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Health Care Utilization before and after an Outpatient Emergency Department Visit in Older People

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Abstract

Background—Older adults in the U.S. receive a significant amount of care in the emergency department (ED), yet the associations between ED and other types of health care utilization has not been adequately studied in this population.

Objectives—The goal of this study were to examine the relationships between health care use before and after an ED visit among older adults.

Methods—This retrospective cohort study examined health care use among 308 patients ≥ 65 years old discharged from a university-affiliated ED. Proportional-hazards models were used to assess the relationship between pre-ED health care use (primary care physician (PCP), specialist, ED and hospital) and risk of return ED visits.

Results—Older ED patients in this study had visited other types of providers frequently in the previous year (median number of primary care physician (PCP) and specialist visits = 4). Patients who used the ED on 2 or more occasions in the previous year were found to have visited their PCP more often than those without frequent ED use (median number of visits 7.0 vs 4.0, $p < .001$). Despite more PCP use in this population, frequent ED use was associated with increased risk of a repeat ED visit (HR 2.20, 95% CI 1.15–4.21), in models adjusted for demographics and health status.

Conclusion—Older adults who use the ED are also receiving significant amounts of care from other sources; simply providing additional access to care may not improve outcomes for these vulnerable individuals.

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Keywords

emergency department, hospital; health services for the aged, ambulatory care

INTRODUCTION

In 2003, adults ≥ 65 made 17 million visits to emergency departments (EDs) throughout the United States, a 26% increase in visit rate from 1993[1]. The Institute of Medicine has called for action to reduce overcrowding of heavily burdened EDs[2] underscoring the importance of examining ED use by older adults. ED visits without hospital admission, hereafter referred to as “outpatient ED visits”, are of particular interest because they account for one half to two thirds of all older adults' ED encounters[3]. Following an outpatient ED visit, older adults are at increased risk for future hospitalization, return visits to the ED and functional decline. This risk occurs even though the ED visit does not result in immediate hospitalization for these patients[3–10].

Lack of access to alternative sources of care is frequently assumed to be a primary reason behind outpatient ED use, but research on this topic has been inconclusive[11–18]. Contrary to prevailing beliefs, a number of studies have found that patients who use the ED frequently are more likely to have a regular source of care[13,15,16]. Among younger cohorts, frequent ED use has been associated with high utilization of other outpatient care[11,12,19,20], however, this relationship has received little investigation in older adults. Examining health care utilization before and after an outpatient ED visit could provide important insights about the reasons older adults seek outpatient care in the ED and inform resource planning and care delivery strategies.

This study describes health care utilization before and after an outpatient ED visit among a cohort of older adults. Additionally, it examines whether older adults with high frequency health care use (primary care, specialist, ED or hospital) preceding an outpatient ED visit faced an increased risk of return outpatient ED visits or hospitalization following the index ED visit.

METHODS

Design and Setting

This retrospective, cohort study was conducted by examining the electronic medical records of older patients in the Duke University Health System (DUHS) who had an outpatient ED visit at the Duke University Medical Center (DUMC) Emergency Department. The DUMC ED provides care for more than 8000 older adults annually; approximately 45% are outpatient ED visits[21]. In addition to DUMC, the DUHS includes a community teaching hospital (with an ED), as well as a network of affiliated primary care and outpatient specialist providers. Approval for the study was obtained from the Duke University Institutional Review Board.

Study sample

The study sample included patients (1) with a DUMC outpatient ED visit, 2) who were ≥ 65 , and 3) who had at least one primary care provider (PCP) visit in the DUHS medical record in the 12 months preceding the index ED visit. This was a convenience sample identified from a query of the ED information system (Wellsoft®) between 6/23/07 and 9/10/07, initially obtained for quality improvement purposes. Patients without a PCP visit in the DUHS medical record were excluded because they were more likely to represent a referral

population who received health services in other geographic locations and because full-access to all health care service utilization was not available for these patients. Patients who were not evaluated by an ED physician or physician assistant during the index ED visit were excluded.

Data Collection

For each eligible patient, data were abstracted from two data sources: the DUHS electronic medical record system and Wellsoft®, the computerized health information system in the DUMC ED. The DUHS electronic medical record system was used to record the dates of all health service use in the 12 months preceding the index ED visit, including dates of all ED visits and hospitalizations in the two non-federal hospitals in the county in which the study was performed, as well as outpatient PCP visits, ED visits, specialist visits and patient demographic information. Provider notes and hospital discharge summaries were examined for baseline health information. Wellsoft® was the source for information about the index ED visit. Subjects deaths were verified using the Social Security Death Index[22].

