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REFERENCES

1. Frey JH: Survey Research by Telephone. Beverly Hills, CA: Sage, 1983; 38–40.
2. Groves RM, Kahn RL: Surveys by Telephone: A National Comparison with Personal Interviews. New York: Academic Press, 1979.
3. Kidder LH, Judd CM: Research Methods in Social Relations. New York: Holt, Rinehart & Winston, 1986.
4. Lavrakas PJ: Telephone Survey Methods. Newbury Park, CA: Sage, 1987.
5. Aday LA, Chiu GY, Anderson R: Methodological issues in health care surveys of the Spanish heritage population. Am J Public Health 1980; 70:367–374.
6. Howard CA, Samet JN, Buechley RW, Schrag SD, Key CR: Survey research in New Mexico Hispanics: Some methodological issues. Am J Epidemiol 1983; 117:27–34.
7. Welch S, Conner J, Steinman M: Interviewing in a Mexican-American community: An investigation of some potential sources of response bias. Public Opinion Q 1973; 37:115–126.
8. Adams-Esquivel H, Lang DA: The reliability of telephone penetration estimates in specialized target groups: The Hispanic case. J Data Collect 1987; 27:35–39.
9. Waksberg J: Sampling methods for random digit dialing. J Am Stat Assoc 1978; 73:40–46.
10. Blair J, Czaja R: Locating a special population using random digit dialing. Public Opinion Q 1982; 46:585–590.
11. Marin G, Perez-Stable EJ, Marin B: Cigarette smoking among San Francisco Hispanics: The role of acculturation and gender. Am J Public Health 1989; 79:196–198.
12. Marin G, Sabogal F, Marin B, Otero-Sabogal R, Perez-Stable EJ: Development of a short acculturation scale for Hispanics. Hispanic J Behav Sci 1987; 9:183–205.
13. Guenzel PJ, Berkmans TR, Cannell CF: General Interviewing Techniques. Ann Arbor: Institute for Social Research, 1983.
14. Kviz FJ: Toward a standard definition of response rate. Public Opinion Q 1977; 41:265–267.
15. Fowler FJ: Survey Research Methods. Beverly Hills, CA: Sage, 1984.
16. Wiseman F, McDonald P: Noncontact and refusal rates in consumer telephone surveys. J Market Res 1979; 16:478–484.
17. Siemiatycki J: A comparison of mail, telephone and home interview strategies for household health surveys. Am J Public Health 1979; 69:238–245.
18. Shoemaker PJ, Reese SD, Danielson WA: Media in ethnic context. Austin, TX: College of Communication, University of Texas at Austin, 1985.
19. Triandis HC, Marin G, Lisansky J, Betancourt H: Simpatia as a cultural script of Hispanics. J Pers Soc Psychol 1984; 47:1363–1375.
20. Vernon CL, D'Augelli AR: Community involvement in prevention programs: The use of a telephone survey for program development. J Community Psychol 1987; 15:23–28.

Sex-specific and Race-specific Hip Fracture Rates

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Abstract: Sex-, race- and age-specific hip fracture rates were determined using Health Care Financing Administration data for Medicare-reimbursed hip fracture hospitalizations from 1980 to 1982. Rates were highest in White women, lowest in Black men, and intermediate in White men and Black women. Proportions of hip fracture patients dying during hospitalization and those discharged to nursing homes, respectively, were: White men (10.5%; 49%); Black men (9.3%; 32%); White women (5.0%; 54%); and Black women (8.2%; 30%). (*Am J Public Health* 1990; 80:326–328.)

Introduction

In 1986 in the United States, there were in excess of 250,000 hospital admissions for hip fracture.[1] Elderly individuals who sustain hip fractures experience increased morbidity[2–7] and mortality.[8–12] In an earlier paper, Farmer, *et al*,[13] reported that age-specific hip fracture rates were higher in White women than in White men, Black women, and Black men, but the differences among age-specific rates for White men, Black men, and Black women could not be estimated precisely.

In this paper we report age-, sex-, and race-specific hip fracture rates extended through age 85 years. In addition, we present findings for proportions of patients dying during hospitalization, and discharged to nursing homes, not previously reported for Blacks.

