



Financial Implications for the Treatment of Medicare Patients With Isolated Intertrochanteric Femur Fractures: Disproportionate Losses Among Healthier Patients

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Abstract

Introduction: With an aging American public, the rising incidence of geriatric hip fractures provides a significant impact on the financial sustainability for hospitals. To date, there is little research comparing reimbursement to hospital costs for geriatric hip fracture treatment. The purpose of this study is to compare hospital costs to reimbursement for patients treated surgically with an isolated intertrochanteric femur fracture, insured by the Center of Medicare and Medicaid Services (CMS). **Materials and Methods:** A retrospective review at an urban, academic, level I trauma center was conducted for 287 CMS-insured intertrochanteric femur fracture patients between 2013 and 2017. The total cost of care was determined using our hospital's cost accounting system. The total reimbursement was determined from the CMS inpatient prospective payment system, based upon the Medical-Severity Diagnosis-Related Grouping (MS-DRG). **Results:** In this patient population, the average CMS reimbursement was US\$19 049 ± 7221 and the average cost of care was US\$19 822 ± 8078. This yielded a net deficit of US\$773/patient and US\$220 417 in total. The average reimbursement and cost for the less comorbid patients (MS-DRG weight < 2.5, n = 215) was US\$16 198 ± 3983 and US\$17 764 ± 5628, respectively, yielding an average net deficit of US\$1 566/patient. For the more comorbid patients (MS-DRG weight > 2.5, n = 72) the mean reimbursement and cost were US\$27 796 ± 3944 and US\$26 180 ± 10 880, respectively, yielding an average net profit of US\$1616/patient. **Discussion:** There are disproportionate average losses in healthier patients undergoing surgical treatment of intertrochanteric femur fractures at our institution. A deficit in less comorbid patients indicates a discontinuity of inpatient health-care costs with MS-DRG-weighted reimbursement in the setting of geriatric intertrochanteric femur fractures. **Conclusions:** To maintain hospitals' financial sustainability and health-care accessibility; costing and reimbursement models need adjusting to properly compensate the treatment of geriatric intertrochanteric femur fractures. **Level of Evidence:** Diagnostic level IV.

Keywords

reimbursement, hip fracture, geriatric, Medicare, intertrochanteric fracture

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Introduction

The treatment of geriatric hip fractures account for 72% of the Center for Medicare and Medicaid Services' (CMS) fracture-care expenses, yet only predicate 14% of their total fracture-care services.¹ Furthermore, intertrochanteric femur fractures are both common and costly; presenting a national incidence of 150 000 fractures annually accruing over US\$6 billion in

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health-care costs.²⁻⁴ These injuries are common among CMS-insured patients and are projected to grow in the coming decades.⁴ Therefore, its' prevalence and fiscal burden is only projected to increase.⁴ This combination leaves hospitals with a potential for substantial profits or losses, dependent on the suitability of their respective reimbursement models.

The current CMS payment model utilizes Medical Severity (MS) Diagnosis Related Groups (DRG) to prospectively assign reimbursement to specific patients, regardless of what treatments are performed.⁵ The DRG system is a departure from the fee-for-service model where reimbursement was proportional to the amount of services provided to each patient.⁶ For the DRG system to be successful, reimbursement has to be appropriately risk-adjusted for health-care costs related to severity of patient comorbidities and injury characteristics.⁶ The current DRG system assigns each patient an MS-DRG weight, which is then multiplied by a constant dollar amount to determine reimbursement.⁶ For financial sustainability, the CMS reimbursement must be equivalent or greater than the hospital's accrued cost. Inadequate risk adjustment for certain populations would yield a disproportionate financial burden to hospitals. This would potentially discourage hospitals from treating certain CMS patients, due to their financial liability.^{7,8}

Hip fracture costs and reimbursement are commonly analyzed as separate entities.^{9,10} However, a 1998 study compared hospital costs to CMS reimbursement in hip fracture patients. The study found reimbursement of the previous DRG system to be inadequate to compensate for the hospital costs.¹¹ Similarly, the purpose of this study was to compare the inpatient costs of care to the MS-DRG reimbursement for CMS-insured intertrochanteric femur fractures. The primary outcome was the net yield between the cost of care, defined from a hospital's perspective, and the resulting CMS reimbursement. We hypothesized that the total CMS reimbursement would equal the inpatient cost of care for geriatric intertrochanteric femur fractures.

