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Identifying potentially preventable emergency department visits by nursing home residents in the United States

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Abstract

Objectives—To identify and describe potentially preventable emergency department (ED) visits by nursing home (NH) residents in the United States. These visits are important because they are common, frequently lead to hospitalization, and can be associated with significant cost to the patient and the health care system.

Design—Retrospective analysis of the 2005-2010 National Hospital Ambulatory Care Survey (NHAMCS), comparing ED visits by nursing home residents that did not lead to hospital admission (potentially preventable) to those that led to admission (less likely preventable).

Setting—Nationally representative sample of United States EDs; Federal hospitals and hospitals with less than six beds were excluded.

Participants—Older (age ≥65 years) nursing home residents with an ED visit during this time period.

Measurements—Patient demographics, ED visit information including testing performed, interventions (both procedures and medications) provided, and diagnoses treated.

Results—Older NH residents accounted for 3,857 of 208,956 ED visits during the time period of interest (1.8%). When weighted to be nationally representative, these represent 13.97 million ED

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visits, equivalent to 1.8 ED visits annually per NH resident in the United States. More than half of visits (53.5%) did not lead to hospital admission; of those discharged from the ED, 62.8% had normal vital signs on presentation and 18.9% did not have any diagnostic testing prior to ED discharge. Injuries were 1.78 times more likely to be discharged than admitted (44.8% versus 25.3%, respectively, $p<0.001$), while infections were 2.06 times as likely to be admitted as discharged (22.9% versus 11.1%, respectively). CT scans were performed in 25.4% and 30.1% of older NH residents who were discharged from the ED and admitted to the hospital, respectively, and more than 70% of these were CTs of the head. NH residents received centrally acting, sedating medications prior to ED discharge in 9.4% of visits.

Conclusion—This nationally representative sample of older nursing home residents suggests ED visits for injury, those that are associated with normal triage vital signs, and those that are not associated with any diagnostic testing are potentially preventable. Those discharged from the ED often undergo important testing and receive medications that may alter their physical exam on return to the nursing facility, highlighting the need for seamless communication of the ED course to nursing homes.

Keywords

preventable emergency visit; nursing home resident; emergency department utilization

INTRODUCTION

Emergency department (ED) visits and subsequent hospital admissions from nursing homes are common -- nursing home residents account for more than 2.2 million ED visits annually[1,2]-- and many may be preventable.[3–10] For example, a structured review of hospital admissions by nursing home clinicians found 67% were potentially avoidable;[8] using ambulatory-care sensitive conditions as a marker of preventable admissions identified 25-40% of ED visits as preventable.[4,9] A recent report conducted by the Office of the Inspector General (OIG) found 22% of Medicare beneficiaries experienced an adverse event leading to harm (usually hospital admission) during a skilled nursing stay, and that 60% of these were considered preventable by physician reviewers if better care processes had been employed.[11]

Identifying preventable ED visits among nursing home residents is therefore of significant importance to older adults, clinicians caring for them, and policy-makers in a cost-constrained environment.[2,12] However, a recent white paper published by the Long Term Quality Alliance (LTQA), an association of the nation's experts in long-term care, found most efforts to establish preventability (including the reports cited above) rely on retrospective, in-depth chart review better suited to root cause analysis than establishing national norms. This report highlighted the need for nationally-representative data that would inform stakeholders about preventable ED and hospital use, and particularly noted the need for evaluation of ED decision-making.[12] In particular, little is known about what testing and treatment NH residents receive in the ED prior to discharge.

One way to shed light on potentially preventable ED visits nationally is to compare nursing home residents seen in the ED who are discharged back to the nursing facility with those

who are admitted to the hospital from the ED. Clearly, not all ED visits leading to ED discharge are preventable, and even some ED visits leading to hospitalization may have been preventable. However, this comparison identifies an enriched cohort of potentially preventable ED visits, and describes important differences between these visits and those that lead to hospital admission. We sought to describe ED visits among nursing home residents using the 2005-2010 National Hospital Ambulatory Medical Care Survey (NHAMCS).

