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Emergency department falls: a longitudinal analysis of revisits and hospitalisations between patients who fall and patients who did not fall

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ABSTRACT

Objective Older adult falls are a national issue comprising 3 million emergency department (ED) visits and significant mortality. We sought to understand whether ED revisits and hospitalisations for fallers differed from non-fall patients through a secondary analysis of a longitudinal, statewide cohort of patients.

Design We performed a secondary analysis using the non-public Patient Discharge Database and the ED data from the California Office of Statewide Health Planning and Development. This is a 5-year, longitudinal observational dataset, which was used to assess outcomes for fallers and non-fall patients, defined as anyone who did not carry a fall diagnosis during this time period.

Setting 2005–2010 non-public Patient Discharge Database and the ED Data from the state of California.

Participants Older adults 65 years and older

Main outcome measure ED revisits and hospitalisations for fallers and non-fall patients.

Results Patients who came to the ED with an index visit of a fall were more likely to be discharged home after their fall (61.1% vs 45.0%, p<0.001). Fallers who were discharged or hospitalised after their index visit were more likely to come back to the ED for a fall related complaint compared with non-fallers (median time: 151 days vs 352 days, p<0.001 and hospitalised: 45 days vs 119 days, p<0.01) and fallers who were initially discharged also returned to the ED sooner for a non-fall related complaint (median time: 325 days vs 352 days, p<0.001).

Conclusion Fall patients tend to be discharged home more often after their index visit, but returned to the ED sooner compared with their non-fall counterparts. Given a faller's rates of ED revisits and hospitalisations, EDs should consider a fall as a poor prognostic indicator for future healthcare utilisation.

Strengths and limitations of this study

- ► This is the first statewide, longitudinal secondary data analysis examining disposition and emergency department (ED) revisits of patients who came to the ED for a fall and compared fallers to all other older adults using a statewide database of approximately 3.8 million patients.
- ► The use of administrative data limits our understanding of other associated variables such as comorbidities and true identification of a patient's index visit for a fall.
- ► The nature of the data does not allow us to understand the reason for fall, which is important for fall prevention purposes.

BACKGROUND

Falls from older adults comprise nearly 3 million emergency department (ED) visits annually and account for 10% of all ED visits among those greater than age of 65 years.[1 2] Mortality from falls increased by 110% from 1999 to 2016[3] and will rise as the population ages.

Adverse event rates for older patients who present to the ED after a fall is high. Over 70% of these patients are discharged after their ED visit, with the remaining 30% admitted to the hospital.[1] Approximately, 36%–44% of patients who come to the ED after experiencing a fall experience a subsequent adverse event, including recurrent falls, ED visits or death within 1 year.[4 5] Previous community-based falls prevention has helped prevent ED use and future hospitalisations. For instance, Mikolaizak *et al* found that older fallers who adhered to a paramedic-initiated assessment and intervention had fewer falls and fall-related ED presentations at 6 months.[6] The PROFET trial showed that a multifactorial intervention for ED falls patients decreased recurrent falls and the odds of hospital admission at 12 months.[7] However, it is not clear whether these adverse event rates are higher than those of non-fall patients. Identifying such patients can help risk stratify when deciding disposition, referring to outpatient services and recommending enrollment into community-based falls prevention programmes. To date, most studies on ED fall patients listing high adverse event rates are limited to one or few sites, are cross sectional or have no controls.[2 5]

- E880 Accidental fall on or from stairs or steps
- E881 Accidental fall on or from ladders or scaffolding
- E882 Accidental fall from or out of building or other structure
- E883 Accidental fall into hole or other opening in surface
- E884 Other accidental falls from one level to another
- E885 Accidental fall on same level from slipping tripping or stumbling
- E886 Fall on same level from collision, pushing, or shoving, by or with other person
- E887 Fracture, cause unspecified
- E888 Other and unspecified fall

Figure 1 Falls diagnostic E codes.

