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Emergency Department Discharge Diagnosis and Adverse Health Outcomes in Older Adults

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Abstract

Objectives—To determine the relationship between the reason for an emergency department (ED) visit and subsequent risk of adverse health outcomes in older adults discharged from the ED.

Design—Secondary analysis of data from the Medicare Current Beneficiary Survey.

Setting—ED.

Participants—One thousand eight hundred fifty-one community-dwelling Medicare fee-for-service enrollees aged 65 and older discharged from the ED between January 2000 and September 2002.

Measurements—Independent variables were ED discharge diagnosis groups: injury or musculoskeletal (MSK) (e.g., fracture, open wound), chronic condition (e.g., chronic obstructive pulmonary disorder, heart failure), infection, non-MSK symptom (e.g., chest pain, abdominal pain), and unclassified. Adverse health outcomes were hospitalization or death within 30 days of the index ED visit.

Results—Injury or MSK was the largest ED diagnosis group (31.4%), followed by non-MSK symptom (22.2%), chronic condition (20.9%), and infection (7.8%); 338 (17.8%) had ED discharge diagnoses that were unclassified. In adjusted analyses, a discharge diagnosis of injury or MSK condition was associated with lower risk of subsequent adverse health outcomes (hazard ratio (HR) = 0.69, 95% confidence interval (CI) = 0.50–0.96) than for all other diagnosis groups. Patients seen in the ED for chronic conditions were at greater risk of adverse outcomes (HR = 1.86, 95% CI =

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1.37–2.52) than all others. There were no significant differences in risk between patients with infections, those with non-MSK symptoms, and the unclassified group.

Conclusion—Adverse health outcomes were common in older patients with an ED discharge diagnosis classified as a chronic condition. ED discharge diagnosis may improve risk assessment and inform the development of targeted interventions to reduce adverse health outcomes in older adults discharged from the ED.

Keywords

emergency department; diagnosis group; health services utilization

Older adults who are discharged directly from the emergency department (ED) face significant risk of subsequent adverse health outcomes. Previous studies have shown that as many as one in six patients aged 65 and older are hospitalized in the months after ED discharge.^{1–5} Individual risk factors, such as greater number of preexisting medical problems and previous health service use, have been shown to predict post-ED hospital use.^{1–6} Many clinicians suspect that the reason for the ED visit may also play a role in predicting subsequent adverse health outcomes. For example, a patient seen in the ED for an exacerbation of heart failure might be at higher risk for post-ED hospital admission than a patient seen for an ankle sprain, even if these patients had similar baseline health. Understanding the relationship between ED discharge diagnosis and adverse health outcomes could improve the ability to identify older adults who are at significant risk of hospitalization or death after ED discharge.

ED discharge diagnoses are commonly coded according to the *International Classification of Diseases* (ICD) system.^{7,8} Although ICD codes are readily available within administrative data used for Medicare billing, there are many thousands of possible diagnosis codes within the ICD system, which presents challenges in using these codes for research on patient outcomes.^{8,9} A number of methods have been developed to reclassify numerical ICD codes into new diagnosis groups or clusters, but all have limitations for handling ED discharge diagnosis codes.^{10–12} There is a need to build upon these previously defined classification systems to develop a discrete number of clinically meaningful ED discharge diagnosis groups that would allow identification of the types of patients at particularly high risk of subsequent adverse outcomes.

In earlier work, risk factors for adverse health outcomes in older patients discharged from the ED were examined, but these analyses did not take into account ED discharge diagnosis.^{4,6} Incorporating ED discharge diagnosis into current risk-stratification models could improve the ability to identify those at risk for subsequent adverse health outcomes and guide the development of targeted interventions to improve health outcomes in older adults discharged from the ED with certain “high-risk” diagnoses. Using a combination of survey and administrative data, the current study extends previous work by addressing two main goals: developing ED discharge diagnosis groups that cluster diagnoses with clinically important similarities into mutually exclusive categories and using these groups to examine the association between ED discharge diagnosis and risk of hospitalization or death in older adults discharged from the ED.