Materials and Methods

Following institutional review board approval, 287 intertrochanteric femur fracture patients at a level 1 academic trauma center were reviewed, January 2013 to December 2017. Inclusion criteria included an isolated low-energy intertrochanteric femur fracture, greater than 65 years of age, CMS-insured, and treated with open reduction internal fixation or intramedullary fixation. Patients were excluded on the basis of polytrauma, open fracture, nonoperative management, or treatment with arthroplasty. Patient demographics, Charlson Comorbidity Index (CCI), surgical details, and injury characteristics were collected from the patient's electronic medical record. In order to review and present the full scope of patients who have isolated intertrochanteric femur fractures treated operatively at our institution, patients were not excluded based on MS-DRG, cost, or reimbursement data.

The inpatient cost of care was determined utilizing the institution's custom-developed costing software; a patient-specific allocation of costs incurred as a relative value to both the time

and cost of treatment. This formula of activity-based costing utilizes a top-down approach to encompass both direct and indirect costs bridging information from both Epic (Madison, Wisconsin) and McKesson (San Francisco, California).¹² Direct costs include products charged to the patient: laboratory testing, clinical personnel, surgical time, and patient's hospital length of stay. Whereas indirect costs account for expenses related to maintain regular hospital operations: utility services, information technologies support, hospital administration, financials and billings, and so on.¹²

The reimbursement was determined from the CMS inpatient prospective payment system, utilizing an MS-DRG determinant. The system assigns each patient to an MS-DRG, which is associated with a specific weight. This weight is then multiplied by a constant number to obtain the reimbursement for that patient. Disproportionate share hospital and indirect medical education additions were included as compensation for treating a large number of patients below the poverty line and providing medical education, respectively. As a result of these additions, our institution received 1.11 times the reimbursement the hospital would otherwise have received.

Statistical analyses consisted of step-wise graphing of net revenue between the MS-DRG and CCI to illustrate the relationship between hospital revenue and a patient's general health (Figure 1). This method plots each individual patient on the x-axis and their MS-DRG on the y-axis, organized from lowest to greatest. Additionally, the aggregate hospital revenue was plotted along a second y-axis. The aggregate slope then relates to the net yield of the hospital. Positive slopes indicate a hospital profit, negative slopes indicate a hospital loss, and 0 slopes indicate a null yield. All statistical analysis was conducted using SAS version 9.4 (SAS Institute; Cary, North Carolina). Study data were compiled and maintained via Microsoft Excel on a secure hospital server (Microsoft Corporation; Redmond, Washington).

Results

A total of 287 patients were included into the study (Table 1). The study population was primarily female ($n = 204$, 71.1%) with a mean age of 83.1 ± 8.5 (82.1-84.1). Per AO Foundation/Orthopaedic Trauma Association (AO/OTA) fracture classification, the majority of intertrochanteric femur fractures were classified as 31-A2 ($n = 151$, 52.6%), followed by 31-A1 ($n = 86$, 30.0%), and 31-A3 ($n = 50$, 17.4%). The majority of patients were treated with a long intramedullary nail ($n = 126$, 43.9%), followed by short intramedullary nail ($n = 111$, 38.7%), and dynamic hip screw ($n = 50$, 17.4%). The average CCI was 2.1 ± 2.0 (1.9-2.3) and 5.7 ± 2.1 (5.5-6.0), adjusting for patient age at time of surgery. All patients were treated definitively at an urban, academic level 1 trauma center.

