



Fig. E-1

Flowchart showing the study cohort generation. The procedural codes of 79.15, 79.35, and 78.55 indicated internal fixation, 81.52 indicated hemiarthroplasty, and 81.51 indicated total hip arthroplasty. Other surgical procedures were identified by the presence of procedural codes of 76, 77, 78, 79, 80, 81, 82, 83, 84, and 007 when a patient did not undergo internal fixation, hemiarthroplasty, or total hip arthroplasty. In situations when a patient underwent more than one of the three surgeries (internal fixation, hemiarthroplasty, and total hip arthroplasty) during a single stay, the first surgery was used to classify the patient's surgical management. A proximal femoral fracture treatment may have involved an episode of care by multiple hospitals (i.e., transfer). The hospital of interest was defined as either where the first surgery was done or, in the case of nonoperative treatment, the last hospital. Therefore, some transfer-in hospitals and/or transfer-out hospitals were removed. One hospital may have been included in multiple categories. For example, a single hospital could have been included in both the rural and low-volume categories. High-volume hospitals were those in the highest quartile of the hip fracture volume, and low-volume hospitals were those in the lowest quartile of the hip fracture volume. HMO = health maintenance organization.

TABLE E-1 Characteristics of Medicare Beneficiaries with Hip Fracture from 1991 to 2008*						
Characteristics	1991 to 1993 N = 200,804	1994 to 1996 N = 210,943	1997 to 1999 N = 194,677	2000 to 2002 N = 179,082	2003 to 2005 N = 170,388	2006 to 2008 N = 163,529
Age† (yr)	81.4 ± 7.5	82.0 ± 7.5	82.6 ± 7.4	82.8 ± 7.4	82.9 ± 7.5	82.9 ± 7.8
Female sex‡	158,589 (79.0)	165,491 (78.5)	151,319 (77.7)	137,421 (76.7)	128,506 (75.4)	121,620 (74.4)
Race						
White‡	186,314 (92.8)	198,330 (94.0)	182,959 (94.0)	167,956 (93.8)	159,537 (93.6)	152,647 (93.3)
Black‡	6538 (3.3)	7305 (3.5)	6843 (3.5)	6433 (3.6)	6122 (3.6)	5871 (3.6)
Other‡§	7952 (4.0)	5308 (2.5)	4875 (2.5)	4693 (2.6)	4729 (2.8)	5011 (3.1)
Comorbidity						
Diabetes‡	19,203 (9.6)	24,555 (11.6)	25,672 (13.2)	26,036 (14.5)	27,025 (15.9)	27,480 (16.8)
Congestive heart failure‡	24,958 (12.4)	32,101 (15.2)	33,012 (17.0)	32,447 (18.1)	32,890 (19.3)	29,847 (18.3)
Obesity‡	626 (0.3)	1030 (0.5)	1042 (0.5)	1075 (0.6)	1303 (0.8)	1555 (1.0)
Renal failure‡	3181 (1.6)	4238 (2.0)	4830 (2.5)	6002 (3.4)	8383 (4.9)	16,957 (10.4)
Multiple fractures‡	10,797 (5.4)	12,080 (5.7)	10,659 (5.5)	9659 (5.4)	9236 (5.4)	9128 (5.6)
No. of comorbid conditions†	1.7 ± 1.4	2.2 ± 1.6	2.3 ± 1.6	2.5 ± 1.6	2.8 ± 1.6	3.0 ± 1.6
*For all comparisons, $p < 0.001$, except for multiple fractures ($p = 0.9222$). †The values are given as the mean and the standard deviation. ‡The values are given as the number of patients, with the percentage in parentheses. §Other race includes Asian, Hispanic, North American Native, or another race not specified.						

