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

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To cite: Shankar KN, Lin F, Epino H, et al. Emergency department falls: a longitudinal analysis of revisits and hospitalisations between patients who fall and patients who did not fall. BMJ Open 2020;10:e041054. doi:10.1136/bmjopen-2020-041054

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.

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.

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. Mortality from falls increased by 110% from 1999 to 2016 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. 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. 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. The PROFET trial showed that a multifactorial intervention for ED falls patients decreased recurrent falls and the odds of hospital admission at 12 months. 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.
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
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 (61.1% vs 45.0%, p<0.001) or an acute care facility from the ED (52.6% vs 35.7%, 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 had 3.69 visits per patient (3.23, p<0.001). 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 χ² test where appropriate. We tested for differences of frequency of disposition type after initial ED visit between fall and non-fall patients using χ² 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 had 3.69 visits per patient (3.23, p<0.001). 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’.

### 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 calculated differences in demographics using Wilcoxon, t-test or χ² test where appropriate. We tested for differences of frequency of disposition type after initial ED visit between fall and non-fall patients using χ² 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.
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 | n | Days | n | Days | n | Days |
|---|---|---|---|---|---|---|---|
| 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 | 1,453 (0.05%) | 1,453 (0.05%) | | 993 | 58.0 | 432 | 114.0 | 623 | 83.0 | |
| Directly to SNF from ED | 15,387 (1.54%) | 9,081 (0.32%) | | 11,456 | 71.0 | 5,247 | 137.0 | 5,087 | 111.0 | |
| Directly to acute care (IRF and LTCH) from ED | 1,166 (0.04%) | 1,166 (0.04%) | | 1,509 | 59.0 | 771 | 96.0 | 654 | 97.0 | |
| ED death | 521 (0.05%) | 12,208 (0.44%) | | 0 | 0 | 0 | 0 | |
| Other | 11,819 (1.18%) | 43,910 (1.57%) | | 9,321 | 30.0 | 5,403 | 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%) | <0.001 | 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 | 4,181 (1.17%) | 11,056 (0.75%) | | 3,338 | 64.0 | 1,645 | 137.0 | 7,950 | 86.0 | |
| Discharge home after hospitalisation | 83,178 (23.34%) | 903,245 (61.27%) | | 61,352 | 119.0 | 25,276 | 313.0 | 59,424 | 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 | 3,551 (1.00%) | 16,484 (1.12%) | | 2,556 | 17.0 | 1,207 | 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.
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-fallers (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.\(^11\) 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.

**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, providers should recognize 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 falls7 15 with a recent Cochrane systematic overview. The SENATOR project ONTOP series. 2

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