Mean (±SD)	124.6 (±118.8)	105.1 (±65.6)[a]	144 (±152.5)	<0.001*
Admission Source, n (%)				0.0108
Skilled Nursing Facility	38 (7.9)	11 (4.5)	27 (11.4)	
Scene of accident	6 (1.2)	2 (0.8)	4 (1.7)	
Home	384 (79.8)	209 (85.3)	175 (74.2)	
Others	53 (11.0)	23 (9.4)	30 (12.7)	
Mode of transportation to ER facility, N (%)				<0.001*
Emergency Medical Service (EMS)	266 (53.2)	77 (30.8)	189 (75.6)	
Car	219 (43.8)	166 (66.4)	53 (21.2)	
Others	15 (3.0)	7 (2.8)	8 (3.2)	
Hospital length of stay (LOS) (days), N (%)				<0.001*
1	37 (7.4)	22 (8.8)	15 (6.0)	
2 to 5	266 (53.2)	151 (60.4)	115 (46.0)	
6 days or more	197 (39.4)	77 (30.8)	120 (48.0)	
Length of stay in ICU (days), N (%)				<0.001*
1	92 (18.6)	22 (8.8)	70 (28.3)	
2 to 5	344 (69.3)	204 (81.9)	140 (56.7)	
6 days or more	60 (12.1)	23 (9.2)	37 (14.9)	
Patient disposition, N (%)				<0.001*
Death	22 (4.4)	15 (6.0)	7 (2.8)	
Home	329 (65.9)	185 (74.3)	144 (57.6)	
Hospice	22 (4.4)	6 (2.4)	16 (6.4)	
Nursing Home	75 (15.0)	24 (9.6)	51 (20.4)	
Transfer to another hospital	14 (2.8)	4 (1.6)	10 (4.0)	
Rehab	37 (7.4)	15 (6.0)	22 (8.8)	

Note: SD: Standard Deviation; HBED: Hospital-Based Emergency Department; FED: Free standing Emergency Department; ICU: Intensive Care Unit; ICU.
N/A: Since the patient was already in hospital, they did not need ambulance service.
[a] Time between consult by ED provider to the ICU and arrival in ICU for FED patients. Also includes the time duration of ambulance service usage.
* Significant p-values < 0.05.

3.3.2. Length of stay in ICU

Table 4 summarizes the correlation between type of ED facility used by patients and length of stay in a ICU. The multivariable linear regression model for this relation was adjusted for confounding variables (age, race, gender, BMI of patients, Time between arrival to ED and finished consultation with ER doctor, Time between consult to ambulance call by ER to arrival in ICU and CCI). We found 26.3% of the variance for total in-hospital LOS of critically ill patients (R square: 0.2626) was explained by the variables accounted in the model. After adjusting for potential confounders, on average, critically ill patients who visited FEDs had an approximately 38.5% shorter total in-hospital LOS (exp $\beta = 0.615$) compared to patients visiting a HBED. The correlation between ED facility type and in-hospital LOS was significant [Confidence Interval (CI): −0.87 to −0.10].

4. Discussion

EDs face challenges in delivering high quality and timely patient care against a background of growing patient numbers and limited hospital personnel and resources. As the number of patients visiting EDs continues to climb, improving patient flow and preventing ED crowding has quickly become a top priority [6]. Due to crowding, critically ill patients may have to wait in the ED for a prolonged time [7]. In fact, one study from Canada reported as much as 18.2% of critically ill patients remained in the ED for more than 4 h awaiting ICU admission [8]. ED crowding contributes to degradation of quality patient care because of delays in the commencement of treatments and less adherence to clinical guidelines. Indeed some studies have concluded that patients with delayed admission to the ICU from the ED are associated with poor outcomes [9].

There have been some studies that have examined outcomes in patients transferred from community hospitals to tertiary care center ICUs. The majority of studies have shown that transfer patients tend to be sicker, have longer LOS, delays in care, and higher mortality rates than non-transfer patients. However, these studies have all looked at transfers from community EDs, medical floors, and ICUs to tertiary care ICUs [10-16].

Our study measured and compared patient flow through the ED as represented by LOS in the ED. LOS in the FED was broken down into four time periods: time from ED arrival to ED provider evaluation, time from provider evaluation to ICU consult placement, time from ICU consult placement to ambulance arrival, and time from ambulance arrival to arrival in the ICU. Patients initially seen at one of the three FEDs experienced a significantly shorter duration for the first two periods (which they both shared), as compared to patients initially seen at the HBED. We found that there was faster patient flow through the FEDs than the HBED. Similarly, we determined that total hospital length of stay, which includes the length of stay in the ICU in addition to the length of stay in the ED, was shorter in patients admitted from the FEDs than those from the HBED. The advent of FEDs may consequently serve as a potential solution to crowding in larger, urban hospital EDs by off-loading some of the ED burden from the main facility, but also by serving as a faster source of emergency care.

