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Toward Understanding the Difference Between Using Patients or Encounters in the Accounting of Emergency Department Utilization

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Abstract

Study objective—Descriptions of emergency department (ED) census often do not differentiate between patients and encounters, and there is no guidance about which unit of analysis is most appropriate. We explore differences between patient- and encounter-level accounting of ED utilization.

Methods—Data extracted from hospital databases were used to identify all registered patients at 3 different but geographically proximate EDs: urban academic, urban community, and suburban community. Data were available from 2000 to 2009 for the academic ED and for all 3 EDs from 2003 to 2007. For each ED, we calculated number of encounters, proportion of encounters for “annual new patients” (ie, not seen previously that year), and number of “new patients” (ie, not seen previously during study period). We also determined the annual number of encounters per patient for each ED.

Results—At the academic ED, there were 890,397 encounters involving 256,805 patients. Annual encounters ($\approx 89,000$) and patients ($\approx 49,000$) remained relatively stable over time. Patients were new in 36.1% (95% confidence interval [CI] 35.8% to 36.4%) of year 2 encounters, 25.3% (95% CI 25.1% to 25.6%) of year 5 encounters, and 22.4% (95% CI 22.1% to 22.7%) of year 10 encounters. For community EDs, 50.9% (95% CI 50.4% to 51.5%) and 53.7% (95% CI 53.1% to 54.2%) were new in year 2, and by the fifth year, 35.0% (95% CI 34.5% to 35.5%) and 36.2% (95% CI 35.7% to 36.7%) were new. In the academic ED, 56% of patients had a single encounter during 5 years and less than 6% had more than 8 encounters during that period. In community EDs, 62% of patients had a single encounter during 5 years and less than 3% had more than 8 encounters overall.

Conclusion—EDs provide care to a relatively static population, with truly new patients composing only a minority of encounters. Although multiple encounters per patient are common, highly frequent use occurs for only a minority of ED patients, and then only for a discrete period. Encounters and patients are not equivalent units of analysis, and policymakers and researchers should determine which is most appropriate for their decisionmaking.

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INTRODUCTION

Background

Emergency department (ED) services focus on unscheduled and acute care, so ED utilization is typically conceptualized in terms of single encounters between a patient and provider, or visits.^{1,2} Alternatively, ED utilization can be described in terms of the number of patients receiving care. The difference between patients and encounters is rarely considered, and the relative merits of these distinct metrics for use in health service utilization assessments or clinical research have not been characterized. How the relationship between encounters and patients varies between EDs is also unknown.

Past research on ED utilization has primarily focused on describing high-frequency users,³ appropriateness of their repeated encounters, their effect on the health system,^{4,5} and interventions to reduce high encounter frequency.⁶ There are few data characterizing the infrequent repeated encounter or exploring repeated encounters during more than 1 or 2 years. For example, although Hunt et al⁷ estimated that 45.2 million adults visit an ED each year, with 92% having 3 or fewer encounters, there was no exploration of repeated encounters beyond the 1-year period. The degree to which repeated visit patterns differ by type of ED is also unknown.

Importance

Planning and improving ED services would be facilitated by understanding how the number of patients served by an ED relates to the number of encounters experienced by that ED. Such information could help with matching capacity with need, providing surveillance for health care access or population health, modifying the role of the ED within the overall health system, guiding disease management, and guiding public health intervention. Differences between patients and encounters would also be highlighted by changes tying reimbursement to the patients rather than encounters (eg, denial of payment for repeated admission). The ability of an ED to penetrate and affect a population is directly dependent on the differences between patients and encounters.

Goals of This Investigation

We sought to explore the association between patients and encounters during extended periods, without respect to health condition or presenting complaint, at 3 different yet geographically proximate EDs.

MATERIALS AND METHODS

Study Design and Selection of Participants

This multicenter retrospective study extracted data from hospital administrative databases. All patients registered to receive ED services at 3 hospitals were included. This study was approved by the institutional review board of the health system's affiliated university.

