Predictors of 30-Day Return Following an Emergency Department Visit for Older Adults

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BACKGROUND Older adults who are discharged following emergency department evaluation are at increased risk for functional decline and health care utilization, and are likely to benefit from close follow-up and additional care services. Understanding factors associated with a return emergency department visit within 30 days among older fee-for-service Medicare beneficiaries discharged to the community may assist in identifying patients at greatest need for interventions.

METHOD Predictors from Medicare data and public sources were evaluated in a retrospective data analysis of North and South Carolina residents (2011–2012) aged ≥ 65 years using Cox regression proportion hazards ratios (HR) and 95% confidence intervals (CI) for time-to-30-day return events.

RESULTS 30-day return rates varied markedly among the 167 emergency department facilities studied (18%–39%). Predictors of 30-day return included: age (85+ versus 65–74; HR, 1.24; 95% CI, 1.22–1.27); male sex (HR, 1.11; 95% CI, 1.14–1.10); non-white race (HR, 1.07; 95% CI, 1.05–1.09); Medicaid eligibility (HR, 1.20; 95% CI, 1.18–1.22); Charlson Score (3+ vs. 0; HR, 1.33; 95% CI, 1.30–1.36); and prior emergency department encounter (3+ vs. 0; HR, 2.35; 95% CI 2.30–2.41).

LIMITATIONS This study was limited to Medicare beneficiaries in North Carolina and South Carolina, 2011–2012. Administrative claims data are limited to information required for financial reimbursement. Because we limited our study to older fee-for-service patients, our findings may not be generalizable to managed care patients and other age groups. Patients transferred to another emergency department or facility were not included in the analysis.

CONCLUSION Factors predicting 30-day return to the emergency department or hospitalization suggest the potential for care transition improvement efforts to better meet patient needs, thereby potentially improving post-emergency department outcomes.

Adults older than 65 years made an estimated 19.8 million emergency department (ED) visits in 2009 [1] and account for 36% of hospitalizations in the United States [2]. Sixty percent of hospitalized Medicare patients are admitted through the ED [3], illustrating the profound role EDs play in determining the health care trajectory of older adults. The health needs of older adults challenge already strained EDs and will increase over the next 15 years as the percentage of older adults in the United States increases from 13% to 19% [4, 5].

Transitioning older adults from the ED to a home setting when hospitalization is not medically indicated (ie, discharging rather than admitting these patients from the ED) is often beneficial to both the patients and the financial sustainability of the health care system. However, being seen in the ED without hospitalization has been associated with functional decline in older adults in the months following discharge [6], and older adults who are not admitted from the ED are at high risk for rapid return to the ED or hospital and death [7]. Safely transitioning older adults home from the ED requires enhanced discharge processes within the ED, including connecting patients at risk for rapid return to the ED or hospital with community social support and medical resources [8]. These enhancements to the discharge process require resources, so it is important to identify which Medicare beneficiaries may need these resources so they may be allocated more precisely.

Initial analysis has been done to better identify older adults at risk of poor health outcomes and return to the ED after ED discharge. Environmental, population, facility, and patient factors are potentially associated with health services outcomes [9]. An ED encounter that results in discharge to the community without admission (ie, ED-to-community encounter) is an opportunity to intervene on these factors and avoid unnecessary use of high-cost health services and risks associated with medical care. Previous reports identify factors predicting hospital admission within 7 days of ED discharge in California subpopulations, including older age, residing in a skilled nursing facility, and having one or more chronic health conditions [10]. Similar studies in populations outside of California are needed to determine if these findings are generalizable. Understanding the factors associated with 30-day ED revisits or readmission, a time period consistent with the Medicare 30-day hospital readmission quality indicator [11], may enhance identification of patients with predisposing social support needs and medical conditions that a better-coordinated discharge plan could address.

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This study identifies Medicare beneficiary characteristics associated with return to the ED or hospitalization within 30 days of ED discharge in large, culturally diverse southern states. We characterize variations in ED use, with emphasis on evaluating patient predictors of 30-day return to ED or hospital inpatient admissions following an ED-to-community encounter, in older, community dwelling, fee-for-service Medicare populations in North and South Carolina.

