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Financial Implications of Hospital Readmission After Hip Fracture

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Abstract

Introduction: Hip fracture is the leading orthopedic discharge diagnosis associated with 30-day readmission in terms of numbers. Because readmission to the hospital following a hip fracture is so common, it adds considerably to the costs on an already overburdened health care system. **Methods:** Patients aged 65 and older admitted to a 261-bed university-affiliated level 3 trauma center between April 30, 2005, and September 30, 2010, with a unilateral, native, nonpathologic low-energy proximal femur fracture were identified from a fracture registry and included for analysis. Readmissions within 30 days of hospital discharge, costs, and outcomes were collected and studied. **Results:** Of 1081 patients, 129 (11.9%) were readmitted within 30 days. The average hospital length of stay for readmissions was 8.7 $\pm$ 18.8 days, which was significantly longer than the initial stay (4.6 $\pm$ 2.3 days) ($P = .03$). Nineteen percent (24 patients $\sim$19%) died during readmission versus 2.8% during the index admission. These patients accumulated an average hospital charge of US$16 308 $\pm$ US$6400 during their initial hospitalization for compared with charges for their readmissions of US$14 191 $\pm$ US$25 035 ($P = .36$). **Discussion:** Readmission was usually associated with serious medical or surgical complications of the original hospitalization. **Conclusions:** Readmission after hip fracture is costly and harmful. Charges were similar between the original fracture admission and the readmission. Patients were readmitted most frequently for medical diagnoses following their original hospital stay. Some of these readmissions may have been avoidable.

Keywords

hip fracture, geriatric fracture, readmission, financial costs, mortality, complications

Introduction

The US Healthcare costs are assuming an increasing level of importance. Medicare expenditures for inpatient care are expected to increase from US$129.1 billion in 2008 to US$234.9 billion in 2019.[1] Approximately 19.6% of Medicare recipients are rehospitalized within 30 days following discharge from an acute care setting.[1,2] In 2010, the Patient Protection and Affordable Care Act (PPACA; P.L.-11-148) was signed into law in the United States. This law included provisions to reduce hospital readmissions.[1] Readmissions are very costly and considered to be "low hanging fruit" for cost-reduction efforts.[3] Hospital readmission is a complex problem with multiple etiologies, and there are no simple strategies to reduce their incidence.[2] Despite the complexity, readmission is seen as an important performance and accountability measure for hospitals.[4]

Hospital readmission following hip fracture is a frequent and serious sentinel event that may be avoidable and may indicate a gap in care.[1,3] There is considerable regional variation in readmission rates according to recently published data.[1,3] Hip fracture is the leading orthopedic discharge diagnosis associated with 30-day readmission in terms of numbers.[3] Because readmission to the hospital following a hip fracture is so common, it adds considerably to the costs on an already overburdened health care system.[2,5,6] Readmission rates following hip fracture have increased slightly from 14.3% in 2004 to 14.5% in 2009.[3] Hip fracture has been shown to be the third most costly diagnosis in Medicare recipients aged 65 and older accounting for 4.6% share of total spending.[7]

Most hip fractures occur in patients aged 65 years and older, which is the most rapidly growing segment of the population in the United States.[8-10] An estimated 330 000 hip fractures occur yearly in the Unites States.[11] The number of hip fractures is predicted to increase by 51% by 2025.[12] With increasing number of patients treated and discharged, the associated economic impact of hospital readmission is also growing. This manuscript will analyze the costs of the initial inpatient admission, readmission, and 30-day hospital

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readmission rates of 1081 patients with a native nonpathologic, low-energy hip fracture treated at a single level 3 trauma center over a 65-month period. The causes of readmission and the outcomes of the readmitted patients will also be examined.

The objective of this study is to evaluate the costs, frequencies, and reasons for readmission after hip fracture. A secondary purpose of the study would be to compare the costs of readmission to the costs of the original admission.

