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Original Contribution

Clinical differences between visits to adult freestanding and hospital-based emergency departments

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ABSTRACT

Objective: Compare clinical characteristics for adult visits to freestanding emergency departments (FEDs) and a hospital-based ED (HBED).
Methods: Electronic health records were collected on adult ED visits from 7/1/14 to 6/30/15 from three FEDs and one level 1 trauma tertiary care HBED.
Results: There were 55,909 HBED visits; 44,108 FED visits. The FED population was slightly more female (61% vs 57%), younger (48 vs 46 years), white (86% vs 60%), and employed (67% vs 49%). A higher percent of FED visits had private insurance (43% vs 20%); a lower percent had Medicaid (25% vs 42%) and Medicare (23% vs 30%). The top three presenting problems were the same at the HBED and FEDs, but the order differed: gastrointestinal (HBED 19% vs FED 18%), cardiorespiratory (18% vs 16%), injury-pain-swelling of extremity (14% vs 17%). Differences were seen in primary ICD9 codes. One quarter of FED visits and only 18% of HBED visits were for injury/poisoning. A higher percent of FED visits were for respiratory diseases (12% vs 9%) but a lower percent were for circulatory system diseases (7% vs 11%) and visits for mental illness (2% vs 6%). Nearly 30% of HBED visits resulted in admission, compared to 8% of FED visits. ESI level differed significantly, with a lower percent of high acuity cases at FEDs (level 1: 0.1% vs 1.6%; level 2: 5% vs 26%).
Conclusion: Differences were observed in clinical characteristics of adult HBED visits versus FEDs. Results of this study can help communities plan their emergency care system.

1. Introduction

1.1. Background

The American College of Emergency Physicians defines a freestanding emergency department (FED) as "a facility that is structurally separate and distinct from a hospital and provides emergency care" [1]. FEDs are typically open 24/7 and are staffed by qualified emergency care providers. Although services provided can vary across FEDs, most offer common radiology and laboratory services in addition to emergency care [2]. A well-equipped FED serves as an alternative to emergency care in a hospital-based emergency department (HBED). FEDs generally offer faster throughput and more efficient hospital admission when necessary [2]. The popularity and number of FEDs has been substantially increasing [2]. In 2007 there were 80 FEDs in the U.S. [3]. The last inventory was conducted in 2015 and found 360 FEDs [4], more than a four-fold increase.

As the number of FEDs increases, two models of FED location sites are becoming apparent. In some instances FEDs are located in rural areas, which can increase access to care when an HBED is too far from the patient or when building a hospital is not a viable option. In contrast, an additional strategy of FED site placement has emerged. Recent national studies have shown that FEDs tend to be located in more affluent areas and in areas with existing HBEDs [4,5]. In these communities with established HBEDs, opening an FED can be an efficient way to provide emergency care to the community and to alleviate high patient volume at the HBED. In one health system where two FEDs were opened within 12 miles of an HBED there was an increase in system visits overall, but a decrease in the volume of visits to the HBED [6].

1.2. Importance

Given that more and more communities have at least one FED and one HBED, patients are frequently faced with choices in the type of

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emergency care setting they seek. At present, not much is known about clinical characteristics of visits at an FED compared to visits at an HBED. One study compared the average Emergency Severity Index (ESI), or the acuity level, for visits at an HBED and FED and found HBED visits have a significantly lower ESI [7]. Another study examined patient insurance status and found that FED visits were more likely to be covered by commercial/private insurance and less likely to be covered by Medicaid, Medicare, or self-pay when compared to the HBED visits [8]. These studies indicate there might be some differences in the patient populations served and the clinical reasons for the ED visit. Understanding the differences is important for emergency care system planning. Many FEDs are being built in areas to supplement an established emergency care infrastructure that is at maximum capacity. As the number of FEDs increases, understanding the clinical characteristics and diagnoses of patients seeking care will be crucial for providing an appropriate level of emergency care services within communities.

1.3. Goals of this investigation

The objective of this study was to describe the clinical characteristics and diagnoses of adult visits at FEDs compared to HBEDs. We hypothesize that there will be significant differences in clinical characteristics.