Patients were assigned an average MS-DRG weight of 2.3 ± 0.6 (2.2-2.3), corresponding to an average reimbursement of US\$19 049 \pm US\$7221 (US\$18 215, US\$19 884). The reported mean cost for these patients was US\$19 822 \pm US\$8078 (US\$18 888, US\$20 755), yielding a net-deficit of

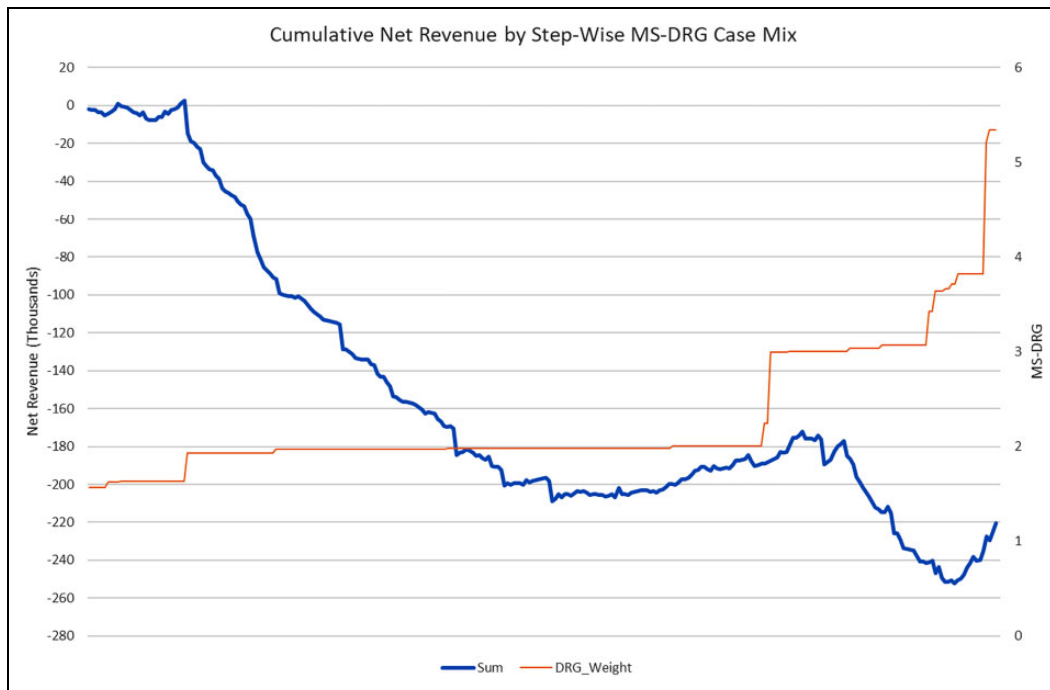


Figure 1. Cumulative net hospital revenue by step-wise MS-DRG weight associated with the treatment of patients with intertrochanteric hip fractures. The left vertical axis represents USD and is associated with the blue line, which plots the cumulative hospital revenue. Patients are plotted from left to right by increasing MS-DRG weight. Segments of the line with a positive slope indicate net profit for the hospital in the treatment of those patients. Segments of the line with a negative slope indicate net loss for the hospital in the treatment of those patients. The right vertical axis represents the MS-DRG weight and is associated with the orange line, which plots the MS-DRG weight of each individual patient. MS-DRG indicates Medical-Severity Diagnosis-Related Grouping.

Table 1. Population Characteristics for Study Sample Between 2013 and 2018.^{a,b}

	n (% of N)	Mean ± SD (95% CI)
Gender		Male: 83 (28.9%) Female: 204 (71.1%)
Age		83.1 ± 8.5 (82.1-84.1)
AO/OTA fracture classification		31-A1: 86 (30.0%) 31-A2: 151 (52.6%) 31-A3: 50 (17.4%)
Anesthesiologist Society of America (ASA) Score		2: 43 (15.0%) 3: 204 (71.1%) 4: 38 (13.2%) 5: 2 (0.7%)
Charlson Comorbidity Index (CCI)		2.1 ± 2.0 (1.9-2.3)
Age-Adjusted Charlson Comorbidity Index (CCI)		5.7 ± 2.1 (5.5-6.0)
Medical Severity Diagnosis Related Grouping (MS-DRG)		2.3 ± 0.6 (2.2-2.3)
Implant Type		Dynamic hip screw: 50 (17.4%) Short intramedullary nail: 111 (38.7%) Long intramedullary nail: 126 (43.9%)
Hospital length of stay		4.9 ± 2.7 (4.6-5.2)
Total cost		US\$19 822 ± US\$8078 (US\$18 888- US\$20 755)
CMS reimbursement		US\$19 049 ± US\$7 221 (US\$18 215- US\$19 884)
Net yield		Net-loss: 180 (62.7%) Net profit: 107 (37.3%)
Mortality		90-day: 39 (13.6%) 1-year mortality: 71 (24.7%)

Abbreviations: CMS, Center of Medicare and Medicaid Services; MS-DRG, Medical-Severity Diagnosis-Related Grouping.

