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Original Contributions

FREQUENT EMERGENCY DEPARTMENT VISITORS ASSOCIATED WITH A PAIN-DISCHARGE DIAGNOSIS

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□ **Abstract—Background:** Emergency departments (EDs) have experienced an increase in annual patient visits and length of stay over the past decade. Management of frequent-user patients with pain-related diagnoses are challenging in a time-limited setting. **Objective:** The purpose of this study was to describe characteristics of frequent ED users with pain-related diagnoses. **Methods:** This was a retrospective longitudinal cohort study of hospital ED visits from two EDs in using encounters from September 2016 to August 2018. Frequent users were characterized as having four or more visits in a 1-year period and were further classified into three categories based on the number of pain-related visits in the study period. Descriptive statistics and regression analysis results are reported for all demographic and clinical characteristics for index encounters, patient level data, and pain subgroups. **Results:** Of all patients, 11.3% (n = 5174) were identified as frequent users, accounting for 38.9% (n = 91,114) of all ED visits. Overall, frequent pain users were more likely to be of middle age (odds ratio [OR] 1.70, 95% confidence interval [CI] 0.80–1.72), female (OR 2.43, 95% CI 1.79–3.29), have commercial insurance (OR 1.91, 95% CI 1.37–2.66), and have 10 or more ED encounters (super user status) in a 12-month period (OR 23.66, 95% CI 17.12–32.71). **Conclusion:** Understanding characteristics of ED frequent users with pain-related diagnoses may inform community-based interventions designed to reduce episodic care and thereby improve care coordination and management. © 2020 Elsevier Inc. All rights reserved.

□ **Keywords**—emergency department; frequent users; pain

INTRODUCTION

Despite efforts to reduce the number of emergency department (ED) visits annually, utilization has continued to increase. Between 1996 and 2010, it was found that nearly 50% of hospital-associated medical care in the United States is delivered in EDs (1). According to the Health Cost and Utilization project, the number of ED visits nationally increased 14.8% from 2006 to 2014 (2). In 2015, there were 136.9 million ED visits, and level 4 and level 5 ED visits accounted for 31.6% of those visits (3). That same year, 18% of insured and uninsured, non-elderly adults visited the ED one or more times. It is estimated that 13% to 27% of ED visits could be managed with the same resources in other health settings (4). In a systematic literature review conducted in 2010, it was found that frequent ED users comprised only 4.5% to 8% of all ED visits, but that those visits also accounted for 21% to 28% of all visits nationally (5).

Frequent ED utilization groups are not well defined in the literature and are variable based on the setting.

This study was approved by the Institution's Human Research Protections Program.

Frequent ED utilization has been defined as six or more visits to a rural hospital in a 12-month period, four or more visits to an urban ED four or more times per year, and at least four visits to an ED in a 12-month period (1,6,7). Recurrent ED utilization may be attributed to the attractiveness of the 24/7 availability of a physician with many resources at their disposal. Whereas some studies have found that frequent ED utilization may be attributed to a lack of insurance or knowledge of available resources to treat a specific concern, others have found that it may be attributed to low socioeconomic status or poor mental or physical health (8,9).

Although frequent ED utilization has been studied in the literature, limited information exists pertaining to frequent-user subgroups. Studying smaller sub-groups within frequent-user categories, such as individuals with pain, can provide information on which patients are most at risk of visiting the ED multiple times in a year, to better equip them with knowledge of existing resources and reduce unnecessary utilization. The purpose of this study is to describe demographic and clinical characteristics related to frequent ED visitors with pain.

MATERIALS AND METHODS

Design And Setting

This was a retrospective longitudinal cohort study of hospital ED visits from two academic EDs in San Diego, California between September 2016 and August 2018 using data from a shared electronic medical record. One hospital is an urban academic teaching hospital (Level I trauma center) with an annual census of approximately 40,000 visits. The second hospital is a suburban community hospital with an annual census of approximately 24,000 visits. This study was approved by the institution's Human Research Protections Program.

Selection of Participants

Adult patients at least 18 years of age with at least one ED encounter between September 2017 and August 2018 were included in the study. We identified all ED encounters in a 1-year period looking back 12 months from the last visit in the study period for each patient. We defined frequent ED users as those patients with four or more visits in a 1-year period. We further classified frequent ED users into pain subgroups based on the numbers of pain-related visits in the same period: non-pain users (0 pain visits), occasional pain users (1–3 pain visits), and frequent pain users (4 or more pain visits). Figure 1 outlines the steps of the procedure to identify the analysis cohort.

