GERIATRICS/BRIEF RESEARCH REPORT

Factors Associated With Geriatric Frequent Users of Emergency Departments

Edward M. Castillo, PhD, MPH*; Jesse J. Brennan, MA; James Howard, MD, MS; Renee Y. Hsia, MD, MSc;
Christen Chalmers, BS; Theodore C. Chan, MD; Kelly J. Ko, PhD*

*Corresponding Author. E-mail: emcastillo@ucsd.edu or kko@westhealth.org.

Study objective: Frequent users of the emergency department (ED) are often associated with increased health care costs. Limited research is devoted to frequent ED use within the increasing senior population, which accounts for the highest use of health care resources. We evaluate patient characteristics and patterns of ED use among geriatric patients.

Methods: This was a multicenter, retrospective, longitudinal, cohort study of ED visits among geriatric patients older than 65 years in 2013 and 2014. Logistic regression analysis was used to identify independent associations with frequent users. The setting was a nonpublic statewide database in California, which includes 326 licensed nonfederal hospitals. We included all geriatric patients within the database who were older than 65 years and had an ED visit in 2014, for a total of 1,259,809 patients with 2,792,219 total ED visits. The main outcome was frequent users, defined as having greater than or equal to 6 ED visits in a 1-year period, starting from their last visit in 2014.

Results: Overall, 5.7% of geriatric patients (n=71,449) were identified as frequent users of the ED. They accounted for 21.2% (n=592,407) of all ED visits. The associations of frequent ED use with the largest magnitude were patients with an injury-related visit (odds ratio 3.8; 95% confidence interval 3.8 to 3.9), primary diagnosis of pain (odds ratio 5.5; 95% confidence interval 5.4 to 5.6), and comorbidity index score greater than or equal to 3 (odds ratio 7.2; 95% confidence interval 7.0 to 7.5).

Conclusion: Geriatric frequent users are likely to have comorbid conditions and be treated for conditions related to pain and injuries. These findings provide evidence to guide future interventions to address these needs that could potentially decrease frequent ED use among geriatric patients. [Ann Emerg Med. 2018;■:1-6.]

Please see page XX for the Editor's Capsule Summary of this article.

INTRODUCTION

Health care spending in the United States continues to increase, with a 5.3% increase to $3.0 trillion from 2013 to 2014.[1] Although the emergency department (ED) is often portrayed as a significant and costly portion of this spending, much of this is attributed to the increasing trend of community-based providers' relying on EDs to evaluate patients with complex disease who were previously admitted to the hospital, as evidenced by an increase in high-intensity ED visits.[2-4] As a result, the ED's role in delivering care for a large proportion of the population is expanding, especially for older and sicker patients.

The increasing senior population, estimated to double by 2050, currently represents 15% of the population, yet contributed to 21% of total health care expenditures in 2012 and is among almost half of the top 1% of health care spenders.[5] Additionally, annual ED visits by seniors increased by 24.5% between 2001 and 2009. In comparison to other age groups, older adults use the ED at a higher rate, have longer stays in the ED, and require more resources and medical interventions during their visit.[6,7] Although frequent users of the ED have been well studied,[8] there is limited research examining the frequent users within the increasing geriatric population.

The purpose of this study was to evaluate patient characteristics and patterns of ED use among geriatric patients to inform interventions to improve health care delivery in and out of the ED for this population.

MATERIALS AND METHODS
Study Design

This was a multicenter retrospective cohort study using nonpublic visit-level data (obtained from the California Office of Statewide Health Planning and Development) from 326 licensed, nonfederal, general, acute care hospitals in California. Patient index visits were defined as the last recorded visit in calendar year 2014, with individual

Editor's Capsule Summary

What is already known on this topic
As with all age groups, there is a segment of the geriatric population who are high users of emergency care.

What question this study addressed
What are the characteristics of elderly patients who use nonfederal emergency departments (EDs) 6 or more times per year in California?

What this study adds to our knowledge
Of elderly patients, 5.7% were frequent users; they accounted for 21.2% of all ED visits by this group. Higher numbers of comorbidities and of pain and injury reasons for visits were predictors of high use.

How this is relevant to clinical practice
This study primarily provides important information on how to plan interventions that improve care for this population.

365-day "look-back" periods extending into 2013. The data set used for this study combined the Patient Discharge Dataset and Emergency Department Dataset. The combination of these data sets and detailed descriptions of these data sources are described elsewhere.[9] This project was approved by the University of California, San Diego institutional review board.

Selection of Participants

The study population included patients who visited any of the 326 California nonfederal EDs during calendar year 2014 and were aged 65 years or older at the last ED visit in the year (index visit). Multiple visits were linked by using unique patient record linkage numbers. Patients younger than 65 years at the index visit were excluded because they were outside the target geriatric age range. Patient visits without valid record linkage numbers were excluded. Among 12,996,953 total ED visits in 2014 at acute care hospitals in California, 1,259,809 patients aged 65 years or older at their last visit were identified for the study, with a total of 2,792,219 visits in the 1-year look-back period.