Methods

Numbers of Medicare-reimbursed hospitalizations for hip fracture in Illinois residents over 65 years of age were obtained from data collected by the Professional Standards Review Organization in Illinois during 1980, 1981, and 1982. The Uniform Hospital Discharge Format was used in the data collection, and the data tape was made available through the Health Care Financing Administration (HCFA). Hip fracture was defined according to the ninth revised International Classification of Diseases[14] categories 820.0–820.9: transcervical fractures, closed and open; pertrochanteric fractures, closed and open; and fractures of unspecified parts of the neck of the femur, closed and open. Populations at risk for hip fracture were obtained from the 1980 United States Census figures for the Illinois population by age, race and sex.

Mean numbers of hip fractures for 1980, 1981, and 1982 were used to calculate the sex-, race- and age-specific annual incidence rates for hip fracture. Miettinen test-based confidence intervals were calculated for the hip fracture relative risks.[15] Age-adjusted odds ratios for death and nursing home placement were determined using the Statistical Analysis System multiple logistic regression program.[16] Race- and sex-specific means for days of hospital stay were adjusted for age with the Statistical Analysis System linear regression program.[17]

Results

Age-group specific hip fracture rates were highest for White women, and lowest for Black men in all age groups after age 70 years (Figure 1). The rates in Black women are

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similar to those in White men, and intermediate to those observed for White women and Black men. Hip fracture rates began to increase exponentially after age 70 years in White women, after age 75 in White men and Black women, and at approximately 85 years of age in Black men. Hip fracture rates in White women were approximately twice those in White men from age 65 to 85 years.*

In-hospital hip fracture death rates were highest for White men (10.5%), followed by Black men (9.3%), Black women (8.2%), and White women (5.0%). Age-adjusted odds ratios for death among hip fracture cases are shown in Table 1. After age-adjustment, in-hospital death rates were twice as high for White men as for White women. Black men had only slightly higher death rates than Black women.

The means for lengths of hospital stays were: Black men (28.0 days), Black women (28.2 days), White men (24.2 days), and White women (23.1 days). Discharge status of survivors is shown in Table 2. Both Black men and women were discharged to nursing homes less frequently than White men and women. After age-adjustment, the odds ratio for nursing home placement in White women compared with Black women was 2.70 (95% CI: 2.21, 3.30), and in White men compared with Black men 1.93 (95% CI: 1.16, 2.61).

Discussion

These data are consistent with earlier observations showing highest age-specific hip fracture rates for White women.[13] However, our findings also indicate higher age-specific rates in women than in men among both Blacks and Whites, although the sex difference occurred at older ages in Blacks than in Whites, as did the race-related differences. These findings are consistent with the age-, sex- and race-specific hip fracture rates recently reported for hip fracture hospitalizations in California.[18]

Black men and women may have lower hip fracture rates because, as adults, they exhibit higher levels of bone mass attained during growth and development.[19–25] In addition, race-related differences in the Vitamin D endocrine system suggest that Blacks are protected from the bone-resorptive effects of parathyroid hormone,[26] and reports of lower bone turnover rates in Blacks may result in slower rates of age-related bone mass than occurs in Whites.[27] The race difference in women is compatible with evidence that obesity is more common in Black women which may increase their extra-ovarian production of estrogen,[28] and that Black women may experience lower rates of menopause-associated bone loss than White women.[29]

While risk for falling, in addition to bone mass, influences hip fracture incidence,[30,31] the extent to which falling risk contributes to race- and sex-differences in hip fracture rates remains unclear. Elderly men are reported to fall less frequently than elderly women.[32] While Black women are reported to have greater muscle mass than White women,[33–35] it is not known if muscle mass acts independently of its documented influence on bone mass, to influence falling risk.

The finding of higher mortality rates in White men than in women is consistent with observations from earlier studies.[8–12] The most comparable race-specific mortality data were reported for small numbers of non-White hip fracture patients in which the risk for mortality at three months post hip fracture in non-Whites versus Whites was 1.5 (95% CI: 0.6, 3.6).[12] In addition to length of hospital stay, in-hospital mortality rates are also influenced by the numbers and severity of co-existing illnesses.[12] In the absence of comorbidity and severity of illness data in this analysis, interpretation of the in-hospital mortality data reported is difficult.