2. Methods

2.1. Study design and setting

This was a retrospective study of electronic medical records for patients presenting to the emergency departments (EDs) of a multicenter health system in Northeast Ohio. Records of patient visits from four ED locations were included: a level 1 trauma tertiary-care HBED in a downtown urban area and three FEDs located in suburban settings all within 12 miles of the HBED. The health system serves an urban-rural area, including a major metropolitan statistical area of 700,000 [9]. The HBED is a certified chest pain and stroke center. All four facilities take EMS traffic as well as all types of insurance. All facilities are staffed with board eligible or board certified emergency medicine physicians. The HBED serves as a teaching hospital and has multiple residency programs including an emergency medicine residency. The emergency medicine residents rotate at the FEDs in addition to being based at the HBED. This study was approved by the Cleveland Clinic Akron General Institutional Research Review Board.

2.2. Selection of participants

Records were pulled for visits to one of four EDs from 7/1/2014 to 6/30/2015 based on arrival time. A children's hospital is two blocks from the HBED, drawing most pediatric cases away from the HBED and FEDs included in this study. Therefore, a visit record was excluded if the patient was <18 years old. Eleven percent of the FED visits were by patients < 18 years of age compared to 0.5% of HBED visits.

2.3. Methods and measurements

Patient data were extracted from two systems – the ED electronic health record and the health system's billing/registration data. Records were linked using a unique encounter ID. All EDs used the same electronic health record system, PICIS ED PulseCheck, which captured clinical information such as ESI level, patient condition, arrival method, presenting problem, and disposition. ESI level, patient condition, and presenting problem were determined during triage assessment and entered into the patient's PICIS record. Disposition was classified as admitted or not. FED admissions are direct admissions to the hospital and are therefore not counted as HBED admissions. Demographic information such as age, gender, race/ethnicity, employment, and marital status were extracted from the registration data which was entered by a registration technician based on patient self-report. Insurance type and the primary diagnosis code, recorded with International Classification of Diseases, 9th Revision, Clinical Modification (ICD9) codes, were extracted from the billing data, which were assigned after the visit and finalized through the billing process. Note that the ICD9 codes were assigned by a trained reviewer after the ED visit whereas the presenting problem was assigned at triage based on patient self-report; thus, they will not always align. The ICD9 codes were aggregated using the Clinical Classification Software (CCS) developed by the Agency for Healthcare Research and Quality [10]. This software provides a classification schema that groups similar ICD9 codes into mutually exclusive categories. It is a hierarchical structure – meaning that each category can be broken down into more specific categories. For this analysis we report only the two highest (broadest) levels. For one category, level 3 was examined to provide an appropriate level of detail.

2.4. Analysis

Patient visit records were classified into HBED and FED visits. Visit level demographics and clinical characteristics were summarized by location. For categorical characteristics, chi-square tests were used to test statistically significant differences between HBED and FED visits. For continuous variables, two-sample *t*-tests were used to test statistically significant differences between HBED and FED visits. All analyses were performed in IBM SPSS version 22.

3. Results

There were 105,625 visits to the four EDs during the study period, of which 5608 were excluded because the patient was under 18 years old. The total sample size for analysis was 100,017, with 55,909 (56%) visits to the HBED and 44,108 (44%) visits to the FEDs. About 58% of all visits were by females; 71% were by White, Non-Hispanics. The average age was 47 years old.

Table 1 compares the demographic characteristics of patients for the HBED and FED visits. To help the reader understand the differences in the patient populations, each FED is presented separately. Statistical comparisons are made between the HBED and the FEDs combined. All differences were statistically significant. FED visits were significantly more likely to be by Non-Hispanic white (86% versus 60%) and married (41% versus 28%) patients. HBED visits were more likely to be unemployed (51% versus 33%). The difference in gender and age was small yet statistically significant.

Table 2 describes the visit-level clinical characteristics. All differences were statistically significant. Just over one-quarter of HBED visits were assigned an ESI level 1 or 2, compared to 5.1% of FED visits. FEDs had a higher concentration of ESI levels 3 and 4 visits (94% versus 69%), but the HBED had a higher percent of ESI level 5 visits with 3%, compared to 0.5% at FEDs. Similarly, the HBED had a higher proportion of visits with an arrival method via emergency services (26% versus 6%). Nearly 30% of the HBED visits resulted in admission, as opposed to only 8% of FED visits. The payer type for the visit differed substantially. One-fifth of the HBED visits were from patients with a commercial/private payer, compared to 43% of visits to the FED. Medicaid was the largest payer at the HBED (42% of visits), but only about 25% of FED visits were by Medicaid patients. Visits by patients with no insurance made up a similar proportion at the HBED (6%) compared to the FEDs (5.5%).