Methods

Study Design, Setting, and Participants

In this retrospective cohort study, ED encounters and hospital admissions were identified (see Figure 1) using fee-for-service claims from an older Medicare population with addresses in North Carolina or South Carolina during 2011 and 2012 (N = 2,331,440). We excluded beneficiaries younger than 65 years of age on 1/1/2011 (N = 622,086) and those enrolled in managed care during this period (N = 366,820). Beneficiaries alive in 2012 and not present in state-specific denominator files in both years were also excluded (N = 8,069). Analyses were performed on the remaining population (N = 1,334,465).

Data Sources

Health care service and demographic information was obtained from Medicare claims and enrollment data provided by the Centers for Medicare and Medicaid Services (CMS) to its Quality Improvement Organization contractor, The Carolinas Center for Medical Excellence. These data were analyzed to support statewide quality improvement initiatives overseen by CMS. Enrollment data included information about demographics, date of death, and managed care coverage. Medicare claims data included all claims for 100% of Medicare beneficiaries with Medicare mailing addresses in North Carolina or South Carolina. The data extracted from these claims included information about health services provided at the hospital and ED encounters covered by Medicare Part A insurance, and services from physicians and other health care providers in community outpatient settings covered by Medicare Part B insurance. We also obtained data from other sources to characterize ED facilities and the communities where they are located. The CMS Provider of Services files provided data on characteristics of hospitals with ED facilities including name, address, and type of Medicare services the facility provides [12]. County level characteristics of ED facility locations were obtained from the Area Health Resource File (AHRF). The AHRF is comprised of data collected by the Health Resources and Services Administration from more than 50 sources, including information about health facility numbers and types, hospital utilization, population characteristics, and economic data [13]. Information about hospital facility ratings and availability of emergency services was obtained from the CMS Hospital Compare website [14].

Characterizing ED Facilities and Populations

Prior to performing regression analyses, we performed univariate and bivariate analyses using data from a variety of sources to characterize the diverse ED facilities in North and South Carolina and the populations they serve. ED facility characteristics were examined in order to understand the care context of patients receiving ED services. These included facility site characteristics from the CMS Provider files and Hospital Compare and facility site community characteristics from the AHRF. Characteristics examined include facility setting (ie, rural versus urban), facility designation (ie, acute versus critical access), associated-hospital size (ie, number of beds), and ownership (ie, public versus private). Characteristics of counties containing ED facility sites derived from the AHRF included per capita income in 2010 and number of primary care physicians in 2011. Facility level characteristics derived from Medicare claims data included the number of Medicare patients discharged during the observation period and the percent of Medicare patients seen in the ED who were admitted to the hospital from the ED during the observation period.

Patient population characteristics, including age, gender, race, and eligibility for Medicaid (dual eligibility), were determined from Medicare enrollment data.

Time Frame

Medicare claims for services performed from 1/1/2011 through 7/30/2012, inclusive, were analyzed in this study (see Figure 2). Claims for services performed from 1/1/2011 through 6/30/2011, inclusive, were used to assess pre-event medical history. An included beneficiary had to have an ED encounter during the observation period between 7/1/2011 and 6/30/2012. A 30-day follow-up period after the index ED encounter (during which the main outcome, ED return,
or hospital admission was identified) could have included claims for services performed during the 12-month observation period, or during July 2012 if the index encounter occurred in the final 30 days of the observation period.

**Index Events**

An ED-to-community encounter was defined as an ED encounter that did not result in hospital admission, transfer to another institution, or death in the ED. For regression analyses, the earliest ED-to-community encounter in the observation period was designated the index encounter and subsequent encounters were not considered in analyses except as potential outcome events.