METHODS

Study Design and Setting

This was a secondary analysis of the NHAMCS, an annual national probability sample survey of ED visits conducted at general and short-stay hospitals across the United States by the National Center for Health Statistics (NCHS). Federal hospitals and hospitals with less than six operating beds are excluded. The NHAMCS uses a four-stage probability design, identifying 1900 primary sampling units across the country, then sampling hospitals from within each primary sampling unit, Emergency Departments and clinics within that hospital, and patients who visited these care locations. Data were collected using a standardized data abstraction form, which was similar between the study years. During 2005-2010, an average of 409 hospitals (range: 396-414) per year were selected for participation and 368 participated (90.0%), producing 34,826 ED records annually on average for a total 208,956 records during the study period.

Our study received institutional review board approval as an exempt protocol with a waiver of informed consent.

Study Protocol

We restricted our analysis to ED visits by nursing home residents 65 years of age or older (n=4032; 1.84% of total dataset). Beginning in 2005, NHAMCS identified patient residence in nursing homes as separate from other institutions (prisons, mental hospitals, group homes). In our cohort, the 56 nursing home residents who died in the ED and another 119 who died in the hospital were excluded from the analysis (final n=3857). We then split the total cohort into visits followed by ED discharge and those followed by hospital admission. We chose to include observation stays (7% of cohort) with those that resulted in hospital admission as these patients were also felt by ED providers to require further hospital monitoring and/or treatment.

We analyzed the following variables recorded by trained NCHS abstractors: patient demographic information (age, sex, race/ethnicity), hospital region, triage acuity (emergent, urgent, semi-urgent/non-urgent), initial/triage vital signs (pulse, temperature, systolic blood pressure, respiratory rate, oxygen saturation), prior utilization (ED visit in last 72 hours or last 12 months, hospital discharge in last 7 days), and median hospital length of stay. We categorized primary provider diagnosis for the ED visit using the Agency for Healthcare Research and Quality's Clinical Classification Software (CCS) categories[13] to aggregate ICD-9 codes into clinically relevant groups. Infections were coded as CCS categories 1-9,

76-78, 122-126, 135, 142, 148, 159, 201, and 246-8. Injuries are captured by a distinct NHAMCS data element that also includes accidental poisonings and medication overdoses.[14] We categorized time of day of ED visit into during normal business hours (9am to 5pm, Monday through Friday) or outside normal business hours.

We also evaluated the frequency and type of diagnostic testing in the ED, including blood and urine testing and imaging tests. We collected information about procedures performed in the ED (which included intravenous hydration, casting or splinting, wound repair, incision and drainage, foreign body removal, nebulizer therapy, bladder catheterization, pelvic examination, central line placement, performance of cardiopulmonary resuscitation or endotracheal intubation). Finally, we evaluated the frequency with which anxiolytics, sedatives, and hypnotics, opioid analgesics, and antipsychotics were administered in the ED and prescribed on ED discharge since these medications may have significant adverse cognitive effects in older adults, affecting evaluation in the nursing home after discharge. Variables with >5% missing data were coded as a separate “Missing” category; if <5% “missingness”, these observations were excluded for that variable.

Statistical Analysis

The primary analysis was descriptive, reporting 95% confidence intervals (CIs). We analyzed clinical characteristics, diagnoses treated, testing performed, and treatment given (including procedures and medications) within the two groups of nursing home patients (those admitted to the hospital, those not admitted to the hospital). We compared groups using t-tests or Chi-Square tests (including contingency tables) as appropriate for continuous or categorical variables, respectively. We performed the statistical analyses using Stata 10.0 (StatCorp, College Station, TX) and used survey commands to adjust for the complex survey design and weight the sample to provide estimates for all U.S. ED visits.

RESULTS

Overall, 2,025 (53.5%, 95% CI 50.7-56.3) ED visits by nursing home residents were followed by ED discharge while 1,832 (46.5%, 95% CI 43.7-49.3) led to hospital admission, nationally representative of 7.5 million ED visits leading to discharge and 6.5 million leading to hospital admission, respectively (Table 1). Overall, these 14 million ED visits over the time period correspond on average to 1.8 ED visits per nursing home resident per year.[15] More than 70% of all nursing home residents presenting to the ED had been to the ED in the prior 12 months. Previous visits to the ED within 72 hours or a hospital discharge in the last 7 days were uncommon in both groups, though both measures had substantial missing data.

