Journal of Gerontology: MEDICAL SCIENCES
2001, Vol. 56A, No. 11, M686–M692

Do the Risks and Consequences of Hospitalized Fall Injuries Among Older Adults in California Vary by Type of Fall?

Arthur A. Ellis and Roger B. Trent

Injury Surveillance and Epidemiology Section, Epidemiology and Prevention for Injury Control Branch, California Department of Health Services, Sacramento.

Background. Research on fall injuries in older persons generally does not examine different types of falls separately. (The main types are same level, from one level to another, and on or from stairs and steps.) There is no a priori reason to believe that various types of falls have similar demographic risk factors and consequences. Therefore, we examined patterns in types of falls, place of falls, and consequences of fall injuries as Californians move through their later decades.

Methods. We analyzed all computerized patient discharge records for all adults 20 years and over hospitalized with a fall as the principal external cause of injury in California nonfederal acute care hospitals, from 1995 through 1997 (N = 242,166). Older-adult age groups were compared with all younger adults. Place of fall, hospital charges, and disposition at discharge were analyzed by type of fall.

Results. The three main types of fall injury increase with age, but each type shows variation by age and sex. Women have the highest rates for the main types but not for the less common types. Hospitalized falls vary by place of fall. Mean hospital charges ($17,086) vary by type of fall, with falls from one level to another having the largest mean hospital charge ($19,632). Disposition at discharge does not vary by type of fall.

Conclusions. We found significant variation in demographic factors, place of fall, and mean hospital charges for falling by type of fall, suggesting that future research should focus on individual types of falls rather than on aggregated falls.

FALLS, common at any age, are endemic among older adults (1–5). Each year, one in three Americans over 65 years of age falls (6,7). In California in 1995, 688 people 65 years and older died because of falls, and another 53,312 were hospitalized, a ratio of 1:77. Among injuries, falls were the leading cause of hospitalization in this age group, dwarfing the second leading cause (car crash injuries) by 60-fold (unpublished data).

Although most falls among older adults (90%) do not cause injury or death (8), research shows that many are medically and personally serious (4,6,7,9–16). Older adults who suffer a fall injury become heavy users of medical resources (15,17). Fractures are a common consequence of falls among older adults, and hip fractures produce the greatest morbidity and mortality (18–20).

Falls are the most costly injury among older persons in the United States (21–23). The total annual cost of falls was estimated to be $75 to $100 billion, according to an earlier report (24). However, the projected costs for slip and trip injuries and deaths for persons aged 75 years and older are expected to increase at a substantially higher rate (59%) than for the population in general (27%) (25). Hospitalization costs are higher for women than men, rise dramatically with age (15), and increase with fall frequency and severity (21).

Falls among elderly persons have distinct age and sex patterns. The risk of suffering a fall injury rises sharply with age (4,17,19,25,26). Our earlier (unpublished) data for California show that fall injuries start rising at about age 55. Women have a higher hospitalization rate from falls (3,4,15,17).

The literature on falls among the elderly population is large, but no study has analyzed serious older-adult fall injuries by type (e.g., from slipping or tripping). Most studies aggregate types of fall, and some focus on one type. There is no empirical or a priori reason to believe that various types of falls have similar demographic risk factors and consequences.

Research has shown that the largest proportion of falls among older adults occurs at home and indoors (25–30). However, no one has documented whether the various types of falls take place mainly at home. Inasmuch as a common fall prevention approach is to reduce fall hazards, such as obstacles and slippery surfaces, it is important to know where various types of falls occur.

This study describes older-adult fall injuries in California by type of fall. We use a large hospitalized injury data set to examine patterns in types of falls, place of falls, and consequences of fall injuries as people move through their later decades. Specifically, our study addresses the following questions: (i) Do particular types of falls account for the large increase in fall injuries that come with age? (ii) Does the typical place of fall vary with type of fall and change as people age? and (iii) Do medical outcomes vary with type of fall and become more adverse with age?