**Covariates**

Covariates for beneficiary level regression analyses from Medicare enrollment data included age, gender, race, and eligibility for Medicaid (dual eligibility). Derived from Medicare Part A and Part B claims were the Charlson comorbidity index [15], the number of ED encounters, and the number of hospital admissions 6 months prior to index ED-to-community encounters. The Charlson comorbidity index is a commonly used measure of mortality risk associated with health conditions identified from diagnoses codes on Medicare claims. We include this to control for differences in health-related risks among patients. An indicator of physician face-to-face encounters occurring after the index encounter and before the 30-day return event, or the end of the 30-day follow-up if no event occurred, was derived from claims data. This indicator includes any face-to-face encounter with a physician regardless of specialty.

**Outcomes**

Our primary outcome for regression analyses, 30-day return, was defined as the occurrence of one or more ED encounters or hospital admissions within 30 days following the index ED-to-community encounter. The outcome variable used for proportional hazards regression modeling was time-to-30-day return event. The outcome was all-cause return to any ED facility or all-cause admission to any hospital within 30 days of the index encounter. Death date from Medicare data was used for censoring in proportional hazards analyses.

**Regression Analysis**

Proportional hazards regression analyses were performed to evaluate potential predictors of index ED encounter characteristics with 30-day return event follow-up times. Proportional hazards models relate time that passes before some event occurs to factors that may predict the occurrence of the event. Proportional hazards regression evaluates risk using a measure called the hazards ratio (HR), which quantifies the relative risk of an event. The HR may be thought of as a multiplier of increased risk associated with the presence of a predictive condition. Time to event was determined as the number of days from the index encounter to the return event. If no such event occurred within 30 days, the follow-up time was set to 30. If death occurred within the 30-day follow-up period without a prior outcome event, then follow-up time was set to the number of days between the index encounter and death. Regression analyses were limited to patients with at least one ED-to-community encounter during the observation period. A time-varying covariate was included in the model for the number of days until a physician office visit. A random effect was included in the model for the deviation of each ED facility as compared to the overall model. A test for the homogeneity of hazards among the facilities was performed.

**Results**

**Characteristics of ED Facilities and Encounters**

About 17% of the study population experienced at least one of the 361,059 ED encounters observed during the 12-month observation period in 107 EDs in North Carolina and 60 EDs in South Carolina (see Figure 1). Almost half (North Carolina: 48.5%, South Carolina: 55.0%) of the EDs were in urban settings, and about a third (North Carolina: 29.9%, South Carolina: 30.0%) were affiliated with a public hospital. One-fifth (21.5%) of the EDs in North Carolina and 8% of the EDs in South Carolina were in critical access hospitals. During the observation period, the facility specific ED encounter count ranged from 121 to 7,717 (meanN = 2,162),

![FIGURE 2. Analytical Timeframe for 30-Day Return Regression Analyses](image-url)
and the number of patients seen in these encounters ranged from 87 to 5,488 (mean = 1,510).

The overall study population (N = 1,334,465) had a mean age of 75 years, was 57% female, 80% white, and 18% black. The population with ED encounters compared to the population without ED encounters was older on average (mean = 76 years versus 74 years), had a higher proportion of black race (20% versus 15%), and had substantially higher proportions of individuals with dual eligibility (16% versus 9%) and end-stage renal disease (1.6% versus 0.5%) (see Table 1).

Facility specific percentage of patients classified as white race ranged from 34% to 100% (mean = 75%) aggregated across encounters (see Table 2). The percent of encounters involving female patients ranged from 42% to 68% (mean = 57%). The patient age distribution varied markedly across ED facilities; encounters involving patients aged ≥85 years ranged from 9% to 28% (mean = 15%). Encounters involving dually eligible patients ranged from 4% to 44% (mean = 20%). Hospital admission rates from ED encounters ranged from 4% to 52% (mean = 32%) and the percentage of ED encounters resulting in return to the community (including skilled nursing facilities) ranged from 32% to 90% (mean = 57%). The percentage of ED encounters with 30-day return from the 167 EDs ranged from 18% to 39% (median = 23%).