The presenting problem, as reported by the patient and documented by the triage nurse, is shown in Table 3. The top four presenting problems were the same at both locations, although the order differed. The top condition was “gastrointestinal” at both locations: 19% of HBED visits and 18% of FED visits. The second most common presenting problem at the HBED was “cardiorespiratory” (18% of visits), followed by “extremity injury/pain/swelling” (14%), and “trauma” (13%). At the FEDs, the second most common presenting problem was “trauma”

Table 1
Demographic characteristics of adult visits to a hospital-based emergency department (HBED) vs freestanding emergency departments (FEDs), 7/1/2014–6/30/2015.

Demographic	HBED		FED A		FED B		FED C		Total FED		HBED vs All FEDs P-value
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
Gender											<0.0001
Male	24,345	43.5%	7016	41.0%	5395	38.0%	5009	39.2%	17,420	39.5%	
Female	31,563	56.5%	10,105	59.0%	8817	62.0%	7766	60.8%	26,688	60.5%	
Race/ethnicity											<0.0001
White, non-Hispanic	33,261	59.7%	15,016	87.8%	10,598	74.6%	11,930	93.4%	37,544	85.9%	
Black, non-Hispanic	21,255	38.2%	1557	9.1%	3015	21.2%	598	4.7%	5170	11.8%	
Hispanic	310	0.6%	35	0.2%	44	0.3%	33	0.3%	112	0.3%	
Asian	106	0.2%	30	0.2%	34	0.2%	22	0.2%	86	0.2%	
Other	747	1.3%	376	2.2%	311	2.2%	132	1.0%	819	1.9%	
Employment status											<0.0001
Unemployed	27,865	50.9%	5663	33.3%	4346	30.9%	4530	35.7%	14,539	33.2%	
Employed	26,889	49.1%	11,330	66.7%	9743	69.2%	8169	64.3%	29,242	66.8%	
Marital status											<0.0001
Married	15,026	27.5%	7423	44.4%	6496	47.5%	5596	44.3%	19,515	45.4%	
Single	26,771	49.0%	6785	40.6%	4958	36.2%	4275	33.9%	16,018	37.2%	
Divorced	6615	12.1%	1459	8.7%	1043	7.6%	1655	13.1%	4157	9.7%	
Separated	1123	2.1%	99	0.6%	86	0.6%	217	1.7%	402	0.9%	
Widowed	4885	8.9%	935	5.6%	1092	8.0%	862	6.8%	2889	6.7%	
Life partner	28	0.1%	7	0.04%	8	0.06%	19	0.15%	34	0.1%	
Age (mean, standard deviation)	48	19.9	45	18.9	49	20.7	45	18.4	46	19.5	<0.0001

(18%), followed by "extremity injury/pain/swelling" (17%) and "cardiorespiratory" (16%).

The primary ICD9 code as classified by CCS level one categories is presented in Table 4. One-quarter of FED visits had a primary diagnosis for *Injury and Poisoning*, compared to 18% of HBED visits. The HBED saw a higher proportion of visits for *Diseases of the Circulatory System* (11% vs 7%) and *Mental Illness* (6% versus 2%) while FEDs saw a higher proportion of visits for *Diseases of the Respiratory System* (12% versus 9%). The level two categories were examined to see what conditions were driving these differences. Within the *Injury and Poisoning* category, several conditions accounted for the differences seen between the HBED and FEDs. The FEDs saw a higher percent of visits for *sprains and strains* (HBED 4% vs FED 7%); *superficial injury, contusion* (HBED 3% vs FED 6%); and *open wounds* (HBED 2% vs FED 5%). Within visits for *Diseases of the Respiratory System*, *respiratory infections* accounted for nearly all of the difference (HBED 4% vs FED 8%). Within visits for *Diseases of the Circulatory System*, *diseases of the heart* accounted for nearly all of the difference (HBED 8% vs FED 5%). Examining the *Mental Illness* visits further showed differences within *mood disorders* (HBED 2% vs FED 0.2%); *alcohol and other substance-related disorders* (HBED 2% vs FED 0.4%); and *schizophrenia and other psychotic disorders* (HBED 0.9% vs FED 0.1%).