Dependent Variables

The main dependent variables for this study were repeat outpatient ED utilization and hospitalization in the 90 days after the index ED visit. Both dependent variables and the observation period of 90 days were selected to be commensurate with existing literature,[10] and based on our estimates of event rates in this population. Repeat outpatient ED visits and hospitalizations were considered separately because of previous data demonstrating that risk factors differ for these two outcomes[10]. Deaths were also recorded.

Independent Variables

Main independent variables were high frequency health care use defined as: PCP ≥ 8 visits, outpatient ED ≥ 2 visits, specialist ≥ 11 visits, and hospital stay ≥ 5 days in the 12 months preceding the index ED visit. The definitions for high frequency care were determined by examining the upper quartile data for each care type. This data driven approach was used because there are no standard definitions for “high health care use” in this population and this created the most clinically meaningful definitions.

Patient and ED Characteristics

Patient socio-demographics included age, race, gender and living arrangements. Health status information included medical co-morbidities, assessed by recording the presence or absence of 12 specific diagnoses: coronary artery disease (CAD), congestive heart failure (CHF), hypertension, stroke, cancer (including skin cancer), chronic kidney disease, diabetes mellitus, arthritis, dementia, osteoporosis, Parkinson's disease and chronic obstructive pulmonary disease (COPD)[23]. The number of chronic medications was recorded and the medication list was assessed for the presence of 6 high risk categories: anticoagulants, antiplatelets/aspirin, antihistamines, cardiovascular medications, anti-diabetes medications, CNS active medications, and those with low therapeutic index (digoxin and phenytoin)[24–28].

Index ED characteristics included arrival by ambulance[7], ED nurse triage score[29], day and time of ED discharge, total time and active care time in the ED[30], Clinical Evaluation Unit (CEU) admission, primary discharge diagnosis, primary discharge diagnosis category, [31] new medication prescriptions, and recorded follow-up. The ED CEU is an observation unit intended for patients with selected conditions whom are expected to have an ED stay between 8 and 24 hours. Nurse triage scores were assigned according to the 5-level

Emergency Severity Index, with 1 being the highest level of acuity and expected resource utilization and 5 being the lowest[29].

Analysis

Descriptive statistics for continuous variables were reported as means with standard deviations (SD) if normally distributed and medians with 25%, 75% interquartile range (IQR) for skewed distributions. Bivariate comparisons were performed using chi-square tests (2-sample t-test for means and Wilcoxon Rank Sum medians). Cox regression proportional-hazards models were estimated to assess the association between prior care utilization and return outpatient ED visits and hospitalization in the 90 days after the index outpatient ED visit. Each independent variable was entered into an unadjusted model and a multivariable model with a maximum of 7 covariates.[32] Covariates included demographics, other health service use and health variables. All covariates were entered into the model simultaneously. Subjects in all models were censored at the time of death or at the end of the 90 day observation period. To account for competing risks, censoring occurred at time of death or at 90 days minus the number of hospital days (which ever came first) in models with repeat outpatient ED visit as the dependent variable. All analyses were performed using SAS software, version 9.0 (SAS Institute, Cary, NC) with $p < 0.05$ as the predetermined level of statistical significance.

RESULTS

Sample and ED visit characteristics

During the 11-week observation period, 662 patients ≥ 65 had outpatient ED visits in the DUMC ED. After excluding patients without a PCP visit in the past year in the DUHS medical record ($n=350$) and those who left without being evaluated by an ED provider ($n=4$), 308 remained for analysis. Patients in the cohort were receiving care from 19 different primary care clinics. Notably, nearly one-third of the cohort was aged 80 or over. There was a significant amount of comorbidity among patients, with 25% having 5 or more chronic conditions and 56% taking 9 or more medications. One quarter of the index ED visits occurred on a weekend day and a majority of patients (89%) spent 3 or more hours in the ED (Table 1).

