

Effect of Fracture on the Health Care Use of Nursing Home Residents

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Background: Osteoporotic fractures result in increased health care use. Care following fracture has been characterized for community dwellers but not for nursing home residents, whose fracture rates are as much as 11 times higher than those of age-matched community dwellers. Knowing the amount of care following fracture may help determine the effects of fracture prevention on use and costs in this population.

Methods: A prospective cohort study was conducted, with 18 months of follow-up, of 1427 randomly selected white, female nursing home residents 65 years and older from 47 randomly selected nursing homes in Maryland.

Results: After controlling for age, comorbidities, and mobility, nursing home residents who experienced a fracture were hospitalized more than 15 times as often as those who did not in the month following the fracture (relative rate, 15.35; 95% confidence interval, 12.27-19.21) and at a higher rate from 3 through 12 months postfracture.

Rates in the first month were higher for persons with a hip fracture (relative rate, 31.01; 95% confidence interval, 26.52-36.24). Rates of emergency department use and contacts with physicians and therapists were increased, the latter two for 12 months following fracture. Also, before the fracture, patients who experienced a fracture visited the emergency department and had more physician contacts; for those with a hip fracture, there were fewer prefracture hospitalizations.

Conclusions: Health care use remained elevated through 1 year postfracture. Comparisons with community patients suggest that this care may be less than what would be provided in other settings. For patients who fractured a hip, higher use decreased after 6 months, similar to community cohorts. Nursing home residents who visit the emergency department may warrant special screening for a fracture.

Arch Intern Med. 2002;162:1502-1508

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OSTEOPOROSIS AND osteoporotic fractures are a major health concern, resulting in decreased quality of life and increased mortality, morbidity, and health care use.¹⁻⁶ In the United States, an estimated \$13.8 billion was spent on osteoporosis and related health problems in 1995, primarily for hospitalization (62%), nursing home care (28%), and outpatient services (9%).⁷ Projections indicate that the need for hospital care alone for those with osteoporotic fractures will almost double between 2000 and 2050.⁸

Increased medical needs and health care use following fracture have been documented in community dwellers, but little is known about use following fracture in nursing home residents. This lack of in-

formation is surprising, considering that the rate of incident hip fracture among nursing home residents is between 3 and 11 times that of age-matched community dwellers.⁹⁻¹¹ Recent reports suggest that 97% of nursing home residents have osteoporosis or osteopenia¹² and that bone mineral density is a significant predictor of osteoporotic fracture in nursing home residents,¹³ implying that interventions targeting bone mineral density may lessen fracture and resultant health care costs for this cohort. Before reductions in care and related costs can be detected, information regarding the extent of use is needed.

This analysis examined the extent of health care use (hospitalizations, emergency department visits, and physician, physical therapy [PT], and occupational therapy [OT] contacts) by nursing home

SUBJECTS AND METHODS

SAMPLE

Subjects were recruited from facilities participating in the Maryland Long-term Care Project, a random sample of 59 nursing homes stratified by location and size and selected from all 221 licensed facilities in Maryland. Only 2 (3%) homes refused to join the project. Participating facilities are located in rural, urban, and suburban localities; 9 are small (1-50 beds), 28 are medium (51-150 beds), and 22 are large (>150 beds). Power calculations determined that collecting data from residents of 47 (80%) of these facilities was sufficient for these analyses.

Persons 65 years and older were eligible to participate. Because bone mineral density measurements were required for other analyses and because subjects were followed up over time for fracture, nursing home residents were ineligible if they were comatose; had metastatic bone disease, terminal cancer, a prosthetic implant or significant open skin lesions on both wrists and forearms; or were admitted for rehabilitation only. A target number of subjects was determined for each facility to maintain representation by strata. If more than the required number of persons from a nursing home were eligible, subjects were randomly selected for inclusion until the quota was met. Informed consent was obtained from residents or family members if subjects were cognitively impaired and unable to provide their own consent, in accordance with procedures approved by the University of Maryland, Baltimore, Institutional Review Board. Trained evaluators collected data between April 18, 1995, and May 21, 1997, and white, female nursing home residents were followed up for fracture and health care use for 18 months following the baseline assessment.