Regression Analyses

About 57% of the 361,059 ED encounters identified in the study population (see Figure 1) resulted in discharge to the community and were eligible to be index ED-to-community encounters. ED encounters resulting in hospital admissions, transfers, and death were excluded from regression modeling as index ED-to-community encounters, but could be considered 30-day return outcome events when occurring after an index encounter. Proportional hazards regression analyses (see Table 3) evaluate encounter-level risk factors or correlates of 30-day return based on relative risks expressed as HRs. Risks reported from this model are those related to index ED-to-community encounters controlling for the effects of ED facilities. The regression model adjusted for age, race, sex, dual eligible status, Charlson score, 30-day post-index-discharge physician encounter status, and ED and hospital utilization.

Patient age was directly related to the risk of 30-day return. Patients aged 75–84 years and aged ≥85 years were 1.12 (HR, 1.12; 95% confidence interval [CI], 1.11–1.14) and 1.24 (HR, 1.24; 95% CI, 1.22–1.27) times as likely to experience 30-day return, respectively. Female patients were at lower risk of 30-day return than male patients (HR, 0.90; 95% CI, 0.88–0.91). Patients other than white race were at higher risk for 30-day return than white patients (HR, 1.07; 95% CI, 1.05–1.09). Dually eligible patients were 1.2 times as likely to experience 30-day return as patients not dually eligible (HR, 1.20; 95% CI, 1.18–1.22).

Patients with Charlson scores ≥3 had about 1.3 times the risk of 30-day return compared to those with scores of 0 (HR, 1.33; 95% CI, 1.30–1.36). Having a face-to-face encounter with a physician following an index ED-to-community encounter was associated with higher risk of 30-day return (HR, 1.11; 95% CI, 1.09–1.13). Patients with ≥3 prior hospitalizations in 6 months were at 12% higher risk for 30-day return compared to patients with no prior hospital stays within 6 months (HR, 1.12; 95% CI, 1.09–1.16). The strongest predictor of 30-day return was the number of prior ED visits within 6 months of the index ED-to-community encounter. Patients

### Table 1

| Characteristic                  | Beneficiaries with no ED encounter (N = 1,194,894) | Beneficiaries with any ED encounter (N = 236,205) |
|--------------------------------|-------------------------------------------------|-------------------------------------------------|
| Male (%)                       | 42.90                                           | 42.59                                           |
| Race                           |                                                 |                                                 |
| White (%)                      | 83.36                                           | 78.73                                           |
| Black (%)                      | 14.65                                           | 19.91                                           |
| Mean age (years)               | 74.44                                           | 75.66                                           |
| Dually eligible (%)            | 8.96                                            | 16.48                                           |

Note. ED = emergency department.

### Table 2

| Characteristic                  | Minimum | Q1 | Median | Mean (SEM) | Q3 | Maximum |
|--------------------------------|---------|----|--------|------------|----|---------|
| Encounter volume                | 121     | 1045 | 1756   | 2162.0 (115.6) | 2931 | 7717    |
| Patient volume                  | 87      | 707  | 1228   | 1510.4 (83.2)  | 2099 | 5488    |
| Race other than white (%)       | 0       | 9.1  | 22.4   | 24.9 (1.3)    | 39.9 | 66.2    |
| Female (%)                      | 41.5    | 55.1 | 58.8   | 57.2 (0.3)    | 59.9 | 67.5    |
| Age (%)                         |         |     |        |             |     |         |
| 65–74 years                     | 36.8    | 46.7 | 49.4   | 49.3 (0.3)    | 52.5 | 64.4    |
| 75–84 years                     | 26.9    | 33.6 | 35.4   | 35.4 (0.2)    | 36.8 | 44.6    |
| ≥ 85 years                      | 8.6     | 13.4 | 15.1   | 15.3 (0.2)    | 17.1 | 28.0    |
| Dually eligible (%)             | 4.0     | 16.4 | 19.5   | 20.1 (0.4)    | 23.2 | 44.2    |
| Facility-specific hospital admission rate (%)* | 3.6 | 27.9 | 33.4 | 32.2 (0.8) | 38.6 | 51.8 |
| Community discharge rate (%)*   | 32.4    | 49.7 | 56.1   | 56.7 (0.8)    | 62.9 | 90.3    |

*Does not include ED encounters resulting in transfers to other institutions and those who died in the ED.