We examined the CCS level two categories for the three most common CCS level one categories: *Injury and Poisoning*, *Diseases of the Respiratory System*, and *Symptoms; signs; and ill-defined conditions and factors influencing health status*. Fig. 1 shows the *Injury and Poisoning* CCS category, with the proportion of each level two category at a FED vs HBED as well as the average ESI level for each diagnosis category. This figure shows the ESI level was similar at the HBED compared to FEDs for many of the categories. The ESI level for *intracranial injury*, *crushing injury or internal injury*, and *spinal cord injury* were all substantially lower for HBED visits compared to FED visits. The only category where the HBED visits had a higher ESI was for *burns*.

Similarly, Fig. 2 shows the same graph but for *Diseases of the Respiratory System*. For these conditions, ESI level was consistently lower at the HBED for all categories, except for *other respiratory disease* where the ESI level for these visits at the HBED was the same as those at the FEDs.

The final category examined was *Symptoms; signs; and ill-defined conditions and factors influencing health status* (Fig. 3). ESI level was substantially lower at the HBED for visits in the category of *malaise and*

Table 2
Characteristics of adult visits to hospital-based versus freestanding emergency departments (EDs), 7/1/2014–6/30/2015.

Characteristic	Hospital ED		Freestanding ED		P-value
	Number	Percent	Number	Percent	
Emergency Severity Index level					<0.0001
Level 1	886	1.6%	64	0.1%	
Level 2	14,651	26.4%	2201	5.0%	
Level 3	24,865	44.8%	24,082	54.6%	
Level 4	13,384	24.1%	17,489	39.7%	
Level 5	1716	3.1%	230	0.5%	
Arrival method					<0.0001
Car/motorcycle	33,622	60.1%	38,824	88.0%	
Emergency services	14,377	25.7%	2591	5.9%	
Ambulatory	6211	11.1%	2110	4.8%	
Wheelchair	803	1.4%	434	1.0%	
Bus	510	0.9%	83	0.2%	
Other	383	0.7%	66	0.1%	
Patient admitted					<0.0001
Yes	16,466	29.5%	3651	8.3%	
No	39,443	70.5%	40,457	91.7%	
Condition on arrival					<0.0001
Good	18,079	34.5%	13,590	31.1%	
Stable	29,748	56.8%	27,967	64.0%	
Fair	3223	6.1%	1809	4.1%	
Serious	500	1.0%	169	0.4%	
Critical	704	1.3%	123	0.3%	
Expired	163	0.3%	52	0.1%	
Insurance type					<0.0001
Commercial	10,971	19.6%	18,904	42.9%	
Medicaid	23,212	41.5%	10,918	24.8%	
Medicare	16,618	29.7%	9941	22.5%	
Uninsured	3354	6.0%	2425	5.5%	
Other	1754	3.1%	1920	4.4%	

Table 3
Top ten presenting problems at hospital-based vs freestanding emergency departments (EDs), 7/1/2014–6/30/2015.

Presenting problem	Hospital-based ED		Freestanding ED	
	Number	Percent	Number	Percent
Gastrointestinal	10,603	19.0%	7979	18.1%
Cardiorespiratory	10,274	18.4%	7083	16.1%
Extremity injury-pain-swelling	7911	14.2%	7437	16.9%
Non-specific musculoskeletal trauma	7307	13.1%	7776	17.6%
General medical	7143	12.8%	4093	9.3%
Skin	2528	4.5%	3017	6.8%
Throat	1179	2.1%	1460	3.3%
Genitourinary	2725	4.9%	2150	4.9%
Neurology	2554	4.6%	423	1.0%
Psychiatry	1109	2.0%	894	2.0%

Table 4
Primary reason for visit classified into clinical classification system level 1 categories, hospital-based vs freestanding emergency departments (EDs), 7/1/2014–6/30/2015.