Setting

Three teaching hospitals were included, an urban academic, urban community, and suburban community hospital located within a 10-mile diameter. Patients were predominantly adults; a large pediatric hospital was nearby. During the study, all 3 hospitals were partnered, with shared purchasing, information technology, and other operational support, though they were separately owned and served different patient populations with different missions. Each ED hosted research and residency training and was staffed by the same emergency physician group. In 2009, at the end of this study period, the surrounding county had a population of

855,062 that was 72% white, 25% black, 2% Asian, and 2% Hispanic. These statistics were stable throughout the study period.⁸

The urban academic center was a 665-bed tertiary care teaching hospital and the region's only adult Level I trauma center. The hospital operated in part on a tax levy basis to treat the uninsured. The urban community hospital was less than a mile from the academic center, had 550 beds, and was recognized as one of the region's premier centers for cardiac care. The 200-bed suburban community hospital was located about 10 miles north amid wealthy suburbs and served patients of higher socioeconomic status. The hospitals were open to all patients, with no regional payer exclusions and no structured referral system. There were 3 other competing health systems with 16 other EDs in the area.

Data Collection and Processing

Data for this study were exported directly from hospital administrative databases using a standardized query that was written to generate reports describing presentations to the 3 EDs. Data were available from the urban academic ED from 2000 to 2009 and from the community hospitals for 2003 to 2007. Exported data reflected registration information; individuals presenting for care were registered using date of birth, social security numbers, names, and government identification. Patients were issued a unique medical record number at their first encounter that remained static across time. Each separate encounter generated a unique account number. For billing and reconciliation, medical records underwent frequent and ongoing internal quality assurance review that including merging records, purging of duplicate records, and updating of names.

Primary Data Analysis

We defined patients according to medical record numbers and encounters according to account number. We defined the term "new patient" as the first-ever presentation by an individual to that ED during the study period and "annual new patient" for a first presentation in a given calendar year. All analyses were descriptive and conducted relative to a single ED; we did not explore whether patients visited more than 1 ED. Within each ED, we quantified the number of encounters and number of patients for each calendar year and the study period overall. We then determined the proportion who were annual new patients or new patients. We secondarily calculated the number of encounters per patient. Data management and analyses were performed with SPSS (version 18.0; SPSS Inc., Chicago, IL). Ninety-five percent confidence intervals (CIs) were calculated with Wilson score and Bayes methods.

RESULTS

Between January 1, 2000, and December 31, 2009, there were 890,397 encounters by 256,805 patients at the urban academic ED. Between January 1, 2003, and December 31, 2007, there were 184,874 encounters by 85,633 patients in the urban community ED. Also for 2003 to 2007, there were 166,709 encounters by 82,400 patients in the suburban ED. Table 1 details the demographic characteristics observed for first-time and repeated encounters for each ED.

At all 3 EDs, the numbers of annual encounters and annual new patients remained relatively stable, whereas the number of new patients declined each year during the observed periods (Figure 1). However, the rate of decline for new patients was greater at the urban academic ED (Figure 2). Exponential decay curves were fit to estimate the rate of decline in the number of new patients, which was -0.52 (95% CI -0.63 to -0.41) at the urban academic

ED, -0.43 (95% CI -0.45 to -0.40) at the urban community ED, and -0.43 (95% CI -0.45 to -0.41) at the suburban community ED.

In the 5-year period from 2003 to 2007, slightly more than half of the patients had just a single encounter. Few patients had more than 8 encounters during the observation period. Repeated usage was rarely sustained; of patients with multiple encounters between 2003 and 2007, a minority had multiple encounters per year in more than 1 year (Table 2).

LIMITATIONS

Our data illustrate that accounting for ED visits at the patient level and the encounter level are distinctly different and that first-time encounters differ from repeated encounters. However, the administrative data sets used for analysis may contain unknown errors, including inaccurate or missing data. We do not know whether patients might have had multiple record numbers within the system, but this is likely to be rare, given the multiple identifiers collected and maintained by the hospital and the ongoing internal quality checks.

Generalizability of our findings might be limited. Although strengthened by the examination of more than 1 hospital type and the fact that similar results were observed at the community sites despite serving different populations, all sites were teaching hospitals in a single geographic area staffed by the same emergency physician group. That all hospitals were part of an aligned delivery system may have biased results, although not likely with much significance as each hospital was independently owned and there were no exceptional hospital-payer relationships. Less than 1% of encounters were for children younger than 14 years; our findings may not be applicable to institutions that treat a significant number of children. We did not explore overlap in patient population between these 3 EDs or the other EDs in the region. The degree to which individual patients seek care at more than 1 ED remains a question for future research. In addition, we did not control for changes in the regional health care system and societal norms during the study period; although our region is relatively stable, it is inevitable that there were some changes that affected use of EDs and repeated encounters at those EDs.

Results may be limited if many patients used the same ED as a consequence of a geographic limitation. The effect of this is ameliorated because the urban EDs were less than 1 mile away from each other, there were numerous other EDs in the area, and no special payer relationships existed. Furthermore, in many areas of the United States, communities, particularly rural ones, are often served by single EDs, with limited choice of mobility.

