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Older Adult Falls Seen by Emergency Medical Service Providers:

A Prevention Opportunity

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Abstract

Introduction—Among people aged ≥65 years, falling is the leading cause of emergency department visits. Emergency medical services (EMS) are often called to help older adults who have fallen, with some requiring hospital transport. Chief aims were to determine where falls occurred and the circumstances under which patients were transported by EMS, and to identify future fall prevention opportunities.

Methods—In 2012, a total of 42 states contributed ambulatory data to the National EMS Information System, which were analyzed in 2014 and 2015. Using EMS records from 911 call events, logistic regression examined patient and environmental factors associated with older adult transport.

Results—Among people aged ≥65 years, falls accounted for 17% of all EMS calls. More than one in five (21%) of these emergency 911 calls did not result in a transport. Most falls occurred at home (60.2%) and residential institutions such as nursing homes (21.7%). Logistic regression showed AORs for transport were greatest among people aged ≥85 years (AOR=1.14, 95% CI=1.13, 1.16) and women (AOR=1.30, 95% CI=1.29, 1.32); for falls at residential institutions or nursing homes (AOR=3.52, 95% CI=3.46, 3.58) and in rural environments (AOR=1.15, 95% CI=1.13, 1.17); and where the EMS impression was a stroke (AOR=2.96, 95% CI=2.11, 4.10), followed by hypothermia (AOR=2.36, 95% CI=1.33, 4.43).

Conclusions—This study provides unique insight into fall circumstances and EMS transport activity. EMS personnel are in a prime position to provide interventions that can prevent future falls, or referrals to community-based fall prevention programs and services.

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Introduction

Among people aged ≥65 years, falls are a leading cause of death and most frequent cause of emergency department (ED) visits for injury.[1] One in three older adults (aged ≥65 years) falls each year.[2] In 2012, a total of 2.4 million older adults were treated in EDs for falls and about 722,000 (30%) of those were hospitalized.[1]

Emergency medical services (EMS) are often called upon to help older adults who have fallen. Although many of these patients are transported to hospitals for evaluation and treatment, some are not transported because they are uninjured, sustain only minor injuries, or refuse transport. Studies involving EMS data from various countries show that 11%–56% of older adults who receive emergency treatment for a fall are not transported to a medical facility,[3] often because they did not sustain an injury.[4]

As the population ages, more older adults will fall, and the responsibilities of EMS to help these patients will also increase. Lowthian and colleagues[5] found that, between 1994 and 2008, the number of transports for older adults increased 75%. Their model forecasted continued and substantial growth in these numbers, largely because of falls among people aged ≥85 years.

Community paramedicine is a developing healthcare delivery model that increases access to basic services through the use of specially trained EMS providers in an expanded role.[6] Better information on transports for falls among older adults will help inform the states and localities on how best to shape a community paramedicine program.

Limited information is available about factors that influence whether or not an older adult is transported to a medical facility following a fall. The purpose of this study was to (1) describe the characteristics of older adults and locations of falls that were treated by EMS; and (2) identify the factors associated with the likelihood that an older adult would be transported following a fall. To date, no large-scale, multistate study in the U.S. has examined EMS data to answer these questions.

Methods

Data Source

This study used data from the 2012 National EMS Information System (NEMSIS). Complete or partial data contributed by 42 states were consolidated to create the NEMSIS data set, which contains nearly as many records as the nationally representative National Hospital Ambulatory Care Survey. Additional information on how NEMSIS was constructed is available.[7] This data set contains demographic data, basic 911 call information, details about the scene of injury or illness, administered medications, and other information recorded by EMS. The data set includes data from a convenience sample; data are not weighted to reflect national estimates. The 2012 NEMSIS data set contained 19.8 million records of EMS events, with most of the events prompted by 911 calls. For this study, a record was included if the dispatch complaint indicated a fall or if the EMS provider recorded the injury cause as a fall. Only EMS events prompted by 911 calls were included.