Health Services Use in the 12 months prior to the Index ED Visit

PCP and Specialist Visits—In the 12 months prior to the index ED visit, the median number of PCP visits was 4.0. Sixty-three patients (21%) had high frequency PCP use defined as ≥ 8 PCP visits in the previous year (Table 2). Patients with high frequency PCP use also had a higher median number of previous outpatient ED visits (1.0 vs 0.0, $p < 0.001$) and hospital days (2.5 vs 0.0, $p < 0.001$).

A total of 246 patients (80%) had at least one specialist visit in the year prior to the index visit (Table 2). These patients accounted for a total of 2053 visits with 32 different types of specialists, most commonly cardiologists (31%), orthopedists (20%) and urologists (14%). The 67 patients (22%) with high frequency specialist use had a higher median number of hospital days in the preceding year (2.0 vs 0.0, $p < 0.001$) compared to the remainder of the sample.

Outpatient ED Care—Approximately one-third of the sample had at least one previous outpatient ED visit in the 12 months prior to the index ED visit. Fifty-two patients had high frequency outpatient ED use, defined as ≥ 2 ED visits in the year prior (Table 2). Patients among this subset had a higher baseline burden of illness, as evidenced by a higher number of both chronic conditions (mean 4.0 vs 3.3, $p=.009$) and medications (mean 10.5 vs 9.3,

trend $p=.056$). Among high frequency outpatient ED users, there was a higher proportion of patients with chronic kidney disease (29% vs 18%, trend $p=.091$), diabetes mellitus (42% vs 27%, $p=.030$) and COPD (31% vs 20%, trend $p=.069$). These individuals also had more PCP visits (median 7.0 vs. 4.0, $p<.001$) and hospital days (3.0 vs 0.0 $p<.001$), compared to patients without high frequency outpatient ED use.

Hospital Use—Overall, 138 patients (44.8%) had been hospitalized in the year prior to their index ED visit. Among all patients, 70 (23%) had high frequency hospital use (Table 2.). Patients with high frequency hospital use also had a higher median number of PCP visits (5.0 vs 4.0, $p=.026$), specialist visits (6.0 vs 3.0, $p<.001$), and outpatient ED visits (1.0 vs 0.0, $p<.001$).

Health Services Use in the 90 days after the Index ED Visit

At the end of their index ED visit, the vast majority of patients (95%) were given advice regarding follow-up care. About half of all patients (52%) were given a time frame in which they should schedule follow-up, but only 42 patients (14%) had a follow-up appointment date scheduled at the time they left the ED. Table 3 displays the median time to first PCP or specialist visit based on whether the patient received a recommendation to schedule their own follow-up or were given a specific appointment.

PCP and Specialist Visits—By the end of the 90 day observation period, 223 patients (72.4%) had at least one visit with their PCP; the median time to first visit was 17.0 days. Overall, 208 patients (67.5%) had at least one specialist visit during the 90 day follow-up period. Patients were most likely to visit cardiologists (18.8%) orthopedists (15.9%), or anticoagulation clinic (8.4%) in the 90 days after the index visit.

Repeat Outpatient ED Use—Of the 308 patients in this cohort, 54 (17.5%) had at least one return outpatient ED visit; the median time to first return ED visit was 24.0 days (Table 4). Fourteen patients (4.6%) died within the 90 day observation period. The rate of repeat outpatient ED use was higher among patients with high frequency outpatient ED use (34.6% vs 14.1%, $p<.001$), high frequency PCP use (27.0% vs 15.1%, $p=.040$) and high hospital use (28.6% vs 13.6%, $p=.006$) in the 12 months before the index visit. In multivariable models, high frequency outpatient ED use (HR 2.20, 95% CI 1.15–4.21) before the index visit was associated with reduced time to first repeat outpatient ED visit (Table 5).

Hospital Use—Overall, 80 patients (26.0%) had at least one hospitalization (median time to first hospitalization 20.0 days) in the 90 days following their index outpatient ED visit. The hospitalization rate was highest among patients with ≥ 5 days of hospitalization in the 12 months before the index visit (45.7% vs 19.5%, $p<.0001$). Crude hospitalization rates were also higher among patients with high frequency specialist use (38.8% vs 22.4%, $p=.007$). In adjusted models, high frequency hospital use in the year prior remained significantly associated with reduced time to hospital admission in the 90 day follow-up period (Table 5).