Hospital lengths of stay observed in this study are for the period prior to the implementation of the diagnosis-related group (DRG)-based prospective payment system (PPS), and are consistent with those reported by Fitzgerald, *et al*,[36] which also noted that the shorter lengths of stay after the PPS (12.6 days) were associated with fewer in-hospital physical

TABLE 1—Age-adjusted Odds Ratios for Death during Medicare-reimbursed Hospitalization for Hip Fracture, Illinois, 1980–82

	Age-adjusted Odds Ratios for Death	95% CI*
White men vs White women	2.41	2.17, 3.00
Black men vs Black women	1.18	0.53, 2.35
White men vs Black men	1.02	0.63, 2.23
Black women vs White women	1.64	1.09, 2.47

*Miettinen, test-based confidence intervals.[15]

TABLE 2—Discharge Status of Survivors and Duration of Stay for Medicare-reimbursed Hospitalization for Hip Fracture, Illinois, 1980–82.

	White		Black	
	Men (N = 3575)	Women (N = 14,768)	Men (N = 204)	Women (N = 523)
Nursing home (%)	49	54	32	30
Skilled (%)	73	73	69	66
Intermediate (%)	23	24	29	30
Other (%)	4	3	2	4
Home (%)	46	43	65	66
Self-care (%)	91	90	94	93
Home-health (%)	9	10	6	7
Transferred to another hospital (%)	4	3	2	3
Left hospital against medical advice	1	1	1	1

*Exact data available upon request from author.

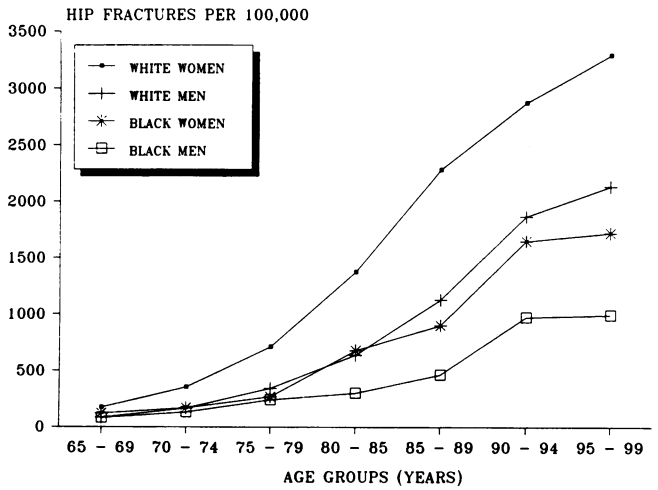

FIGURE 1—Comparison of Sex-specific and Race-specific Hip Fracture Incidence Rates by Age for Illinois Residents, 1980–82

therapy sessions, poorer ability to ambulate on hospital discharge, and higher rates of discharge to nursing homes.

The finding of lower proportions of Black men and women discharged to nursing homes is consistent with race-specific national data for nursing home use.[37]