^aN = 287.

^bA summary of the study populations' characteristics.

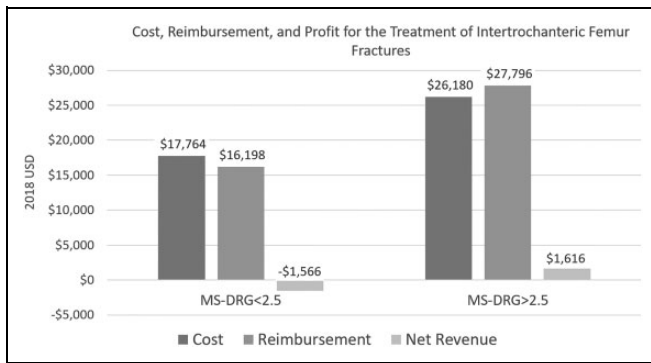


Figure 2. Total hospital cost, CMS reimbursement, and net hospital revenue associated with the treatment of patients with intertrochanteric femur fractures broken down into 2 subgroups: less medically complex (MS-DRG < 2.5) and more medically complex (MS-DRG > 2.5). CMS indicates Center of Medicare and Medicaid Services; MS-DRG, Medical-Severity Diagnosis-Related Grouping.

US\$773/patient and US\$220 417 in total (Figure 1). The mean reimbursement and cost for the less comorbid patients (MS-DRG weight < 2.5, n = 215) was US\$16 198 ± 3983 and US\$17 764 ± 5628, respectively, yielding a net-deficit of US\$1566 per patient. However, for the more comorbid patients (MS-DRG > 2.5, n = 72), the mean reimbursement and cost were US\$27 796 ± 3944 and US\$26 180 ± 10 880, respectively, yielding a net profit of US\$1616 per patient (Figure 2). The more comorbid patients had a significantly greater length of stay, 6.9 ± 3.8 days versus 4.3 ± 1.8 days ($P < .01$), and greater wait time from injury to surgery, 1.1 ± 1.0 days versus 0.6 ± 0.7 days ($P < .01$). Additionally, the more comorbid patients had a greater reoperation rate, 9.7% versus 6.5%, but was not statistically significant. Lastly, both the 90-day mortality rate, 32.6% versus 17.8% ($P = .03$), and 1-year mortality rate, 43.6% versus 29.7% ($P = .05$), were significantly greater in the more comorbid patient population (Table 2). There were

Table 2. Population Characteristics and Surgical Outcomes for Sample Population Between 2013 and 2018, Stratified by the Medical-Severity Diagnosis Related Groupings (MS-DRG).^{a,b}

	MS-DRG < 2.5 (n = 215)	MS-DRG > 2.5 (n = 72)	P Value
Gender	Male: 48 (22.4%) Female: 167 (77.6%)	Male: 35 (48.6%) Female: 37 (51.4%)	<.01^c
Age	83.2 ± 8.4 [82.1-84.3]	82.9 ± 9.0 [80.7-85.0]	.79 ^d
AO/OTA Fracture Classification	31-A1: 65 (30.2%) 31-A2: 114 (53.0%) 31-A3: 36 (16.8%)	31-A1: 21 (29.2%) 31-A2: 37 (51.4%) 31-A3: 14 (19.4%)	.86 ^c
Anesthesiologist Society of America (ASA) Score	2: 39 (18.2%) 3: 163 (75.8%) 4: 13 (6.0%) 5: 0 (0.0%)	2: 4 (5.6%) 3: 41 (56.9%) 4: 25 (34.7%) 5: 2 (2.8%)	<.01^c
Charlson Comorbidity Index (CCI)	1.9 ± 1.8 [1.6-2.1]	2.9 ± 2.3 [2.3-3.4]	<.01^e
Age-Adjusted Charlson Comorbidity Index (CCI)	5.5 ± 2.0 [2.0, 2.2]	6.4 ± 2.3 [5.9, 7.0]	<.01^d
Implant type	DHS: 40 (18.6%) Short IMN: 82 (38.1%) Long IMN: 93 (43.3%)	DHS: 10 (13.9%) Short IMN: 29 (40.3%) Long IMN: 33 (45.8%)	.67 ^c
Hospital length of stay	4.3 ± 1.8 [4.0-4.5]	6.9 ± 3.8 [6.0-7.8]	<.01^d
Time from Injury to surgery (days)	0.6 ± 0.7 [0.5-0.7]	1.1 ± 1.0 [0.9-1.4]	<.01^e
Cost	US\$17,764 ± US\$5,628 [US\$17,739-US\$17,788]	US\$26,180 ± US\$10,880 [US\$26,099-US\$26,260]	<.01^e
Reimbursement	US\$16,198 ± US\$3,983 [US\$16,180-US\$16,215]	US\$27,796 ± US\$3,944 [US\$27,766-US\$27,825]	<.01^d
Reoperation	14 (6.5%)	7 (9.7%)	.37 ^c
Mortality	90-Day: 24 (17.8%) 1-Year: 47 (29.7%)	90-Day: 15 (32.6%) 1-Year: 24 (43.6%)	.03^c .05^c