Outcome Measures

The definition of frequent ED utilization is based on that from previous literature.[5] Less frequent use was defined as having 1 to 5 ED visits within 365 days. Frequent users were defined as having 6 or more ED visits

within 365 days, and "superusers" were defined as having more than 20 ED visits within a 365-day period. A higher frequent user threshold was used to decrease the proportion of the frequent user group. Patient-level demographic variables were assigned according to reported values at the index visit and included race or ethnicity, age in years, sex, and the source of payment expected to pay the greatest share of the patient's bill. Diagnosis and injury-related variables were identified by using all visits in the study period and included ED disposition, E-codes, and both primary and up to 24 secondary ED or hospital discharge diagnosis codes from the *International Classification of Diseases, Ninth Revision* (ICD-9). Primary or secondary diagnosis codes were used to identify patients with psychiatric illness (*ICD-9-CM* [*Clinical Modification*] codes 290 to 302 and 306 to 316) and substance abuse (*ICD-9-CM* codes 303 to 305). The primary diagnosis was used to identify patients with a pain-related diagnosis (*ICD-9-CM* codes 338, 346, 724, 784, and 789). An injury-related visit was identified by the presence of an E-code. The Charlson comorbidity index score was calculated for each patient with the enhanced coding algorithm provided by Quan et al.[10]

Primary Data Analysis

Descriptive statistics are presented as total figures and stratified by less frequent and frequent user status for individual patient characteristics and visits. Demographic and visit characteristics included age group (65 to 74, 75 to 84, and ≥85 years), race or ethnicity, expected payer, history of hospital admission or transfer during the study period, discontinued care (left against medical advice or started care but did not complete it) at any visit during the study period, and comorbidity index score (0, 1, 2, and ≥3 comorbidities). A single direct logistic regression model was developed with the patient as the unit of analysis, comparing the frequent user group with the less frequent user group to determine the independent association of each predictor with frequent user status. Superusers were included in the frequent user group for analysis. Predictors were based on clinical relevance, given the available data from the Office of Statewide Health Planning and Development, and included patient age in years (65 to 74, 75 to 84, and ≥85 years), female sex, ethnicity or race (non-Hispanic white, Hispanic/Latino, non-Hispanic black, and non-Hispanic other), admitted or transferred at any visit, psychiatric diagnosis at any visit, substance abuse diagnosis at any visit, any injury-related visit, and patient comorbidity score (0, 1, 2, and ≥3). All predictors were entered into the model regardless of bivariate association with the outcome and were used as categoric variables, with

the first category serving as the reference. Multicollinearity diagnostics were assessed for the model and collinearity was not found to be a significant issue; variance inflation factor values for all variables were found to be acceptable, ranging from 1.0 to 1.7. Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) are reported for each predictor. An α level equal to .05 was used for interpretation of statistical significance for all statistical analyses. Missing data for all variables were minimal (<0.1%). All statistical analyses were conducted with IBM SPSS Statistics (version 24.0; SPSS, Inc, Chicago, IL).

RESULTS

Characteristics of Study Subjects

A total of 1,188,360 patients (94.3%) were identified as less frequent users (<6 ED visits in a year) and accounted for 2,199,812 (78.8%) of all ED visits. A total of 70,300 patients (5.6%) were classified as frequent users (6 to 20 ED visits in a year) and accounted for 556,477 of all ED visits (19.9%), and 1,149 patients (0.1%) were classified as superusers and had more than 20 ED visits in a 1-year period, for a total of 35,930 ED visits (1.3%).

Patient-level characteristics are reported in Table 1. Overall, the majority of patients (43.9%) were aged 65 to 74 years, and there were more female patients (57.8%) and non-Hispanic whites (61.3%). Medicare was the primary expected payer for the majority of patients (86.3%). There were minimal differences in the distribution of patient demographics by patients identified as less frequent and frequent ED users.

Unlike patient demographics, there were differences in disposition and diagnoses between less frequent and frequent ED users. Less frequent users were less likely to have been admitted or transferred (44.6%) or to discontinue care (1.7%) compared with frequent users (85.8% and 7.8%, respectively). When diagnosis was considered, in general as utilization increased, there were increasing proportions of patients with a psychiatric diagnosis, substance abuse, primary pain diagnosis, or primary injury code. Frequent users also had more comorbidities than less frequent users. Finally, as utilization patterns increased, there were significant proportional differences in patients visiting 3 or more hospitals in the year before their index visit.