Clinical classification system category	Hospital-based ED		Freestanding ED	
	Number	Percent	Number	Percent
Injury and poisoning	9848	17.7%	11,190	25.4%
Diseases of the respiratory system	5264	9.4%	5318	12.1%
Symptoms; signs; and ill-defined conditions and factors influencing health status	5649	10.1%	4250	9.7%
Diseases of the musculoskeletal system and connective tissue	5188	9.3%	4289	9.7%
Diseases of the circulatory system	6104	11.0%	3077	7.0%
Diseases of the digestive system	4808	8.6%	3552	8.1%
Diseases of the nervous system and sense organs	4076	7.3%	3421	7.8%
Diseases of the genitourinary system	3990	7.2%	3462	7.9%
Diseases of the skin and subcutaneous tissue	1853	3.3%	1839	4.2%
Mental illness	3296	5.9%	673	1.5%
Infectious and parasitic diseases	1922	3.4%	1054	2.4%
Endocrine; nutritional; and metabolic diseases and immunity disorders	1326	2.4%	773	1.8%
Complications of pregnancy; childbirth; and the puerperium	793	1.4%	639	1.5%
Residual codes; unclassified; all E codes	844	1.5%	319	0.7%
Diseases of the blood and blood-forming organs	469	0.8%	92	0.2%
Neoplasms	275	0.5%	72	0.2%
Congenital anomalies	11	<0.1%	3	<0.1%

fatigue and somewhat lower for visits in the category of *syncope* and *fever of unknown origin*.

3.1. Limitations

This study has several limitations. First, the retrospective study design using existing data is subject to the limitations of using such data. The potential for missing data and misclassification exists. Second, this study included patients visiting one healthcare system in one metropolitan area, which could limit the generalizability of the results. However, the service region is an urban-rural mix not unlike many other healthcare service areas in the country. Finally, differences observed between the HBED and FED patients could be due to underlying differences in communities served. Although the FEDs are all within 12 miles of the HBED, the FEDs are located in more suburban communities as compared to the downtown urban environment of the HBED. In this study we found differences in the patient demographics between the HBED and the FEDs. We do not know if the differences in the demographics reflect differences in patients or differences in the communities in which the facilities are located. Indeed, the surrounding zip codes in the FED locations have a higher proportion of Non-Hispanic White residents than the zip codes surrounding the HBED. Furthermore, in a separate study we conducted we found FED patients were more likely to come to the ED because it is convenient, potentially indicating that FEDs pull more patients from their surrounding areas.

4. Discussion

This study indicates that adult patients requiring more resources or perceived to be at a higher severity, are more likely to be seen at the HBED. Visits to the HBED were much more likely to be classified as ESI level 1 and level 2, the most severe categories, compared to FED visits. The FED visits were almost exclusively level 3 or level 4. However, the HBED had a much higher percent of visits classified as level 5, the lowest severity score, compared to the FEDs. The difference in severity could also be seen by the patient disposition. Nearly 30% of visits to the HBED resulted in hospital admission while only 8% of FED visits resulted in hospital admission. This pattern indicates there is some sort of triaging occurring in ED location choice – with the more severe cases seeking care at the HBED. However, it is unclear from this data if adult patients are triaging themselves and choosing a location based on perceived severity of illness, or if the medical community is helping to triage adult patients to the most appropriate ED type. Over one-quarter