MEASURES

Information about fracture occurrence between the baseline assessment and 18 months of follow-up was abstracted from physician progress notes, consultation notes, radiologist reports, and hospital discharge summaries. Fractures were considered only if they were confirmed by radiographic or physician report and the site of the fracture was coded. Health care use included hospitalization, emergency department visit (without hospitalization), and physician and PT and OT contacts from the baseline assessment through 18 months of follow-up. Physician contact was defined as face-to-face visits with all physicians, except psychiatrists. All data were abstracted from physician orders, physician progress notes, nurses' notes, hospital

discharge summaries, and patient transfer forms. Additional data were available from baseline interviews with nursing home residents and staff members and from medical record review, including comorbid conditions, from which a Charlson Index was computed.¹⁴ The degree of dependence in activities of daily living was assessed using information from the Minimum Data Set, a comprehensive assessment tool in universal use in US nursing homes. Completed by a staff member trained in its use, with input from other staff,¹⁵ it included independence in bed mobility, transfer, and locomotion, from which a 3-item summary mobility score was derived (indicating the number of items performed with no more than limited assistance).

ANALYSIS

Nursing home residents who did not experience a fracture were compared with those who did during 7 intervals: prefracture (projected over a standard 30-day period), fracture to 30 days postfracture, 31 to 60 days postfracture, 61 to 90 days postfracture, 3 to 6 months postfracture, 6 to 12 months postfracture, and 12 to 18 months postfracture. Nursing home residents who experienced a fracture were further differentiated by whether their first fracture was a hip fracture. Poisson regression models were used to estimate event rates and relative risks for medical care use according to fracture status during follow-up. An offset term in the model took into account each resident's length of follow-up. It allowed those who died to contribute to the use rates as long as they were alive. Covariates known to relate to fracture (age, comorbid status, transfer independence, and mobility score)¹³ were included in the model to adjust for differences in case mix among the fracture and nonfracture groups. The longitudinal Poisson regression models were fitted using generalized estimating equations¹⁶ to account for the dependence of repeated observations in the same individual. An exchangeable covariance structure was used to model this dependence. To estimate and describe changes in event rates during the 18 months, time period indicator variables and interaction terms of the time period by fracture status group were included.

Use during follow-up for nursing home residents who did and did not experience a fracture was examined in 4 medical services areas: hospitalizations, emergency department visits, physician contacts, and combined PT and OT contacts. Results are shown for all residents who experienced a fracture compared with all who did not experience a fracture, and then specifically for those who fractured a hip only (eliminating residents experiencing other fracture types first).

residents experiencing a fracture within an 18-month period. Use rates among those who did not experience a fracture were compared with rates among those who did experience a fracture, and were examined separately for hip fracture.

RESULTS

A total of 1456 white women were enrolled in the study; 29 (2.0%) could not be followed up because of missing

records or an inability to access records. During the 18-month follow-up of the remaining 1427 subjects, 441 (30.9%) died, 19 (1.3%) were transferred to another facility, and 22 (1.5%) were discharged home; in these cases, follow-up data were abstracted until death or discharge home. The total follow-up was 1762 woman-years.

Descriptive information comparing subjects who experienced a fracture with those who did not, and comparisons among those fracturing a hip vs another bone, are presented in **Table 1**. Of the 1427 white

Table 1. Descriptive Statistics for Nursing Home Subjects Who Did and Did Not Experience a Fracture During the 18-Month Follow-up*