Methods

Study Population

All patients aged 65 and older admitted to a 261-bed university-affiliated level 3 trauma center between April 30, 2005, and September 30, 2010, with a unilateral, native, nonpathologic low-energy proximal femur fracture were identified from a fracture registry and included for analysis. Patients with periprosthetic fractures, pathologic fractures, bilateral injuries, and high-energy mechanisms were excluded. All patients had retrospective chart reviews completed by a member of the research team as part of a hospital quality management initiative. Data were collected by a study nurse from patients directly and from their medical records and included demographic information, comorbidities, surgical management, in-hospital complications as well as any readmission within 30 days of original discharge. Readmissions within the original health care system, which includes 2 hospitals, were confirmed with the hospital's admission tracking computer system. Six patients were readmitted to other regional hospitals. These patients were contacted by telephone for information regarding their readmission. Because data on costs of care could not be obtained, these patients were excluded from financial analysis. We also analyzed charges for care rather than actual costs because charges are typically reported by governmental reports.

Statistical analyses were performed on SPSS v20 software with statistical significance being reached on the 2-tailed student *t* test when $P < .05$. Univariate and multivariate logistical regression analyses were performed on characteristics of readmitted patients.

This study was approved by the university research subjects review board.

Results

There were 1081 patients who met the inclusion criteria for this study. Characteristics of the study population are described in Table 1. The average time to surgery after admission for these patients was 25.5 hours, with a hospital length of stay (LOS) of 4.2 ± 1.9 days. Of these patients, 129 (11.9%) were readmitted to an acute care facility within 30 days of their initial discharge date. The average hospital LOS for readmissions was 8.7 ± 18.8 days, which was significantly longer than the initial stay (4.6 ± 2.3 days) for these patients after presenting with a native hip fracture ($P = .03$). Full data were available on 123 of these patients; 6 patients were readmitted to regional hospitals from which financial data could not be obtained. These 6 patients were excluded from all financial analysis. Group characteristics are presented in Table 1. The primary causes of readmission were medical complications or other reasons in 108 (83.7%) of 129 patients and surgical complications in 21 (16.3%) of 129 patients. There were a total of 24 other medical diagnoses associated with these 108 medical readmissions.

Table 1. Basic Group Characteristics.

Patient characteristics	N = 1081
Gender	
Male	24.0%
Female	76.0%
Age (mean ± SD)	85.1 ± 8.4
Race, %	
Caucasian	94.8
Hispanic	1.3
Black	1.2
Asian	2.1
Native American	0.2
Other	0.3
Prefracture residence, %	
Community	48.9
Skilled nursing facility	37.6
Assisted living	13.5
Charlson score, mean ± SD	3.1 ± 2.1
Dementia,%	47.4
Parker mobility, mean ± SD	3.8 ± 3.2
Readmission rate, %	11.9
Reoperation rate, %	0.74
Length of stay for readmitted patients, days	
Initial hospitalization	4.6 ± 2.3
Readmission	8.7 ± 18.8
P value	.03
12-month mortality rate	
Patients not readmitted	21.8%
Readmitted patients	56.2%
P value	.0001
Hospital charges for readmitted patients	
Initial admission	US$16 308 ± US$6400
Readmission	US$14 191 ± US$25 035
P value	.36

Abbreviation: SD, standard deviation.

Of the surgical readmissions, 12 (9.3%) involved an injury that was caused by falling after hospital discharge. Of these 12 patients, 3 patients sustained a periprosthetic femoral fracture, 3 had a contralateral hip fracture, 2 dislocated their hemiarthroplasties, and 4 sustained nonhip fractures. Five patients developed surgical site infections. There were 3 patients with failed fixation—1 sliding hip screw cutout, 1 failed fixation of a femoral neck fracture (with cannulated screws), and 1 failed hemiarthroplasty that required reoperation. One patient was admitted with a hematoma. Eight (6.2%) patients ultimately underwent a reoperation.

Pneumonia represented the most common medical reason for readmission (27 patients, 20.9%). The next most common reasons were congestive heart failure (CHF) and atrial fibrillation (7 patients each, 5.4%). Mental status changes, renal complications (dehydration, acute renal failure, and

Table 2. Causes of Readmission.