Methods

Data Source

We obtained computerized hospital discharge summaries for 1991 through 1997 from the California Office of Statewide Health Planning and Development (OSHPD). As required by law, all nonfederal acute care hospitals report discharges to the OSHPD. All injury records contain an external cause of injury (E-) code (31). Only the first hospitalization for a fall injury is E-coded, permitting us to look at incident cases and avoid duplication of counts for patients re-admitted in the same year for the same fall. California hospital discharge data appear reliable, as demonstrated by the OSHPD's reabstraction studies of hospital records. Computerized edits and analyst review are performed on every record. The OSHPD allows an error tolerance level of 0.1% for E-codes (32).

For denominator populations, we used California Department of Finance population estimates by age, sex, and the following race/ethnicity categories: white, black, Hispanic, Asian, and Native American. No "other" category is given for persons not included in the previous categories or for persons of mixed race.

Case Definition

This study includes all adults, aged 20 years and older, hospitalized with a fall injury as the principal external cause of injury in California nonfederal acute care hospitals. Older adults were stratified by age group for analyses (55–64 years, 65–74 years, 75–84 years, and 85 years and older) and were compared with all younger adults (20–54 years). We selected three recent years of patient discharge data—1995 through 1997—to increase the size of the population analyzed. Hospitalized falls and fall injury rates (per 100,000) rose significantly each year (Table 1).

We identified older-adult fall injuries by using the *International Classification of Diseases, Ninth Revision* E-code series "Accidental Falls," E880 through E888, with the exception of E887 (fracture, cause unspecified). Because this code probably contains some (unidentifiable) nonfalls, we excluded 4704 (1.9% of E880–E888 cases) to avoid including as cases patients who did not fall (5).

Variables

We used the following patient discharge data set variables: age, type and place of fall injury (both derived from E-codes), sex, race, disposition at discharge, hospital charges (billed charges only, not revenue, excluding professional fees), and length of stay (days between admission and discharge).

Place of fall was determined for cases admitted because of one E-coded fall injury (n = 219,402 or 91% of all falls). Multiple fall cases (n = 7292) were disregarded because place of occurrence cannot be determined uniquely.

Analysis

To determine risk, we calculated average age-specific crude incidence rates per 100,000 California population per year (rate = mean fall injuries for 1995–1997/California population, July 1, 1996 × 100,000). Rates based on numerators less than 20 are unstable and are not shown. Statistically significant differences between rates were determined by nonoverlapping confidence intervals at the 95% level. All rate comparisons cited in the text are statistically significant at $p < .05$. Rate increases by age and sex were described by fitting the rates to an exponential curve using Prism Release 3.0 software (Prism Software Corp., Lake Forest, CA). Statistical Analysis System for Windows, Release 6.12 (SAS Institute, Inc., Cary, NC) was used for all other analyses.

Results

Trends, Incidence, and Population Characteristics

Falls are a major public health problem in California, with 268,181 fall injuries requiring hospitalization during the 1995 through 1997 study period. Table 2 illustrates how the risk of falling rises dramatically with age, with women falling more frequently than men starting at age 50. The average annual rate of falls was 276/100,000 (all ages). For 1995 through 1997, there were 242,166 hospitalized falls among all adult residents of California (aged 20 years and older), an average annual rate of 358.

Table 3 shows demographic risk factors and types of falls for California adults from 1995 through 1997. Women have

Table 1. Hospitalized Falls and Fall Injury Rates (per 100,000) Among California Residents, 1995–1997

Year	Number	Rate	95% CI
1995	77,466	346	344–349
1996	80,124	356	353–358
1997	84,576	370	368–372

Note: CI = confidence interval.

Source: California Office of Statewide Health Planning and Development, hospital records.

Table 2. Hospitalized Fall Injury Rates (per 100,000) by Gender and Age Among California Residents, 1995–1997

	Both Genders		Men		Women	
	Number*	Rate	Number	Rate	Number	Rate
All ages	268,181	276	103,766	213	164,412	339
<10 y	16,102	98	9,781	116	6,321	79
10–19 y	9,913	75	7,328	108	2,584	40
20–29 y	9,408	68	6,521	88	2,887	44
30–39 y	14,153	83	9,163	104	4,990	60
40–49 y	16,763	118	9,815	139	6,948	98
50–59 y	17,044	196	8,142	190	8,901	202
60–69 y	25,973	414	10,100	341	15,873	479
70–79 y	57,672	1,176	18,226	868	39,446	1,407
80–89 y	74,884	3,507	19,306	2,529	55,577	4,050
90+	26,269	7,058	5,384	5,454	20,885	7,638

*Includes three cases with gender unknown.