Variable	All Nursing Home Subjects (N = 1427)			Nursing Home Subjects Who Experienced a Fracture (n = 203)		
	Those Who Did Not Experience a Fracture (n = 1224)	Those Who Did Experience a Fracture (All Types) (n = 203)	P Value	Hip Fracture (n = 65)	Nonhip Fracture (n = 138)	P Value
Age, mean (SD), y	85.0 (7.4)	85.9 (6.7)	.11	86.3 (6.2)	85.7 (6.9)	.58
ADL impairment						
Mobility score, mean (SD)	1.24 (1.28)	0.91 (1.20)	<.001	0.82 (1.16)	0.96 (1.23)	.43
Bed mobility, independent	34.0	23.2	.002	16.9	26.1	.15
Transfer, independent	48.3	36.5	.002	30.8	39.1	.25
Locomotion, independent	42.8	32.0	.004	33.9	31.1	.70
Comorbidities						
Charlson Index, mean (SD)	5.53 (4.51)	5.42 (4.51)	.75	5.31 (4.10)	5.47 (4.71)	.81
Angina	57.7	59.6	.61	52.3	63.0	.15
Dementia	56.6	53.7	.45	60.0	50.7	.22
Hypertension	53.0	51.7	.75	41.5	56.5	.05
Arthritis	48.8	49.8	.80	50.8	49.3	.84
Fractures (ever)	39.9	48.3	.02	43.1	50.7	.31
Glaucoma	34.4	36.5	.57	27.7	40.6	.08
Stroke	33.9	31.0	.42	24.6	34.1	.18
Circulation disorder	25.1	26.1	.76	18.5	29.7	.09
CHF	25.1	21.2	.23	21.5	21.0	.93
Thyroid disorder	20.1	17.2	.35	15.4	18.1	.63
Diabetes	18.5	19.2	.82	20.0	18.8	.84
Asthma	18.0	17.7	.92	10.8	21.0	.08
Diagnosed osteoporosis	17.0	20.2	.26	9.2	25.4	.008
Epilepsy or seizure	8.0	4.9	.12	1.5	6.5	.13
Kidney disease	6.4	3.5	.10	4.6	2.9	.53

*Data are given as percentage of nursing home subjects unless otherwise indicated. ADL indicates activities of daily living; CHF, congestive heart failure.

women, 203 (14.2%) had a confirmed and/or a diagnosed fracture during follow-up. Of these subjects with a fracture, 65 (32.0%) had a hip fracture as their first fracture, while 138 (68.0%) had other types of fractures as their first fracture. Four subjects whose first fracture included the hip and another site (eg, the wrist) on the same date were classified as having hip fractures.

Subjects who experienced a fracture scored significantly worse than those who did not on all baseline activities of daily living impairment measures (eg, 23.2% vs 34.0% were independent in bed mobility) and more of these subjects had a history of fracture (Table 1). Differences between persons fracturing a hip vs another bone were observed for hypertension and diagnosed osteoporosis, both being more prevalent in the non-hip fracture group. More than 90% of subjects fracturing a hip during follow-up had no history of diagnosed osteoporosis.

Rates (per patient per month) of hospitalizations, emergency department visits, physician contacts, and PT and OT contacts for all fracture types are presented in **Table 2** and **Figure 1**, respectively. Compared with subjects who did not fracture, those who did were hospitalized more than 15 times as often within 30 days of the fracture and continued to be hospitalized at a higher rate from 3 to 6 and from 6 to 12 months postfracture. Subjects who experienced a fracture during

follow-up were more likely to have visited the emergency department before the fracture and during the month following the fracture. Contacts with physicians occurred more often for patients who experienced a fracture before and immediately after the fracture, and continued at a higher rate for as long as 12 months following the fracture. Subjects who experienced a fracture during follow-up also had higher rates of PT and OT contacts during the first month postfracture and throughout 12 months following the fracture.

Patterns of use for subjects who fractured a hip compared with subjects who did not (excluding patients whose first fracture was not a hip fracture) are shown in **Table 3** and **Figure 2**. Patients whose first fracture during follow-up was a hip fracture were less likely to be hospitalized before the fracture than subjects who did not experience a fracture; however, they were more likely to be hospitalized within 1 month of fracture, but not thereafter. Differences in emergency department visit rates were also evident, with patients who fractured a hip showing significantly higher use rates before and for 1 month following the fracture. These patients had higher rates of physician contacts during the months following the fracture than patients who did not experience a fracture, but the rate returned to normal after 6 months. Finally, patients with hip fractures showed higher rates of PT and OT contacts

from the time of fracture through 6 months, ranging from a relative rate of 20.68 for the first month to a relative rate of 3.96 from 3 to 6 months postfracture.