Organ system		Subtotal	Total (n = 129)	Died	Percentage of 129
Pulmonary					
	Pneumonia	27	35	11	27.3
	Respiratory failure	6		1	
	Chronic obstructive disease	2			
Gastrointestinal					
	Gastrointestinal bleed	5	21		16.4
	Small bowel obstruction	3			
	Fecal impaction[a]	3		1	
	C. difficile infection[a]	6		1	
	Illeus	2			
	Failure to thrive	2		2	
Neurologic					
	Stroke	5	10		7.8
	Delirium	2		1	
	Seizure	2			
	Intracranial hemorrhage	1			
Cardiovascular					
	Congestive heart failure[a]	7	16	3	12.5
	Atrial fibrillation	7			
	Myocardial infarction	2			
Musculoskeletal					
	Refracture	3	24		18.8
	Failure of fixation	3			
	New site fracture	7			
	Deep wound infection	3		2	
	Superficial wound infection	2			
	Dislocation of joint	2			
	Pressure ulcer[a]	3		1	
	Hematoma	1			
Genitourinary					
	Urinary infection[a]	5	13		10.2
	Urosepsis	2		1	
	Urinary retention	1			
	Acute renal failure	3			
	Electrolyte abnormality	2			
Hematologic			5		3.9
	Anemia	2			
	Pulmonary emboli or deep vein thrombosis	3			
Other		5	5		3.9

[a]Deemed potentially avoidable readmissions. Died indicates patient died during the readmission stay.

hyponatremia), and other cardiac conditions (myocardial infarction) were other diagnoses associated with readmission.

Additional diagnoses included 6 (4.6%) intestinal obstructions (small bowel obstruction and fecal impaction), 5 gastrointestinal bleeds, 6 (4.6%) patients with *Clostridium difficile* infections, 3 patients with stage III or greater pressure sores, 2 patients with adult failure to thrive, and 5 each with cerebral vascular accidents, urinary infection, and other diagnoses. See Table 2 for detailed causes of readmission.

Nineteen percent (24 patients) died during their readmission versus 2.8% during the index admission (see Table 2 for causes of death). When analyzing the 1-year mortality those patients readmitted within 30 days had a 1-year mortality rate of 56.2% versus 21.8% for those patients not readmitted ($P < .0001$).

Patient factors analyzed for association with readmission are presented in Table 3 (univariate) and Table 4 (multivariate logistic regression). In multivariate analysis, the odds of readmission were significantly increased with age greater than 85, at least partial disability in Katz activities of daily living score, in-hospital delirium, preoperative arrhythmia, presence of pacemaker, diabetes, and dementia. There were strong associations that did not meet statistical significance on multivariate analysis between readmission and male sex ($P = .05$), time to surgery over 24 hours ($P = .05$), medium Parker mobility scores ($P = .06$), 4 or higher Charlson score ($P = .05$), and presence of gastroesophageal reflux disease ($P = .05$).

Hospital charges were available for 123 of the 129 readmitted patients. These patients accumulated an average

Table 3. Characteristics of readmitted patients.[a]

	Total, n = 1081	Readmitted, n = 129	Rate, 11.9%	*P* value
Age				
60-69	63	3	4.7%	.005
70-79	183	15	8.1%	
80-89	467	51	10.9%	
≥90	368	60	16.3%	
Gender				
Male	252	40	15,9%	.035
Female	829	89	10.7%	
Residence				
Community	529	55	10.3%	.21
Assisted living	147	22	14.9%	
Skilled nursing	384	51	13.2%	
Preoperative Parker Mobility Score				
High (9)	191	16	8.9%	.16
Medium (5-8)	268	38	14.2%	
Low (0-4)	622	75	12.1%	
Preoperative function				
Independent	479	460	9.6%	.094
Partial dependence	421	60	14.3%	
Dependent	181	23	12.7%	
Charlson score				
Low (0-1)	281	24	8.5%	.106
Medium (2-3)	401	50	12.5%	
High (4 or more)	399	55	13.8%	
Dementia				
Yes	516	69	13.4%	.10
No	565	60	10.6%	

[a]*P* values represent univariate analysis. The Parker Mobility score is a functional assessment that rates the patient's ability to get about the house, to get out of the house, and to go shopping, *with no difficulty* (3), *with an aid* (2), *with help from another person* (1), and *not at all* (0). The score is the total from 0 to 9.

Table 4. Multivariate Analysis for Independent Predictors of Readmission.