Variables and Analysis

The binominal dependent variable in the statistical model was whether or not the person was transported. The independent variables that were thought to influence the transport decision included demographic (age, gender); clinical (primary symptom, primary impression, EMS certification level); and EMS data (incident location and urbanization). The primary impression is the EMS provider's assessment of the patient's primary problem or most significant condition. EMS certification level was determined by the highest EMS provider level in the response team. The factors that influenced transport decisions were analyzed using logistic regression. The results of the multivariate logistic regression are presented as AORs with 95% CIs. All data were analyzed in 2014 and 2015 using SAS, version 9.3.

Results

In 2012, there were 4.3 million records of people aged ≥65 years in the NEMSIS data set. Among that group, falls accounted for 903,588 (17.4%) of the 911 calls attended by EMS (Table 1). Compared with non-fall events, the percentage of calls for falls increased for 10-year age group, from 12.7% among people aged 65–74 years to 22.6% among people aged ≥85 years. About 19.1% of the total EMS calls for women were for falls, compared with 15.0% of the calls for men.

The EMS events prompted by 911 emergency calls for older adults were dispatched mostly to personal residences/homes (60.2%) and residential institutions (21.7%) (Table 2). Other identified locations, such as businesses and streets or highways, accounted for <5% within each category.

Overall, 186,712 (20.7%) patients who fell were not transported, compared with 10.9% of no fall–related events. People aged <75 years were less likely to be transported than those aged ≥75 years of age. Women were more likely to be transported than men (66.7% and 32.8%, respectively). EMS calls increased as a function of age (24% for adults aged 65–74 years, 35.9% for those aged 75–84 years, and 40.1% for people aged ≥85 years).

The greatest number of falls occurred in urban areas. However, regardless of population density, the percentage of patients who were not transported was similar, between 19.5% and 22.6%. The majority of falls (69.5% of falls among people transported and 57.8% among those not transported) occurred at home, but 23.8% of people who fell at home were not transported. By contrast, only 7.9% of people who fell in residential institutions were not transported to a medical facility. The most common type of recorded EMS provider was Paramedic (Emergency Medical Technician [EMT]–Paramedic), who provided treatment to 80.8% of non-transported patients and 81.2% of transported patients. EMS providers record their primary impression for the EMS call. About 71.5% of people who were not transported had no observed injury or illness, compared with 40.1% of patients who were transported. About 23.0% of patients not transported had a provider impression of traumatic injury, compared with 47.8% of patients who were transported. The proportion with a provider impression of syncope or fainting was similar (3.1% not transported vs 4.0% transported). Other provider impressions, which encompassed numerous conditions including

hypoglycemia, abdominal pain, and cardiac distress, accounted <1.2% of total EMS events, regardless of transport status.

The most frequent reasons given for non-transport were that patients refused care (57.0%); were given emergency treatment and released (20.9%); and that no treatment was required (19.2%).

Logistic regression was used to assess the factors that influenced whether or not an older person was transported after a fall. The model had a 71.8% concordance rate, indicating that the model correctly predicted EMS transport decisions that percentage of the time. Using the area under the curve c-statistic, the overall logistic regression model was statistically significant (c-statistic=0.726, cut off=0.7).[8] Women were more likely to be transported than men (AOR=1.30, 95% CI=1.29, 1.32) (Table 3). The likelihood of transport increased with age. Compared with those aged 65–74 years, people aged 75–84 years had higher odds of being transported (AOR=1.04, 95% CI=1.03, 1.06) and people aged ≥85 years had the highest odds of being transported (AOR=1.14, 95% CI=1.13, 1.16).

Scene location also affected transport decisions. Compared with urban environments, the likelihood of transport was highest for falls in rural areas (AOR=1.15, 95% CI=1.13, 1.17), followed by wilderness environments (AOR=1.11, 95% CI=1.08, 1.15); it was lowest for suburban environments (AOR=0.92, 95% CI=0.91, 0.94). Compared with the home, the odds of transport were highest for falls in residential institutions such as nursing homes (AOR=3.52, 95% CI=3.46, 3.58). Transport was least likely when the fall occurred in a business location (e.g., store, restaurant) (AOR=0.8, 95% CI=0.78, 0.82).