Methods and Measures

Data for this study consisted of standardized utilization data collected from the electronic medical record, which included demographics, service date, primary source of payment, discharge disposition, and International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9) diagnoses codes. Patient demographic information was based on the last visit in the study period, and included patient age in years, ethnicity and race, sex, and payer. Primary pain visits were defined as visits with any of the following primary diagnoses (standard ICD-9-CM codes): abdominal symptoms (789.x), head and neck symptoms (784.x), other or unspecified disorders of the back (724.x), migraine (346.x), or pain (338.x).

Analysis

We defined frequent ED users as those patients with four or more visits in the consecutive 12-month period after the index visit. We further classified frequent ED users into three smaller groups based on the maximum number of primary pain visits in the 1-year period: frequent non-pain users (frequent ED users with no primary pain visits), frequent occasional pain users (frequent ED users with one to three primary pain visits), and frequent pain users (frequent ED users with four or more primary pain visits). Table 1 summarizes this information further.

We conducted descriptive analyses of patient demographic and encounter characteristics during the study period on the overall index sample and separately for each frequent-user subgroup. We developed two separate binary logistic regressions models using the patient as the unit of analysis, to compare the non-pain group with both the occasional and frequent pain groups to determine the independent association of each variable with each outcome. We included variables such as patient age in years (18–34, 35–54, 55+), female gender, ethnicity/race (non-Hispanic white, Other), payer (Commercial, other), ever being transported by an ambulance, ever having a psychiatric consultation, ever being admitted, and super user status. We reported adjusted odds ratios and 95% confidence intervals for each variable. We conducted all statistical analyses using the IBM SPSS Statistic 25.0 software package (10).

RESULTS

Overall, 45,959 patients were found to have 91,114 encounters in the 1-year look-back period. Of the 45,959 ED patients, 40,785 (88.7%) were nonfrequent users (fewer than four visits in the 12-month period) and made up 55,710 (61.1%) of all of the encounters. Frequent users, however, made up only 5174 (11.3%)
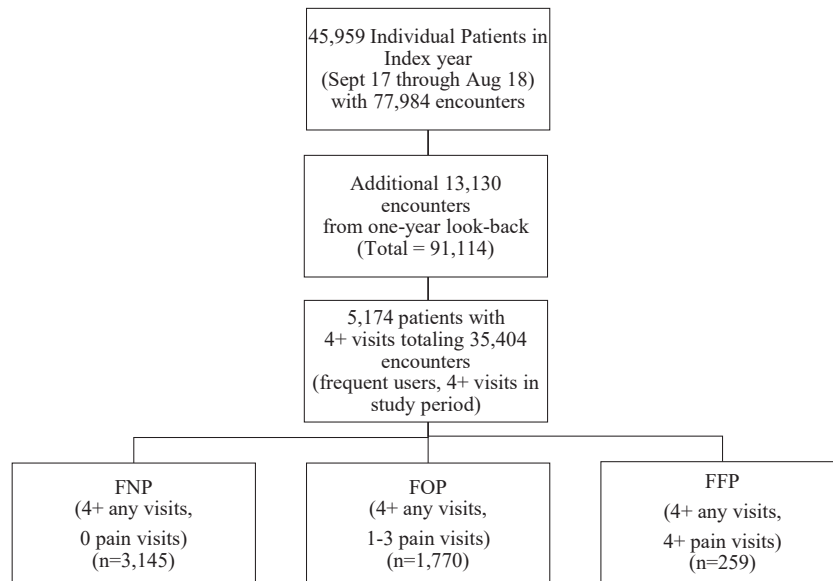
Figure 1. Procedure for identifying frequent ED user pain subgroups. ED = emergency department; FNP = frequent non-pain users (frequent user with no pain visits); FOP = frequent user with occasional pain visits; FFP = frequent user with frequent pain visits.

of the patients but had 35,404 (39%) encounters. Demographic and clinical characteristics pertaining to patient- and encounter-level data are summarized in Table 1.

Of the frequent ED users (more than four visits in the 12-month period, n = 5174), 3145, 1770, and 259 made up the non-pain users (0 pain visits), occasional pain user (1–3 pain visits), and frequent pain user (4 or more pain visits) subgroups, respectively, and made up 18,983 (20.8%), 12,602 (13.8%), and 3819 (4.2%) of the ED encounters, respectively, as summarized in Table 1. The encounter-to-patient ratio for nonfrequent users, frequent non-pain users, frequent occasional pain users, and frequent pain users was 1.37, 6.04, 7.12, and 14.75, respectively.