Factor	Odds	95% confidence interval	*P* value
Age > 85	1.58	1.02-2.26	.02[a]
Male	1.49	1.00-2.24	.05
Assisted living	1.52	0.82-2.59	.12
Skilled nursing	1.24	0.84 -1.85	.29
Time to surgery > 24 hours	1.46	1.00-2.15	.05
Parker Mobility score			
Medium (5-8)	1.81	0.98-3.35	.06
Low (0-4)	1.50	0.85-2.64	.16
Activities of daily living			
Partial or Complete Disability	1.51	1.03-2.25	.03[a]
Charlson Score			
Medium (2-3)	1.53	0.97-2.55	.11
High (4 or more)	1.65	1.00-2.74	.05
In-hospital Complications (initial hospitalization for index fracture)			
Delirium	1.66	1.14-2.41	.01[a]
Hematoma	7.51	0.47-121	.16
Urinary tract infection	1.84	0.39-8.84	.44
Preoperative arrhythmia	1.62	1.09-2.39	.02[a]
Past medical history			
Pacemaker	1.75	1.11-2.76	.02[a]
GERD	1.44	0.99-2.10	.05
Diabetes	1.91	1.22-2.99	.005[a]
Dementia	1.61	1.12-2.22	.01[a]
Cardiac disease	1.02	0.66-1.59	.92
Alcoholism	1.12	0.46-2.68	.81
Tobacco use	0.99	0.56-1.73	.54

Abbreviation: GERD, Gastroesophageal reflux disease.
[a]Denotes statistical significance (*P* < .05)

hospital charge of US$16 308 ± US$6400 during their initial hospitalization for their native hip fractures. The average charges accumulated during their readmission within 30 days was US$$14 191 ± US$25 035 ($P = .36$). Hospital charges by diagnosis are presented in Table 5. The timing of the readmissions is listed by diagnosis in Table 6.

Discussion

This is the first study looking at patient-level clinical and financial data on patients with hip fracture from the United States. Readmission to the hospital after hip fracture proved to be costly in our series. Readmission is often associated with serious medical and surgical complications of the original hospitalization,[1-3,5,6] and this was true in this study. Not all hospital readmissions are preventable and many are certainly necessary. However, here we identified some reasons for readmissions that are indicators or poor quality and are potentially preventable (Table 2). In this study, 19% of readmissions were thought to have been preventable. These preventable causes can serve as targets for future quality improvement efforts.

Under PPACA, the Centers for Medicare and Medicaid Services (CMS) will begin to hold hospitals accountable for their medical readmission rates starting with 4 specific diagnoses.[4] This will be accomplished with public reporting of individual hospital readmission rates and decreased hospital reimbursement from CMS.[4]

It is clear that government policy is capable of altering practice habits of clinicians through financial incentives or penalties.[13] Reducing payments and ultimately reducing monetary resource allocation toward the most costly medical conditions does not necessarily result in similar outcomes.[14]

Patients with hip fracture may increase financial burden on the health care system before they have sustained a fracture. Kilgore et al recently studied 60 354 Medicare patients with hip fractures and found 88% of increased health care expenditure is directly associated with the fracture.[15] Furthermore, in the months leading up to their fracture, these patients consumed significantly more health care resources than matched controls.[15] Expenditures on every body system studied (ie, cardiovascular, pulmonary, endocrine, neurologic, genitourinary, etc) increased significantly after their hip fracture. This suggests that the patient who sustains a hip fracture is experiencing a general decline in

Table 5. Hospital Charges by Diagnosis.[a]

Diagnosis	Average Charge (±SD)
Atrial fibrillation	US$16 523.00 ± US$4200.81
Congestive heart failure	US$14 526.71 ± US$3921.52
Myocardial infarction	US$15 131.50 ± US$1720.39
Clostridium difficile infection	US$16 016.40 ± US$2193.88
Obstipation	US$15 693.00 ± US$4922.85
Gastrointestinal bleed	US$15 418.00 ± US$6153.86
Small bowel obstruction	US$18 322.50 ± US$5438.36
Ileus	US$17 017.67 ± US$2570.99
Thromboembolic event	US$10 508.33 ± US$10 453.86
Decubitus ulcer	US$16 343.00 ± US$6398.96
Deep infection	US$15 842.75 ± US$3233.37
Superficial infection	US$10 029.50 ± US$1207.03
Hip dislocation	US$22 262.00 ± US$1711.20
Failure of fixation	US$11 976.00 ± US$3710.90
Second fracture	US$18 676.29 ± US$4840.90
Stroke	US$14 836.00 ± US$5456.59
Delirium	US$11 314.33 ± US$1049.60
Seizure	US$15 439.50 ± US$5479.37
COPD exacerbation	US$20 908.67 ± US$5972.60
Pneumonia	US$16 145.20 ± US$4765.17
Acute kidney injury	US$13 119.67 ± US$8624.22
Fluid/electrolyte disturbance	US$16 003.67 ± US$4703.08
Urinary tract infection	US$16 796.00 ± US$11 724.00