Age, gender, and race/ethnicity were not significantly different between patients admitted and those discharged from the ED (Table 1). Patients in this cohort admitted from the ED had a median hospital length of stay of 7.1 days (interquartile range 6.8-7.5). In contrast, the median length of stay for all adults over age 65 in the United States in 2011 was 4.0 days.[16] Only 248 of the 1832 visits (13.5%) leading to admission subsequently had short hospital stays (≤2 days, data not shown).

The pattern of primary diagnoses treated in the ED were quite different between visits followed by discharge from the ED and those leading to hospital admission (Table 2), though injuries (58.7%) and infections (48.6%) were the most common diagnostic groups in both cohorts. Visits followed by ED discharge were more frequently characterized by treatment for injuries (44.8% vs. 25.3%, $p<0.001$); visits leading to admission were more likely to be treated for infection (22.9% vs. 11.1%, $p<0.001$). There was a similar frequency of discharge from the ED outside usual business hours (51.2% vs. 50.4% of visits seen outside of business hours were discharged from the ED or admitted, respectively, $p=0.88$). There was no significant difference in the number of injuries presenting outside business hours leading to ED discharge or hospital admission (54.7% vs 49.3%, $p=0.16$)

Overall, 62.8% of visits followed by ED discharge had normal vitals at triage compared to 41.8% of visits leading to hospital admission ($p<0.001$). Normal vital signs were particularly common in visits characterized by treatment for an injury; 47.6% of visits followed by ED discharge had an injury with normal triage vital signs, compared to 25.7% of visits with an injury and normal vitals leading to hospital admission ($p<0.001$, data not shown). In contrast, few visits characterized by normal triage vital signs were treated for infections (7.9% and 14.1% were discharged and admitted, respectively).

Testing was common in visits followed by ED discharge and hospital admission, though 18.9% of visits leading to ED discharge had no diagnostic testing at all; imaging tests were more common than blood and urine tests in visits followed by ED discharge (Table 3). Computed tomography (CT) scans were performed in more than a quarter of all nursing home resident visits to the ED; the vast majority of these (78% in those discharged, 70% in those admitted) were head CTs, which did not differ in frequency between visits leading to ED discharge and hospital admission. MRI and ultrasound studies were uncommon in all groups (overall 0.6% had an MRI, 2.2% had an ultrasound). Patients who did not undergo any diagnostic testing did not fall into any particular diagnostic group (data not shown).

While 19.4% of visits by nursing home residents followed by hospital admission were preceded by urinary catheter placement in the ED, 9.0% of visits followed by ED discharge also were characterized by catheter placement (Table 3). Anxiolytics/sedatives, narcotic analgesics, and antipsychotics were administered during 14.5% of ED visits (anxiolytics/sedatives, 4.4%; narcotics, 9.6%; antipsychotics 0.5%) and prescribed to patients to take at the nursing home after 9.4% of visits (2.2%; 6.8%; 0.4% respectively).

DISCUSSION

ED visits from NHs were frequent (1.8 ED visits per year per nursing home resident in the United States, on average), and more than half did not lead to hospital admission. This is particularly notable given nursing home residents are more than twice as likely to be admitted to the hospital as ambulatory older adults.[1] Taken at face value, it is striking that ED visits more commonly led to discharge than admission, that nearly 2/3 of nursing home patient ED visits were characterized by normal triage vital signs, and that nearly 1 in 5 of ED visits had no diagnostic testing performed prior to ED discharge.