TABLE E-2 Hip Fracture Treatment in Teaching Hospitals, Rural Hospitals, and High and Low-Volume Hospitals*							
	1991 to 1993 N = 200,804	1994 to 1996 N = 210,943	1997 to 1999 N = 194,677	2000 to 2002 N = 179,082	2003 to 2005 N = 170,388	2006 to 2008 N = 163,529	P Value
Hip fractures treated in major teaching hospitals†	20,142 (10.0)	21,426 (10.2)	19,814 (10.2)	18,842 (10.5)	18,749 (11.0)	19,747 (12.1)	<0.001
Internal fixation‡	5441 (27.0)	6133 (28.6)	5652 (28.5)	5455 (29.0)	5305 (28.3)	5532 (28.0)	0.10
Hemiarthroplasty‡	12,472 (61.9)	13,244 (61.8)	12,251 (61.8)	11,553 (61.3)	11,648 (62.1)	12,194 (61.8)	0.87
Total hip arthroplasty‡	1286 (6.4)	1169 (5.5)	1083 (5.5)	939 (5.0)	917 (4.9)	1095 (5.6)	<0.001
No surgery‡	943 (4.7)	880 (4.1)	828 (4.2)	895 (4.8)	879 (4.7)	926 (4.7)	0.05
Hip fractures treated in rural hospitals†	46,646 (23.2)	52,151 (24.7)	51,293 (26.3)	48,149 (26.9)	43,407 (25.5)	38,764 (23.7)	<0.001
Internal fixation‡	11,337 (24.3)	13,245 (25.4)	13,466 (26.3)	12,724 (26.4)	11,205 (25.8)	10,011 (25.8)	<0.001
Hemiarthroplasty‡	30,250 (64.9)	33,593 (64.4)	32,914 (64.2)	30,743 (63.9)	27,862 (64.2)	24,840 (64.1)	0.01
Total hip arthroplasty‡	2435 (5.2)	2687 (5.2)	2446 (4.8)	2164 (4.5)	2068 (4.8)	1762 (4.6)	<0.001
No surgery‡	2624 (5.6)	2626 (5.0)	2467 (4.8)	2518 (5.2)	2272 (5.2)	2151 (5.6)	0.57
Hip fractures treated in high-volume hospitals†§	115,481 (57.5)	129,282 (61.3)	115,264 (59.2)	101,797 (56.8)	98,623 (58.0)	93,216 (57.0)	<0.001
Internal fixation‡	29,356 (25.4)	34,277 (26.5)	30,656 (26.6)	27,029 (26.6)	25,800 (26.2)	24,775 (26.6)	<0.001
Hemiarthroplasty‡	73,882 (64.0)	82,765 (64.0)	74,297 (64.5)	66,094 (64.9)	64,244 (65.1)	60,452 (64.9)	<0.001
Total hip arthroplasty‡	7978 (6.9)	7663 (5.9)	6340 (5.5)	5048 (5.0)	4812 (4.9)	4562 (4.9)	<0.001
No surgery‡	4265 (3.7)	4577 (3.5)	3971 (3.5)	3626 (3.6)	3767 (3.8)	3427 (3.7)	0.09
Hip fractures treated in low-volume hospitals†#	11,540 (5.8)	10,680 (5.1)	10,691 (5.5)	10,059 (5.6)	9041 (5.3)	8979 (5.5)	0.34
Internal fixation‡	3069 (26.6)	2841 (26.6)	2897 (27.1)	2674 (26.6)	2463 (27.2)	2460 (27.4)	0.15
Hemiarthroplasty‡	6657 (57.7)	6194 (58.0)	6167 (57.7)	5937 (59.0)	5225 (57.8)	5185 (57.8)	0.73
Total hip arthroplasty‡	813 (7.1)	826 (7.7)	719 (6.7)	570 (5.7)	506 (5.6)	506 (5.6)	<0.001
No surgery‡	1001 (8.7)	819 (7.7)	908 (8.5)	878 (8.7)	847 (9.4)	828 (9.2)	<0.001

*Hospitals may be included in multiple categories. For example, a single hospital could be included in both the rural and low-volume categories. †Values are given as the number of patients, with the percentage of total patients for that time period in parentheses. ‡Values are given as the number of patients, with the percentage for each category in parentheses. §High-volume hospitals are those in the highest quartile of the hip fracture volume. #Low-volume hospitals are those in the lowest quartile of the hip fracture volume.