DISCUSSION

As the population of the U.S. ages, patients ≥ 65 will represent a growing proportion of ED visitors. As more time and resources are typically required for older adults, this will add to the strain placed on an already overcrowded system[33]. This study is among the first to provide a detailed investigation of other types of health care services that older patients were receiving both before and after an outpatient ED visit. We found that older adults who used the ED for outpatient services were also receiving a significant amount of ambulatory care

from both primary care physicians and specialists, challenging the assumption that lack of access to other care providers was the main driving force behind their ED use.

When we evaluated the subset of patients who had a history of using the ED for outpatient services frequently, we found that these individuals were receiving even more ambulatory care from other sources including PCPs and specialists than their counterparts with less frequent ED use. Previous studies have demonstrated a similar association between increased ED use and higher utilization of care in other ambulatory settings, but most of these have focused on younger populations[11,12,15,19,36]. In the current study, we also found that high frequency ED users also had more previous hospital use and a higher number of co-morbid conditions. These data, taken in conjunction with studies that have shown that older adults usually use the ED appropriately[34,35], suggest that increased burden of illness and perhaps some level of unmet need in the context of adequate access[11,13,15,16] may be driving ED use in this population.

Despite the presence of an established PCP and frequent use of specialist care, nearly 1 in 5 patients in this study returned to the ED, and 1 in 4 were admitted to the hospital, in the 90 days following the index visit. This is consistent with rates of repeat ED use (17%–36%) found in studies of older adults in other settings, including a national sample of Medicare patients[4,7,10]. The findings of this study support previous reports that prior ED use or hospitalization are among the strongest predictors of future such events[3–10]. The current study extends these findings by examining these relationships in the context of other care the patients were receiving.

For many older adults, an outpatient ED visit can be viewed as a sentinel health event that might signify a “breakdown in care”[37]. Better methods of identifying the individuals at highest risk and those that may benefit from intensive follow-up and/or alternative primary care delivery strategies are needed. The current study found that patients with scheduled follow-up appointments (as opposed to recommendations to make their own follow-up arrangements) were more likely to have their first follow-up visit within the time recommended at discharge from the ED. Previous studies have shown that scheduling appointments improves follow-up rates; thus, this is one example of a system level change that may improve outcomes for older patients[10]. Other strategies such as group primary care, enhanced care coordination, closer monitoring through telephone or home-based services, and/or improving communication between health care providers[37–40] may provide opportunities for reducing outpatient ED use and subsequent adverse outcomes by improving primary care delivery for certain vulnerable patients.

This study has several limitations that must be acknowledged. This study was conducted within a single, university-affiliated health care system. Although this health system includes a large network of hospitals and clinics, it is possible that additional care could have been received outside of this system leading to an underestimation of health care use. We addressed this issue by including only patients with a PCP within the system; however this reduced the generalizability of our findings because not all patients (even those 65 and older) have a PCP. Also, our sample was limited to patients with ED visits in the summer months, and this may further limit the generalizability of our findings. All data for this study was collected through chart abstraction, and therefore, the impact of other potentially important factors such as insurance status and functional status could not be estimated. Despite these limitations, this study can serve as a foundation for further research into care utilization among older adults treated and released from the ED and associated adverse outcomes.

Older adults in this study who used the ED for outpatient services also received a significant amount of ambulatory care. After an outpatient ED visit, patients faced significant risk of future repeat ED visits or hospitalization. Further study is needed to determine whether enhanced care coordination between the ED and other ambulatory care providers and/or alternative primary care delivery strategies can reduce outpatient ED use and subsequent adverse outcomes in this vulnerable population.