Note. SEM = standard error of the mean.
with $\geq 3$ prior ED encounters within 6 months were more than twice as likely to experience 30-day return compared to those with 0 prior encounters (HR, 2.35; 95% CI, 2.30–2.41).

**Discussion**

ED revisit patterns in North Carolina and South Carolina provide an important snapshot of a significant region of the country with high chronic disease rates and varied socioeconomic status, race, and rural and urban settings. As such, understanding ED revisit patterns for the Carolinas may help enhance our understanding of this region's care utilization patterns and its relationship with national patterns.

Older adults seen in the ED are more likely to be hospitalized than younger adults [17-19], presumably because of increased complexity of illness believed to be better managed in an inpatient setting. However, hospitalization is associated with adverse outcomes affecting cognition, function, and mobility [20-22], as well as high cost [23]. As over 25% of hospitalizations for Medicare and Medicaid enrollees may be avoidable [24], and hospitalization poses dangers of iatrogenesis, transitioning older adults home from the ED when safe is desirable in order to decrease adverse events and costs associated with hospitalization. Unfortunately, ED discharge processes fail to adequately convey the discharge care plan [25], to identify social needs [26], and to consistently connect patients to outpatient social or medical resources [27, 28]. Identifying those patients at increased risk for return visit to the ED, hospitalization, or death within 30 days of initial ED visit is important in determining which patients should be prioritized for an enhanced ED transition-to-home process. Though in some cases these events are planned, frequently they suggest failed care transitions. The median 30-day return rate for EDs in the Carolinas was 23%, with a range of 18%–39%. This wide range may indicate significant differences among care transition success across EDs; analysis of ED case-mix is required to know if this wide range is associated with the facilities or case-mix.

Several patient factors were associated with higher return rates to an ED or hospital, including older age, male, non-white race, Medicaid eligibility, recent physician encounter, prior number of ED encounters, and prior number of hospital stays. These findings differ in some respects from those of other international studies [29, 30] and may reflect differences in our patient populations and health care systems.

That patients with a recent visit to a physician are more likely to return to the ED may be a marker of illness severity, or indicate that the need for hospitalization was recognized in those who saw a primary care provider (PCP). Although analysis was not limited to patients who saw a PCP, this phenomenon is reminiscent of the paradox in PCP follow-up and higher readmission rates among patients in the Veterans Health Administration [31]. Our findings may help ED providers, case managers, and nurses identify which patients are at greater risk of failed care transitions and in need of resources.

Our data suggests that a history of frequent ED utilization is the most significant predictor of return visits to the ED or hospital admissions following an index ED visit. Among Medicare beneficiaries who had not been seen in the ED in the prior 6 months, 18% returned to the ED within 30 days of the index; 45% of those who had been in an ED $\geq 3$ times in the prior 6 months returned (risk ratio, 2.35). Frequent ED utilizers should be considered for additional medical and social support upon discharge.

It is an important consideration that this analysis presumes that return visits to the ED soon after ED discharge suggest failed care transitions. Although this is probably correct in many cases, there are some situations in which discharge with a return ED visit is the optimal way to care for the patient. Value in health care is defined by health outcomes over total costs [32]. This definition does not weigh

| Patient Characteristic | Hazard ratio | 95% Confidence interval |
|------------------------|--------------|-------------------------|
| Age 75–84 vs. 65–74    | 1.12         | 1.11–1.14               |
| Age 85+ vs. 65–74      | 1.24         | 1.22–1.27               |
| Female vs. male        | 0.90         | 0.88–0.91               |
| Non-white vs. white    | 1.07         | 1.05–1.09               |
| Dual (Y versus N)      | 1.20         | 1.18–1.22               |
| Prior Charlson score 1-2 vs. 0 | 1.15 | 1.13–1.17 |
| Prior Charlson score 3+ vs. 0 | 1.33 | 1.30–1.36 |
| Physician visit after return to community† | 1.11 | 1.09–1.13 |
| 6-month prior ED encounters (1-2 vs. 0) | 1.29 | 1.26–1.31 |
| 6-month prior ED encounters (3+ vs. 0) | 2.35 | 2.30–2.41 |
| 6-month prior hospital stays (1-2 vs. 0) | 1.04 | 1.02–1.06 |
| 6-month prior hospital stays (3+ vs. 0) | 1.12 | 1.09–1.16 |