We found for our cohort of critically ill patients that insurance status was significantly different between patients seen initially at the FEDs compared to the HBED. While the FEDs saw more privately insured patients than the HBEDs, 64% of FED patients were Medicaid, Medicare or

Table 3
Multivariable linear regression model: predictors of length of stay in hospital (n = 500).

Variable	Beta[b]	Exponentiated beta[c]	95% Confidence Interval
Intercept	−0.2557	0.774	−1.425–0.913
Facility type	−0.4867	0.615	−0.871 to −0.103[a]
Age (in years)	0.0092	1.009	−0.002–0.020
Gender	−0.0423	0.959	−0.331–0.247
Race	0.1597	1.173	−0.256–0.576
Insurance type	0.1470	1.158	−0.041–0.335
Do-not-Resuscitate (DNR) status	0.4673	1.596	0.083–0.852[a]
Time between consult to ambulance call by ED to arrival in ICU/ICU (in minutes)	0.0003	1.000	−0.001–0.002
Time between arrival to ED and finished consultation with ED provider (in minutes)[d]	0.0007	1.001	−0.001–0.002
Charlson Co morbidity Index (CCI)	0.0207	1.021	−0.030–0.071
Time spent in ventilator	0.0316	1.032	−0.030–0.071[a]
Body Mass Index	0.0649	1.067	−0.065–0.195
Patient Disposition	−0.2557	0.774	−1.425–0.913

R-square: 0.2626.
[a] Statistically Significant Confidence Interval.
[b] Regression model adjusted for age, race, gender, Insurance type, DNR status, BMI of patients, Time between arrival to ED and finished consultation with ED physician, Time between consult to ambulance call by ED to arrival in ICU, CCI, and time spent in ventilator.
[c] To interpret "Exponentiated beta" as a percent chance: first, subtract one from the number and multiply by 100. For every one-unit chance in independent variable/s, the average dependent variable (length of stay in hospital) increases/ decreases by [*calculated*] percentage.
[d] Time between arrival to ED and finished consultation with ED provider = *Time between patient arrival in ED to evaluation by ED provider + Time between seen by ED provider and determine need for ICU.*

self-pay patients. This indicates that FEDs do care for underserved patient populations.

Table 4
Multivariable linear regression model: predictors of length of stay in Intensive care unit (ICU). (N = 500).

Variable	Beta[b]	Exponentiated beta[c]	95% Confidence Interval
Intercept	0.4789	1.614	−0.597–1.555
Facility type	−0.3449	0.708	−0.705–0.016
Age (in years)	−0.0008	0.999	−0.011–0.010
Gender	0.0506	1.052	−0.218–0.319
Race	0.2303	1.259	−0.152–0.613
Insurance type	−0.0310	0.969	−0.205–0.143
Do-not-Resuscitate (DNR) status	0.2343	1.264	−0.121–0.589
Time between consult to ambulance call by ED to arrival in ICU (in minutes)	−0.0004	1.000	−0.002–0.001
Time between arrival to ED and physician disposition (in minutes)[d]	−0.0006	0.999	−0.002–0.001
Charlson Co morbidity Index (CCI)	0.0242	1.025	−0.022–0.071
Time spent in ventilator	0.0355	1.036	0.010–0.061[a]
Body Mass Index	0.0573	1.059	−0.063–0.178

R-square: 0.1745.
[a] Statistically Significant Confidence Interval.
[b] Regression model adjusted for age, race, gender, BMI of patients, Time between arrival to ED and ED physician disposition, Time between consult to ambulance call by ED to arrival in ICU and CCI.
[c] To interpret "Exponentiated beta" as a percent chance: first, subtract one from the number and multiply by 100. For every one-unit chance in independent variable/s, the average dependent variable (ED length of stay) increases/ decreases by [*calculated*] percentage.
[d] Time between arrival to ED and finished consultation with ED provider = *Time between patient arrival in the ED to evaluation by ED provider + Time between patient seen by provider to determine need of ICU.*

Patients seen at the FEDs were also more likely to be discharged home and less likely to go to a skilled nursing facility than patients seen at the HBED. Returning home is often considered an indicator of quality of care. However many patients, especially older individuals, cannot return to their initial living arrangement after discharge and must be admitted to long-term care facilities [17].