EMS providers record their impression of the medical situation associated with the fall event. Compared with “obvious death,” EMS transport was least likely when the provider impression was listed as “none” (AOR=0.17, 95% CI=0.13, 0.23). These were 911 calls where the EMS provider found nothing wrong with the person or where they could not categorize the illness or disease. The provider impression most strongly associated with transport was stroke (AOR=2.96, 95% CI=2.11, 4.10), followed by hypothermia (AOR=2.36, 95% CI=1.33, 4.43); cardiac distress/chest pain (AOR=2.19, 95% CI=1.58, 2.98); and altered level of consciousness (AOR=1.87, 95% CI=1.36, 2.50). Conditions that were associated with lower likelihood of transport were diabetic symptoms/hypoglycemia, syncope/fainting, and behavioral/psychiatric disorder (AOR=0.28, 95% CI=0.20, 0.37; AOR=0.46, 95% CI=0.34, 0.61; and AOR= 0.50, 95% CI=0.36, 0.68; respectively).

Finally, the decision to transport a patient was associated with the EMS provider’s certification level. Compared with EMT-Basic, EMT-Intermediates were least likely to transport patients (AOR=0.91, 95% CI=0.88, 0.95), whereas nurse providers were most likely (AOR=1.47, 95% CI=1.39, 1.54) to be associated with EMS transport.

Discussion

Falls among older adults occur frequently, and up to 30% of falls cause moderate to severe injuries.[9] Although EMS is often called to assist people who have fallen, some of these patients are not transported to a medical facility. In this study, almost 21% of older adults

who were attended by EMS for a fall were not transported. The most common reasons for non-transport were because patients refused care or were treated and released. Even though this study used a large number of records, the results are generally consistent with previous studies. A systematic review of 12 studies conducted in the United Kingdom, Australia, and the U.S. found that between 11% and 56% of patients in fall-related emergency calls were not transported.[3] Although the older adult non-transported patients may have sustained only minor injuries, they comprise a particularly vulnerable cohort. They often have a high prevalence of chronic health conditions, impaired mobility, and functional limitations.[10] In one study, 49% of non-transported patients subsequently required health care within 2 weeks.[11] In another study, one third of non-transported people were seen in the ED or hospitalized within 28 days of their initial fall.[12]

Patient demographics, such as gender, age, and location of the fall, had a large influence on the transport decision. Women were 30% more likely to be transported than men and people aged ≥85 years were 14% more likely to be transported than people aged <75 years. The risk of falling increases with age, and women are more likely than men both to seek medical care after a fall[13] and to suffer serious fall injuries such as hip fractures.[14] People who fell in institutional settings, such as nursing homes, were 3.5 times more likely to be transported. Nursing home residents are older and frailer than community-dwelling older adults. As such, they are at much greater risk of falling and more likely to suffer a serious injury, such as a fracture or head injury.[15]

This study found that the majority of older adults who were not transported refused care (57%). Many older adults do not want to be identified as a person who is likely to fall because they fear losing their ability to live independently and remain in their own home.[16] The data also showed that most falls occurred at home. When an EMS call for a fall does not require transport, the older adult may be more receptive to information about steps they can take to reduce their chances of falling again by eliminating home hazards or undertaking a strengthening and balance training program, as demonstrated in Logan et al.[17] A fall prevention program, administered by EMS professionals, could provide important information and help reduce falls. Further, because most falls occur at a residence, relatively private interventions would likely be more acceptable.

Enhanced EMS patient involvement is a type of “community paramedicine,” which are programs that are designed to provide integrated, community health in a specific geographic region.[6] EMS providers have opportunities to provide fall risk assessments and fall prevention education material, as well as other services such as reconciling medications, scheduling appointments, and interfacing with primary care providers. People who fall once are two to three times more likely to fall within a year.[18] This high-risk population is most likely to benefit from fall prevention interventions.

Some EMS providers have turned a non-transport event into a prevention opportunity. For example, an experimental health education program has been well received among people who fell and were not transported. King County in Washington State utilized firefighter–EMTs and found that non-transported patients were receptive to a health education program.[19] These EMTs provided four types of health information that included a referral

source for fall prevention programs. Wake County EMS providers have also developed a program to manage falls in skilled nursing facilities.[20] Although there has been no widespread national effort to have EMS providers incorporate fall prevention into their activities, this study, along with the evidence of success by some EMS providers, offers additional evidence that incorporating fall prevention into EMS calls is a feasible and underutilized prevention opportunity. Because this study revealed that a large proportion of EMS calls for older adults are not transported (21%), a community paramedicine program, at a minimum, could provide a pamphlet designed to educate older adults about how the first initial fall can be a harbinger of declining health and how future falls could be prevented (strength training, exercise, and removal of hazards in a home). CDC has this information readily available for dissemination.[21]

Another option is for EMS to offer referrals to community-based fall prevention resources. Older adults may be more receptive to follow through with recommendations and benefit from the “teachable moment.” Such a program would likely be cost effective because EMS is already on site.