Source: California Office of Statewide Health Planning and Development, hospital records and California Department of Finance, 1970–1996 Population Estimates, January 1998.

Table 3. Hospitalized Fall Injuries, Percentages, and Rates (per 100,000) by Gender, Age, Race/Ethnicity and Type of Fall Among California Residents Aged 20 and Older, 1995–1997

Parameter	Number	Percentage	Average Rate per 100,000 per Year	95% CI
All falls	242,166	100	358	356.0–360.9
Gender*				
Men	86,657	36	258	255.5–261.4
Women	155,507	64	457	453.0–460.8
Age group				
20–54 y	48,658	20	97	95.8–98.8
55–64 y	19,072	8	269	262.8–276.0
65–74 y	40,030	17	683	671.3–694.4
75–84 y	72,818	30	2089	2063.4–2115.4
85 y +	61,588	25	5532	5458.2–5605.3
Race/ethnicity†				
White	190,121	79	488	483.8–491.4
Black	10,510	4	233	224.9–240.2
Hispanic	27,770	11	168	164.6–171.4
Native American	395	‡	96	79.3–112.0
Asian/Pacific Islander	9,051	4	127	122.9–132.0
Other	2,519	1	NA	NA
Type of fall				
On or from stairs and steps (E880)§	10,638	4	16	15.2–16.3
On or from ladder or scaffolding (E881)	7,367	3	11	10.5–11.3
From or out of building or other structure (E882)	3,857	2	6	5.4–6.0
Into pool or hole opening in surface (E883)	678	‡	1	0.9–1.1
From one level to another (E884):	27,838	11	41	40.4–42.0
Other falls (E844.9)	10,340	4	15	14.8–15.8
Chair (E884.2)	7,129	3	11	10.1–11.0
Bed (E844.4)	6,293	3	9	8.9–9.7
Wheelchair (E884.3)‖	2,023	1	NA	NA
Commode (E844.6)	1,064	‡	2	1.4–1.7
Other furniture (E844.5)	444	‡	1	0.6–0.8
Cliff (E884.1)	432	‡	1	0.5–0.7
Playground equipment (E884.0)	113	‡	0	0.1–0.2
Same level from slipping/tripping/stumbling (E885)	99,630	41	147	145.9–149.1
Same level contact with another person (E886)	2,315	1	3	3.2–3.7
Other and unspecified fall (E888)	89,841	37	133	131.5–134.5

Notes: CI = confidence interval; NA = not applicable. For race/ethnicity, see Methods; for Wheelchair, see reference 11.

*Two cases with gender unknown shown in the total only.

†1800 cases (0.7%) with race/ethnicity unknown shown in the total only.

‡Less than 0.05%.

§External cause of injury (E) codes are from the *International Classification of Diseases, Ninth Revision*, E-code series "Accidental Falls," E880–E888, with the exception of E887 (fracture, cause unspecified).

‖The E-code for wheelchair falls became effective October 1995, so these data are for October 1995 through December 1997.

Source: California Office of Statewide Health Planning and Development, patient discharge records and California Department of Finance, 1970–1996 Population Estimates, January 1998.

an elevated rate, nearly double that of men (457 vs 258). Fall risk shows a 2.5- to 3-fold increase between each successive age group. The rate difference between adults aged 20 to 54 years and 85 years and older is 57-fold. The increase in rates across age for both men and women is exponential (data not shown). Whites are at the most risk, with a rate double that of Blacks, followed by Hispanics, Asian/Pacific Islanders, and Native Americans. Fall injuries from slipping, tripping, and stumbling on the same level are clearly most common among adults, followed by injuries from falling from one level to another and from falling on or from stairs and steps. These three types of falls represent 91% of all fall injuries with type known (excluding other and unspecified). Among fall injuries from one level to another, falls from a bed or chair are particularly common.