We sought to explore whether the rate of ED revisits and hospitalisations among older fall patients differ significantly from non-fall patients in a large statewide cohort of ED patients that could be tracked longitudinally, with a specific interest on revisits for fall-related complaints. We hypothesised that fallers would revisit the ED and have more hospitalisations than their non-fall counterparts. Targeting at-risk older adults, particularly those discharged to home or home healthcare through community-based interventions or non-pharmacological clinical trials, is an underexplored, cost-effective mechanism with potential to reduce ED revisits and improve patient care.

METHODS

Data sources

To determine the rate of ED revisits and hospitalisations for elderly patients who present to the ED after a fall, we used de-identified, patient-level data for the 2005–2010 non-public Patient Discharge Database (PDD) and the ED Data (EDD) from the California Office of Statewide Health Planning and Development. The PDD captures demographic and clinical data for all admissions to non-Department of Veterans Affairs hospitals in California. The EDD provides data on all ED encounters, including those patients discharged from the ED. We also used hospital utilisation data to capture hospital characteristics.

We included all adult patients aged 65 years and older that were seen in the ED. Fall patients were defined as patients who came for a fall-related complaint between 1 January 2005 and 12 December 2010 with the International Classification of Disease E codes E880.x-E888.x included anywhere in their visit (see figure 1). Non-fall patients were defined as all older patients seen in the ED between 1 January 2005 and 12 December 2010 with any other diagnosis. The censor time for death was 12 December 2011. More specifically, if a patient had non-fall

Table 1 Comparison of demographics of elderly patients who fall to patients who did not fall

	Fall (N=997 524)	Non-fall (N=2 805 508)	P value
Age (in years)	79.5±8.3	74.7±7.9	<0.001
Gender			
Male	336 060 (33.7%)	1 298 346 (46.3%)	<0.001
Female	661 152 (66.3%)	1 506 065 (53.7%)	
Other	312 (0.03%)	1097 (0.04%)	
Ethnicity/race			
Non-Hispanic white	710 852 (71.3%)	1 770 408 (63.1%)	<0.001
Non-Hispanic black	38 699 (3.9%)	167 215 (6.0%)	
Hispanic	133 594 (13.4%)	433 837 (15.5%)	
Asian	26 611 (2.7%)	145 804 (5.2%)	
Other	68 661 (6.9%)	220 746 (7.9%)	
Unknown	19 107 (1.9%)	67 498 (2.4%)	
Median income	67 290±24 323	66 563±24 330	<0.001
Payer type (primary insurance)			
Self-pay	14 471 (1.5%)	57 962 (2.1%)	<0.001
Medicare	867 863 (87.0%)	2 269 251 (80.9%)	
Medicaid	19 220 (1.9%)	106 590 (3.8%)	
Commercial Insurance/Commercial Health Maintenence Organization	82 435 (8.3%)	331 897 (11.8%)	
Other	13 301 (1.3%)	39 099 (1.4%)	
Missing	30 (0.0%)	170 (0.0%)	
Teaching hospital			
No	922 366 (92.5%)	2 550 886 (90.9%)	<0.001
Yes	75 158 (7.5%)	254 622 (9.1%)	

Table 2 (A) Breakdown of all visits by year. (B) Fall versus non-fall generalised visit patterns

	Fall patients	Non-fall patients	Total
A			
Number of patients	997 524	2 805 508	3 803 032
Total visits	4 769 880	9 245 450	14 015 330
2005	491 604	1 310 892	1 802 496
2006	554 715	1 258 444	1 813 159
2007	615 788	1 234 484	1 850 272
2008	687 179	1 280 194	1 967 373
2009	746 467	1 315 321	2 061 788
2010	807 063	1 370 785	2 177 848
2011	867 064	1 475 330	2 342 394
B			
Number of patients	997 524	2 805 508	3 803 032
Total visits	4 769 880	9 245 450	14 015 330
# visits per patient	4.78±5.18* 3(2–6)†	3.30±3.58 2(1–4)	3.69±4.12 2(1–5)
# visits for fall patients	1.53±1.05 1(1–2)	NA	0.40±0.86 0(0–1)
% revisit for fall patients	291 025		

*Mean±SD.
†Median (IQR).

visit before the fall visit for those aged >65 years, specific non-fall visit was not counted. However, if he/she had a non-fall visit after a fall visit, said patient was counted as a faller. For patients who never had a fall visit, all of their non-fall visits were counted.