Compared with non-pain users, individuals that were between ages 35 and 54 years (odds ratio 1.25, 95% confidence interval [CI] 1.05–1.50), female (adjusted odds ratio [AOR] 1.55, 95% CI 1.37–1.75), of commercial payer status (AOR 1.23, 95% CI 1.08–1.39), and had 10 or more visits (super user status) in a year (AOR 2.36, 95% CI 1.96–2.84), were independently and significantly associated with being occasional pain users, as summarized in Table 2. Furthermore, compared with non-pain users, individuals that were female (AOR 2.43, 95% CI 1.79–3.29), non-Hispanic white (AOR 1.11, 95% CI 0.83–1.50), of commercial payer status (AOR 1.91, 95% CI 1.37–2.66), and had 10 or more ED visits (super user status) in the 12-month period (AOR 23.66, 95% CI 17.12–32.71) were independently and significantly associated with being frequent pain users, as summarized in Table 2.

DISCUSSION

In this study, frequent ED users made up a small portion (11.3%) of the patients included in the study but accounted for nearly 40% of all ED encounters in the study period. There were more frequent ED users with pain-related visits that were between the ages of 34 and 54 and female, which is consistent with existing literature (9,11). In fact, the most commonly cited reason for an ED visit from adults ages 18–64 years of age is that they believed that the seriousness of the medical problem solicited an ED visit (11). It is not immediately apparent why more women had more pain-related visits. Patients with maternity-related visits made up 1% or less of the patient population and overall encounters at all levels of analysis. There, this may be attributed to sex-specific differences in pain perception and experience (12,13).

Based on findings from Matsumoto et al. (2017), using the cutoff point of four or more visits in a 12-month period works well for defining frequent ED utilization in an urban setting (14). This is especially important when considering frequent ED user subgroups such as those with pain in this study because if the cutoff points are too high or too low, ED utilization in subgroups may not be well represented. This study reinforces these definitions when examining patients unique to a hospital system or when dealing with a smaller sample of ED user data from an urban ED. Brennan et al. (2014) found that patients with a psychiatric diagnosis were more likely to be frequent ED users (7). This finding is similar to this study in that the pain user subgroups were also more