DISCUSSION

That EDs care for some individuals more than once is commonly understood. We augment previous studies' data by demonstrating that most patients treated in an ED have previously been treated in that ED and that there are differences when tabulating repeated encounters during 1 year compared with across multiple years. Our data suggest that EDs serve a relatively static population; over time, the number of encounters for new, never previously encountered patients diminishes to less than a third of the population served. The percentage of new patients declined more quickly in the urban academic ED, suggesting that this hospital experienced higher utilization by a smaller population than the community facilities.

The realization that EDs service a relatively static group of patients has significant influence on our understanding of the role of the ED in the health care system. Researchers, policymakers, and practitioners have typically used the number of ED encounters, often referred to as visits, as a benchmark for ED description, utilization review and planning,

billing, and reimbursement, as well as in planning for research and public health interventions. This ignores that repeated visits may be related or that an ED intervention may have a positive or negative effect beyond the index visit. Conversely, patient-level metrics ignore the true extent of care requirements. Although the full implications of our findings have yet to be elucidated, a number of interesting questions are raised. There are a variety of examples in which the patient metric could dramatically affect decisionmaking. From a purely business perspective, hospitals often invest significantly in marketing to attract new customers; the number of patients may be a more informative measure of market share than the number of encounters. Public health interventions such as screening or vaccination may have enduring effects⁹ and even reduce the need for future ED utilization.¹⁰ They might even be viewed as feasible if the number of interventions were calculated for patients (smaller) rather than encounters (larger). Our data do not show whether multiple encounters by the same patients are related. This becomes important as reimbursement becomes increasingly tied to patients served and to lump-sum payments for health care events, rather than payments for individual services delivered, and so exploration of the relatedness of repeated encounters is warranted.

Our study complements previous reports that suggest only a minority of patients are highly frequent users and that the majority of repeated users present to the ED infrequently.⁷ Extension of the study period over multiple years suggests that a greater proportion of patients are repeated users than are observed when a single year's worth of data is examined. The extended study period also allowed us to discover that when highly frequent ED usage does occur, it is almost never sustained for more than about 2 years, demonstrating the time-limited nature of frequent usage. This finding might inform interventions designed to reduce ED usage by patients with frequent encounters. In addition, review of sociodemographic data in Table 1 provides clues about populations of patients that might benefit from such interventions. Future studies should explore the contribution of sociodemographics and other factors to the propensity for patients to exhibit high-frequency utilization. Such studies might also consider the time between repeated encounters and any relationship between repeated encounters based on the presenting complaint.

We have shown that encounters, patients, and new patients are distinct yet complementary metrics for describing an ED census. Although the majority of patients are infrequent users, the difference between patients and encounters accumulates rapidly within a given year and continues to increase gradually over longer periods. Individual EDs are likely to serve a far more static population than commonly considered, and the number of completely new patients presenting to an ED is relatively small and stable over time. The conceptualization of ED encounters as isolated and discrete events is not adequate for all patients, disease conditions, or administrative and policy issues. Although there are repeated encounters by many patients, few patients have frequent encounters. Those patients who are frequent users exhibit this behavior only for a discrete period. Policymakers and investigators engaged in health systems and public health research should consider whether a patient-level, encounter-level, or combined analysis is most appropriate for accounting of health care utilization, epidemiology, and intervention effect.

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Encounters refer to a patient presentation to the ED regardless of whether it was an initial or repeat visit. Annual new patient refers to encounters where the patient had not been seen previously in that year. New patient refers to encounters where the patient had never been seen previously during the study period. Year 1 refers to the first year for which a particular ED was studied.

Figure 1.
Relationship between annual encounters, annual new patients, and new patients over time.

New patient refers to encounters where the patient had never been seen previously during the study period. Year refers to the study year.

Figure 2.
Percentage of encounters by new patients each year by facility.