The decision to use patient level in lieu of visit-level data stemmed from the need to look at both patient characteristics and longitudinal outcomes on disposition and revisits. As such, we obtained data, including age, sex, ethnicity/race, payer type and whether the visit was at a teaching versus non-teaching hospital. We calculated income based on zip code as a proxy[8] and then examined disposition of the patient from the ED or after hospitalisation (ED death, or discharge from ED or hospital to an acute care facility, skilled nursing home or home with visiting nurse). This study used de-identified data but was approved by the institutional review board.

Patient and public involvement

This research was done without patient or public involvement. Patients were not invited to comment on the study design and were not consulted to develop patient relevant outcomes or interpret the results. Patients were not invited to contribute to the writing or editing of this document for readability or accuracy.

Outcomes

We examined the frequency of various dispositions (eg, where the patient was discharged to) from the ED between geriatric fall and non-fall patients. Our primary outcome was disposition and the median time to ED revisits for a fall between fall and non-fall patients. Our secondary outcome was the median time to an ED revisit for any reason between fall and non-fall patients. We also examined the frequency of at least one ED revisit for a fall as well as an ED revisit for any reason at 7 days and 30 days, 6 months and 1 year among fall and non-fall patients. We also performed a Kaplan-Meier analysis for time to revisit for any reason, controlling for age, sex, race, insurance, teaching and median income. For the sake of brevity, we termed those older adult patients who presented for a fall-related complaint as 'fallers' and those who did not fall as 'non-fallers'.

Statistical analysis

We calculated differences in demographics using Wilcoxon, *t*-test or χ^2 test where appropriate. We tested for differences of frequency of disposition type after initial ED visit between fall and non-fall patients using $\chi 2$ test. To access the median times to the ED revisits, we used a Cox model with a type 3 test of the effect of the eight-way classifications. To access survival rate to ED revisit, we fit a Cox model for the association of fall versus non-fall patients with time to each event, adjusting for age, sex, race, insurance, teaching hospital and median income. All analyses were completed using SAS V.9.4.

RESULTS

The fall cohort predominantly consisted of women who were of 79.5 years of age compared with the non-fall cohort who were primarily men with an average age of 74.7 years (p<0.001). Fallers were also predominantly non-Hispanic white (71.3% vs 63.1%, p<0.001), seen primarily in non-teaching hospitals (92.5% vs 90.9%, p<0.001) with Medicare as their primary insurance (87% vs 80.9%, p<0.001). While non-fallers also predominantly used Medicare as their primary payer, they notably had a higher mix of non-Medicare primary payers, including commercial insurers (private), Medicaid and self-pay, compared with fallers. (table 1). Overall, fallers had a total of 4.76 million visits between 2005 and 2011, or approximately 4.78 visits per patient while non-fallers made 9.24 million visits in this time span or approximately 3.30 visits per patient (table 2A,B).

Patients who came to the ED with an index visit of a fall were more likely to be discharged home after their fall (61.1% vs 45.0%, p<0.001) or sent directly to a skilled nursing facility (SNF) or an acute care facility from the ED (1.5% vs 0.3% and 0.2% vs 0.04%, respectively, p<0.001). Patients who came to the ED for non-fall related visit were more likely to be hospitalised (52.6% vs 35.7%); however, fallers who were admitted were more often transferred to an SNF or an acute care facility post-hospitalisation

Table 3 Type of disposition after initial ED visit for all patients (A), time to ED revisit for fallers (B) and time to ED revisit for non-fall patients (C)