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REFERENCES

1. McCaig, LF.; Burt, CW. National Hospital Ambulatory Medical Care Survey: 2003 Emergency Department Summary. 358 ADFVaHSN, ed.. National Center for Health Statistics; Hyattsville, MD: 2005.
2. Release. IoMP. Action Needed to Bolster Nation's Emergency Care System; Lack of Funds, Coordination Lead to Overcrowding and Ambulance Diversions. [Accessed August 5, 2009]. Available at: <http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=06142006>.
3. Aminzadeh F, Dalziel WB. Older adults in the emergency department: a systematic review of patterns of use, adverse outcomes, and effectiveness of interventions. *Ann Emerg Med*. 2002; 39:238–47. [PubMed: 11867975]
4. Hastings SN, Schmader KE, Sloane RJ, et al. Adverse health outcomes after discharge from the emergency department--incidence and risk factors in a veteran population. *J Gen Intern Med*. 2007; 22:1527–31. [PubMed: 17828432]
5. Caplan GA, Brown A, Croker WD, Doolan J. Risk of admission within 4 weeks of discharge of elderly patients from the emergency department--the DEED study. Discharge of elderly from emergency department. *Age Ageing*. 1998; 27:697–702. [PubMed: 10408663]
6. McCusker J, Cardin S, Bellavance F, Belzile E. Return to the emergency department among elders: patterns and predictors. *Acad Emerg Med*. 2000; 7:249–59. [PubMed: 10730832]
7. Friedmann PD, Jin L, Karrison TG, et al. Early revisit, hospitalization, or death among older persons discharged from the ED. *Am J Emerg Med*. 2001; 19:125–9. [PubMed: 11239256]
8. McCusker J, Healey E, Bellavance F, Connolly B. Predictors of repeat emergency department visits by elders. *Acad Emerg Med*. 1997; 4:581–8. [PubMed: 9189191]
9. Meldon SW, Mion LC, Palmer RM, et al. A brief risk-stratification tool to predict repeat emergency department visits and hospitalizations in older patients discharged from the emergency department. *Acad Emerg Med*. 2003; 10:224–32. [PubMed: 12615588]
10. Hastings SN, Oddone EZ, Fillenbaum G, et al. Frequency and predictors of adverse health outcomes in older Medicare beneficiaries discharged from the emergency department. *Med Care*. 2008; 46:771–7. [PubMed: 18665056]
11. Mustard CA, Kozyrskyj AL, Barer ML, Sheps S. Emergency department use as a component of total ambulatory care: a population perspective. *CMAJ*. 1998; 158:49–55. [PubMed: 9475909]
12. Savageau JA, McLoughlin M, Ursan A, et al. Characteristics of frequent attenders at a community health center. *J Am Board Fam Med*. 2006; 19:265–75. [PubMed: 16672680]
13. Lucas RH, Sanford SM. An analysis of frequent users of emergency care at an urban university hospital. *Ann Emerg Med*. 1998; 32:563–8. [PubMed: 9795318]
14. Milbrett P, Halm M. Characteristics and predictors of frequent utilization of emergency services. *J Emerg Nurs*. 2009; 35:191–8. quiz 273. [PubMed: 19446122]