Methods

Design and Setting

Data were obtained from the Medicare Current Beneficiary Survey (MCBS) Cost and Use files and linked Medicare claims after approval of data use agreement 17470. The MCBS is a continuous survey of a nationally representative sample of Medicare beneficiaries drawn from the Centers for Medicare and Medicaid Services enrollment file.¹³ Beneficiaries (or their

proxies) are interviewed in person three times a year about a range of topics, including medical comorbidities and functional status. The results from the survey are then combined with Medicare administrative claims data to provide additional information, such as healthcare utilization event dates.¹³ Approval for the study was obtained from the institutional review board of Duke University Medical Center.

Study Sample

The study sample included Medicare beneficiaries with an ED visit that did not result in admission to the hospital (hereafter referred to as “outpatient ED visit”) between January 2000 and September 2002. The sample was restricted to community-dwelling subjects who were age-entitled to Medicare (65) and not enrolled in a Medicare health maintenance organization (HMO). Subjects enrolled in a Medicare HMO plan were excluded, because they did not have fee-for-service bills generated, and therefore it was not possible to determine the dates of their health service use. Residents of long-term care facilities were excluded, because a different data collection instrument was used for these individuals. Additional details of how the sample was constructed have been published elsewhere.⁴

Measurements

ED Discharge Diagnosis Groups—Building on and extending previous work on ICD, Ninth Revision, Clinical Modification (ICD-9-CM) classification systems,^{8,14,15} the study authors developed ED diagnosis groups based on review of pertinent literature and consultation with clinical experts. The goal was to assign diagnoses with clinically important similarities to mutually exclusive categories. After agreeing on the diagnosis groups, three clinicians (SH, HW, KJ) reviewed all unclassified diagnoses and made one revision (combined musculoskeletal conditions with injuries). The final ED discharge diagnosis groups were injury or musculoskeletal (MSK), chronic condition, infection, and non-MSK symptom. Individual diagnoses were assigned to one of these four groups based on the primary ICD-9-CM code associated with the index ED visit, which was obtained through Medicare billing records.

Injury or MSK—This group included all patients with a diagnosis of injury or an MSK condition. Injury codes were taken from a preexisting category within the ICD-9-CM classification system (800xx–854xx, 860xx–897xx, 900xx–904xx, 910xx–929xx, and 940xx–959xx). MSK codes included 710xx to 739xx.

Chronic Condition—This group included all patients whose ED diagnosis was classified as a chronic condition according to the Chronic Condition Indicator (CCI), a software tool developed as part of the Healthcare Cost and Utilization Project sponsored by the Agency for Healthcare Research and Quality.¹⁴ The CCI was used, because the ICD-9-CM classification system was not designed to group chronic diseases together. The CCI definition of a chronic condition is a condition that lasts 12 months or longer and meets one or both of the following tests: it places limitations on self-care, independent living, and social interactions; and it results in the need for ongoing intervention with medical products, services, and special equipment.¹⁴

Infection—This group included all patients with an ED discharge diagnosis of infection based on a previously published list of ICD-9-CM codes that identified infections particularly relevant to elderly people.¹⁵ Specific infections and associated codes included in this diagnosis group were cellulitis (681xx, 682xx, 683, 686xx); influenza (487x); pneumonia (481, 482xx, 483xx, 485, 486); ear, nose, or throat infection (382xx, 462, 463, 465x, 4721); urinary tract infection (590xx, 5990, 5950, 5970, 5978, 6010, 6012, 6013); and bronchitis (4660x, 490xx).

Non-MSK Symptom—This group included all ICD-9-CM codes that represented symptoms (other than musculoskeletal) rather than precise diagnoses. Because these codes are frequently restatements of the patient's presenting complaint (e.g., chest pain or cough), they were grouped together based on the hypothesis that they may represent diagnostic uncertainty on the part of the coding provider. All codes within this ICD-9-CM category (780xx–799xx) were included in the non-MSK symptom group.

Unclassified—All ICD-9-CM codes that did not fit into one of the above-mentioned four diagnosis categories were grouped together and designated “unclassified.”