Visits to the ED characterized by normal vital signs on presentation and treatment for an injury account for 21.3% of all visits by nursing home residents followed by ED discharge and only 6.5% of visits followed by hospital admission. Efforts to prevent falls and injury in nursing homes are prevalent and important, but have not consistently resulted in reductions in falls or injury.[17] It is likely that some falls in nursing home residents are not preventable[18] and will continue to occur despite these efforts. In striking contrast to the substantial literature on fall prevention, there is little to no evidence regarding best practices in evaluating a fall or related injury in a nursing home resident. Given a minority of patients experience significant injury,[19] developing evidence-based algorithms that accurately predict occult significant injury is a critical and under-addressed gap in the literature that could result in substantially fewer ED visits in nursing home residents.

In particular, it seemed many injuries were evaluated with a head CT to rule out more significant injury. Of note, four of the six commonly-used clinical decision instruments used for assessing the need for head imaging in the setting of injury include age (>60 or 65 years) as a criterion.[20] Further stratification or novel rules derived in older populations may reduce the need for head imaging and reduce ED visits and hospital admissions in the nursing home population.

Demographic factors and previous ED use were not useful for distinguishing the groups. Our hypothesis was that older patients would be less likely to be discharged from the ED; instead the proportion admitted and not admitted to the hospital was very similar within each age group category of our analysis. Similarly, race and gender did not reliably distinguish between those admitted and those that were not, though the majority of the patients were considered non-Hispanic white.

Nearly 1 in 5 visits followed by ED discharge had no blood, urine, or diagnostic imaging tests performed in the ED. Many clinicians would agree that a population of nursing home residents who do not undergo diagnostic testing and are discharged from the ED represent potentially preventable ED visits. On the other hand, the fact that more than 80% of non-admitted nursing home residents undergo testing, particularly diagnostic imaging, underscores the importance of communication between hospitals and nursing facilities, which is frequently inadequate.[21,22] Similarly, high-risk medications are commonly administered in the ED and on ED discharge in non-admitted patients. These are known to be high-risk in elderly patients and may result in alteration of cognitive and functional assessments on return to the nursing home, resulting in further hospital use.[23–25] Their use should be minimized and at a minimum communicated in discharged patients so a change in mental status or functional ability can be interpreted in this context by the nursing home provider.

This study should be interpreted in the context of its design. Data from NHAMCS is subject to possible errors in data collection and coding, though data collectors undergo rigorous training in the classroom and the field, and input of study data is subject to a 10% random sample cross-check. While administrative data has important strengths -- it is nationally representative both in terms of hospitals and patients, and standardized data collection is less prone to errors -- it also has important limitations in terms of important unmeasured

variables that may affect our findings. These include clinician bedside impression, family insights or concerns, results of diagnostic testing, and outcomes after the ED visit for discharged or admitted patients. We were unable to capture important temporal trends in ED visits by nursing home patients due to the relatively low frequency with which they are sampled by NHAMCS year to year.

Further, it is important to reiterate that not all ED visits followed by discharge are preventable, and not all ED visits leading to hospital admission are non-preventable. However, our low rate of short-stay hospitalizations (13.5%) and overall 7.1 day median length of stay among those admitted may be reassuring that many nursing home residents required hospitalization for evaluation and treatment.

CONCLUSIONS

This nationally-representative sample identifies several areas of potentially preventable ED visits, including visits associated with injury, normal triage vital signs, and visits not associated with diagnostic testing. These findings may complement important efforts already underway to reduce preventable ED visits and hospital admissions in nursing home residents.[3,5,26] Future work based on these findings includes: 1) developing evidence-based algorithms that accurately predict fall-related injury in nursing home residents that could be used at the point of care to help decide whether ED transfer is needed; 2) developing clinical prediction rules that accurately identify serious head injury in older adults to reduce need and improve accuracy of CT scanning; 3) reviewing Emergency Department records to identify nursing home residents who did not undergo any diagnostic testing, and the circumstances of these visits. Our findings also highlight the importance of improving ED-nursing home communication as nursing home residents often undergo testing and receive treatments (including centrally-acting, sedating medications) in the ED that have implications for evaluation and subsequent care in the nursing home.