Table 1

Patient characteristics for each ED. *

Patient Characteristics	First Encounter to Facility [†]	All Encounters to Facility [‡]
Urban academic		
Age at encounter, y [§]	37 (17)	39 (15)
Race		
Black	94,817 (36.9)	481,789 (54.1)
White	137,992 (53.7)	372,474 (41.8)
Other or not documented	23,996 (9.3)	36,134 (4.1)
Sex		
Male	136,783 (53.3)	456,298 (51.2)
Payer		
Self-pay	99,898 (38.9)	349,220 (39.2)
Medicaid	36,621 (14.3)	217,809 (24.5)
Medicare	25,381 (9.9)	132,970 (14.9)
Commercial	56,520 (22.0)	107,428 (12.1)
Other/not documented	38,385 (14.9)	82,970 (9.3)
Disposition		
Discharged home	178,395 (69.5)	629,101 (70.7)
Admitted	41,697 (16.2)	131,636 (14.8)
Other or not documented	24,873 (9.7)	77,245 (8.7)
Left without being seen	10,850 (4.2)	50,820 (5.7)
Died	952 (0.4)	1,485 (0.2)
Left before treatment complete	38 (0)	110 (0)
Urban community		
Age at encounter [§]	46 (20)	47 (20)
Race		
Black	31,471 (36.8)	86,883 (47.0)
White	50,181 (58.6)	92,516 (50.0)
Other or not documented	3,981 (4.6)	5,475 (3.0)
Sex		
Male	35,188 (41.1)	71,061 (38.4)
Payer		
Self-pay	12,015 (14.0)	23,304 (12.6)
Medicaid	10,295 (12.0)	33,323 (18.0)
Medicare	19,621 (22.9)	53,365 (28.9)
Commercial	34,961 (40.8)	58,435 (31.6)
Other/not documented	8,741 (10.2)	16,447 (8.9)
Disposition		
Discharged home	59,240 (69.2)	125,677 (68.0)
Admitted	22,406 (26.2)	50,785 (27.5)

Patient Characteristics	First Encounter to Facility [†]	All Encounters to Facility [‡]
Other or not documented	1,652 (1.9)	3,233 (1.7)
Left without being seen	2,275 (2.7)	5,069 (2.7)
Died	59 (0.1)	109 (0.1)
Left before treatment complete	1 (0)	1 (0)
Suburban community		
Age at encounter [§]	46 (23)	50 (23)
Race		
Black	18,797 (22.8)	43,248 (25.9)
White	59,333 (72.0)	117,683 (70.6)
Other or not documented	4,270 (5.2)	5,778 (3.5)
Sex		
Male	36,252 (44.0)	68,573 (41.1)
Payer		
Self-pay	10,049 (12.2)	18,700 (11.2)
Medicaid	6,340 (7.7)	16,886 (10.1)
Medicare	20,405 (24.8)	55,210 (33.1)
Commercial	36,090 (43.8)	59,665 (35.8)
Other/not documented	9,516 (11.5)	16,248 (9.7)
Disposition		
Discharged home	59,523 (72.2)	112,614 (67.6)
Admitted	19,151 (23.2)	46,569 (27.9)
Other or not documented	2,162 (2.6)	4,449 (2.7)
Left without being seen	1,128 (1.4)	2,337 (1.4)
Died	417 (0.5)	689 (0.4)
Left before treatment complete	19 (0)	51 (0)
Total for all EDs		
Age at encounter [§]	41 (19)	42 (18)
Race		
Black	145,085 (34.2)	611,920 (49.3)
White	247,506 (58.3)	582,673 (46.9)
Other or not documented	32,247 (7.5)	47,384 (3.8)
Sex		
Male	208,223 (49.0)	595,932 (48.0)
Payer		
Self-pay	121,962 (28.7)	391,224 (31.5)
Medicaid	53,256 (12.5)	268,018 (21.6)
Medicare	65,407 (15.4)	241,545 (19.4)
Commercial	127,571 (30.0)	225,528 (18.2)
Other/not documented	56,642 (13.3)	115,665 (9.3)
Disposition		
Discharged home	297,158 (69.9)	867,392 (69.8)

Patient Characteristics	First Encounter to Facility [†]	All Encounters to Facility [‡]
Admitted	83,254 (19.6)	228,990 (18.4)
Other or not documented	28,687 (6.8)	84,927 (6.8)
Left without being seen	14,253 (3.4)	58,226 (4.7)
Died	1,428 (0.3)	2,283 (0.2)
Left before treatment complete	58 (0)	162 (0)

* Data are provided for each first encounter only (new patients) and for all encounters, and are reported as frequency (percentage) except where noted.

[†] Each patient is counted only once.

[‡] Patients may be counted more than once; thus, demographics may be skewed to the frequent user.

[§] Data are reported as mean (SD).