*All estimates are adjusted for other variables listed.
†Face-to-face outpatient physician encounter within 30-days following the index ED-to-community encounter and prior to 30-day return event, if any.
return ED visits as “bad” except in that they cost more than either no visits or visits to a PCP [33]. Because of the need for acute care and limited access to primary care, achieving high value care for some patients in resource-limited communities may require frequent ED visits. For high-risk patients whose symptoms resolve in the ED, encouraging the patient to return to the ED for reevaluation is likely more cost effective than admitting that patient to the hospital, and may be safer than encouraging the patient to wait for an appointment with a PCP if symptoms recur.

Although our entire study population was insured by Medicare, we recognize that many factors in addition to insurance influence access to medical care. Community level measures of care availability, including indices of underservice (particularly workforce availability) such as “primary care physicians per population,” are important to consider because limited availability of medical care in the community may affect both insured and uninsured populations. Additional studies are needed to explore community level measures of access to care as potential predictors of 30-day return.

Limitations
First, this study was limited to Medicare beneficiaries in North Carolina and South Carolina from 2011 to 2012. Together, these states have a diverse population and a unique cultural and medical environment that may be only partially representative of the United States. Second, administrative claims data are limited to information required for financial reimbursement. The available information, though advantageous in that it is not limited to a single ED or hospital, does not contain the clinical and facility information needed to more deeply understand provider and patient determinants of short-term returns to the ED or hospitalizations. Third, because we limited our study to older fee-for-service patients, our findings may not be generalizable to managed care patients and other age groups. Patients who were transferred to another ED or facility were not included in our analysis, so our findings may not apply to this population. Broad limitations of using Medicare administrative data are discussed elsewhere [16]. Also, we are limited in our ability to consider fully the multiple potential variables in the domains of standard conceptual models of health care utilization [9]. Available data allows us to consider several patient characteristics aligning with these models. Our inability to consider other important potential predictors and confounders, such as the convenience, acceptability, and affordability of health care services; patient income and education; and socio-environmental characteristics of place of residence likely bias these findings in unpredictable ways.

Conclusion
An ED encounter can be an indicator of multiple factors that influence health and health care, involving treatment of acute exacerbations of poorly managed chronic conditions, treatment of non-emergent conditions when primary care alternatives are not desirable or available, or treatment of truly unavoidable emergent conditions that require ED services. Unaddressed, non-medical needs including malnutrition, abuse, and poor access to transportation may contribute to ED visits [34, 35]. In some cases, recognizing and addressing these problems may be far less expensive and have a greater impact than efforts to medically optimize the patient. Others have suggested that inpatient readmission at least 7 days post-discharge is associated with factors beyond hospital control [36]. Our findings do not address the underlying pathways associated with any of these factors and the risk of 30-day return. Nevertheless, our findings identify populations at risk and suggest that an ED encounter could be an opportunity to prevent subsequent institutional encounters for patients returning home from the ED. Our findings demonstrate a wide range among institutions of likelihood that patients discharged from the ED will revisit the ED or be hospitalized within 30 days. If this wide range is not explained by case-mix, it would be reminiscent of the range in hospital readmission rates that contributed to an emphasis on decreasing readmissions for Medicare patients [37]. Further study is needed to determine the causes for the wide range in return rates after ED discharge, and to develop and implement ED-centered care transitions processes that support patient self-management and remove barriers to care after leaving the ED.

In summary, older patients, certain vulnerable patient populations, more chronically ill patients and, in particular, patients with multiple recent ED visits, have high rates of return to the ED or hospitalization following ED discharge. These findings may help focus future care transitions improvement efforts to better meet patient needs.
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