^aN = 287.

^bA summary of study sample (N = 287) characteristics. Summary statistics are provided in either count (proportion) or mean ± SD [95% CI] format. The appropriate is used for each characteristic listed within the table. Parentheses proportions are representative of only responses and excludes missing responses.

^cResulting P value for a χ^2 test between groups.

^dResulting P value of a student 2-sample t test between groups.

^eResulting P value from a Welch 2-sample t test, due to unequal variances confirmed by a Folded-F test for variances ($P < .05$).

^fThe Re-operation variable was determined based on patients returning to the OR for one of the following reasons: malunion, non-union, infection, or mechanical implant failure. Bold values indicate P values reaching statistical significance, $P < .05$.

no significant differences with regard to implant type use (long nail, short nail, or dynamic hip screw) between the more or less comorbid patient groups.

Discussion

With incidence expected to increase exponentially over the next 25 to 30 years, geriatric hip fractures present as a growing challenge.^{9,13} Due to their high incidence and relatively expensive treatment, treatment for hip fracture care has a substantial impact on the financial sustainability of hospitals. To date, there is little information comparing reimbursement to hospital costs for these patients. The purpose of this study was to compare the CMS reimbursement with total hospital costs for patients treated operatively for intertrochanteric femur fractures in a single urban, academic level 1 trauma center. The majority of patients ($n = 215$, 75.5%) in the study were without significant medical comorbidities (MS-DRG weight < 2.5). The care of these patients averaged a net loss of US\$1566 for the hospital. Patients with greater comorbidity, MS-DRG weight > 2.5 ($n = 70$, 24.5%), averaged a US\$1616 net profit for the hospital. Overall, our study identifies a mean net loss of US\$773/patient when treating CMS-insured intertrochanteric femur fractures.

A previous 1998 study compared hospital costs to the CMS reimbursement in hip fractures. This study derived reimbursement using the previous DRG system.¹¹ Dr Clancy study identified an average net-deficit of US\$935/patient between hospital costs and CMS reimbursement for treated hip fractures.¹¹ Adjusting cost and reimbursement values to 2018 USD, the previous study's average loss is 1.87-times greater than our own, US\$1445 versus US\$773. This would suggest that the current MS-DRG system more accurately reflects hospital costs compared to the previous system in 1998. Additionally, the previous study found a lower average cost, US\$14 878 versus US\$19 822, and reimbursement, US\$13 433 versus US\$19 049. This indicates that both hospital costs and reimbursement have increased at a rate greater than the rate of USD inflation.¹¹ Lastly, a consistent per-patient deficit specifies that the relationship between reimbursement and hospital costs has remained constant in the 20-year interval between the 2 studies.