Incidence Rates by Type of Fall Injuries and Age

The risk of injury from falling varies by type of fall, age, and sex (Table 4). For the three main types of falls, rates jump dramatically with age. The increase between younger adults aged 20 to 54 and older adults aged 85 and older was 76-fold for fall injuries from slipping, tripping, and stumbling on the same level (31 vs 2383), 33-fold for fall injuries from one level to another (17 vs 556), and 19-fold for fall injuries on or from stairs and steps (7 vs 132).

Women have higher rates for the three leading types, whereas men have higher rates for all less common types. The risk for women increases with age for fall injuries from slipping, tripping, and stumbling (from 33 for ages 20–54 to 2690 for ages 85 and older) and those from stairs and steps (from 8 to 144). For fall injuries from one level to another,

Table 4. Hospitalized Falls, Rates (per 100,000)* by Gender and Age, and Type of Fall Among California Residents Aged 20 and Older, 1995–1997

	All Ages		20–54 y		55–64 y		65–74 y		75–84 y		85+ y	
Characteristic	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
Both Genders												
Same level from slipping/tripping/stumbling (E885)†	99,630	147	15,671	31	7,798	110	17,294	295	32,335	928	26,533	2,383
From one level to another (E884)	27,838	41	8,506	17	2,319	33	4,082	70	6,743	193	6,188	556
On or from stairs and steps (E880)	10,638	16	3,409	7	1,175	17	1,978	34	2,604	75	1,472	132
On or from ladder or scaffolding (E881)	7,367	11	3,898	8	1,189	17	1,278	22	809	23	193	17
From or out of building or other structure (E882)	3,857	6	3,135	6	313	4	233	4	142	4	34	3
Same level contact with another person (E886)	2,315	3	1,652	3	111	2	148	3	235	7	169	15
Into pool or hole in surface (E883)	678	1	528	1	62	1	39	1	38	1	11	‡
Other and unspecified (E888)	89,841	133	11,859	24	6,105	86	14,978	255	29,912	858	26,988	2,424
Total	242,166	358	48,658	97	19,072	269	40,030	683	72,818	2,089	61,588	5,532
Men												
Same level from slipping, tripping, or stumbling (E885)	29,194	87	7,643	30	2,654	77	4,975	188	8,281	593	5,641	1,675
From one level to another (E884)	12,759	38	6,072	24	1,232	36	1,727	65	2,259	162	1,469	436
On or from stairs and steps (E880)	3,556	11	1,487	6	406	12	582	22	726	52	355	105
On or from ladder or scaffolding (E881)	6,060	18	3,388	13	968	28	973	37	599	43	132	39
From or out of building or other structure (E882)	3,309	10	2,708	11	280	8	195	7	108	8	18	‡
Same level contact with another person (E886)	1,503	4	1,323	5	52	2	51	2	42	3	35	10
Into pool or hole in surface (E883)	497	1	413	2	39	1	21	1	19	‡	5	‡
Other and unspecified (E888)	29,779	89	6,653	26	2,633	77	5,388	204	8,899	637	6,206	1,843
Total	86,657	258	29,687	115	8,264	240	13,912	527	20,933	1,498	13,861	4,116
Women												
Same level from slipping, tripping, or stumbling (E885)	70,436	207	8,028	33	5,144	141	12,319	382	24,053	1,152	20,892	2,690
From one level to another (E884)	15,079	44	2,434	10	1,087	30	2,355	73	4,484	215	4,719	608
On or from stairs and steps (E880)	7,082	21	1,922	8	769	21	1,396	43	1,878	90	1,117	144
On or from ladder or scaffolding (E881)	1,307	4	510	2	221	6	305	9	210	10	61	8
From or out of building or other structure (E882)	548	2	427	2	33	1	38	1	34	2	16	‡
Same level contact with another person (E886)	812	2	329	1	59	2	97	3	193	9	134	17
Into pool or hole in surface (E883)	181	1	115	0	23	1	18	‡	19	‡	6	‡
Other and unspecified (E888)	60,062	176	5,205	21	3,472	95	9,590	298	21,013	1,006	20,782	2,676
Total	155,507	457	18,970	78	10,808	297	26,118	810	51,884	2,485	47,727	6,146

*Average annual rates for 1995–1997.