15. Zuckerman S, Shen YC. Characteristics of occasional and frequent emergency department users: do insurance coverage and access to care matter? *Med Care*. 2004; 42:176–82. [PubMed: 14734955]
16. Hunt KA, Weber EJ, Showstack JA, et al. Characteristics of frequent users of emergency departments. *Ann Emerg Med*. 2006; 48:1–8. [PubMed: 16781914]
17. Howard MS, Davis BA, Anderson C, et al. Patients' perspective on choosing the emergency department for nonurgent medical care: a qualitative study exploring one reason for overcrowding. *J Emerg Nurs*. 2005; 31:429–35. [PubMed: 16198724]
18. Owens PLaM, R. HCUP Statistical Brief #77. Quality AfHRa, ed.. Rockville, MD: July. 2009 Payers of Emergency Department Care, 2006.
19. Huang JA, Weng RH, Lai CS, Hu JS. Exploring medical utilization patterns of emergency department users. *J Formos Med Assoc*. 2008; 107:119–28. [PubMed: 18285244]
20. Rask KJ, Williams MV, McNaghy SE, et al. Ambulatory health care use by patients in a public hospital emergency department. *J Gen Intern Med*. 1998; 13:614–20. [PubMed: 9754517]
21. Hastings SN, Barrett A, Weinberger M, et al. Older Patients' Understanding of Emergency Department Discharge Information and its Relationship with Adverse Outcomes. *J Patient Safety* 2009. in press.
22. Social Security Death Index. <http://ssdi.rootsweb.ancestry.com>
23. Adler GS. A profile of the Medicare Current Beneficiary Survey. *Health Care Financ Rev*. 1994; 15:153–163. [PubMed: 10138483]
24. Beers MH, Ouslander JG, Fingold SF, et al. Inappropriate medication prescribing in skilled-nursing facilities. *Ann Intern Med*. 1992; 117:684–9. [PubMed: 1308759]
25. Hastings SN, Sloane RJ, Goldberg KC, et al. The quality of pharmacotherapy in older veterans discharged from the emergency department or urgent care clinic. *J Am Geriatr Soc*. 2007; 55:1339–48. [PubMed: 17767675]
26. Field TS, Gurwitz JH, Harrold LR, et al. Risk factors for adverse drug events among older adults in the ambulatory setting. *J Am Geriatr Soc*. 2004; 52:1349–54. [PubMed: 15271125]
27. Gurwitz JH, Field TS, Harrold LR, et al. Incidence and preventability of adverse drug events among older persons in the ambulatory setting. *JAMA*. 2003; 289:1107–16. [PubMed: 12622580]
28. Budnitz DS, Shehab N, Kegler SR, Richards CL. Medication use leading to emergency department visits for adverse drug events in older adults. *Ann Intern Med*. 2007; 147:755–65. [PubMed: 18056659]
29. Tanabe P, Gilboy N, Travers DA. Emergency Severity Index version 4: clarifying common questions. *J Emerg Nurs*. 2007; 33:182–5. [PubMed: 17379042]
30. Kyriacou DN, Ricketts V, Dyne PL, et al. A 5-year time study analysis of emergency department patient care efficiency. *Ann Emerg Med*. 1999; 34:326–35. [PubMed: 10459088]
31. Hastings SN, Whitson HE, Purser JL, et al. Emergency Department Discharge Diagnosis and Adverse Health Outcomes Among Older Adults. *J Am Geriatr Soc*. Oct; 2009 57(10):1856–61. [PubMed: 19694872]
32. Motulsky, H. *Intuitive Biostatistics*. Oxford; New York: 1995.
33. Wilber ST, Gerson LW, Terrell KM, Carpenter CR, Shah MN, Heard K, Hwang U. Geriatric emergency medicine and the 2006 Institute of Medicine reports from the Committee on the Future of Emergency Care in the U.S. health system. *Acad Emerg Med*. 2006; 13:1345–51. [PubMed: 17071799]
34. Wolinsky FD, Liu L, Miller TR, et al. Emergency department utilization patterns among older adults. *J Gerontol A Biol Sci Med Sci*. 2008; 63:204–9. [PubMed: 18314459]
35. Parboosingh EJ, Larsen DE. Factors influencing frequency and appropriateness of utilization of the emergency room by the elderly. *Med Care*. 1987; 25:1139–47. [PubMed: 3695643]
36. Byrne M, Murphy AW, Plunkett PK, McGee HM, Murray A, Bury G. Frequent attenders to an emergency department: a study of primary health care use, medical profile, and psychosocial characteristics. *Ann Emerg Med*. 2003; 41:309–18. [PubMed: 12605196]

37. Coleman EA, Eilertsen TB, Kramer AM, et al. Reducing emergency visits in older adults with chronic illness. A randomized, controlled trial of group visits. *Eff Clin Pract.* 2001; 4:49–57. [PubMed: 11329985]
38. Guttman A, Afilalo M, Guttman R, et al. An emergency department-based nurse discharge coordinator for elder patients: does it make a difference? *Acad Emerg Med.* 2004; 11:1318–27. [PubMed: 15576523]
39. Mion LC, Palmer RM, Meldon SW, et al. Case finding and referral model for emergency department elders: a randomized clinical trial. *Ann Emerg Med.* 2003; 41:57–68. [PubMed: 12514683]
40. Caplan GA, Williams AJ, Daly B, Abraham K. A randomized, controlled trial of comprehensive geriatric assessment and multidisciplinary intervention after discharge of elderly from the emergency department--the DEED II study. *J Am Geriatr Soc.* 2004; 52:1417–23. [PubMed: 15341540]