Community paramedicine programs are common outside the U.S. For example, researchers in the United Kingdom have integrated a fall risk assessment into an established Home Fire Safety Visiting program conducted by fire departments.[22] This program includes a fall prevention educational program provided by trained EMS providers but does not include a fall risk assessment. Also in the United Kingdom, a pilot study showed that linking older adults who had fallen and been seen by EMS but not transported to a hospital to a community-based fall prevention program reduced fall rates by 55%. It also improved clinical outcomes and quality of life.[17]

This study also revealed the associations among the underlying causes of falls (no underlying cause, traumatic injury, fainting, and diabetes). It identified medical conditions where a non-transport event occur (poisoning and traumatic injuries). Although poisoning events were uncommon for this age group,[23] it is common for EMS to administer naloxone for opioid-related drug poisoning, which reverses the poisoning and may remove the need to transport to the ED. Also, traumatic injuries associated with falls are often contusions and low–energy transfer events that can be treated by EMS on the scene. This information can be used to create a more-effective and better-targeted fall prevention program.

Several states and communities have formed partnerships composed of representatives from public health, aging services, and healthcare systems to address the growing threat that falls pose to older adult health. These multisector partnerships can serve as a resource for EMS providers interested in learning more about community-based fall prevention activities occurring in their area, and can foster collaboration among EMS and community-based programs to reach this high-risk population. Many states have leveraged such partnerships and created fall prevention activities through policy.[24]

Providers of EMS often communicate with trauma centers using “medical control” procedures to ensure the hospital is ready for the patient and to have access to a physician while EMS are in the field. Trauma centers help coordinate transport and are a second point

where fall prevention can be applied. Such a pilot program was implemented by Johns Hopkins University.[25] Trauma centers have a mandate to develop injury prevention programs that address the most common injuries in their community.[26] Injury prevention program development is one criterion that the American College of Surgeons uses to verify the trauma center designation. Because falls are the most common cause of fatal and non-fatal injuries in older adults, trauma centers can play a critical role in prevention efforts, including outreach to first responders and overall coordination of patient care.

Trauma centers verified by the American College of Surgeons are required to utilize proven injury prevention strategies, and there may be opportunities to identify and develop evidence-based programs that can be adopted widely. Because head injuries from falls are a major cause of fall-related deaths,[27] trauma centers should emphasize the need to transport all older adults who have fallen and are taking anticoagulants. For these cases, rapid transport to the highest level of care is recommended.[28] Trauma centers, working in cooperation with EMS providers, also can help develop and encourage fall prevention education and injury prevention interventions at the scene whenever possible. The data in this study help create a way for future integrated injury prevention program development.

Potential barriers to program implementation include funding and competing EMS priorities. Regarding funding, EMS systems in the U.S. have historically been funded by patient fees and local tax subsidies.[29] The success of a fall prevention program depends partly on funding EMS to provide education or referral services. Because EMS activities are time sensitive, any interventions should take flexibility and response time into consideration.

Limitations

A major strength of this study is that it included a large number of EMS events. However, a limitation is that these data were from a convenience sample and therefore may not be nationally representative. Also, given the limited number of nurses in this study, those results should be interpreted with caution.