COMMENT

To our knowledge, this is the first study to prospectively characterize health care use in nursing home residents following fracture, despite the high risk of fracture in this population. As would be expected, nursing home residents who experienced a fracture consumed more health care services than those who did not experience a fracture. Relative rates of hospitalization for subjects who experienced a fracture were 15 times higher than for control subjects in the first month postfracture, and more than 31 times higher for those who fractured a hip; they also exhibited elevated rates again 3 through 12 months postfracture. Patients who experienced a fracture had more physician and PT and OT contacts from the time of fracture through 1 year and more emergency department visits in the first month following fracture.

Hospitalization following fracture constitutes a significant cost to our health care system. In 1995, the cost of inpatient treatment for osteoporotic fractures totaled \$8.6 billion; 57% of these 432 448 hospitalizations were hip fractures.⁷ Considering that the mean cost of the index hospitalization for hip fractures is \$11 480 (1993 dollars),¹⁷ the implications of the 31-fold increased rate among nursing home residents with a hip fracture compared with controls is staggering.

In addition to the initial increase in hospitalizations immediately following a fracture, the rate was elevated again from 3 to 12 months following a fracture. To determine whether the cause for this additional hospitalization was related to the initial fracture, *International Classification of Diseases, Ninth Revision (ICD-9)*, codes for patients who experienced a fracture were compared with those of patients who did not experience a fracture but were hospitalized during this period. There was no strong evidence that subsequent hospitalizations were related to the fracture (eg, the most prevalent condition among patients who experienced a fracture was urinary tract infection, at a rate of 28 of 100 patients, compared with a rate of 22 of 100 patients for those who did not experience a fracture). The second most common condition was senile dementia (rate, 18 of 100 vs 16 of 100 patients). Others¹⁸ have also found that the long-term medical costs due to complications from fracture are low. Alternate conclusions for this elevation could be as follows: (1) following fracture, there is a general deterioration in the patient's underlying health status¹⁹; (2) health care providers in long-term care change their response to medical care following fracture; or (3) despite the effort to analytically control for differences related to age, comorbid status, and mobility, hospitalization rates partially reflect the comparative frailty of the subjects who experience a fracture. Supporting the assumption that those who experienced a fracture were among the most frail nursing home residents is the finding that they used more emergency depart-

Table 2. Health Care Use for Nursing Home Subjects Who Did Not (n = 1224) and Who Did (n = 203) Experience a Fracture (All Types) During the 18-Month Follow-up*

Group	Monthly Rate	Relative Rate (95% Confidence Interval)
Hospitalizations		
Nonfracture	0.03	1.00†
Fracture		
Prefracture	0.02	0.75 (0.52-1.08)
Time of fracture to 1 mo	0.47	15.35 (12.27-19.21)‡
1-2 mo	0.04	1.19 (0.54-2.62)
2-3 mo	0.02	0.64 (0.21-1.98)
3-6 mo	0.06	1.83 (1.10-3.02)§
6-12 mo	0.06	1.83 (1.18-2.86)
12-18 mo	0.03	1.05 (0.38-2.89)
Emergency Department Visits		
Nonfracture	0.02	1.00†
Fracture		
Prefracture	0.06	3.32 (2.56-4.29)‡
Time of fracture to 1 mo	0.35	18.78 (14.28-24.69)‡
1-2 mo	0.02	1.29 (0.48-3.43)
2-3 mo	0.02	1.05 (0.34-3.26)
3-6 mo	0.02	1.07 (0.54-2.14)
6-12 mo	0.04	1.90 (1.12-3.21)§
12-18 mo	0.02	1.35 (0.52-3.53)
Physician Contacts		
Nonfracture	1.15	1.00†
Fracture		
Prefracture	1.35	1.17 (1.09-1.26)‡
Time of fracture to 1 mo	2.59	2.25 (2.03-2.49)‡
1-2 mo	1.62	1.41 (1.25-1.59)‡
2-3 mo	1.39	1.20 (1.06-1.37)
3-6 mo	1.35	1.17 (1.04-1.31)
6-12 mo	1.32	1.14 (1.00-1.30)§
12-18 mo	1.22	1.06 (0.08-1.31)
Physical and Occupational Therapy Contacts		
Nonfracture	0.36	1.00†
Fracture		
Prefracture	0.36	1.00 (0.62-1.62)
Time of fracture to 1 mo	3.71	10.25 (7.42-14.15)‡
1-2 mo	2.19	6.05 (4.08-8.97)‡
2-3 mo	1.33	3.66 (2.21-6.07)‡
3-6 mo	0.85	2.35 (1.35-4.09)
6-12 mo	1.04	2.88 (1.46-5.67)
12-18 mo	0.67	1.85 (0.82-4.18)