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Table 1

Characteristics of U.S. emergency department visits by nursing home residents

Characteristics	Discharged N=2025 (unweighted) N=7,476,662 (weighted) % (95%CI)	Admitted N=1832 (unweighted) N=6,494,811 (weighted) % (95%CI)	Difference p-value
Patient Characteristics			
Age, years			0.90
65-79	32.5 (29.2-35.9)	32.5 (29.6-35.6)	
80-89	45.6 (42.3-49.0)	46.0 (43.8-48.2)	
≥90	21.9 (19.5-24.5)	21.5 (19.9-23.2)	
Female sex	62.1 (59.0-65.0)	63.1 (60.2-65.9)	0.65
Race/ethnicity			0.39
Non-Hispanic White	78.6 (75.4-81.5)	76.7 (73.0-80.0)	
Non-Hispanic Black	15.0 (12.6-17.9)	16.4 (13.5-19.8)	
Hispanic	4.6 (3.3-6.5)	4.4 (3.1-6.3)	
Other	1.7 (1.1-2.7)	2.5 (1.5-4.1)	
ED visit in last 72 hours			**0.011**
Yes	3.9 (3.0-5.2)	2.9 (2.0-4.0)	
No	79.5 (75.3-83.1)	85.3 (82.3-87.8)	
Missing	16.6 (13.1-20.8)	11.9 (9.4-15.0)	
ED visits in last 12 months			0.95
None	29.5 (24.7-34.8)	29.7 (25.3-34.5)	
≥1	70.5 (65.2-75.3)	70.3 (65.5-74.7)	
Discharge in last 7 days			0.23
Yes	3.5 (2.8-4.5)	5.0 (3.7-6.5)	
No	60.8 (55.8-65.7)	58.3 (52.9-63.6)	
Missing	35.6 (30.9-40.6)	36.7 (31.3-42.5)	
Visit Characteristics			
Triage acuity			**<0.001**
Emergent	19.1 (16.2-22.4)	32.3 (29.0-35.7)	
Urgent	46.1 (42.5-49.6)	46.2 (42.8-49.5)	
Semi-urgent/non-urgent	23.8 (21.3-26.5)	12.7 (10.5-15.2)	
Missing	11.0 (8.4-14.3)	8.9 (6.9-11.5)	
Vital signs			
Any abnormalities	37.2 (33.6-40.9)	58.2 (54.1-62.2)	**<0.001**
Pulse ≤60 or ≥100	15.2 (13.2-17.5)	26.8 (23.7-30.1)	**<0.001**
SBP ≤90 or ≥180	13.3 (11.7-15.1)	17.4 (15.5-19.5)	**0.001**
Temp ≤97 F or ≥101 F	15.9 (13.7-18.5)	20.8 (18.3-23.7)	**0.002**
Respiratory rate ≥20*	15.7 (13.2-18.6)	30.2 (27.1-33.6)	**<0.001**
O2 Saturation <93%*	11.0 (9.1-13.2)	18.6 (16.3-21.2)	**<0.001**
Hos LOS, median day (IQR)		7.1 (6.8-7.5)	

*Respiratory rate values were available in NHAMCS 2007-2010, and O2 (oxygen) saturation 2006-2010. Discharge in last 7 days connotes hospital discharge in the prior 7 days before ED presentation. ED = Emergency Department, SBP = systolic blood pressure, Temp = temperature, LOS = length of stay, Hos = hospital.

Table 2

Diagnoses treated during nursing home resident emergency department visits

Primary provider diagnosis	Discharged % (95%CI)
Injury (overall, aggregated)	44.8 (41.8-47.9)
Infection (overall, aggregated)	11.1 (9.2-13.3)
Specific diagnoses:	
Superficial injury, contusion	10.5 (8.9-12.4)
Open wound	4.8 (3.7-6.3)
Urinary tract infection	4.4 (3.4-5.7)
Other injury	4.1 (3.1-5.5)
Other gastrointestinal disorders	4.0 (3.1-5.2)
Residual codes; unclassified	3.3 (2.6-4.3)
Other lower respiratory disease	2.6 (1.8-3.7)
COPD	2.6 (1.6-4.0)
Abdominal pain	2.6 (1.7-3.3)
Pneumonia, not caused by TB	2.2 (1.4-3.6)