Table 2

Distribution of repeated encounters by patients for each ED.*

No. of Encounters or Years	Urban Academic				Urban Community				Suburban Community			
	No.	%	(95% CI)		No.	%	(95% CI)		No.	%	(95% CI)	
Number of encounters during study period[†]												
1	88,405	55.9	(55.7–56.2)		53,018	61.9	(61.6–62.2)		51,320	62.3	(61.9–62.6)	
2	26,634	16.9	(16.7–17.0)		14,652	17.1	(16.9–17.4)		14,745	17.9	(17.6–18.2)	
3	13,232	8.4	(8.2–8.5)		6,641	7.8	(7.6–7.9)		6,410	7.8	(7.6–8.0)	
4	7,869	5.0	(4.9–5.1)		3,575	4.2	(4.0–4.3)		3,481	4.2	(4.1–4.4)	
5	5,305	3.4	(3.3–3.4)		2,288	2.7	(2.6–2.8)		2,014	2.4	(2.3–2.6)	
6	3,541	2.2	(2.2–2.3)		1,439	1.7	(1.6–1.8)		1,228	1.5	(1.4–1.6)	
7	2,585	1.6	(1.6–1.7)		948	1.1	(1.0–1.2)		871	1.1	(1.0–1.1)	
8	1,876	1.2	(1.1–1.2)		685	0.8	(0.7–0.9)		597	0.7	(0.7–0.8)	
9	1,493	0.9	(0.9–1.0)		478	0.6	(0.5–0.6)		397	0.5	(0.4–0.5)	
10+	7,080	4.5	(4.4–4.6)		1,909	2.2	(2.1–2.3)		1,337	1.6	(1.5–1.7)	
Number of years in which an encounter occurred[‡]												
1	18,620	26.7	(26.4–27.1)		9,468	29.0	(28.5–29.5)		8,233	26.5	(26.0–27.0)	
2	28,207	40.5	(40.2–40.9)		14,520	44.5	(44.0–45.1)		14,744	47.4	(46.9–48.0)	
3	12,928	18.6	(18.3–18.9)		5,491	16.8	(16.4–17.2)		5,313	17.1	(16.7–17.5)	
4	6,495	9.3	(9.1–9.5)		2,235	6.9	(6.6–7.1)		2,048	6.6	(6.3–6.9)	
5	3,365	4.8	(4.7–5.0)		901	2.8	(2.6–2.9)		742	2.4	(2.2–2.6)	
Number of years in which >1 encounter occurred[‡]												
0	17,040	24.5	(24.2–24.8)		9,543	29.3	(28.8–29.8)		10,673	34.3	(33.8–34.9)	
1	35,740	51.3	(51.0–51.7)		17,242	52.9	(52.3–53.4)		15,580	50.1	(49.6–50.7)	
2	9,831	14.1	(13.9–14.4)		3,846	11.8	(11.4–12.1)		3,330	10.7	(10.4–11.1)	
3	4,142	5.9	(5.8–6.1)		1,265	3.9	(3.7–4.1)		979	3.1	(3.0–3.3)	
4	1,878	2.7	(2.6–2.8)		521	1.6	(1.5–1.7)		376	1.2	(1.1–1.3)	
5	984	1.4	(1.3–1.5)		198	0.6	(0.5–0.7)		142	0.5	(0.4–0.5)	
Number of years in which >8 encounters occurred[§]												
0	6,215	72.5	(71.5–73.4)		1,876	78.6	(76.8–80.1)		1,440	83.0	(76.8–80.1)	
1	1,591	18.6	(17.7–19.4)		379	15.9	(14.4–17.3)		231	13.3	(14.4–17.3)	

No. of Encounters or Years	Urban Academic			Urban Community			Suburban Community		
	No.	%	(95% CI)	No.	%	(95% CI)	No.	%	(95% CI)
2	454	5.3	(4.8–5.8)	89	3.7	(3.0–4.5)	31	1.8	(3.0–4.5)
3	174	2.0	(1.7–2.3)	23	1.0	(0.6–1.4)	20	1.2	(0.6–1.4)
4	91	1.1	(0.9–1.3)	13	0.5	(0.3–0.9)	8	0.5	(0.3–0.9)
5	48	0.6	(0.4–0.7)	7	0.3	(0.1–0.6)	4	0.2	(0.1–0.6)

* Data are for 2003 to 2007. Summary data for each site for the 5-year study period: urban academic, 158,020 patients total, 69,915 with multiple encounters and 8,573 with more than 8 encounters; urban community, 85,633 patients total, 32,615 with multiple encounters and 2,387 with more than 8 encounters; suburban community, 82,400 patients total, 31,080 with multiple encounters and 1,734 with more than 8 encounters.

[†]All patients.

[‡]Patients with multiple encounters.

[§]Patients with more than 8 encounters.