Abbreviation: COPD, chronic obstructive pulmonary disease; SD, standard deviation.
[a]Charges were similar between groups.

health prior to his or her fracture.[15] Such patients may be targeted for prevention of hip fracture. More critical research into this topic may yield models that could potentially predict a patient's risk of hip fracture, which may allow for preventive measures to be developed. Preventing hip fractures would likely lead to more significant cost reductions.

There is little guidance on how to reduce readmission after hip fracture. One study of 606 patients for 180 days after hip fracture found an readmission rate of 8.3%.[16] The rate varied by discharge destination—with inpatient rehabilitation (4.5%) and home (5.1%) having the lowest rates. Multivariate analysis in this study further supported that inpatient rehabilitation decreased readmission rates, while patients with longer LOSs had higher odds of readmission.[16] Buecking et al reviewed 402 patients with hip fracture (80% living at home alone or with family) and found a 12% readmission rate.[17] The majority (79%) were not related to their fracture, with respiratory failure (25%), cardiovascular morbidity (15%), and infectious disease (10%) being the most common reasons for readmission, all similar to our data in this study.[17] Multivariate analysis suggested that males and specifically femoral neck fractures had an increased risk of readmission.[17] Gender and fracture type are not modifiable risk of readmission. Discharge to inpatient rehabilitation, especially those with more comorbidities, may be a potential route for improving readmission rates. Admission requirements that must be met for Medicare inpatient rehabilitation are extensive.[16]

French et al described a 30-day readmission rate of 18.3% using claims data from 41 331 US veterans aged ≥65 years with a hip fracture.[6] The readmitted patients in that study had a 1-year mortality rate of 48.5% compared with a 24.9% mortality rate in veterans who were not readmitted.[6] Bookvar et al described a prospective analysis of 562 patients with hip fracture aged ≥50 years.[5] They noted a 1-month readmission rate of 14.2%. Of these readmissions, 11% were readmitted for surgical causes and 89% were readmitted for medical reasons. These findings were very similar to our findings. They also describe a worsened prognosis for readmitted patients. Readmitted patients in their series were found to have an increased risk of mortality, impaired gait, and placement in a nursing home 6 months following fracture.[5] Jencks et al published a 30-day readmission rate of 17.9% after major hip or femur surgery and cited pneumonia and CHF as being the 2 most frequent causes of readmission.[2]

The recently published Dartmouth Atlas report on readmissions highlights the considerable variation seen in readmission rates seen among both community and academic medical centers.[3] The specific causes for this variation are not clear. There has been no improvement in readmission rates over the past decade, 14.3% in 2004 and 14.5% in 2009.[3] For New York State hospitals, the rate in 2004 was 14.5% and increased to 15.3% in 2009.[3] Many causes for readmission have been described including communication issues, problems with medication reconciliation, lack of satisfactory follow-up care, and defects in the original inpatient care.[3,18] Other causes for readmissions may include shorter LOSs, increased age of the patients, and increased burden of comorbidity carried by these patients. Some have argued that many medical hospital readmissions are likely preventable in nature.[3] Typically, the inpatient care team only addresses the inpatient care phase[19] with no interventions extending past the inpatient stay.

The authors believe that some of our readmissions are likely of a preventable nature including some cases of constipation, cutout of implants, and congestive failure.[20] There are likely some cases that could be avoided with improved communication with receiving providers at the time of the discharge handoff.[21] There have been several successful methods published for reduction in readmissions following medical hospitalization including early follow-up care with the primary care physician, the Coleman discharge coaching model, and the Naylor model.[21-23] There have been no published methods shown to successfully reduce readmission following hip fracture. Additional efforts at improving the discharge process, communication, and postdischarge follow-up may improve the readmission rates.