*Adjusted for age, comorbid status, and mobility.

†Reference.

‡ $P < .001$.

§ $P < .05$.

|| $P < .01$.

ment and physician care before the fracture. However, an alternate conclusion for this increased use before fracture is that an injury occurred and medical care was deployed because the fracture was suspected but not immediately detected. Further exploration of this prefracture care is warranted, including the decreased prefracture hospitalization rate among those with a hip fracture (relative rate, 0.47; 95% confidence interval, 0.25-0.89), which is harder to understand.

Physician contacts, emergency department use, and PT and OT contacts were also elevated following

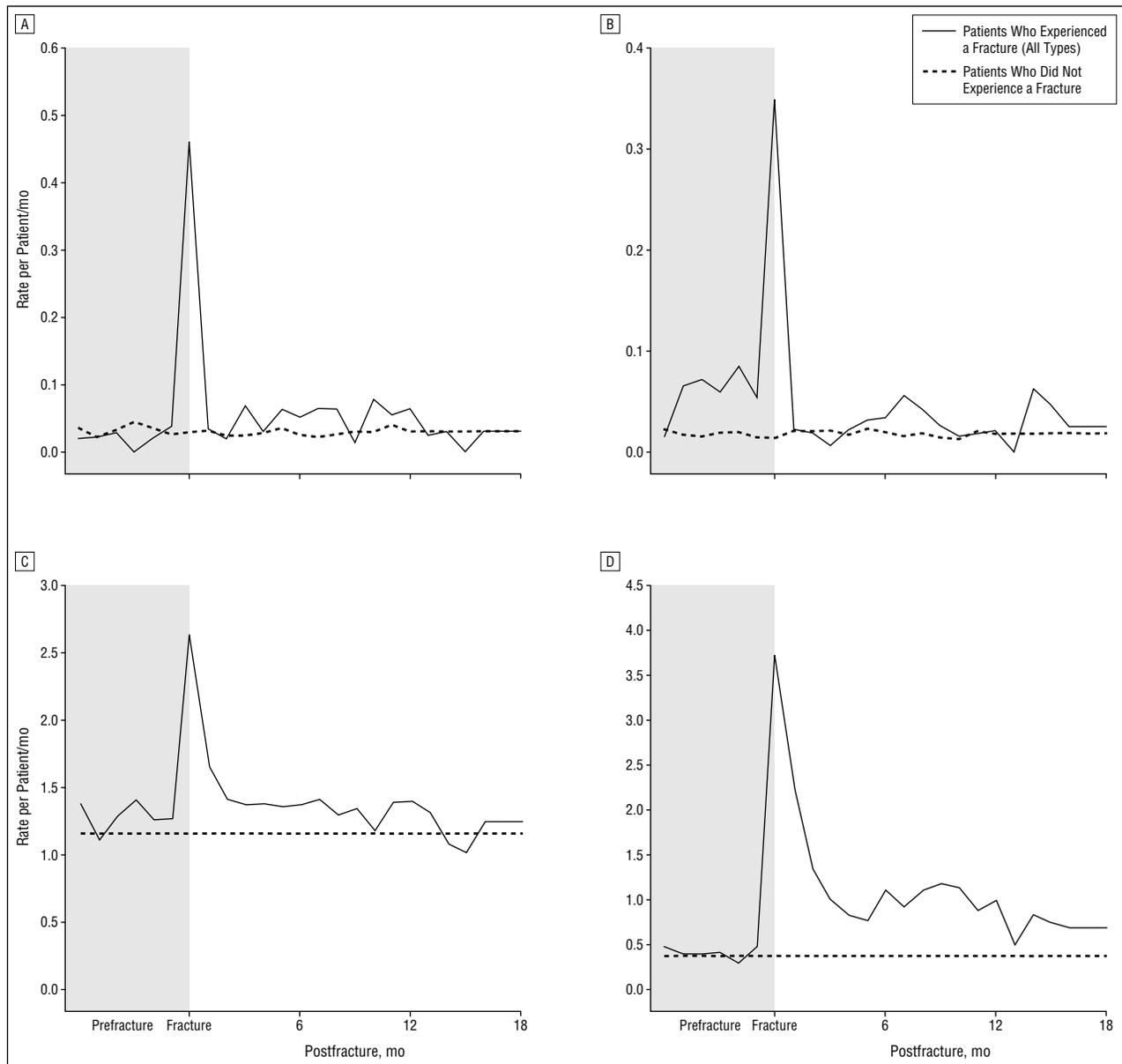


Figure 1. Data are given for nursing home subjects who did and did not experience a fracture during the 18-month follow-up (all fracture types). A, Hospitalization rates. B, Emergency department visit rates. C, Physician contact rates. D, Physical and occupational therapy contact rates.

fracture among nursing home residents. Data from other studies put the scope of these services in context. In 1995, there were more than 2.48 million physician visits, 807 349 emergency department encounters, and 193 557 PT sessions for the treatment of osteoporotic fractures in the United States. Overall, \$1.3 billion was spent for outpatient care, most of which was associated with emergency departments (44%) and physician care (36%).⁷ Among nursing home residents, increased physician and PT and OT contacts for all fractures continued through 1 year; specific to hip fracture, they remained elevated through 6 months only. This finding is similar to that witnessed among community dwellers who fracture a hip, who exhibit increased use in the first 6 months following fracture, which decreases by the end of the first year.¹⁷ No comparison information is

available to explain the ongoing use of services for the general nursing home population that experiences a fracture.

It is interesting to consider the implications of residence in a nursing home for these patients. Studies have shown that patients who experience a fracture and are discharged from the hospital to rehabilitation facilities receive significantly more PT and OT contacts than those discharged to skilled nursing facilities (mean time in the nursing home for PT and OT being 18.35 and 7.76 hours, respectively, compared with 19.44 and 17.48 hours, respectively, in rehabilitation facilities)²⁰; similarly, those in subacute skilled nursing facilities receive significantly more OT and physician care than those in traditional nursing facilities (mean OT visits, 12.4 vs 7.6; and mean physician visits, 3.3 vs 2.2).²¹ Consequently, over-

Table 3. Health Care Use for Nursing Home Subjects Who Did Not Experience a Fracture (n = 1224) and Who Fractured a Hip (n = 65) During the 18-Month Follow-up*