With the introduction of proposed mandatory bundled payments, the Surgical Hip and Femur Fracture Treatment model (Table 3),¹⁴ efforts to improve the risk adjustment of the MS-DRG system has been a recent topic of investigation in hip fractures.¹⁰ Bundled payment models require accurate risk adjustment to ensure the reimbursement is equitable for all health-care providers. Research has focused on which variables provide the best risk adjustment model. A recent study of Medicare data for hip fracture patients identified a combined model for sex, age, and CCI comorbidities as an improved model for risk stratification in hip fractures versus the MS-DRG system alone.¹⁰ Additionally, a previous study of hip fracture patients in the German DRG system found patients with lower medical comorbidities, $CCI \leq 3$, generated fewer losses for the hospital than patients with more medical comorbidities, $CCI > 3$.¹⁵ The

Table 3. The Surgical Hip and Femur Fracture Treatment Model (SHFFT).

Characteristics	The SHFFT Model
Participants	67 metropolitan statistical areas (same as Comprehensive Joint Replacement model)
Convener	Hospital
Clinical diagnoses	MS-DRG 480-482
Care episode	All part A/B services and 90 days post-discharge
Quality measures	Mandatory thresholds (NQF # 1550/1551, HCAHPS)
Gainsharing arrangements	Regulated by CMS, state, and federal laws
Expected discount	1.5% to 3% (higher quality = lower discount factor)
Risk model	Upside in performance year (PY) 1; upside and downside from PY2 to PY5
Payment schedule	Retrospective

Abbreviations: CMS, Center of Medicare and Medicaid Services; MS-DRG, Medical-Severity Diagnosis-Related Grouping.

^aThe above figure has been adopted from Elbuluk.¹⁴

authors attributed this to not enough risk adjustment for sicker patients to offset the increased cost of treating these patients. In contrast, our study found the treatment of patients with low medical comorbidities, $CCI \leq 3$ (average loss = US\$888, $n = 236$), yielded a greater loss for our institution than patients with greater medical comorbidities, $CCI > 3$ (average loss = US\$210, $n = 51$; Figure 3). This suggests the current MS-DRG system is potentially underestimating the reimbursements for treatment in patients with fewer or no medical comorbidities. While the MS-DRG system is able to compensate for the treatment of more comorbid patients, providing health-care institutions the resources required to treat increasingly complex patients. The current system demonstrates an inability to appropriately reimburse healthcare institutions for less comorbid patients. Additionally, overutilization of unnecessary or extraneous resources during hospitalization of healthy patients is a possibility for this reimbursement disparity, providing a focus for future research investigations. Ultimately, the decision to modify the current reimbursement system is controlled by CMS, meaning reduction in costs associated with intertrochanteric care may be the most reliable short-term method to improve financial sustainability.

The findings in our study are the results of a single, urban, academic level 1 trauma center, and wide-sweeping conclusions cannot be made. However, our experience and results highlight concerns with the current financial system for CMS-insured intertrochanteric femur fracture care. The apparent overpayment for sicker patients (MS-DRG > 2.5) is possibly a reflexive effect of the MS-DRG system due to the potential for unpredictable catastrophic costs by this patient group (prolonged intensive care unit stay, prolonged hospitalizations for medical conditions, etc). This group additionally is susceptible to outliers creating significant cost variations. Although there appears apparent opportunity for healthy system profit from this group, the unpredictable medical and fiscal