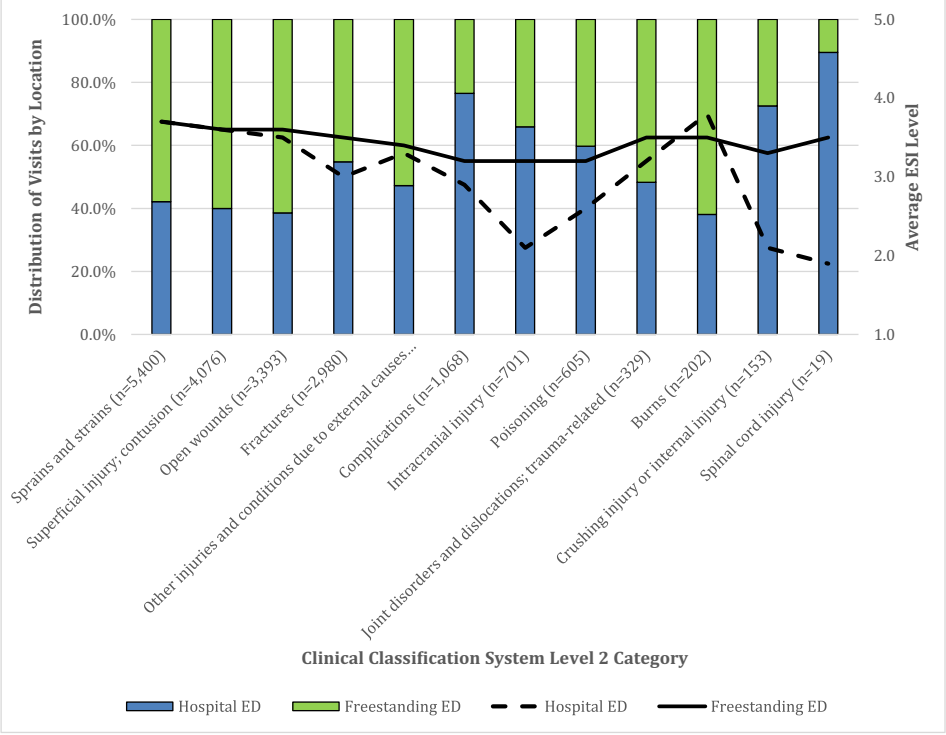

Fig. 1. Breakdown of "Injury and Poisoning" adult visits to an HBED and FEDs, with average ESI level by location type.

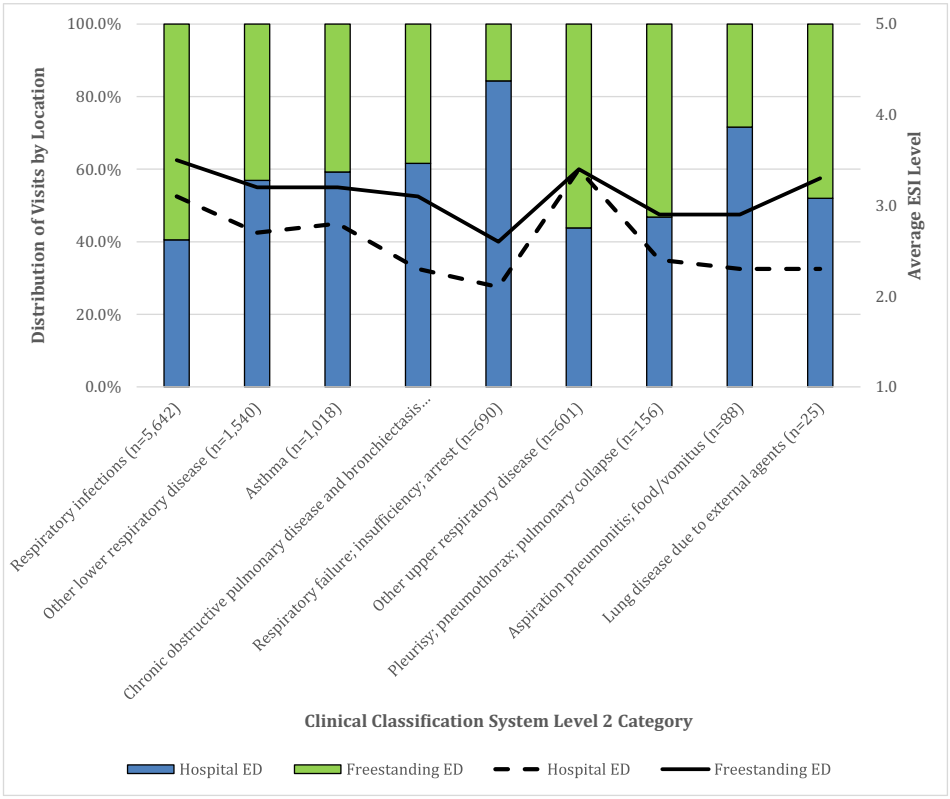

Fig. 2. Breakdown of "Diseases of the Respiratory System" adult visits to an HBED and FEDs, with average ESI level by location type.

of HBED visits had an arrival method of emergency services, compared to only 6% of FED visits. This could indicate emergency services are playing some role in triaging by location type, that more EMS runs are completed in closer proximity to the HBED or that patient preference when EMS is needed is for an HBED.