†External cause of injury (E) codes are from the *International Classification of Diseases, Ninth Revision*, E-code series "Accidental Falls," E880–E888, with the exception of E887 (fracture, cause unspecified).

‡Two cases with gender unknown shown in the total only.

§Rates not computed for fewer than 20 cases.

Source: California Office of Statewide Health Planning and Development, hospital records and California Department of Finance, 1970–1996 Population Estimates, January 1998.

men have higher rates until age 64, and women have higher rates thereafter.

Place of Fall Injury by Type of Fall and Age

Nearly two thirds of all hospitalized falls occur at home, with the proportion increasing with age (from 39% for ages 20–54 to 70% for ages 85+) (Table 5). A residential institution is the second leading place for fall injuries (with 14%), and the proportion increases with age (from 7% for ages 20–54 to 21% for ages 85+). For all other specified places, fall injury becomes less frequent with age. The place of fall injury also varies by type of fall injury. For example, more than two thirds of fall injuries from slipping, tripping, and stumbling occur at home, but only one half of those from one level to another occur at home.

Fall Injury Outcomes and Consequences by Age

Hospital charges, which are partly a function of length of stay, do not rise with age for older adult fall injuries (Table 6). However, hospital charges for older adult fall injuries are about $2000 higher than charges for the age 20 through 54 comparison group. Hospital charges for all fall injuries amounted to $4.1 billion for 1.7 million hospital days for the study period. Mean charges came to $17,086, and the mean stay was 7 days. Mean charges and length of stay vary by type of fall injury, with those from one level to another having the largest means (charges = $19,632, and length of stay = 8 days).

Figure 1 shows that disposition at discharge varies by age. However, examination revealed that it does not vary by type of fall injury. Transfer from hospital to long-term nursing care, the most common discharge destination for older adults with fall injuries, is typically an adverse outcome. Nearly 67% of those aged 85 years and older were transferred to long-term care, compared with only 5% of those in the 20 to 54 age group. The percentage of fall injury patients dying in the hospital also rose consistently with age (from 1% for ages 20–54 to 4% for ages 85 and older). In contrast, the percentage of patients experiencing a routine discharge and returning home was strongly inversely related to age

Table 5. Hospitalized Falls and Percentage of Distribution by Age, Type, and Place of Fall Among California Residents Aged 20 and Older, 1995–1997

Type of Fall Place of Fall	All Ages Number	All Ages Percentage (Number)	20–54 Percentage (Number)	55–64 Percentage (Number)	65–74 Percentage (Number)	75–84 Percentage (Number)	85+ Percentage (Number)
All Falls							
Home	137,885	63	39	57	67	71	70
Residential institution	31,159	14	7	10	12	15	21
Place unspecified	23,528	11	21	17	11	8	5
Public building	8,087	4	5	5	5	3	2
Recreation place	6,559	3	12	3	2	1	0
Street or highway	6,023	3	5	4	3	2	2
Industrial place*	5,919	3	11	5	1	0	0
Farm	242	0	0	0	0	0	0
Total	219,402	100	100	101	101	100	100
			(40,915)	(16,760)	(36,401)	(67,414)	(57,912)
Slipping/Tripping/Stumbling on Same Level							
Home	62,078	69	42	60	71	76	75
Residential institution	10,515	12	7	8	9	11	17
Place unspecified	5,979	7	15	11	7	5	3
Public building	4,035	4	6	7	6	4	3
Recreation place	3,110	3	16	4	2	1	0
Street or highway	3,205	4	7	5	4	3	2
Industrial place*	1,449	2	6	5	1	0	0
Farm	55	0	0	0	0	0	0
Total	90,426	101	99	100	100	100	100
			(13,334)	(6,802)	(15,606)	(29,763)	(24,921)
Falling From One Level to Another							
Home	12,702	52	35	50	60	61	56
Residential institution	6,410	26	11	20	26	32	39
Place unspecified	2,152	9	20	12	7	3	2
Public building	604	2	3	4	3	2	1
Recreation place	867	4	11	3	1	1	0
Street or highway	489	2	4	3	1	1	1
Industrial place*	1,295	5	16	8	1	0	0
Farm	71	0	1	0	0	0	0
Total	24,590	100	101	100	99	100	99
			(6,684)	(2,018)	(3,749)	(6,288)	(5,851)
Falling on/From Stairs/Steps							
Home	6,321	66	57	66	69	71	75
Residential institution	234	2	2	2	3	2	3
Place unspecified	1,342	15	24	17	12	9	8
Public building	710	7	5	8	9	9	7
Recreation place	75	1	1	0	1	1	0
Street or highway	536	6	5	4	6	7	6
Industrial place*	209	2	5	3	1	0	0
Farm	5	0	0	0	0	0	0
Total	9,523	99	99	100	101	99	99
			(2,966)	(1,046)	(1,779)	(2,375)	(1,357)