Table 1. Summary of ED Patients and Encounters

Characteristic	Patients (n = 45,959)				Encounters (n = 91,114)			
	NF (n = 40,785)	FNP (n = 3145)	FOP (n = 1770)	FFP (n = 259)	NF (n = 55,710)	FNP (n = 18,983)	FOP (n = 12,602)	FFP (n = 3819)
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Age, years								
18–34	13,602 (33.4)	521 (16.6)	313 (17.7)	66 (25.5)	17,237 (30.9)	3174 (16.7)	2192 (17.4)	972 (25.5)
35–54	12,043 (29.5)	957 (30.4)	663 (37.5)	118 (45.5)	16,617 (29.8)	6125 (32.3)	4807 (38.1)	1678 (43.9)
55+	15,140 (37.1)	1667 (53.0)	794 (44.8)	75 (29.0)	21,856 (39.2)	9684 (51.0)	5603 (44.5)	1169 (30.6)
Male	20,641 (50.6)	1835 (58.3)	830 (46.9)	96 (37.0)	28,121 (50.5)	11,551 (60.8)	6414 (50.9)	1598 (41.8)
Race/ethnicity								
Non-Hispanic white	19,109 (46.9)	1592 (50.6)	839 (47.4)	130 (50.2)	26,416 (47.4)	9748 (51.4)	6114 (48.5)	1982 (51.9)
Other	21,676 (53.1)	1553 (49.4)	931 (52.6)	129 (49.8)	29,294 (52.6)	9235 (48.6)	6488 (51.5)	1837 (48.1)
Payer								
Commercial	25,828 (63.3)	1791 (56.9)	1131 (63.9)	192 (74.1)	34,794 (62.5)	10,656 (56.1)	7840 (62.2)	2548 (66.7)
State/Fed insured	10,731 (26.3)	1248 (39.7)	580 (32.8)	63 (24.3)	15,835 (28.4)	7673 (40.4)	4449 (35.3)	1170 (30.6)
Self-pay/uninsured	4226 (10.4)	106 (3.4)	59 (3.3)	4 (1.6)	5081 (9.1)	654 (3.5)	313 (2.5)	101 (2.7)
Acuity level								
Resuscitation	170 (0.4)	12 (0.4)	4 (0.2)	0 (0.0)	197 (0.4)	36 (0.2)	15 (0.1)	0 (0.0)
Emergent	4481 (11.0)	523 (16.7)	185 (10.5)	21 (8.1)	6213 (11.2)	2871 (15.2)	1236 (9.8)	262 (6.9)
Urgent	28,380 (69.8)	2143 (68.3)	1347 (76.5)	198 (76.4)	39,184 (70.6)	13,233 (70.0)	9494 (75.6)	2918 (76.6)
Less urgent	7263 (17.9)	418 (13.3)	203 (11.5)	36 (13.9)	9,458 (17.0)	2508 (13.3)	1674 (13.3)	573 (15.0)
Nonurgent	365 (0.9)	43 (1.4)	21 (1.2)	4 (1.5)	481 (0.9)	265 (1.4)	146 (1.2)	58 (1.5)
Missing	126 (0.0)	6 (0.0)	10 (0.0)	0 (0.0)	177 (0.0)	70 (0.0)	37 (0.0)	8 (0.0)
Transported by ambulance	11,553 (28.3)	1986 (63.1)	990 (55.9)	139 (53.7)	17,053 (30.6)	12,890 (67.9)	8085 (64.2)	2466 (64.6)
Admission	9591 (23.5)	2141 (68.1)	1060 (59.9)	155 (59.8)	15,738 (28.2)	13,276 (69.9)	8203 (65.1)	2465 (64.5)
Psych consultation	2448 (6.0)	739 (23.5)	314 (17.7)	59 (22.8)	3974 (7.1)	5402 (28.5)	3040 (24.1)	1278 (33.5)
Super user status								
4–9 visits	–	2847 (90.5)	1479 (83.6)	96 (37.1)	–	14,714 (77.5)	8079 (64.1)	651 (17.0)
10+ visits	–	298 (9.5)	291 (16.4)	163 (62.9)	–	4269 (22.5)	4523 (35.9)	3168 (83.0)

1) There were 11 patients of unknown gender; 2) Percentages represent proportions within groups and not among groups.
ED = emergency department; NF = nonfrequent users (nonfrequent user, no pain visits); FNP = frequent non-pain users (frequent user with no pain visits); FOP = frequent user with occasional pain visits; FFP = frequent user with frequent pain visits.

Table 2. Associations of Selected Factors With Occasional Pain and Frequent Pain User Status

	FNP vs. FOP		FNP vs. FFP	
	AOR (95% CI)	p-Value	AOR (95% CI)	p-Value
Age, years				
18–34	Reference	–	Reference	–
35–54	1.25 (1.05–1.50)	0.012	1.17 (0.80–1.72)	0.408
55+	0.94 (0.78–1.12)	0.467	0.55 (0.36–0.83)	0.004
Sex (Female)	1.55 (1.37–1.75)	< 0.001	2.43 (1.79–3.29)	< 0.001
Race (Non-Hispanic white)	0.95 (0.84–1.07)	0.425	1.11 (0.83–1.50)	0.485
Payer (Commercial)	1.23 (1.08–1.39)	0.001	1.91 (1.37–2.66)	< 0.001
Ever transported by ambulance (yes)	0.79 (0.69–0.89)	< 0.001	0.53 (0.38–0.74)	< 0.001
Ever admitted (yes)	0.75 (0.66–0.85)	< 0.001	0.67 (0.49–0.92)	0.012
Ever psych consultation (yes)	0.67 (0.57–0.78)	< 0.001	0.54 (0.37–0.78)	0.001
Super user status (10+ visits)	2.36 (1.96–2.84)	< 0.001	23.66 (17.12–32.71)	< 0.001

FNP = frequent non-pain users (frequent user with no pain visits); FOP = frequent user with occasional pain visits; FFP = frequent user with frequent pain visits; AOR = adjusted odds ratio to reflect the output of the adjusted regression analysis.

likely to be frequent ED users. Frequent ED user subpopulations represent a dynamic group of patients that need more coordinated care or that have recurrent health concerns that cannot be adequately assessed and addressed in a time-sensitive environment like the ED. Substance use challenges have also been defined as characteristics for frequent ED use. Frequent ED utilization, especially when examining specific subgroups, are a population that can be defined by both health and social factors such as pain, psychiatric illnesses, and substance use challenges.