Adverse Health Outcomes

The primary dependent variable was time to first adverse health outcome, defined as hospital admission or death, within 30 days of the index ED visit. The 30-day time frame was chosen to reflect the period during which adverse events were most frequent⁴ and most likely to be related to the index ED visit. Hospital admission and death were considered together, because there were insufficient numbers of events to permit separate analyses of deaths.

Covariates

Models were adjusted for sociodemographic variables and factors that have previously been shown to be important independent predictors of adverse health outcomes in this population;⁴ age, sex, race (white vs nonwhite), annual income (above or below the poverty line, defined as \$10,000), living arrangements (alone vs with others), health insurance status (Medicaid vs other), number of instrumental activity of daily living deficiencies (0–6), number of pre-existing comorbidities (0–10), recent outpatient ED visits (last 6 months, yes or no), and recent hospital admissions (last 6 months, yes or no). The number of comorbidities was determined according to a simple count of respondent endorsements of 10 clinical conditions: coronary heart disease, hypertension, stroke, cancer, diabetes mellitus, arthritis, Alzheimer's disease, osteoporosis, Parkinson's disease, and emphysema. All covariates were taken from survey data that patients provided before their ED visit.

Analysis

Sample weights were applied (all proportions presented are weighted), and statistical procedures that accounted for the complex sampling design of the MCBS were used for all analyses.¹⁶ Cox proportional hazards regression models were used to examine the relationship between discharge diagnosis group and event hazards. Individual models were constructed with each diagnosis group as an independent variable. (Separate models were fitted for each diagnosis group.) These analyses were designed to compare the risk of each discharge diagnosis group with those of all others. All models were constructed in two steps; first, only the independent and dependent variables were entered into the model to estimate crude hazards, and then models were adjusted for all of the covariates described above. Results were expressed as hazard ratios (HRs) and 95% confidence intervals (CIs). Analyses were conducted using STATA version 10 (StataCorp, College Station, TX).

Results

ED Discharge Diagnosis Groups

Of 1,851 patients, 1,521 (82.2%) were assigned to one of the four prespecified ED discharge diagnosis groups based on the primary ICD-9-CM disposition code associated with the visit. Injury or MSK was the largest group (31.4%), followed by non-MSK symptom (22.2%), chronic condition (20.9%), and infection (7.8%). Three hundred thirty patients (17.8%) had

ED discharge diagnoses that were unclassified. Table 1 lists the five most common diagnoses within each category.

Patient Characteristics

Selected patient characteristics are presented in Table 2. Patients in the injury or MSK diagnosis group were older and more likely to be white and female. They were more likely to live alone but less likely to have low income or Medicaid insurance. Patients in the chronic condition diagnosis group more often had low annual income and Medicaid insurance and reported a higher number of preexisting comorbidities and functional impairments. Patients with infection were more likely to be nonwhite and to have Medicaid insurance than others in the sample. Previous outpatient ED visits and hospitalizations were significantly less common in the injury or MSK group and more common in the chronic condition diagnosis group. Women were more likely to have an unclassified ED discharge diagnosis; otherwise, there were no significant differences between patients in the non-MSK symptom group and the unclassified group and all others.

Relationship Between ED Discharge Diagnosis Group and Adverse Health Outcomes

Overall, 234 patients (11.5%) were hospitalized or died within 30 days of ED discharge (Table 3). The adverse event rate was lowest in patients in the injury or MSK group (9.1%) and highest in patients seen in the ED for a chronic condition (20.9%). Of the five most common diagnoses in the chronic condition group, the adverse event rate was highest in patients diagnosed with heart failure (7/32, 21.9%) and cardiac dysrhythmia (7/28, 25%). In adjusted analyses, a discharge diagnosis of injury or MSK condition was associated with lower risk of subsequent adverse health outcomes (HR = 0.69, 95% CI = 0.50–.96) than all other diagnosis groups. Patients seen in the ED for chronic conditions were at greater risk of adverse outcomes (HR = 1.86, 95% CI = 1.37–2.52) than all other diagnosis groups. There were no significant differences in risk in patients with infections or non-MSK symptoms and those in the unclassified discharge diagnosis group.