Primary provider diagnosis	Admitted % (95%CI)
Injury (overall, aggregated)	25.3 (22.7-28.2)
Infection (overall, aggregated)	22.9 (20.3-25.8)
Specific diagnoses:	
Pneumonia, not caused by TB	9.3 (7.6-11.2)
Urinary tract infection	7.2 (5.6-9.2)
Residual codes; unclassified	5.6 (4.3-7.2)
Fluid and electrolyte disorder	5.0 (3.8-6.4)
Congestive heart failure; nonhypertensive	4.4 (3.4-5.8)
Nonspecific chest pain	4.1 (2.9-5.9)
Other lower respiratory disease	3.6 (2.8-4.7)
Gastrointestinal hemorrhage	3.3 (2.4-4.4)
Septicemia	3.1 (2.2-4.5)
Syncope	2.9 (2.0-4.0)

The 10 most commonly treated conditions (recorded as the primary diagnosis for the visit given by the ED provider) for discharged and admitted visits are listed; diagnoses represent CCS classifications aggregating ICD-9 codes. Injuries are taken from a separate data element in NHAMCS; infections are an aggregate of relevant CCS codes (1-9, 76-78, 122-126, 135, 142, 148, 159, 201, and 246-8).

Table 3

Testing and treatment of nursing home residents in the emergency department

	Discharged % (95%CI)	Admitted % (95%CI)	Difference p-value
Tests performed			
Any blood, urine, or imaging tests	81.1 (79.0-83.1)	96.4 (94.4-97.8)	**<0.001**
Blood or urine tests in ED			**<0.001**
None	41.4 (38.9-44.1)	6.6 (4.8-9.1)	
1-2	21.6 (18.6-24.9)	18.1 (15.2-21.5)	
3-5	26.1 (23.6-28.8)	43.4 (39.5-47.3)	
6-10	10.9 (9.1-13.0)	31.9 (28.2-35.9)	
Imaging tests in the ED	66.3 (63.3-69.1)	80.1 (77.1-82.8)	**<0.001**
Computed tomography (CT) scan	25.4 (22.6-28.4)	30.1 (26.8-33.5)	**0.012**
CT head*	19.7 (17.0-22.7)	21.2 (17.9-25.0)	0.46
Procedures performed			
Total number performed in ED			**<0.001**
0	41.4 (38.2-44.5)	15.7 (13.4-18.3)	
1	45.3 (42.7-48.0)	55.8 (52.0-59.4)	
>1	13.4 (11.1-15.9)	28.5 (24.9-32.4)	
IV fluids	33.9 (30.6-37.5)	72.7 (69.1-76.0)	**<0.001**
Wound care	9.0 (7.4-11.0)	1.5 (0.9-2.3)	**<0.001**
Bladder catheter	9.0 (7.3-11.1)	19.4 (16.7-22.5)	**<0.001**
Medications administered in ED			
CNS agents			**0.006**
Anxiolytics/sedatives/hypnotics	4.4 (3.4-5.7)	7.1 (5.8-8.7)	
Analgesics	9.6 (8.2-11.2)	11.8 (10.0-13.8)	
Antipsychotics	0.5 (nc)	0.8 (0.5-1.3)	
Total number administered in ED, mean	0.9 (0.89-1.0)	2.0 (1.9-2.1)	**<0.001**
Medications prescribed on discharge			
CNS agents			
Anxiolytics/sedatives/hypnotics	2.2 (1.6-3.2)	-	
Analgesics	6.8 (5.6-8.3)	-	
Antipsychotics	0.4 (nc)	-	

NC = no count, meaning this cell is populated by less than 30 observations and considered unreliable by NHAMCS for national weighting. Procedures include those defined in the Methods (intravenous hydration, casting or splinting, wound repair, incision and drainage, foreign body removal, nebulizer therapy, bladder catheterization, pelvic examination, central line placement, performance of cardiopulmonary resuscitation or endotracheal intubation).

ED = Emergency Department, CT = computed tomography, IV = intravenous, CNS = central nervous system.

* Information on which anatomical location was targeted for CT scan only available 2007-2010.