	Frequency of disposition type after initial ED visit (A)			Median time to ED revisit among fall patients (B)				Median time to ED revisit for non-fall patients (C)		
	Index visit: fall	Index visit: non-fall		Reason for ED revisit: fall		Reason for ED revisit: any reason		Reason for ED revisit: any reason		
	n	Days	P value	n	Days	n	Days	n	Days	P value
Discharge home from ED	609 822 (61.13%)	1 263 272 (45.03%)	<0.001	437 197	151.0	191 925	325.0	524 237	352.0	<0.001
Discharge with home health service from ED	1519 (0.15%)	1453 (0.05%)		993	58.0	432	114.0	623	83.0	
Directly to SNF from ED	15 387 (1.54%)	9081 (0.32%)		11 456	71.0	5247	137.0	5087	111.0	
Directly to acute care (IRF and LTCH) from ED	2007 (0.20%)	1166 (0.04%)		1509	59.0	771	96.0	654	97.0	
ED death	521 (0.05%)	12 208 (0.44%)		0		0		0		
Other	11 819 (1.18%)	43 910 (1.57%)		9321	30.0	5403	9.0	24 444	47.0	
Blank	101 (0.01%)	220 (0.01%)		76	68.5	41	67.0	98	1.0	
Hospitalisation after ED visit	356 348 (35.72%)	1 474 198 (52.55%)	<0.001	269 385	45.0	109 751	242.0	956 264	119.0	<0.001
Then to acute care (IRF and LTCH) after hospitalisation	30 363 (8.52%)	72 214 (4.90%)		28 514	5.0	12 452	69.0	64 385	4.0	
Then to SNF after hospitalisation	169 084 (47.45%)	204 991 (13.91%)		134 491	40.0	53 465	246.0	150 005	35.0	
Then to residential care after hospitalisation	4181 (1.17%)	11 056 (0.75%)		3338	64.0	1645	137.0	7950	86.0	
Discharge home after hospitalisation	83 178 (23.34%)	903 245 (61.27%)		61 352	119.0	25 276	313.0	594 246	192.0	
Discharge home with health services after hospitalisation	47 871 (13.43%)	200 618 (13.61%)		35 425	99.0	14 819	272.0	129 308	148.0	
Invalid/blank	64 (0.02%)	178 (0.01%)		41	9.0	17	67.0	91	7.0	
Other	3551 (1.00%)	16 484 (1.12%)		2556	17.0	1207	85.0	10 279	44.0	

*Any reason excludes any visit pertaining to a fall.
ED, emergency department; IRF, inpatient rehabilitation facility; LTCH, long-term care hospital; SNF, skilled nursing facility.

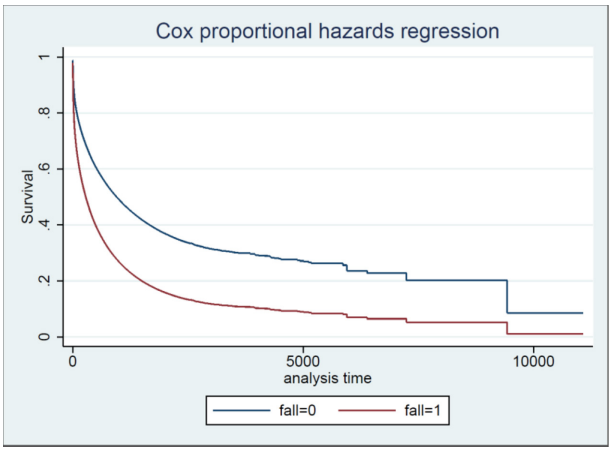

Figure 2 Kaplan-Meier survival curve: time to emergency department revisit for any reason.

compared with non-fallers (47.5% vs 13.9% and 8.5% vs 4.9%, respectively, p<0.001), whereas non-fallers were more often discharged home post-hospitalisation (61.3% vs 23.3%, p<0.001) (table 3).

Fallers who were discharged after their index visit were more likely to come back to the ED for both a fall-related and non-fall-related complaint compared with non-fallers (median time: 151 days and 325 days vs 352 days, p<0.001) (table 3).

Fallers who were initially hospitalised returned to the ED sooner for another fall-related complaint compared with non-fall patients (45 days vs 119 days, p<0.001), but non-fallers returned earlier to the ED for any reason (excluding falls) compared with fallers (119 days vs 242 days, p<0.001) (see table 3). Furthermore, based on a Kaplan-Meier analysis, non-fallers had a lower probability of returning to the ED compared with fallers at each time point after adjusting for age, sex, race, insurance, teaching and median income (figure 2 and table 4).

It is worth noting that we could not calculate the rate of ED return among non-fallers for a fall-related visit as this would have placed them into the fallers cohort.