Limitations of this Study

There are several important limitations of this study. This is a single-center study conducted in a hip fracture program with a strong history for quality improvement, comanaged care, and utilizing standardized protocols. The sample size of

Table 6. Timing of Readmission by Diagnosis.[a]

		Average age (number of patients)	1-7 days	8-14 days	15-21 days	22-30 days
Pulmonary						
	Pneumonia	89 ± 5 (n = 27)	13	9	3	2
	Respiratory failure	88 ± 5 (n = 6)	4	1	0	1
	Chronic obstructive disease	82 ± 7 (n = 2)	0	1	0	1
Gastrointestinal						
	Gastrointestinal bleed	87 ± 6 (n = 5)	1	3	0	1
	Small bowel obstruction	90 ± 6 (n = 3)	2	1	0	0
	Fecal Impaction	92 ± 13 (n = 3)	0	1	0	2
	Clostridium difficile infection	93 ± 2.5 (n = 6)	2	3	0	1
	Illeus	72 ± 8 (n = 2)	2	0	0	0
	Failure to thrive	88 ± 4 (n = 2)	2	0	0	0
Neurologic						
	Stroke	83 ± 11 (n = 5)	2	2	0	1
	Delirium	86 ± 6 (n = 2)	1	0	0	1
	Seizure	77 ± 8 (n = 2)	1	0	1	0
	Intracranial hemorrhage	87 (n = 1)	0	0	1	0
Cardiovascular						
	Congestive heart failure	92 ± 8 (n = 7)	1	0	1	5
	Atrial fibrillation	85 ± 6 (n = 7)	5	0	0	2
	Myocardial infarction	94 ± 1(n = 2)	1	0	0	1
Musculoskeletal						
	Refracture	78 ± 9 (n = 3)	2	0	0	1
	Failure of fixation	92 ± 3 (n = 3)	1	1	1	0
	New site fracture	87 ± 4 (n = 7)	4	0	2	1
	Deep wound infection	85 ± 10 (n = 3)	0	3	0	0
	Superficial wound infection	79 ± 6 (n = 2)	0	1	1	0
	Dislocation of joint	74 ± 16 (n = 2)	0	0	2	0
	Pressure ulcer	89 ± 6 (n = 3)	0	0	1	2
	Hematoma	89 (n = 1)	1	0	0	0
Genitourinary						
	Urinary infection	90 ± 7 (n = 5)	1	2	2	0
	Urosepsis	87 ± 5 (n = 2)	1	1	0	0
	Urinary retention	98 (n = 1)	1	0	0	0
	Acute renal failure	83 ± 10 (n = 3)	1	1	0	1
	Electrolyte abnormality	96 ± 1 (n = 2)	1	1	0	0
Hematologic						
	Anemia	82.5 ± 1 (n = 2)	2	0	0	0
	Pulmonary emboli or deep vein thrombosis	78 ± 6 (n = 3)	2	0	1	0
Other		90 ± 3 (n = 5)	2	2	0	1

[a]Number of patients readmitted in each time period. Most readmissions occur within the first 14 days after hospital discharge.

1081 with 129 readmissions is certainly not large enough to generalize these results. Larger, multicenter studies may be useful to determine whether these results can be generalized to other centers.

Another limitation is the retrospective nature of the data collection which may not fully capture all readmissions or adverse events. As a countermeasure, we have tried to capture all the 30-day readmissions by reviewing medical records and calling the patients, families, or caregivers following discharge. The patients included in this study may not accurately represent the populations seen at many centers. Half of our patient population were admitted from a nursing home or assisted (residential care) living home, whereas most published studies describe 80% to 90% of patients with hip fracture admitted from a home living setting. We were also unable to access a detailed data sample for 6 of the patients readmitted to regional hospitals. This is a limitation inherent to the US health care system where medical and economic data are typically not shared between regional hospitals.

Conclusion

Readmission after hip fracture is costly and harmful. Charges were similar between the original fracture admission and the readmission. Patients were readmitted most frequently for medical complications following their original hospital stay. The most common reasons for readmission include pneumonia, CHF, new fractures, intestinal obstructions, and infections. Of the patients, 19% died during their readmission, and the average readmission LOS was 8.7 days. Readmitted patients

generated similar average hospital charges during readmission (US$14 191) compared to their initial hospitalization (US$16 308). Future research efforts should focus on techniques to reduce readmission rates after hip fracture.

Declaration of Conflicting Interests

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