Note: Cases with place unknown not shown on table: total 15,471; slipping/tripping/stumbling 6,204; falling from one level to another 2,289; falling on/from stairs/steps 819; and other types 6,159.

*Includes falls in mine and quarry; 24 in total.

Source: California Office of Statewide Health Planning and Development, hospital records.

(decreasing from 83% for ages 20–54 to 14% for ages 85 and older).

Discussion

Unlike falls in general, types of fall injuries have not been widely studied. Taking advantage of California's large population, we were able to see how fall injuries—and major fall types—change as people age. The increase in rate with age is remarkable. From age 50 on, the increase is exponential. By age 90, the rate reaches 7058 per 100,000.

Like recent studies in Finland (33) and the United States (34), we found an upward trend in rates among older adults. The reasons for the rising trend among older adults are unclear, but the implications for health care are serious. In California, demographers have forecasted that the population of those 55 and older will increase from 18% of the total population in 1999 to 26% in 2040 (35).

All major types of fall injuries climbed significantly with age in our study, but same-level falls from slipping, tripping, and stumbling accounted for the majority. Most of

Table 6. Hospitalized Falls and Mean Hospital Charges by Type of Fall and Age Among California Residents Aged 20 and Older 1995–1997

	All Falls	Slipping, Tripping, or Stumbling on Same Level	Falling From One Level to Another	Falling on or From Stairs and Steps
All ages	$17,086	$16,333	$19,632	$15,507
20–54 y	$15,976	$12,920	$19,377	$13,363
55–64 y	$17,970	$16,182	$22,719	$15,825
65–74 y	$17,799	$16,647	$22,063	$15,835
75–84 y	$17,511	$17,352	$19,158	$17,401
85+ y	$16,723	$16,950	$17,740	$16,427

Source: California Office of Statewide Health Planning and Development, hospital records.

these occur at the patient's home, as the literature has shown (26,27,29,30). Exposure is key: Older adults may have less chance of falling in places they are presumably less likely to visit as they get older, such as recreation and industrial places.

The consequences of older-adult fall injuries are extreme and increase with age. Falls are the most costly injury among older adults (21,22). Hospital charges alone amounted to $4.1 billion for 1.7 million hospital days during our study period. We found that hospital charges do vary by type of fall, with falls from one level to another having the largest charges.

Disposition at discharge varied radically by age but not by type of fall. Transfers to long-term care in nursing homes increased with age, and this was the most typical discharge destination for older adults with fall injuries, as other studies report (4,36). Among very old fall patients, long-term care becomes the norm. This pattern suggests high morbidity and high costs.

The following caveats should be kept in mind when interpreting our data. We include only serious adult fall injuries requiring hospitalization and, therefore, do not consider falls that cause death before admission or fall injuries treated in outpatient settings. Although there is little ambiguity as to what constitutes a hospitalized fall injury, the decision to hospitalize a person who falls is made by thousands of physicians in nearly 600 acute care hospitals in California.