Consistent with previous literature [8], we found a difference in patient insurance type by location. The FEDs saw a much smaller proportion of visits with a Medicaid payer and a much higher proportion of visits with a commercial/private payer type. Interestingly, the proportion of visits without insurance was similar between the HBED and FEDs. With 25% of FED visits having a Medicaid payer, and almost 6% without any insurance, this shows that, at least in our study, a substantial portion of adult FED care is for underserved and/or low-income patients.

This study included a thorough comparison of the primary ICD9 diagnosis code by location. FED visits were more likely to have an

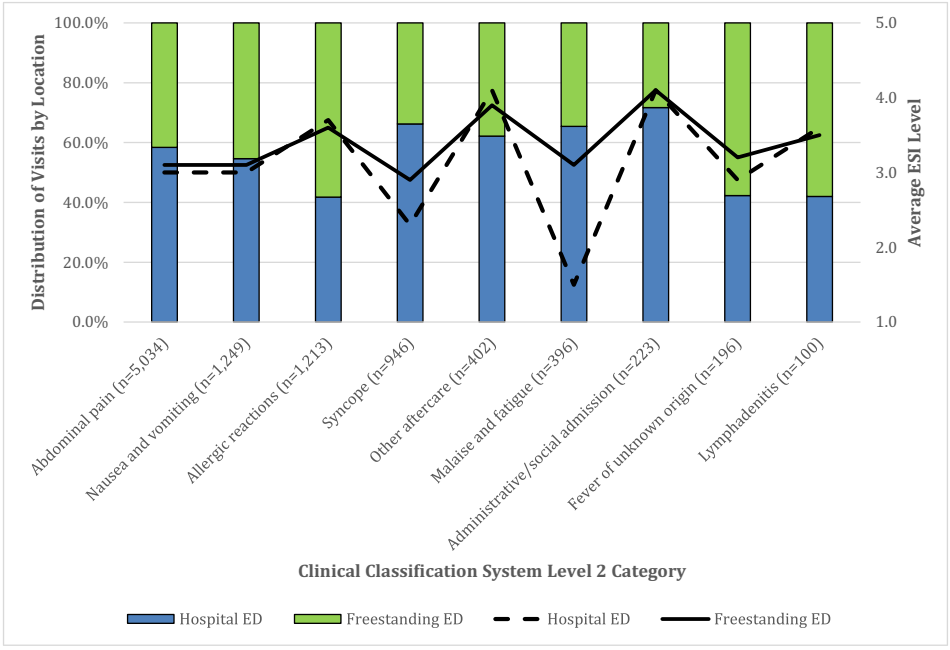

Fig. 3. Breakdown of "Symptoms; Signs; and Ill-defined Conditions and Factors Influencing Health Status" adult visits to an HBED and FEDs, with average ESI level by location type.

injury/poisoning diagnosis and a respiratory system diagnosis. HBED visits were more likely to have a circulatory system diagnosis and a mental illness diagnosis. Drilling down into the CCS level 2 categories revealed that particular diagnoses had substantially different ESI levels as well as many diagnoses with no difference in ESI level. This type of analysis can be extremely helpful to ED administration and planners to understand what types of conditions and the severity of those conditions for adult patients are most common in an FED setting compared to an HBED setting.

This study was conducted in an area with both established FEDs and HBEDs. In this context, where many patients have a choice in where they seek ED care, we saw differences in the adult patient populations at the FED compared to the HBED. This model of emergency care – the building of FEDs to alleviate the overcrowding of HBEDs as well as to gain market share and expand the hospital brand – is becoming a popular model of providing emergency services in communities [2]. As healthcare providers consolidate and health systems grow, the FED-HBED model will continue to gain popularity in communities across the country. The results of this study will be important to consider as communities plan for providing effective and efficient emergency care services.

In summary, this study characterized the clinical characteristics of adult visits to an HBED compared to FEDs. Because FEDs continue to grow in popularity, understanding the differences in the clinical characteristics is important for health care planners, for hospital systems, and for communities.

Meetings

Society for Academic Emergency Medicine Annual Meeting, Orlando, May 2017.

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Conflicts of interest

ELS is on the physician advisory board for Tandem Hospital Partners and owns stock in the company.

Author contributions

All authors developed the idea and designed the study. RB, BK, and LK obtained the data. RB conducted the literature review. RB standardized, cleaned, and analyzed the data. RB drafted the manuscript; all authors contributed substantially to its revision. RB takes responsibility for the paper as a whole.

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