Table 1

Patient and Index Emergency Department Visit Characteristics, N=308

	N (%)
Patient Characteristics	
Age, mean (SD)	76.3 (7.47)
Female	185 (60.06)
Black race	127 (41.23)
Living Arrangements	
Private Residence – alone	69 (22.4)
Private Residence – with others	154 (50.0)
Assisted Living or Nursing Home	25 (8.12)
Unknown	60 (19.5)
Number of baseline chronic health conditions, ²⁵ mean (SD)	3.45 (1.68)
Coronary Artery Disease	111 (36.04)
Congestive Heart Failure	72 (23.38)
Hypertension	251 (81.49)
Stroke	54 (17.53)
Cancer (including skin cancer)	103 (33.44)
Chronic Kidney Disease	62 (20.13)
Diabetes Mellitus	90 (29.22)
Arthritis *	161 (52.27)
Dementia	32 (10.39)
Osteoporosis	54 (17.53)
Parkinson's Disease	5 (1.62)
Chronic Obstructive Pulmonary Disorder	67 (21.75)
Total number of chronic medications, [†] mean (SD)	9.47 (4.34)
Chronic high risk medications, ^{26–30‡}	
Anticoagulants/antiplatelets	212 (68.83)
All antihistamines	46 (14.94)
Cardiovascular drugs [§]	243 (78.90)
Anti-diabetes medication	78 (25.32)
CNS active medication	170 (55.19)
Admission to skilled nursing or rehab facility in year prior to the index visit	31 (10.06)
Index ED Visit Characteristics	N (%)
Arrival by ambulance ¹⁰	95 (30.84)
ED Nurse triage score, ^{31¶}	
1	2 (0.65)
2	150 (49.02)
3	113 (36.93)

	N (%)
4	37 (12.09)
5	4 (1.31)
Weekend day index ED visit	81 (26.30)
Evening/Night discharge from index ED visit	155 (50.32)
Total time spent in the ED, ^{32#}	
<1 Hour	3 (0.97)
1–2.99 Hours	30 (9.74)
3– 9.99 Hours	197 (63.96)
≥ 10 Hours	78 (25.32)
Active care time ≥ 60 minutes ^{32**}	277 (90.52)
Patient admitted to Clinical Evaluation Unit during index ED visit	45 (14.61)
Most common primary ED discharge diagnosis ^{18††}	
Chest Pain	18 (5.83)
Abdominal Pain	10 (3.24)
Fall	10 (3.24)
Syncope	10 (3.24)
Urinary Tract Infection	7 (2.27)
Categories of primary discharge diagnosis ³³	
Injury/Acute Musculoskeletal Symptom	86 (27.92)
Chronic condition	45 (14.61)
Non-musculoskeletal Symptom	103 (33.44)
Serious infection	30 (9.74)
Unclassified	44 (14.29)
New medication prescribed at discharge from index ED visit ⁱ	165 (53.57)
Acetaminophen and oxycodone	127 (12.16)
Ciprofloxacin	73 (7.00)
Ibuprofen	65 (6.23)
Oxycodone	65 (6.23)
Acetaminophen and hydrocodone	52 (4.98)
Number of new medications prescribed at discharge from index ED visit	
0	143 (46.43)
1	92 (29.87)
2	54 (17.53)
3–4	19 (6.17)

ED=emergency department

SD = standard deviation

* Includes arthritis, osteoarthritis, rheumatoid arthritis, gouty arthritis or gout, psoriatic arthritis, degenerative joint disease or DJD, and spondylosis

† Includes prescription medications, vitamins and supplements administered by the following routes were counted: oral, nasal spray, ophthalmic, patch, injection or IV.

[‡] High risk drug categories include: Anticoagulants/antiplatelets, all antihistamines, cardiovascular drugs, anti-diabetes medication and CNS-active medications

[§] Includes diuretics, antiarrhythmics, beta blockers, calcium channel blockers and digoxin

^{//} Includes antidepressants, antipsychotics, benzodiazepines, barbituates, opioids and anti-seizure medications

[¶] Data missing for 2 subjects

[#] Defined as time from documented arrival at ED to documented time of discharge from ED; data missing for 2 subjects

^{**} Defined as time from first documented physician interaction to documented time of discharge from ED; data missing for 2 subjects

^{††} Data shown for the 5 most common categories

Table 2

Care Utilization in the 12 months Prior to the Index Emergency Department Visit, N=308

PCP Care	
Median number of visits (IQR)	4.0 (2, 7)
1–7, n (%)	245 (79.55)
≥ 8, n (%)	63 (20.45)
Specialist Care	
Median number of visits (IQR)	4.0 (1, 9)
0, n (%)	62 (20.13)
1–10, n (%)	179 (58.12)
≥ 11, n (%)	67 (21.75)
Outpatient ED Care	
Median number of visits (IQR)	0 (0, 1)
0, n (%)	196 (63.64)
1, n (%)	60 (19.48)
≥ 2, n (%)	52 (16.88)
Hospitalization	
Median number of total hospital days [†] (IQR)	0 (0, 4)
0, n (%)	170 (55.19)
1–4, n (%)	68 (22.08)
≥ 5, n (%)	70 (22.72)