Since most patients arrived from home for both the FED and HBED groups (Table 2), it may be important to understand the mode of transportation these patients used when coming from home. There was an interaction effect between the source of admission and mode of transportation to the FEDs and HBED. Of the patients who came to the FEDs from home, most arrived via car. For every other admission source the FED group of patients arrived from (SNF, scene of accident, work, other) the majority of them arrived via EMS. For patients who came to the HBED from home, however, most arrived via EMS.

4.1. Limitations

The potential limitations for this study include those inherent to all retrospective chart reviews and include sampling bias, measurement bias, and classification bias. Chart documentation was not complete for some of the variables examined, which may also serve as a source of error and those variables were excluded from analysis. Socioeconomic factors not captured in our database may have affected disposition destination and consequently hospital LOS. There were fewer patients admitted to the ICU from the FEDs compared to the HBED, which is why the sample was randomized. Also, we should take into consideration that these linear models can estimate the change in average hospital LOS for the demographic characteristics used for the study. For example, these models will not be valid to estimate change in average hospital LOS of patients who are under 18 years of age or higher than 99 years of age.

5. Conclusion

Patients admitted to ICUs from FEDs have greater comorbidities, yet shorter hospital length of stay, when compared to those admitted from a tertiary care HBED.

Prior presentations

American College of Emergency Physicians Annual Meeting. San Diego, California October 2018.

Funding sources/disclosures

None

References

[1] Gaieski DF, Agarwal AK, Mikkelsen ME, Drumheller B, Cham Sante S, Shofer FS, et al. The impact of ED crowding on early interventions and mortality in patients with severe sepsis. Am J Emerg Med 2017;35:953–60.
[2] Henneman P, Garb J, Capraro G, Li H, Smithline H, Wait R. Geography and travel distance impact emergency department visits. J Emerg Med 2011;40:333–9.
[3] Simon EL, Griffin PL, Jouriles NJ. The impact of two freestanding emergency departments on a tertiary care center. J Emerg Med 2012;43:1127–31.
[4] Hung SC, Kung CT, Hung CW, Liu BM, Liu JW, Chew G, et al. Determining delayed admission to intensive care unit for mechanically ventilated patients in the emergency department. Crit Care 2014;18:485. https://doi.org/10.1186/s13054-014-0485-1.
[5] Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. J Chronic Dis 1987;40(5):373–83.
[6] Rui P, Kang K. National Hospital Ambulatory Medical Care Survey: 2015. Emergency Department Summary Tables Available from: https://www.cdc.gov/nchs/data/nhamcs/web_tables/2015_ed_web_tables.pdf. Accessed Sept 13 ; 2018.
[7] Forster AJ, Stiell I, Wells G, Lee AJ, van Walraven C. The effect of hospital occupancy on emergency department length of stay and patient disposition. Acad Emerg Med 2003;10:127–33.

[8] Green RS, McIntyre J. The provision of critical care in emergency departments at Canada. J Emerg Trauma Shock 2011;4:488–93. https://doi.org/10.4103/0974-2700.86638.
[9] Sprivulis PC, Da Silva JA, Jacobs IG, Frazer AR, Jelinek GA. The association between hospital overcrowding and mortality among patients admitted via western australian emergency departments. Med J Aust 2006;184:208–12.
[10] Duke G, Green J. Outcome of critically ill patients undergoing interhospital transfer. Med J Aust 2001;174:122–5.
[11] Flabouris A. Patient referral and transportation to a regional tertiary CRITICAL CARE UNITCCU: patient demographics, severity of illness and outcome comparison with non-transported patients. Anesth Intensive Care 1999;27:385–90.
[12] Flabouris A, Hart G, George C. Outcomes of patients admitted to a tertiary intensive care units after interhospital transfer: comparison with patients admitted from emergency departments. Crit Care Resusc 2008;10:97–105.
[13] Mortality of patients transferred to a tertiary care hospital. Cleve Clin J Med 1993;60:449–54.
[14] Surgenor SD, Corwin HL, Clerico T. Survival of patients transferred from tertiary intensive care from rural community hospitals. Crit Care 2001;5:100–4.
[15] Bernard AM, Hayward RA, Rosevear J, Chun H, McMahon LF. Comparing the hospitalizations of transfer and non-transfer patients in an academic medical center. Acad Med 1996;71:262–6.
[16] Rishu AH, Aldawood AS, Haddad SH, Tamim HM, Al-Dorzi HM, Al-Jabbary A, et al. Demographics and outcomes of critically ill patients transferred from other hospitals to a tertiary care academic referral center in Saudi Arabia. Ann Intensive Care 2013;3:26. https://doi.org/10.1186/2110-5820-3-26.
[17] Kus S, Muller M, Strobl R, Grill E. Patient goals in post-acute geriatric rehabilitation–goal attainment is an indicator for improved functioning. J Rehabil Med 2011;43:156–61.