DISCUSSION

Older adults who present to the ED with a fall between 2005 and 2010 were more likely to be older, female, non-Hispanic white, covered by Medicare and primarily present to community facilities as compared with those patients who presented to the ED for a non-fall-related complaint. Furthermore, fall patients were discharged home more often, but returned to the ED sooner for both a fall-related and non-fall-related complaint compared with their non-fall counterparts (p<0.001). This study is unique in that it is the first statewide, longitudinal secondary data analysis examining disposition and ED revisits of patients who came to the ED for a fall and compared fallers to all other older adults using a statewide database of approximately 3.8 million patients, but similar outcomes to a retrospective cohort study looking at fall-related, 30-day readmissions using the hospital cost and utilisation project data.[9]

This database shows that fallers appear to be a high-risk patient population who return to the ED much sooner than patients who did not fall for a second fall-related complaint regardless of whether they were admitted or discharged from their index ED visit. Often, fallers may minimise their reason for falling and are reluctant to engage in fall prevention efforts on their own.[10] Also, most EDs do not do a comprehensive fall evaluation, thus missing many opportunities to address the risk factor that lead to the fall or prevent future falls.[11 12] Although this study does not delineate the underlying reason for a fall or reason for their return ED visit, our findings suggest that this patient population warrants close evaluation, workup and follow-up to assess their reasons for falling and potential intervention.

Among hospitalised patients, non-fallers returned to the ED sooner than fallers for any other non-fall-related reason (p<0.001). This may be due to a sicker case-mix of non-fall patients reflected through the higher percentage of Medicaid among non-fallers or the higher percentage of non-fallers being treated at teaching hospitals containing tertiary services,[13 14] or that more non-fallers were discharged home without services post-hospitalisation. However, this difference warrants further investigation.

Table 4 Survival time to ED revisit, fall versus non-fallers, adjusted for age, sex, race, insurance, teaching and median income (p=0.000)

Days	Fall	Non-fall
7	0.88	0.94
30	0.78	0.87
182	0.57	0.74
365	0.45	0.66
1826	0.18	0.38

LIMITATIONS

There were many limitations to this study including those inherent to the retrospective nature of this analysis. First, it is possible that what we classified as an index visit for a fall may not have been the actual first visit for a fall. Although some index visits for a fall may have occurred outside the state of California, we expect this number to be minimal. Second, because we are using administrative data, we have limited understanding of other important variables, including functional status, comorbidities and relative frailty of patients, which could contribute to the observed result. Third, as with any administrative dataset, there are potential errors due to miscoding, data linkage and missing data. However, these would not bias our study unless these errors were distributed unevenly across both categories of patients, which would be unlikely. Furthermore, while the dataset is statewide, results cannot be generalised across the entire country or other healthcare

systems. Last, we do not have a reason for the fall, which is often important for fall prevention and may provide a better sense as to why patients who presented initially for a fall-related complaint are returning to the ED sooner than patients who did not fall.

CONCLUSION

This epidemiological study suggests that patients who fall are a sick patient population who are more likely to return to the ED for a second fall regardless of whether they are discharged or admitted and are more likely to return for any reason if discharged. Given the increasing rates of falls over time,[2] providers should recognise the significance of a fall as a risk factor for future healthcare utilisation. Multiple studies have shown the benefit of multifactorial falls prevention interventions to decrease the rates of recurrent falls[7 15] with a recent Cochrane Review underscoring the benefit of exercise and physical-therapy-based programmes as a particularly beneficial modality to decrease the rate of injurious falls.[16] While the most recent randomized trial of multifactorial strategies did not show a benefit for community-based falls prevention for at-risk individuals, it did not assess prevention activities for ED patients after a fall and it also acknowledges that behaviour modification through exercise, one of the most important interventions for future fall prevention, was not underscored.[17 18] Qualitative data indicates that patients who present to the ED may have more willingness for falls prevention[10] and programmes should continue to capitalise on this motivation for secondary fall prevention strategies.[19] Further studies should also look at the cause of falls and patients' associated comorbidities as indicators for outcomes. EDs should also consider urgently referring discharged fall patients to physical therapy or an evidence-based exercise and/or falls prevention programme.

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