Conclusions

This study found that one in five older adults seen by EMS for a fall were not transported to a medical facility. These non-transported patients are at high risk of falling again; they could benefit substantially from community paramedicine programs that address fall prevention. This study provides valuable insights that can help inform state and local interventions to prevent older adult falls, including opportunities for EMS to partner with community-based organizations and trauma systems to serve this high-risk population. Such programs offer opportunities to reduce medical costs, increase cost effectiveness of fall prevention interventions, and improve the health and quality of life for older adults. Evidence-based fall prevention materials are available from CDC.[30]

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Table 1

Fall-Related Population Characteristics as Reported by Emergency Medical Service (EMS) Providers Prompted by 911 Calls

Characteristic	Falls, *n* (%)	Non-falls, *n* (%)
Age		
65–74	217,262 (12.7)	1,495,004 (87.3)
75–84	324,436 (17.4)	1,542,446 (82.6)
≥85	361,890 (22.6)	1,238,414 (77.4)
Gender		
Men	308,168 (15.0)	1,751,082 (85.0)
Women	588,894 (19.1)	2,495,698 (80.9)
Unknown	6,526 (18.3)	29,084 (81.7)
Total	903,588 (17.4)	4,275,864 (82.6)

Source: National EMS Information, 2012.

Table 2

Characteristics of People Aged ≥65 Years Who Fell and Were Seen by Emergency Medical Services

Characteristic	Not transported *n* (%)	Transported *n* (%)	Percent not transported within category	Total *n* (%)
Age				
65–74	50,630 (27.1)	166,632 (23.2)	23.3	217,262 (24.0)
75–84	70,117 (37.6)	254,319 (35.5)	21.6	324,436 (35.9)
≥85	65,965 (35.3)	295,925 (41.3)	18.2	361,890 (40.1)
Gender				
Female	110,706 (59.3)	478,188 (66.7)	18.8	588,894 (65.2)
Male	73,047 (39.1)	235,121 (32.8)	23.7	308,168 (34.1)
Unknown	2,959 (1.6)	3,567 (0.5)	45.3	6,526 (0.7)
Urbanicity				
Rural	21,142 (11.3)	87,078 (12.1)	19.5	108,220 (12.0)
Suburban	19,894 (10.7)	68,029 (9.5)	22.6	87,923 (9.7)
Urban	136,987 (73.4)	527,004 (73.5)	20.6	663,991 (73.5)
Wilderness	5,651 (3.0)	23,120 (3.2)	19.6	28,771 (3.2)
Unknown	3,038 (1.6)	11,645 (1.6)	20.7	14,683 (1.6)
Location				
Home/residence	129,679 (69.5)	414,166 (57.8)	23.8	543,845 (60.2)
Unknown	18,705 (10.0)	43,585 (6.1)	30.0	62,290 (6.9)
Residential institution (nursing home, jail/prison)	15,436 (8.3)	180,503 (25.2)	7.9	195,939 (21.7)
Other location	9,197 (4.9)	32,518 (4.5)	22.0	41,715 (4.6)
Trade or service (business, bars, restaurants, etc.)	8,798 (4.7)	25,779 (3.6)	25.4	34,577 (3.8)
Street or highway	4,897 (2.6)	20,325 (2.8)	19.4	25,222 (2.8)
Level of services				
EMT-Basic	20,671 (11.1)	63,710 (8.9)	24.5	84,381 (9.3)
EMT-Intermediate	4,770 (2.6)	16,293 (2.3)	22.6	21,063 (2.3)
EMT-Paramedic	150,939 (80.8)	582,152 (81.2)	20.6	733,091 (81.1)
Nurse	2,198 (1.2)	11,693 (1.6)	15.8	13,891 (1.5)
Physician	1,634 (0.9)	8,343 (1.2)	16.4	9,977 (1.1)
Unknown	6,500 (3.5)	34,685 (4.8)	15.8	41,185 (4.6)
EMS impression				
Abdominal pain/problems	332 (0.2)	5,011 (0.7)	6.2	5,343 (0.6)
Altered level of consciousness	958 (0.5)	20,982 (2.9)	4.4	21,940 (2.4)
Behavioral/psychiatric disorder	457 (0.2)	2,895 (0.4)	13.6	3,352 (0.4)
Cardiac distress/chest pain	329 (0.2)	7,679 (1.1)	4.1	8,008 (0.9)
Diabetic symptoms (hypoglycemia)	1,099 (0.6)	3,258 (0.5)	25.2(	4,357 (0.5)
Hyperthermia	99 (0.1)	799 (0.1)	11.0	898 (0.1)
Hypothermia	15 (0.0)	372 (0.1)	3.9	387 (0.0)