REFERENCES

1. National Center for Health Statistics, Graham D: Detailed diagnoses and procedures for patients discharged from short-stay hospitals, United States, 1986. Vital and Health Statistics, Series 13, No. 95 DHHS Publ No. (PHS) 88–1756. Washington DC: Govt Printing Office, 1988.
2. Katz S, Kingsbury GH, Downs TD, Ford AB, Scott CP: Long-term course of 147 patients with fracture of the hip. Surg Gynecol Obstet 1967; 124:1219–1230.
3. Ceder L, Thorngren K, Wallden B: Prognostic indicators and early home rehabilitation in elderly patients with hip fracture. Clin Orthop 1980; 152:173–184.
4. Cedar L, Svenssin K, Thorngren KG: Statistical prediction of rehabilitation in elderly patients with hip fractures. Clin Orthop 1980; 152:185–190.
5. Cedar L, Elmqvist D, Svensson SE: Cardiovascular and neurological function in elderly patients sustaining a fracture of the neck of the femur. J Bone Joint Surg (Br) 1981; 63B:560–566.
6. Swanson AJG, Murdoch G: Fractured neck of femur: Pattern of incidence and implications. Acta Orthop Scand 1983; 54:348–355.
7. Mossey JM, Mutran E, Knott K, Craik R: Determinants of recovery 12 months after hip fracture: The importance of psychosocial factors. Am J Public Health 1989; 79:279–286.
8. Beals RK: Survival following hip fracture: Long-term follow-up of 607 patients. J Chronic Dis 1972; 25:235–244.
9. Miller CW: Survival and ambulation following hip fracture. J Bone Joint Surg (Am) 1978; 60A:930–934.
10. Jensen JS, Tondevold E: Mortality after hip fractures. Acta Orthop Scand 1979; 50:161–167.
11. Matheny L II, Scott FF, Graythorne CM, Lowe RW, Mullen JO: Hospital mortality in 342 hip fractures. W Va Med J 1980; 76:188–190.
12. Magaziner J, Simonsick EM, Kashner TM, Hebel JR, Kenzora JE: Survival experience of aged hip fracture patients. Am J Public Health 1989; 79:274–278.
13. Farmer ME, White LR, Brody JA, Bailey KR: Race and sex differences in hip fracture incidence. Am J Public Health 1984; 74:1374–1380.
14. International Classification of Diseases, 9th Rev. US Department of Health and Human Services Pub No. (PHS) 80–1260. Washington, DC: Govt Printing Office, 1980.
15. Miettinen OS: Estimability and estimation in case-referent studies. Am J Epidemiol 1976; 103:226–235.
16. SAS supplemental library user's guide. Cary NC: SAS Institute Inc, 1980.
17. Freund RJ, Littell RC: SAS for linear models: A guide to the ANOVA and GLM procedures. Cary, NC: SAS Institute Inc, 1981.
18. Silverman SL, Madison RE: Decreased incidence of hip fracture in Hispanics, Asians, and Blacks: California Hospital Discharge Data. Am J Public Health 1988; 78:1482–1483.
19. Bollet AJ, Engh G, Parson W: Epidemiology of osteoporosis. Arch Intern Med 1965; 116:191–194.
20. Niemann KM, Mankin HJ: Fractures about the hip in the elderly indigent patient. Geriatrics 1968; 23:150–158.
21. Engh G, Bollet AJ, Hardin G, Parson W: Epidemiology of osteoporosis: II. Incidence of hip fractures in mental institutions. J Bone Joint Surg 1968; 50A:557–562.
22. Moldawer M, Zimmerman SJ, Collins LC: Incidence of osteoporosis in elderly Whites and elderly Negroes. JAMA 1965; 194:859–862.
23. Trotter M, Broman GE, Peterson RR: Densities of bone of White and Negro skeletons. J Bone Joint Surg (Am) 1960; 40A:50–58.
24. Garn SM, Sandusky ST, Nagy JM, McCann MB: Advanced skeleton development in low-income and Negro children. J Pediatr 1972; 80:965–969.
25. Garn SM, Clark DC, Trowbridge FL: Tendency toward greater stature in American Black children. Am J Dis Child 1973; 126:164–166.
26. Bell NH, Greene A, Epstein S, Oexman MJ, Shaw S, Shary J: Evidence for alteration of the vitamin D-endocrine system in Blacks. J Clin Invest 1985; 76:470–473.
27. Weinstein RS, Bell NH: Diminished rates of bone formation in normal Black adults. N Engl J Med 1988; 319:1698–1701.
28. Kumanyika S: Obesity in Black women. Epidemiol Rev 1987; 9:31–51.
29. Solomon L: Hip fracture and cortical bone density in aging African and Caucasian population. Current Concepts in Bone Fragility. Berlin Heidelberg: Springer-Verlag, 1986; 377–384.
30. Cummings SR, Kelsey JL, Nevitt MC, O'Dowd KJ: Epidemiology of osteoporosis and osteoporotic fractures. Epidemiol Rev 1985; 7:178–208.
31. Melton LJ III, Wahner HW, Richelson LS, O'Fallon WM, Riggs BL: Osteoporosis and the risk of hip fracture. Am J Epidemiol 1986; 124:254–261.
32. Prudham D, Evans JG: Factors associated with falls in the elderly: A community study. Age Ageing 1981; 10:141–146.
33. Cohn SH, Abesamis C, Yasumaura S, Aloia JF, Zanai I, Ellis KJ: Comparative skeletal mass and radial bone mineral content in Black and White women. Metabolism 1977; 26:171–178.
34. Doyle F, Brown J, Lachance C: Relation between bone mass and muscle weight. Lancet 1970; 1:391–393.
35. Ellis KJ, Cohn SH: Correlation between skeletal calcium mass and muscle mass in man. J Appl Physiol 1975; 38:455–460.
36. Fitzgerald JF, Moore PS, Dittus RS: The care of elderly patients with hip fracture: Changes since the implementation of the prospective payment system. N Engl J Med 1988; 319:1392–1397.
37. National Center for Health Statistics, Hing E: Characteristics of nursing home residents, health status and care received. The National Nursing Home Survey, United States, May–Dec 1977. Vital and Health Statistics, Series 13-No. 51, DDHS Pub. No. (PHS) 81–1712. Washington, DC: Govt Printing Office, 1983.

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