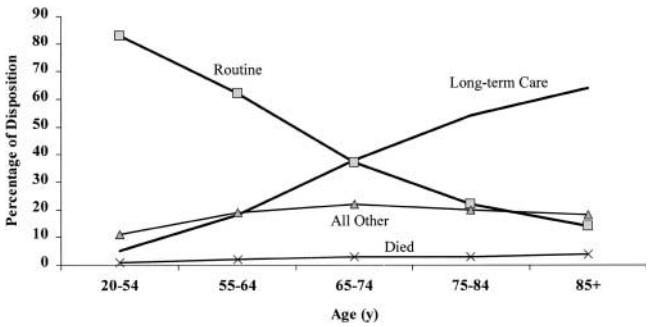

Figure 1. Hospitalized falls and percentage distribution of disposition at discharge from acute care facilities among California residents aged 20 and older, 1995 through 1997. *Source*: patient discharge data, California Office of Statewide Health Planning and Development.

However, hospital records do not identify type of fall for 89,841 (37%) cases. Whether these missing data are distributed so as to bias our findings cannot be determined, although age–sex patterns of unidentified falls are very similar to those of identified falls (data not shown). Intrinsic risk factors are not included in California hospital discharge records and could not be studied. For example, we do not know which patients took medications that affect balance.

Given the extremely high rates of older-adult fall injuries, the aging of our population, and possibly increasing rates, the prevention of falls among older adults should be a top public health priority. The potential cost benefit of programs to prevent morbidity from falls is believed to be very large (21,37). We encourage prevention workers to take note of our findings that demographic factors, place of fall, and mean hospital charges all vary by type of fall. These findings suggest that future research should focus on individual types of falls rather than on aggregated falls.

Acknowledgments

The California Department of Health Services supported this research.

Address correspondence to Arthur A. Ellis, MA, Department of Health Services, Epidemiology and Prevention for Injury Control Branch, Injury Surveillance and Epidemiology Section, 611 N. 7th Street, MS 39A, PO Box 942732, Sacramento, CA 94234-7320. E-mail: aellis@dhs.ca.gov

References

1. Weindruch R, Hadley EC, Ory MG, eds. *Reducing Frailty and Falls in Older Persons*. Springfield, IL: Charles C Thomas; 1991.
2. Sattin RW, Huber DAL, DeVito CA, et al. The incidence of fall injury events among the elderly in a defined population. *Am J Epidemiol.* 1990;131:1028–1037.
3. Lilley JM, Arie T, Chilvers CE. Accidents involving older people: a review of the literature. *Age Ageing.* 1995;24:346–365.
4. Sattin RW. Falls among older persons: a public health perspective. *Ann Rev Public Health.* 1992;13:489–508.
5. Hoskin AF. Fatal falls: trends and characteristics. *Statistical Bull.* 1998;79:10–15.
6. Nevitt MC, Cummings SR, Kidd S, Black D. Risk factors for recurrent nonsyncopal falls. *JAMA.* 1989;261:2663–2668.
7. Tinetti ME, Speechley M, Ginter SF. Risk factors for falls among elderly persons living in the community. *N Engl J Med.* 1988;319:1701–1707.
8. Campbell AJ, Borrie MJ, Spears GF, Jackson SL, Brown JS, Fitzgerald JL. Circumstances and consequences of fall experienced by a community population 70 years and over during a prospective study. *Age Ageing.* 1990;19:136–141.
9. *Accident Facts, 1997 Edition*. Itasca, IL: National Safety Council; 1997.
10. King MB, Tinetti ME. Falls in community-dwelling older persons. *J Am Geriatr Soc.* 1995;43:1146–1154.
11. Lipsitz LA, Jonsson PV, Kelley MM, Koestner JS. Causes and correlates of recurrent falls in ambulatory frail elderly. *J Gerontol Med Sci.* 1991;46:M114–M122.
12. Tinetti ME, Williams TF, Mayewski R. Fall risk index for elderly patients based on number of chronic disabilities. *Am J Med.* 1986;80:429–434.
13. Robbins AS, Rubenstein LZ, Josephson KR, Schulman RL, Osterweil D, Fine G. Predictors of falls among elderly people: results of two population-based studies. *Arch Intern Med.* 1989;149:1628–1633.
14. Tinetti ME, Baker DI, McAvay G, et al. A multifactorial intervention to reduce the risk of falling among elderly people living in the community. *N Engl J Med.* 1994;331:821–827.
15. Alexander BH, Rivara FP, Wolf ME. The cost and frequency of hospitalization for fall-related injuries in older adults. *Am J Public Health.* 1992;82:1020–1023.