Discussion

These data demonstrate that ED discharge diagnosis is an important predictor of adverse health outcomes in older patients, even after taking into account sociodemographic level and baseline health status. In this study, one in five Medicare beneficiaries who was discharged from the ED with a diagnosis classified as a chronic condition was admitted to the hospital or died within 30 days. Older patients with outpatient ED visits for chronic conditions had nearly double the risk of subsequent adverse health outcomes as persons of similar age and health status with ED visits for other reasons.

The ED diagnosis groups developed for this study were effective at classifying the majority of ED discharge diagnoses (82%). Although a different system, known as the Clinical Classification System (CCS), led to greater coverage of ED discharge diagnoses (99%), there were more than 100 resultant diagnosis groups using this method.¹⁰ One group of investigators used only the 10 most common ED diagnosis groups identified by the CCS to make comparisons across groups more feasible, but this caused coverage to drop to 56%.¹⁷ The ED diagnosis groups described in this study provide an alternative method for clustering diagnoses with clinically important similarities into a discrete number of groups so that the influence of ED discharge diagnosis on patient outcomes can be more easily examined.

The proportion of patients assigned to each of the ED diagnosis groups in this study is approximately similar to data reported from the National Hospital Ambulatory Medical Survey (NHAMCS), a national probability sample of nonfederal, general, and short-stay hospitals

conducted by the National Center for Health Statistics.¹⁸ Overall, 21% of ED discharge diagnoses in older Medicare beneficiaries were classified as chronic conditions in the current study, slightly higher than the 16% reported by NHAMCS. The facts that NHAMCS was reporting on all adults aged 18 and older (vs 65 in this study) and that only a limited number of conditions were considered in making their count probably explains this difference.¹⁸ In subjects aged 65 to 74, the NHAMCS reported that the most frequently diagnosed major disease categories were injuries and poisonings (25%) and symptoms, signs, and ill-defined conditions (19%), also similar to the findings reported herein. The NHAMCS reported that only 3% of ED diagnoses were in the infectious and parasitic disease category, although as noted earlier, this ICD category excludes many infections that are classified elsewhere according to affected organ system.

The authors are unaware of previous, national data comparing outcomes for older patients according to ED discharge diagnosis group. Although the importance of discharge diagnosis for predicting subsequent outcomes has face validity for many clinicians, there have been few studies to confirm its value. The current study demonstrates that discharge diagnosis adds additional valuable information to baseline patient sociodemographic and health characteristics. Older patients with an outpatient ED visit for a chronic condition had greater risk of subsequent adverse outcomes than persons of similar age and health status with ED visits for other reasons. There are a number of plausible explanations for these findings. ED visits for chronic conditions may reflect lack of access to timely or appropriate outpatient care or disease management programs, which consequently negatively affects outcomes.^{19,20} Alternatively, patients presenting to the ED because of a chronic condition may be fundamentally sicker than their counterparts in some unmeasured way. These issues cannot be addressed within the context of the current study but are important areas for future inquiry.

In this sample, older patients with injuries or MSK conditions were at the lowest risk of hospitalization or death within 30 days of discharge, although the frequency of adverse events in this group was notable (9%). There were no significant differences in risk found between patients with infections, non-MSK symptoms and the unclassified group. Non-MSK symptoms were grouped together based on the hypothesis that these codes were used in cases when a degree of diagnostic uncertainty was present, but this may not have been the case. In the absence of operational criteria for when certain diagnostic codes are to be applied, it is impossible to account for provider and group tendencies for coding practices. At least three previous clinical studies have also failed to detect a relationship between nonspecific or ill-defined diagnoses and outcomes.^{1,21,22}

A number of limitations affect interpretation of this study's findings. First, diagnosis codes were taken from administrative data (Medicare billing records) and not abstracted from clinical charts. Any classification system based on diagnosis codes is subject to the same limitations; namely, there are multiple ways to code the same diagnosis and differences in provider coding practices.²³ For diagnoses in the chronic condition group, it was not possible to determine whether these were initial diagnoses or exacerbations of existing diseases. Efforts to standardize coding practices would improve the precision of future research in this field. Second, approximately 18% of primary diagnosis codes in this sample were not classified within one of the four prespecified discharge diagnosis groups. The number of discharge diagnosis groups in this study was intentionally limited so that the groups would remain mutually exclusive and be large enough to allow comparisons of risk across groups, but future work is needed to revise diagnosis categories to include as many codes as possible.