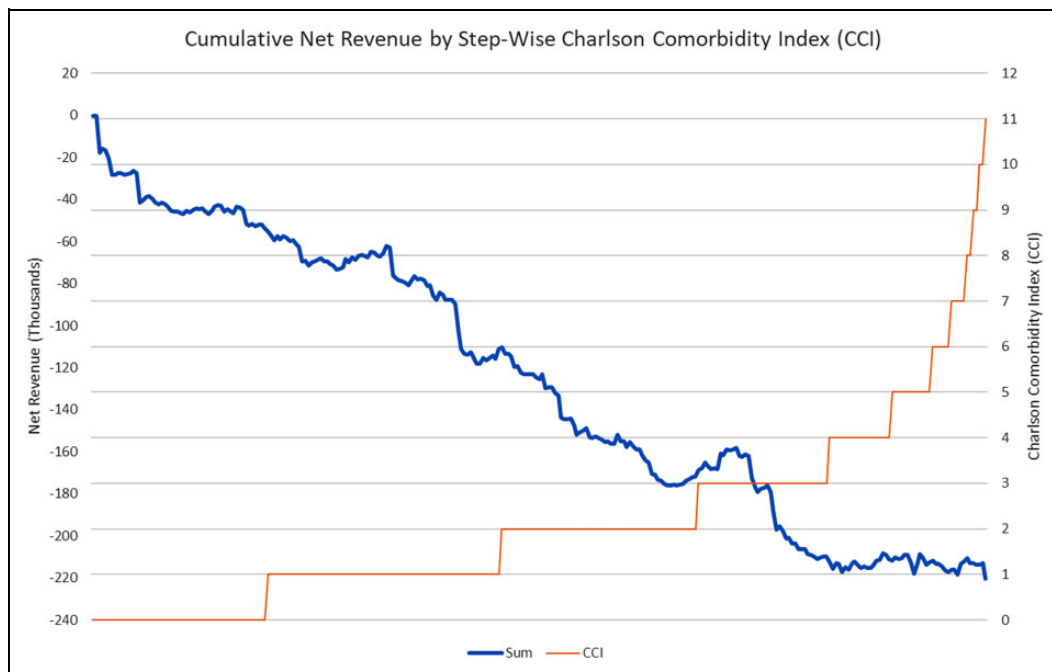


Figure 3. Cumulative net hospital revenue by step-wise Charlson Comorbidity Index, unadjusted, associated with the treatment of patients with intertrochanteric femur fractures. The left vertical axis represents USD and is associated with the blue line, which plots the cumulative hospital revenue. Patients are plotted from left to right by increasing CCI. Segments of the line with a positive slope indicate net profit for the hospital in the treatment of those patients. Segments of the line with a negative slope indicate net loss for the hospital in the treatment of those patients. The right vertical axis represents the CCI and is associated with the orange line, which plots the CCI of each individual patient. CCI indicates Charlson Comorbidity Index.

nature of this less healthy patient population should not be relied upon for profit by health systems. The underreimbursement of the healthier patients highlights a more concerning aspect of the current reimbursement system. Healthier patients (MS-DRG < 2.5) make up the majority of our patient population in this study. While these patients were cheapest to care for on average, their care on average resulted in a deficit for the institution. Profits cannot be relied upon from the more labile sicker patient group (MS-DRG > 2.5). The focus of future cost savings should be directed at reducing cost of care in the healthy patient populations (MS-DRG < 2.5).

Multiple studies have previously assessed the factors that affect the cost of geriatric hip fracture care. Increasing medical severity, utilizing CCI, has shown to increase length of stay and costs associated with hip fracture care.^{16,17} Our study supported this finding as more medically complex patients, CCI > 3, had greater total cost of care (US\$21 364, n = 51) than less medically complex patients, CCI < 3, (US\$19 489, n = 236). For intertrochanteric femur fractures, much of the research has focused on determining how differences in implant selection contributes to cost. Multiple studies have shown intramedullary nail fixation to be more expensive than plate and screw fixation.^{18,19} Additionally, studies have shown wide variation in the utilization of intramedullary nails in different regions of the country, with a substantial increase in the use of nails in the past decade.^{20,21} Factors that influence length of stay have also been shown to increase the cost of hip fracture care. A 2016

study of patients with surgical hip fracture found greater preoperative testing increased the time till surgery and total length of stay, yet only altered the management of few patients.²² Implant selection and preoperative testing may represent areas for possible cost savings. These potential savings would provide the cost reductions needed to offset the lower reimbursement for less comorbid patients.

Cost and reimbursement differences have previously resulted in “cherry picking” and “lemon dropping.”^{7,23,24} “Cherry picking” refers to the practice in which hospitals attempt to attract patients with favorable reimbursement to increase their profits. Conversely, “lemon dropping” is used to describe hospitals transferring or turning away patients with unfavorable reimbursement profiles. Traditionally, risk adjustment has been inadequate for the sickest patients, leading to some hospitals incurring large losses to treat these patients and decreasing these patient’s access to care.^{10,25-27} The results of our study indicates that MS-DRG reimbursement system results in under reimbursement for treating the least sick patients (MS-DRG weight < 2.5, average loss = US\$1566, n = 215) and over reimbursement for treating the sickest patients (MS-DRG weight > 2.5, average profit = US\$1616, n = 72) at our institution. The generalizability of this data is indeterminate. The sickest patients (MS-DRG > 2.5) are greater risk of unpredictable rise in length of stay, intensive care needs, and hospitalization stay. While unlikely, hospitals may be incentivized to attract the sickest patients and turn away or transfer the