Characteristic	Not transported *n* (%)	Transported *n* (%)	Percent not transported within category	Total *n* (%)
Hypovolemia/shock	189 (0.1)	2,385 (0.3)	7.3	2,574 (0.3)
None	133,537 (71.5)	287,516 (40.1)	31.7	421,053 (46.6)
Obvious death	48 (0.0)	522 (0.1)	8.4	570 (0.1)
Poisoning/drug ingestion	277 (0.1)	1,538 (0.2)	15.3	1,815 (0.2)
Respiratory arrest/distress	269 (0.1)	4,428 (0.6)	5.7	4,697 (0.5)
Seizure	83 (0.0)	1,382 (0.2)	5.7	1,465 (0.2)
Stroke/CVA	188 (0.1)	6,154 (0.9)	3.0	6,342 (0.7)
Syncope/fainting	5,795 (3.1)	28,956 (4.0)	16.7	34,751 (3.8)
Traumatic injury	43,037 (23.0)	342,999 (47.8)	11.1	386,036 (42.7)
Patient disposition				
Dead at scene	0 (0.0)	1,117 (0.2)	0.0	1,117 (0.1)
Transported by EMS or law enforcement	0 (0.0)	715,759 (99.8)	0.0	715,759 (79.2)
Cancelled/no patient found	5,510 (3.0)	0 (0.0)	100.0	5,510 (0.6)
No treatment required	36,759 (19.2)	0 (0.0)	100.0	35,759 (4.0)
Treated and released	38,939 (20.9)	0 (0.0)	100.0	38,939 (4.3)
Patient refused care	106,504 (57.0)	0 (0.0)	100.0	106,504 (11.8)
Total	186,712 (20.7)	716,876 (79.3)		903,588 (100.0)

Source: National EMS Information, 2012.

CVA, cerebrovascular accident; EMT, emergency medical technician; EMS, emergency medical services.

Table 3

Likelihood of Transport by EMS Providers: Factors That Were Associated With Fall-Related Events

Factor	OR estimate (lower CI, upper CI)
Gender	
Male	1.0
Female	1.30 (1.29, 1.32)
Unknown	0.46 (0.44, 0.49)
Age	
65–74	1.0
75–84	1.04 (1.03, 1.06)
≥85	1.14 (1.13, 1.16)
Urbanicity	
Urban	1.0
Rural	1.15 (1.13, 1.17)
Suburban	0.92 (0.91, 0.94)
Wilderness	1.11 (1.08, 1.15)
Unknown	0.79 (0.76, 0.83)
Incident location	
Home/residence	1.0
Other location	0.97 (0.94, 0.99)
Residential institution (nursing home, jail/prison)	3.52 (3.46, 3.58)
Street or highway	1.21 (1.17, 1.25)
Trade or service (business, bars, restaurants, etc.)	0.80 (0.78, 0.82)
Unknown	0.74 (0.73, 0.76)
Level of service	
EMT-Basic	1.0
EMT-Intermediate	0.91 (0.88, 0.95)
EMT-Paramedic	0.96 (0.95, 0.98)
Nurse	1.47 (1.39, 1.54)
Physician	1.05 (0.99, 1.11)
EMS impression	
Obvious death	1.0
Abdominal pain/problems	1.31 (0.95, 1.79)
Altered level of consciousness	1.87 (1.36, 2.50)
Behavioral/psychiatric disorder	0.50 (0.36, 0.68)
Cardiac distress/chest pain	2.19 (1.58, 2.98)
Diabetic symptoms (hypoglycemia)	0.28 (0.20, 0.37)
Hyperthermia	0.75 (0.52, 1.07)
Hypothermia	2.36 (1.33, 4.43)
Hypovolemia/shock	1.12 (0.79, 1.55)

Factor	OR estimate (lower CI, upper CI)
Poisoning/drug ingestion	0.60 (0.43, 0.82)
Respiratory arrest/distress	1.48 (1.06, 2.02)
Seizure	1.53 (1.05, 2.21)
Stroke/CVA	2.96 (2.11, 4.10)
Syncope/fainting	0.46 (0.34, 0.61)
Traumatic injury	0.63 (0.46, 0.83)
None	0.17 (0.13, 0.23)

CVA, cerebrovascular accident; EMT, emergency medical technician; EMS, emergency medical services.