Consistent with procedures used by Quan et al,[10] we calculated comorbidity scores as a sum of 17 different clinical conditions weighted for disease severity. Overall, the most common disease classifications that are included in the comorbidity index score according to primary or secondary diagnoses were diabetes without complications

(324,793; 25.8%), chronic pulmonary disease (270,370; 21.5%), renal disease (240,379; 19.1%), congestive heart failure (201,656; 16%), and peripheral vascular disease (189,708; 15.1%) at the index encounter. The most common comorbid conditions for both less frequent and frequent ED users were the same as that of the overall geriatric population.

Independent associations with being a frequent user are reported in Table 2. The associations of frequent ED use with the largest magnitude were related to specific diagnoses and included pain-related diagnoses (OR 5.5; 95% CI 5.4 to 5.6) and injury-related visits (OR 3.8; 95% CI 3.8 to 3.9). The largest association was a comorbidity index score greater than or equal to 3 (OR 7.2; 95% CI 7.0 to 7.5).

LIMITATIONS

Data were accessed from a statewide database (Office of Statewide Health Planning and Development), and notable limitations with these data include a small proportion of invalid patient identifiers, the absence of federal health care facilities, and lack of other important patient and visit characteristics, including urgency, access to primary care, and cost. Additionally, data were limited to acute care facilities within California and may not be generalizable to all less frequent and frequent users among geriatric patients nationwide. Less frequent and frequent user classifications were chosen in accordance with previous literature and the use distribution in the population. Although these cutoffs may match those of previous definitions, they will not necessarily be as relevant in other communities.

In our study of ED utilization among geriatric patients in California, we described characteristics of geriatric frequent users; specifically, that they have a high number of comorbid conditions and often visit the ED for pain-related diagnoses, and that there is a lower proportion of geriatric superusers compared with that in the general population. Future research should further define the population of geriatric frequent ED users and their specific health issues to better understand their health care needs and better serve this vulnerable and complex population.

DISCUSSION

Although frequent ED use has been reported among different study populations, the geriatric segment of the population has not been well studied apart from other frequent users. Given the distinct health care needs of geriatric compared with adult or pediatric patients, our goal

Table 1. Patient characteristics by type of ED user.

Patient Characteristics	Less Frequent User, N=1,188,360		Frequent User, N=71,449	
	Patients	%	Patients	%
Age, y				
65–74	521,596	43.9	28,498	40.0
75–84	395,543	33.3	24,422	34.1
≥85	271,221	22.8	18,529	25.9
Women	687,361	57.8	39,881	55.8
Ethnicity/race				
Hispanic/Latino	217,831	18.3	14,665	20.5
Non-Hispanic white	727,901	61.3	42,016	58.8
Non-Hispanic black	73,237	6.2	7,646	10.7
Non-Hispanic Asian/Pacific Islander	115,187	9.7	4,655	6.5
Non-Hispanic other	54,204	4.6	2,467	3.5
Expected payer				
Private	114,866	9.7	4,257	6.0
Medicare	1,025,929	86.3	64,329	90.0
Medicaid	32,073	2.7	2,308	3.2
Self-pay/indigent	15,492	1.3	555	0.8
Admitted/transferred	530,406	44.6	61,327	85.8
Discontinued care	20,100	1.7	5,600	7.8
Psychiatric diagnosis*	302,545	25.5	45,827	64.1
Substance abuse diagnosis[†]	101,911	8.6	17,047	23.9
Primary pain-related diagnosis[‡]	130,035	10.9	24,188	33.9
Injury-related visit[§]	433,869	36.5	51,025	71.4
Comorbidity score				
0	443,769	37.3	4,581	6.4
1	306,487	25.8	8,522	11.9
2	188,912	15.9	10,857	15.2
≥3	249,192	21.0	47,489	66.5
No. of hospitals				
1	1,018,716	85.7	32,271	45.2
2	152,047	12.8	24,897	34.8
≥3	17,597	1.5	14,281	20.0

*Psychiatric diagnoses (*ICD-9-CM* codes 290 to 302 and 306 to 316).
[†]Substance abuse (*ICD-9-CM* codes 303 to 305).
[‡]Primary pain-related diagnosis (*ICD-9-CM* codes 338, 346, 724, 784, and 789).
[§]Injury-related (E-code) visits in the study period.

was to elucidate these differences by examining factors associated with less frequent and frequent users of ED resources among seniors. Overall, we found vulnerable patients with likely complex medical, psychosocial, and functional issues associated with increased utilization patterns.

After controlling for other factors in the logistic regression model, we found that specific diagnoses, injury-related visits, being admitted at least once during the year, and increasing comorbidity scores were associated

with a higher likelihood of being a frequent user in the geriatric population. There were some differences by demographics, the most notable being an ethnicity relationship in a subset of the population in which black race or ethnicity was associated with increased utilization and Asian race or ethnicity was associated with decreased utilization patterns.