healthier patients if cost and reimbursement data were to consistently show these results. This contrasts with the traditional thought of cherry picking more healthy patients and lemon dropping more sick patients, yet still leads to similar unethical results. More comorbid patients are commonly transferred to higher acuity hospitals, which may make the selection of financially advantageous and more comorbid patients unfeasible for lower acuity centers. In our study, the patients with low medical complexity made up the majority, 75.6%, of the total patients treated. Therefore, the inadequate reimbursement of the less medically complex patients offers a non-sustainable financial formula when taking these patients into account in isolation. The case mix at each hospital defines the cost and reimbursement. The individual hospital and patient factors that may drive cost or reimbursement change are outside the scope of this current study. An unlikely outcome, but at our institution care for more comorbid patients was reimbursed favorably, which may create a potential for unethical practices of “cherry picking” and “lemon dropping” in our community of high and low acuity hospital systems.

This study had several strengths and weaknesses. Strengths include: the comparison of reimbursement to cost of care in a CMS-insured population, so the results are not influenced by the payer type. Additionally, cost in this study was defined as the exact cost attributed to each patient by our hospital’s accounting system, not the charges a patient was billed. Finally, our study utilized a relatively homogenous population, isolated intertrochanteric femur fractures. This is a difference from previous studies that included patients with a heterogeneous hip fracture profile, possibly confounding their results. There are also a number of limitations with this study. First, this study only evaluates inpatient costs, not including cost accrued during the entire episode of care. Second, multiple surgeons were included in the study, which may introduce some heterogeneity into the hospital cost data, due to the variability in provider treatment algorithms. Third, this study was performed at a single metropolitan level I academic trauma center. This limits the generalizability of the study results and may not be applicable to all patient populations. However, our health-care institution utilizes a comanagement strategy in an attempt to contain costs for the care of geriatric hip fractures. This may better alleviate the generalizability gap between the results of our study and those that could be applied to smaller acute-level 3 trauma centers. Fourth, there are existing limitations regarding the retrospective fashion of this study. Due to the retrospective design of this study, the study team is unable to evaluate the accuracy of the diagnosis codes and case-severity DRGs assigned to each patient. Lastly, this study only evaluates hospital costs as a whole, rather than its delineated parts. However, the focus of this project was to investigate the relationships between hospital costs, CMS reimbursement, and risk adjustment formulas for medical comorbidity. Therefore, a comprehensive analysis of the fragmented hospital costs lies beyond the scope of the current investigation. Although, it would act as the natural next step in identifying a potential solution to this problem.

The disparity between cost and reimbursement, particularly in less comorbid patients, is a concerning finding. There is no one clear factor that drives or predominantly contributes to this conclusion. Factors that may be implicated involve delay to surgery and preoperative testing, subspecialist consultations (although all geriatric hip fracture patients regardless of comorbidities have hospitalist consultation and comanagement), implant choice, complications, and length of stay. Further investigation of these factors and how they compare among more and less comorbid patients is the next step at our institution.

Conclusions

For our health system, CMS-insured intertrochanteric femur fracture patients with an MS-DRG weight <2.5 delivered a net loss to the hospital, while patients with an MS-DRG > 2.5 presented a net profit. Given that ~75% of patients identify with an MS-DRG<2.5, this yields a problematic and non-sustainable financial formula. The loss on relatively healthier patients and profit on more comorbid patients indicates a dangerous discontinuity between the inpatient costs and MS-DRG-weighted CMS reimbursement for geriatric intertrochanteric femur fracture care. At this time, it is unclear if the net loss is due to under reimbursement by CMS or over utilization of resources during hospitalization. Economic challenges of the current system must be considered when developing future payment models for hip fractures. Future research should be tasked with better understanding the costs relating to the entire episode of geriatric intertrochanteric femur fracture care, delineating the specific drivers of health-care costs, identify further avenues for costs savings, and developing an improved model for hospital reimbursement.

Declaration of Conflicting Interests

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