16. Mayo NE, Korner-Bitensky N, Levy AR. Risk factors for fractures due to falls. *Arch Phys Med Rehabil.* 1993;74:917–921.
17. Kiel DP, O'Sullivan P, Teno JM, Mor V. Health care utilization and functional status in the aged following a fall. *Med Care.* 1991;29:221–228.
18. Cumming RG, Klineberg RJ. Fall frequency and characteristics and the risk of hip fractures. *J Am Geriatr Soc.* 1994;42:774–778.
19. Rubin CD. Southwestern internal medicine conference: prevention of hip fractures in the elderly. *Am J Med Sci.* 1995;310:77–85.
20. Hayes WC, Myers ER, Morris JN, Gerhart TN, Yett HS, Lipsitz LA. Impact near the hip dominates fracture risk in elderly nursing home residents who fall. *Calcif Tissue Int.* 1993;52:192–198.
21. Rizzo JA, Friedkin R, Williams CS, Nabors J, Acampora D, Tinetti ME. Health care utilization and costs in a Medicare population by fall status. *Med Care.* 1998;36:1174–1188.
22. Runge J. The cost of injury. *Emerg Med Clin North Am.* 1993;11:241–253.
23. Englander F, Hodson TJ, Terregrossa RA. Economic dimensions of slip and fall injuries. *J Forensic Sci.* 1996;41:733–746.
24. Urton MM. A community home inspection approach to preventing falls among the elderly. *Public Health Rep.* 1991;106:192–195.
25. Berg WP, Alessio HM, Mills EM, Tong C. Circumstances and consequences of falls in independent community-dwelling older adults. *Age Ageing.* 1997;26:261–268.
26. Allander E, Gullberg B, Johnell O, Kanis JA, Ranstam J, Elffors L. Circumstances around the fall in a multinational hip fracture risk study: a diverse pattern for prevention. *Accid Anal Prev.* 1998;30:607–616.
27. Norton R, Campbell AJ, Lee-Joe T, Robinson E, Butler M. Circumstances of falls resulting in hip fractures among older people. *J Am Geriatr Soc.* 1997;45:1108–1112.
28. Nyberg L, Gustafson Y, Berggren D, Brannstrom B, Bucht G. Falls leading to femoral neck fractures in lucid older people. *J Am Geriatr Soc.* 1996;44:156–160.
29. Aharonoff GB, Dennis MG, Elshinawy A, Zuckerman JD, Koval KJ. Circumstances of falls causing hip fractures in the elderly. *Clin Orthop.* 1998;348:10–14.
30. Cali CM, Kiel DP. An epidemiologic study of fall-related fractures among institutionalized older people. *J Am Geriatr Soc.* 1995;43:1336–1340.
31. *International Classification of Diseases. Ninth Revision, Clinical Modification (ICD-9-CM).* Los Angeles: Practice Management Information Corporation; 1998.
32. California Code of Regulations. Title 22, Division 7, Chapter 10: Health Facility Data, Article 8, Discharge Data Reporting Requirements, Section 97242 (2000).
33. Kannus P, Palvanen M, Niemi S, et al. Increasing number and incidence of fall-induced severe head injuries in older adults. *Am J Epidemiol.* 1999;149:143–150.
34. Stevens JA, Hasbrouck L, Durant TM, et al. Surveillance for injuries and violence among older adults. *MMWR CDC Surveill Summ.* 1999;48(SS-8):27–50.
35. *1970–2040 Race/Ethnic Population for Counties with Age and Sex Detail.* Sacramento, CA: California Department of Finance; December, 1998.
36. Tinetti ME, Williams CS. Falls, injuries due to falls, and the risk of admission to a nursing home. *N Engl J Med.* 1997;337:1279–1284.
37. Rizzo JA, Baker DI, McAvay G, Tinetti ME. Cost-effectiveness of a mutifactorial targeted prevention program for falls among community elderly persons. *Med Care.* 1996;34:954–969.

Received September 5, 2000
Accepted September 14, 2000
Decision Editor: John E. Morley, MB, BCh