TABLE E-3 Percentage of Hip Fractures Treated with Total Hip Arthroplasty in the Medicare Population by the Number of Comorbid Conditions from 1991 to 2008						
No. of Comorbid Conditions	1991 to 1993	1994 to 1996	1997 to 1999	2000 to 2002	2003 to 2005	2006 to 2008
None*	3144 (7.6)	1934 (6.3)	1335 (6.0)	874 (5.6)	586 (5.8)	447 (6.4)
One to two*	7920 (7.1)	6276 (6.2)	5155 (5.7)	3934 (5.0)	3513 (5.1)	3121 (5.1)
Three to four*	2694 (6.7)	3550 (5.9)	3531 (5.7)	3223 (5.1)	3230 (4.8)	3114 (4.7)
Five or more*	484 (6.7)	1098 (6.0)	983 (5.2)	945 (4.5)	1141 (4.7)	1204 (4.2)
P value	<0.0001	0.03	0.01	<0.001	<0.0001	<0.0001

*The values are given as the number of patients, with the percentage in parentheses based on the total number of hip fractures for each level of comorbidity in each specific time period.

TABLE E-4 Characteristics of U.S. Acute Care Hospitals Managing Patients with Hip Fracture from 1991 to 2008						
Characteristics	1991 to 1993	1994 to 1996	1997 to 1999	2000 to 2002	2003 to 2005	2006 to 2008
No. of total acute care hospitals	5720	5323	5143	4926	4392	5130
Hospitals treating hip fractures*	4208 (73.6)	4048 (75.7)	3931 (76.4)	3722 (75.6)	3445 (78.4)	3540 (69.0)
Mean hip fracture volume†	47.7 ± 48.1	52.1 ± 52.1	49.5 ± 49.0	48.1 ± 47.5	49.5 ± 47.8	46.2 ± 47.4
Median hip fracture volume‡	33 (12 to 68)	37 (14 to 74)	35 (13 to 71)	35 (13 to 70)	36 (14 to 70)	33 (10 to 66)
Hospitals performing more than one operative repair§	3981 (94.6)	3842 (94.9)	3742 (95.2)	3560 (95.6)	3326 (96.5)	3381 (95.5)
Mean hip fracture volume†	50.3 ± 48.2	54.8 ± 52.1	51.9 ± 49.0	50.2 ± 47.5	51.2 ± 47.8	48.3 ± 47.5
Median hip fracture volume‡	36 (15 to 71)	40 (17 to 77)	38 (16 to 73)	37 (15 to 72.5)	38 (16 to 72)	35 (12 to 68)
Major teaching hospitals#	293 (7.4)	292 (7.6)	293 (7.8)	282 (7.9)	281 (8.4)	281 (8.3)
Rural hospitals#	1481 (37.2)	1454 (37.8)	1455 (38.9)	1390 (39.0)	1218 (36.6)	1264 (37.4)
Hospitals performing no operative repairs§	227 (5.4)	206 (5.1)	189 (4.8)	162 (4.4)	119 (3.5)	159 (4.5)
Mean hip fracture volume†	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0
Median hip fracture volume‡	1 (1 to 1)	1 (1 to 1)	1 (1 to 1)	1 (1 to 1)	1 (1 to 1)	1 (1 to 1)
Major teaching hospitals**††	0 (0)	0 (0)	2 (1.1)	0 (0)	1 (0.9)	0 (0)
Rural hospitals††††	177 (78.0)	178 (86.4)	161 (85.2)	142 (87.7)	99 (83.2)	136 (85.5)

*The values are given as the number of acute care hospitals, with the percentage in parentheses. †The values are given as the mean and the standard deviation. ‡The values are given as the median, with the interquartile range in parentheses. §The values are given as the number of hospitals treating hip fractures, with the percentage based on the total number of hospitals in parentheses. #The values are given as the number of hospitals performing more than one operative repair, with the percentage in parentheses. **Thirty-two hospitals could not be linked with teaching status. ††The values are given as the number of hospitals that performed no operative repairs, with the percentage in parentheses. †††Twenty hospitals could not be linked with RUCA status.