Group	Monthly Rate	Relative Rate (95% Confidence Interval)
Hospitalizations		
Nonfracture	0.03	1.00†
Fracture		
Prefracture	0.02	0.47 (0.25-0.89)‡
Time of fracture to 1 mo	0.99	31.01 (26.52-36.24)§
1-2 mo	0.04	1.21 (0.31-4.74)
2-3 mo	0.04	1.32 (0.34-5.13)
3-6 mo	0.06	1.78 (0.62-5.13)
6-12 mo	0.06	1.97 (0.86-4.50)
12-18 mo	0.05	1.52 (0.21-11.20)
Emergency Department Visits		
Nonfracture	0.02	1.00†
Fracture		
Prefracture	0.04	1.67 (1.08-2.57)‡
Time of fracture to 1 mo	0.15	6.61 (3.33-13.14)§
1-6 mo	0.01	0.61 (0.16-2.39)
6-12 mo	0.01	0.60 (0.15-2.37)
12-18 mo	0.02	1.12 (0.15-8.08)
Physician Contacts		
Nonfracture	1.17	1.00†
Fracture		
Prefracture	1.30	1.11 (0.98-1.26)
Time of fracture to 1 mo	2.65	2.26 (1.86-2.73)§
1-2 mo	1.84	1.57 (1.28-1.92)§
2-3 mo	1.45	1.24 (1.00-1.53)
3-6 mo	1.47	1.25 (1.06-1.47)#
6-12 mo	1.10	0.94 (0.74-1.78)
12-18 mo	1.32	1.12 (0.63-2.00)
Physical and Occupational Therapy Contacts		
Nonfracture	0.40	1.00†
Fracture		
Prefracture	0.41	1.03 (0.48-2.23)
Time of fracture to 1 mo	8.20	20.68 (14.87-28.75)§
1-2 mo	4.18	10.55 (6.42-17.33)§
2-3 mo	2.46	6.20 (3.23-11.90)§
3-6 mo	1.57	3.96 (1.83-8.56)§
6-12 mo	0.91	2.30 (0.92-5.74)
12-18 mo	0.52	1.31 (0.38-4.48)

*Adjusted for age, comorbid status, and mobility.

†Reference.

‡P < .05.

§P < .001.

||Because of sparse event frequency, emergency department visits were aggregated from 1 to 6 months postfracture.

¶P < .10.

#P < .01.

all costs following fracture are less in traditional skilled nursing homes than in the other 2 settings, but there is no evidence that differences in the amount of care confer functional benefit.^{20,21} Add to these findings those showing that adjusted rehospitalization rates for patients discharged to nursing homes after the index hospitalization are lower than for those discharged to home health care or rehabilitation,²² and there is some suggestion that while fracture among nursing home residents results in excess health care use, it may not be excessive

compared with what might be expended in other settings.

There are some limitations to this study. First, it was confined to white women. Health care use and related costs are higher for women than men (likely due to their higher mean age and survival time) and higher for white than black persons.^{7,18,19,23} Second, fractures were determined by medical record review and included only those confirmed by radiographic report or physician diagnosis; hence, some fractures, such as vertebral fractures, were likely missed. Similarly, medical record review is likely to have resulted in underreported rates for other medical care as well, although it is not expected to have introduced differences (bias) in comparisons between patients who experienced a fracture and those who did not. Finally, future studies would benefit by including a more comprehensive assessment of use than was possible in this analysis (eg, including an estimation of care provided by nurses and aides) and by deriving estimates that would better enable comparisons across cohorts. Other than the comparisons presented herein, this effort is restricted by different definitions of use (eg, hospital days vs number of hospitalizations), assessment of different types of osteoporotic fractures, and eligibility restrictions of the population under study.

To our knowledge, this study is the first to document health care use following fracture in nursing home residents. It clearly demonstrated short- and long-term effects, including higher use rates through 1 year following fracture, higher prefracture use in some cases (perhaps related to suspected fractures), and a change in the pattern of hospitalization for residents with a hip fracture. Results suggest that, just as in community cohorts, fractures among nursing home residents result in substantial health care expenditures. Better screening and interventions to prevent fractures are warranted, which may be targeted toward high-risk individuals.¹³ In addition, it may be possible to learn more about and work toward reducing the need for care that extends beyond 6 months postfracture. Finally, to better understand the effects of health care use following fracture, more information is needed on recovery following fracture for this population.

Accepted for publication November 20, 2001.

This study was supported by a grant from Merck Research Laboratories, Inc, Blue Bell, Pa (Dr Zimmerman); and grants R29 AG11407 and RO1 AG08211 from the National Institute on Aging, Bethesda, Md (Maryland Long-term Care Project).

We thank Verita Custis Buie, MS, Lori Gorschboth, Justine Golden, MA, and Patricia Greenberg, MA, for their assistance in project and data management, and we thank the nursing home residents and staff of the facilities participating in the Maryland Long-term Care Project for their ongoing dedication to understanding and maximizing the quality of life in long-term care.