PCP = primary care provider

ED = emergency department

IQR = 25%, 75% interquartile range

[†]Data missing for 2 subjects

Table 3Scheduled versus Recommended Follow-up at the Time of Emergency Department Discharge, n=191[†]

Time Frame for Follow-Up	Time to First Outpatient Visit Median (IQR)	P value [‡]
0–1 Days		
Scheduled (n=7)	14.0 (1.0, 41.0)	0.58
Recommended (n=28)	12.0 (4.0, 25.0)	
2–3 Days		
Scheduled (n=12)	3.0 (3.0, 9.5)	0.04
Recommended (n=83)	8.0 (4.0, 19.0)	
4–7 Days		
Scheduled (n=9)	5.0 (5.0, 6.0)	0.08
Recommended (n=43)	8.0 (5.0, 13.0)	
8–14 Days		
Scheduled (n=4)	9.0 (8.5, 20.0)	0.38
Recommended (n=5)	26.0 (17.0, 34.0)	

[†]Data includes all patients with a scheduled or recommended follow-up visit within the time frame categories shown, who completed at least one follow-up visit with an outpatient provider (of any type) within 90 days after the index ED visit.

[‡]Comparing scheduled versus recommended for each time frame; based on Wilcoxon Rank Sums Test IQR= 25%, 75% interquartile range

Table 4

Repeat Outpatient ED Visits, Hospitalizations and Deaths in the 90 days after the index ED visit, N=308

	N (%)
Repeat Outpatient ED visits	54 (17.53)
Median number of visits (IQR)	0.0 (0.0)
Median time to first visit (IQR)	24.0 (48.0)
Hospitalization	80 (25.97)
Median number of hospital days (IQR) *	0.0 (1.0)
Median time to first admission (IQR)	20.0 (47.0)
Death	14 (4.55)

IQR = 25%, 75% interquartile range

* Data missing for 1 subject

Table 5
Adverse Events within 90 Days Associated with Frequency of Pre-ED care (N= 308)

	Repeat Outpatient ED, N=54			Hospitalization, N=80		
	HR			HR		
High Frequency Care	N (%)	Unadjusted (95% CI) P-value	Adjusted (95% CI) P-value [†]	N (%)	Unadjusted (95% CI) P-value	Adjusted (95% CI) P-value [†]
High Outpatient ED Frequency [‡] , N=52	18 (34.6)	2.82 (1.59, 4.99); P<0.001	2.20 (1.15, 4.21); P=0.02	19 (36.5)	1.64 (0.98, 2.74); P=0.06	1.31 (0.73, 2.35); P=0.36
High Hospital Frequency [§] , N=70	20 (28.6)	2.43 (1.39, 4.27); P=0.002	1.73 (0.93, 3.21); P=0.08	32 (46.4)	2.91 (1.85, 4.71); P<0.001	2.39 (1.46, 3.92); P<0.001
High PCP Frequency , N=63	17 (27.0)	1.92 (1.07, 3.47); P=0.03	1.41 (0.74, 2.69) P=0.30	20 (31.8)	N/A *	N/A *
High Specialist Visit Frequency [¶] , N=67	13 (19.4)	N/A *	N/A *	26 (38.8)	1.95 (1.22, 3.12); P=0.005	1.51 (0.90, 2.53); P=0.12

HR = hazard ratio

PCP=primary care provider

CI=confidence interval

* N/A = not applicable; Proportional hazard models run only if bivariate associations with p values ≤0.05.

[†] Models adjusted for age, gender, race, number of comorbidities out of 12, and care utilization in the year prior to the index ED visit, including PCP visits, specialist visits, outpatient ED visits and hospital days.

[‡] High frequency = ≥ 2 outpatient ED visits in the year prior. Outpatient ED visits in year prior excluded from adjusted models.

[§] High frequency = ≥ 5 hospital days in the year prior, N = 306. Hospital days in year prior excluded from adjusted models.

^{||} High frequency = ≥ 8 PCP visits in the year prior. PCP visits excluded from adjusted models.

[¶] High frequency = ≥ 11 Specialist visit in the year prior. Specialist visits excluded from adjusted models.