Many studies have looked at how to define frequent ED utilization (6,14–17). Some studies have considered subgroups of patients to examine for specific factors as well (7,17). However, there is limited literature discussing frequent ED utilization factors that define frequent ED user subgroups with pain. Similar to previous studies, this study suggests that collaborative change is needed to address the needs of complex patients seen in the ED to ensure care coordination and long-term improvement in patient care outcomes (7). In a randomized control trial, it was found that frequent ED users that received ED-based care coordination resulted in fewer ED visits (35%), fewer admissions from the ED (31%), fewer costs per patient (15%), and reduced average inpatient direct costs (8%) compared with patients that did not receive the intervention (16). Similarly, leveraging other occupations such as community health workers may be helpful in ensuring care continuity and availability within primary care, and has the potential to reduce utilization of higher-cost resources in the ED (18). Further expansion of educational interventions holds promise in addressing the complex medical and social needs of frequent ED users, especially those patients with pain. Equally important are accessible resources for ED clinicians to be more adequately equipped to address pain in the ED setting and to connect their patients to care coordination pro-

grams. In fact, in other populations, it has been found that community-based, coordinated programs can positively impact frequent-user subgroups (19–22).

Limitations

This study considered data for ED encounters for two hospitals in San Diego County from a single hospital system. Therefore, the findings may not be representative of larger sample populations or multihospital systems. Because demographic and clinical characteristics were representative of only the two hospitals in the region, additional data and analysis would be needed to have a more complete understanding of ED utilization for the area. Another limitation was the use of the 1-year look-back period. Frequent-user classifications, especially for sub-groups, is not well defined in the literature, and arbitrary in that they are relevant to the population and setting of interest. Using the 1-year look-back period is considered a limitation in that regard because a 12-month cutoff point may underestimate ED utilization by patient. The analyses conducted in this study utilized ICD-9 diagnosis codes. It is possible that patients that frequent the ED may also have other types of pain not included in the diagnoses for this study; therefore, the granularity of ICD-10 pain codes may help improve understanding of more specific types of pain. Alternatively, more information such as patient comorbidities, prior medical history, and previous surgeries were not available here as part of the analysis, but may help to better understand the magnitude of acute vs. chronic pain as it related to ED encounters. Another limitation is that the differences in the characteristics of the ED populations may have impacted utilization. For example, socioeconomic differences, such as homelessness or other social determinants, could also be considered where data are available.

CONCLUSION

In this study, independent associations between occasional and frequent pain users were found among demographic and clinical characteristics such as being female, being of commercial payer status, and having 10 or more ED visits in a year (super user status). Understanding characteristics of ED frequent users with pain-related diagnoses may inform community-based interventions that target specific frequent ED subpopulations. Frequent ED utilization is a complex and growing area in need of understanding, specifically with frequent-user subgroups. Patients with pain represent a dynamic subgroup of frequent-user patients that make up only a small portion of the patient population but comprise a disproportionate number of ED visits annually. Frequent ED users with pain are different than frequent ED users with other health illnesses like psychiatric diagnoses or even substance use disorders, which can lead to misuse of the ED, such as in drug-seeking behaviors. Targeted interventions will require pain management by providers and education of patients with recurrent pain to connect them with more cost-effective, alternative resources outside of the ED. Future analyses should also consider drug use history, primary substance use diagnoses, prescriptions given for pain, and comorbidities.

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ARTICLE SUMMARY

1. Why is this topic important?

Emergency department (ED) utilization has increased over the past decade due to a variety of factors. Frequent visitors to the ED and subgroups of these types of visitors represent a small part of the patient population that comprise a disproportionate number of ED visits.

2. What does this study attempt to show?

Individuals that present to the ED with pain are often seeking help to manage time-consuming, complex cases in which the ED may not be the most suitable environment. Understanding characteristics of patients with pain in the ED can help inform targeted approaches to reducing this type of utilization, which is what this paper aims to understand.

3. What are the key findings?

Overall, frequent ED users with pain tended to be of middle age, female, have commercial insurance and have 10 or more visits to the ED in 1 year (super user status).

4. How is patient care impacted?

This subgroup of the frequent ED visitor population could benefit from care coordination or community-based interventions in the prevention of episodic care.