Geriatric patients identified as frequent ED users had a high number of comorbid conditions. The most common were chronic pulmonary disease, diabetes without

Table 2. Adjusted ORs of frequent user patient characteristics compared with those of less frequent users.

Patient Characteristics	OR	95% CI
Age (ref=65–74), y		
75–84	0.91	0.90–0.93
≥85	0.85	0.83–0.87
Sex (ref=male)	0.93	0.91–0.95
Ethnicity (ref=non-Hispanic white)		
Hispanic/Latino	1.29	1.26–1.32
Non-Hispanic black	1.69	1.64–1.74
Non-Hispanic Asian/Pacific Islander	0.87	0.84–0.90
Non-Hispanic other	0.99	0.94–1.04
Admitted/transferred	2.91	2.84–2.99
Psychiatric diagnosis*	2.69	2.64–2.73
Substance abuse diagnosis†	1.86	1.82–1.90
Primary pain-related diagnosis‡	5.49	5.38–5.60
Injury-related visit§	3.82	3.75–3.89
Comorbidity score (ref=0)		
1	1.79	1.72–1.86
2	2.77	2.67–2.88
≥3	7.24	7.00–7.49

*Psychiatric diagnoses (*ICD-9-CM* codes 290 to 302 and 306 to 316).
†Substance abuse (*ICD-9-CM* codes 303 to 305).
‡Primary pain-related diagnosis (*ICD-9-CM* codes 338, 346, 724, 784, and 789).
§Injury-related (E-code) visits in the study period.

complications, renal disease, and congestive heart failure. Primary pain-related diagnoses were also associated with frequent ED use among geriatric patients; however, there were relatively few patients with more than 20 visits (ie, superusers) per year compared with the general ED patient population. Addressing these issues should be incorporated when treatment strategies in this special cohort of patients are designed.

Although the definition of a frequent ED user varies from study to study, our study used the definition of less frequent users having 1 to 5 visits and frequent users 6 or more visits. Although a group of superusers has been identified in some populations,[9] our results did not identify a large group of them according to our analyses of California acute care hospitals.

There has been an increased focus on health care in the aging population, which is leading to specialty geriatric EDs and focused interventions to improve health care delivery and decrease health care use. Our findings provide an opportunity to help improve the care of geriatric patients who frequently use acute care services by highlighting specific needs of this population. Programs designed to meet the needs of geriatric patients across the continuum of care may be helpful to address the unique needs of geriatric patients to maintain physical and mental health. This may be especially important in care venues outside of the ED and inpatient setting. For instance, our findings rely on retrospective data to identify frequent users from an ED perspective. Although we found that 20% of geriatric ED users visited 3 or more hospitals in a 1-year period, numbers of visits to other primary care and specialty services, which we did not capture, are likely much higher in this population. Thus, identifying needs and targeting interventions across the care continuum, within the ED, and beyond are areas that should be explored.

REFERENCES

1. Martin AB, Hartman M, Benson J, et al. National health spending in 2014: faster growth driven by coverage expansion and prescription drug spending. *Health Aff (Millwood)*. 2016;35: 150-160.
2. Hsia RY, Niedzwiecki M. National trends in emergency department occupancy, 2001 to 2008: effect of inpatient admissions versus

emergency department practice intensity. *Ann Emerg Med*. 2012;60:679-686.

3. Burke LG, Wild RC, Orav EJ, et al. Are trends in billing for high-intensity emergency care explained by changes in services provided in the emergency department? an observational study among US Medicare beneficiaries. *BMJ Open*. 2018;8:e019357.

4. Morganti KG, Bauhoff S, Blanchard JC, et al. The evolving role of emergency departments in the United States. *Rand Health Q*. 2013;3:3.

5. Cohen S. *The Concentration and Persistence in the Level of Health Expenditures Over Time: Estimates for the US Population 2012-2013*. Rockville, MD: Agency for Healthcare Research & Quality; 2015; Statistical Brief 481.

6. Pines JM, Mullins PM, Cooper JK, et al. National trends in emergency department use, care patterns, and quality of care in older adults in the United States. *J Am Geriatr Soc*. 2013;61:12-17.

7. Greenwald PW, Estevez RM, Clark S, et al. The ED as the primary source of hospital admission for older (but not younger) adults. *Am J Emerg Med*. 2016;34:943-947.

8. Castillo EM, Brennan JJ, Killeen JP, et al. Identifying frequent users of emergency department resources. *J Emerg Med*. 2014;47:343-347.

9. Brennan JJ, Chan TC, Hsia RY, et al. Emergency department utilization among frequent users with psychiatric visits. *Acad Emerg Med*. 2014;21:1015-1022.

10. Quan H, Sundararajan V, Halfon P, et al. Coding algorithms for defining comorbidities in *ICD-9-CM* and *ICD-10* administrative data. *Med Care*. 2005;43:1130-1139.