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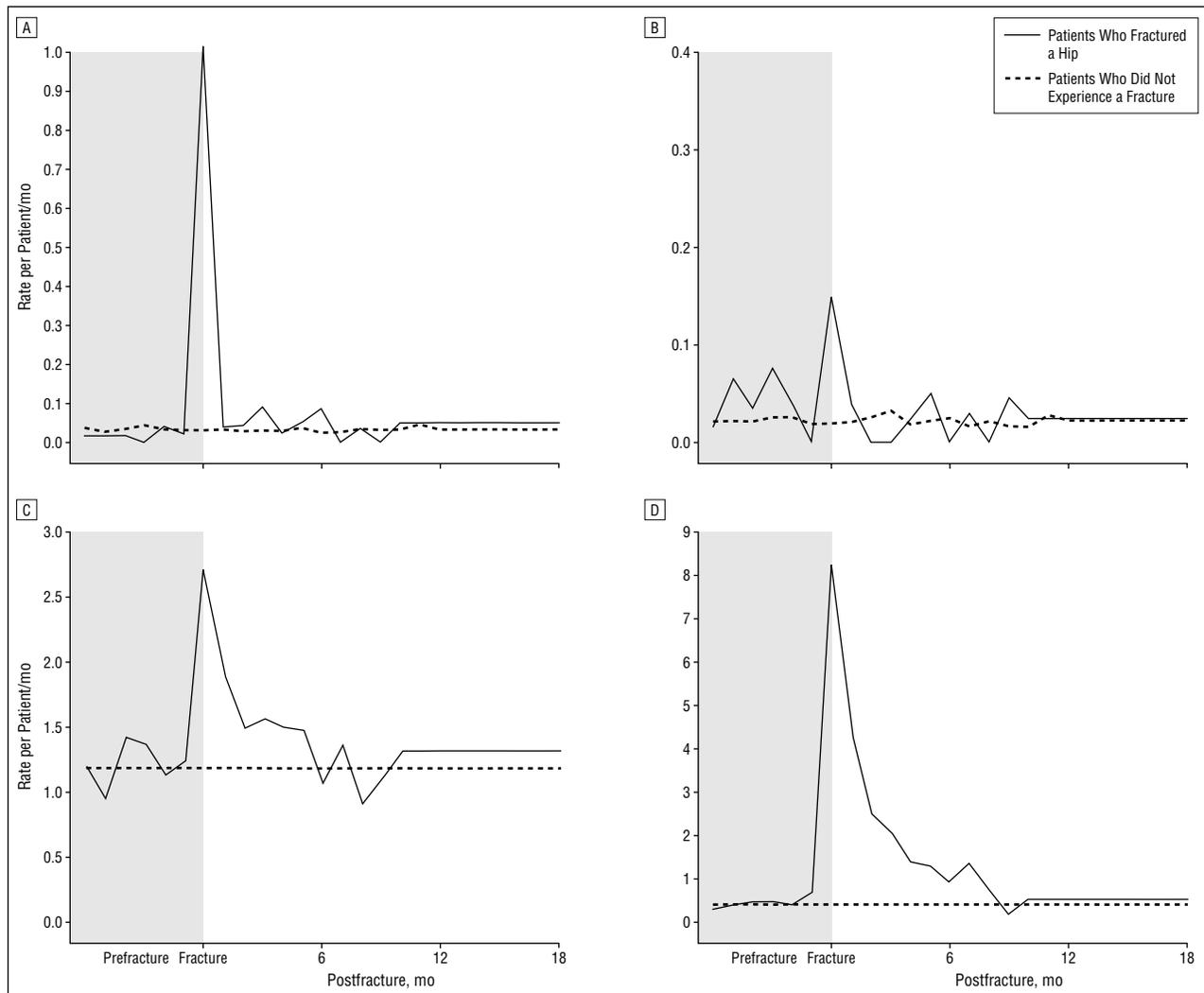


Figure 2. Data are given for nursing home subjects who did not experience a fracture and for those who fractured a hip during the 18-month follow-up. A, Hospitalization rates. B, Emergency department visit rates. C, Physician contact rates. D, Physical and occupational therapy contact rates.

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