Despite these limitations, these data represent an important first step toward understanding the relationship between ED discharge diagnosis and adverse health outcomes in older patients.

Interventions targeting older adults discharged from the ED with “high-risk” diagnoses may improve health outcomes for this vulnerable population. For example, in the current study, heart failure was one of the chronic conditions associated with a significant risk of hospitalization or death in the 30 days after discharge from the ED. Chronic care management programs that employ multidisciplinary teams and in-person communication have been shown to reduce hospital readmission in patients with heart failure.²⁴ Thus, outpatient ED visits for heart failure could be used to identify patients for enrollment in intensive disease-management programs. Other studies have demonstrated that geriatric nursing assessment and home-based services can reduce functional decline in high-risk elderly people after an ED visit, although their effect on health service use has been mixed.^{25–27} Using discharge diagnosis as an additional factor in targeting patients for these types of supportive interventions after ED discharge may enhance the effectiveness of these programs.

By some estimates, older patients will account for one in four of all ED visits by 2030.²⁸ If current trends continue, as many as two-thirds of these patients will be discharged from the ED.¹⁷ ED discharge is well recognized as a potentially problematic transition of care for older adults.

ED discharge diagnosis may improve existing methods of identifying individuals at high risk for problems after ED discharge and may inform the development of targeted interventions to reduce adverse health outcomes in this vulnerable population.

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Table 1
Emergency Department (ED) Discharge Diagnoses (N = 1,851)

ED Discharge Diagnosis Group, * n (% of total)	n (% of Group)
Injury or MSK, 582 (31.4)	
Fracture (any site)	120 (20.6)
Open wound (any site)	113 (19.4)
Contusion or abrasion (any site)	111 (19.1)
Other back pain or sprain	67 (11.5)
Other extremity pain or sprain	62 (10.7)
Non-MSK symptom, 410 (22.2)	
Chest pain	78 (19.0)
Abdominal pain	59 (14.4)
Dizziness	35 (8.5)
Epistaxis	32 (7.8)
Syncope	31 (7.6)
Chronic condition, 387 (20.9)	
Chronic obstructive pulmonary disease or asthma	53 (13.7)
Congestive heart failure	32 (8.3)
Hypertension	31 (8.0)
Diabetes mellitus or hypoglycemia	30 (7.8)
Cardiac dysrhythmia	28 (7.2)
Infection, 142 (7.8)	
Urinary tract infection	50 (35.2)
Bronchitis	39 (27.5)
Pneumonia	19 (13.4)
Cellulitis	17 (12.0)
Ear, nose, and throat infection	11 (7.7)
Unclassified, 330 (17.8)	
Fluid or electrolyte disorder	21 (6.7)
Noninfectious gastroenteritis	17 (5.2)
Constipation	17 (5.2)
Gastrointestinal foreign body	14 (4.2)
Herpes zoster	11 (3.3)

* Data shown for five most common diagnoses in each group.

MSK = musculoskeletal.

Table 2
Selected Characteristics of Medicare Beneficiaries with at Least One Outpatient Emergency Department (ED) Visit According to ED Discharge Diagnosis Group (N = 1,851)

Characteristic	Whole Sample, N = 1,851	Injury/MSK, n = 582	Non-MSK Symptom, n = 410	Chronic Condition, n = 387	Infection, n = 142	Unclassified, n = 330
Age, mean (SE)	77.3 (0.14)	77.8 (0.26)*	77.1 (0.34)	77.2 (0.35)	77.7 (0.55)	76.8 (0.38)
Female, n (%)	1,138 (61.8)	381 (65.9)*	261 (65.0)	239 (61.5)	89 (62.0)	168 (50.6)*
Nonwhite race, n (%)	269 (13.5)	67 (10.6)*	53 (12.2)	69 (16.2)	32 (21.6)*	48 (13.4)
Annual income < \$10,000, n (%)	451 (22.3)	121 (19.0)*	94 (20.9)	120 (28.6)*	40 (26.2)	76 (20.5)
Living alone, n (%)	652 (33.7)	230 (37.6)*	135 (32.1)	131 (32.0)	52 (35.6)	104 (29.7)
Medicaid insurance, n (%)	386 (19.7)	101 (16.3)*	79 (18.3)	104 (25.0)*	39 (27.1)*	63 (17.9)
Number of pre-existing comorbidities, mean (SE) [†]	2.13 (0.04)	2.05 (0.06)	2.16 (0.07)	2.38 (0.09)*	2.15 (0.12)	1.94 (0.07)*
Coronary heart disease	613 (32.9)	181 (31.1)	135 (34.7)	50 (36.1)	149 (36.0)	98 (28.3)
Hypertension	1,170 (62.5)	354 (60.5)	268 (63.4)	261 (65.9)	99 (70.7)*	188 (57.0)*
Stroke	281 (14.4)	78 (12.2)	63 (14.4)	72 (18.3)	27 (17.8)	41 (11.9)
Cancer	386 (21.1)	112 (19.7)	90 (21.7)	91 (24.0)	22 (15.5)	71 (21.8)
Diabetes mellitus	409 (22.1)	117 (20.7)	98 (24.0)	102 (26.9)*	35 (23.1)	57 (15.8)*
Arthritis	200 (10.8)	76 (13.2)	36 (9.0)	33 (8.9)	14 (9.4)	41 (11.6)
Alzheimer's disease	68 (3.2)	19 (2.8)	15 (3.3)	17 (3.7)	6 (3.9)	11 (2.8)
Osteoporosis	356 (19.7)	122 (22.0)	89 (21.6)	73 (19.8)	19 (14.6)	53 (15.4)*
Parkinson's disease	29 (1.6)	12 (2.1)	4 (0.9)	8 (2.0)	2 (1.6)	3 (1.2)
Emphysema	328 (18.0)	90 (16.0)	59 (15.0)	99 (25.9)*	19 (13.9)	61 (17.8)
Number of instrumental activity of daily living deficiencies, mean (SE)	1.09 (0.06)	1.06 (0.07)	1.07 (0.09)	1.27 (0.10)*	1.18 (0.14)	0.91 (0.09)*
Outpatient ED visit within previous 6 months, n (%)	131 (6.7)	27 (4.3)*	22 (5.4)	45 (11.3)*	10 (6.8)	27 (7.3)
Hospitalization within previous 6 months, n (%)	344 (18.2)	81 (12.9)*	84 (20.9)	86 (22.0)*	19 (13.2)	74 (21.6)

* $P < .05$ vs the remainder of the sample.

[†]Based on survey respondent's endorsements of the presence of the 10 conditions that follow.

MSK = musculoskeletal; SE = standard error.

Table 3
Relationship Between Emergency Department (ED) Discharge Diagnosis Groups and Hospitalization or Death within 30 Days of Index ED Visit (N = 1,851)

ED Discharge Diagnosis Group	n (weighted %)		Hospitalization or Death	
	Hospitalization	Death	HR (95% Confidence Interval)	
			Unadjusted*	Adjusted†
Injury or MSK (n = 582)	54 (9.0)	1 (0.09)	0.63 (0.46–0.86)	0.69 (0.50–0.96)
Non-MSK symptom (n = 410)	43 (11.2)	3 (0.9)	0.94 (0.65–1.37)	0.93 (0.64–1.34)
Chronic condition (n = 387)	68 (18.0)	11 (2.9)	2.08 (1.56–2.79)	1.86 (1.37–2.52)
Infection (n = 142)	16 (10.9)	0	0.85 (0.50–1.44)	0.93 (0.54–1.61)
Unclassified (n = 330)	35 (9.9)	3 (0.7)	0.81 (0.56–1.15)	0.79 (0.55–1.12)

* Separate models were fitted for each diagnosis group; thus hazard ratios (HRs) are for each designated group compared with remainder of the sample.

† Adjusted for age, sex, race, income, living alone, insurance status, number of pre-existing comorbidities, number of instrumental activity of daily living deficiencies, outpatient ED visits, and hospitalization within the previous 6 months.

MSK = musculoskeletal.