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Insurance Status Affects In-Hospital Complication Rates After Total Knee Arthroplasty

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abstract

Insurance status has been shown to be a predictor of patient morbidity and mortality. The purpose of this study was to evaluate the effect of patient insurance status on the in-hospital complication rates following total knee arthroplasty. Data were obtained from the Nationwide Inpatient Sample (2004 through 2011). Patient demographics and comorbidities were analyzed and stratified by insurance type. Analysis was performed with a matched cohort comparing complication rates between patients with Medicare vs private insurance using the coarsened exact matching algorithm and multivariable logistic regression. A total of 1,352,505 patients (Medicare, 57.8%; private insurance, 35.6%; Medicaid/uninsured, 3.1%; other, 3.3%; unknown, 0.2%) fulfilled the inclusion criteria. The matched cohort analysis comparing Medicare with privately insured patients showed significantly higher risk of mortality (relative risk [RR], 1.34; P<.001), wound dehiscence (RR, 1.32; P<.001), central nervous system complications (RR, 1.16; P=.030), and gastrointestinal complications (RR, 1.13; P<.001) in Medicare patients, whereas privately insured patients had a higher risk of cardiac complications (RR, 0.93; P=.003). Independent of insurance status, older patients and patients with an increased comorbidity index were also associated with a higher complication rate and mortality following total knee arthroplasty. These data suggest that insurance status may be considered as an independent risk factor for increased complications when stratifying patients preoperatively for total knee replacement. Further research is needed to investigate the disparities in these findings to optimize patient outcomes following total knee arthroplasty. [*Orthopedics*. 201x; xx(x):xx-xx.]

Total knee arthroplasty (TKA) is one of the most commonly performed inpatient procedures in the United States. In 2010, 693,400 total knee replacements were performed in patients older than 45 years, and the demand is projected to rise dramatically during the next decade in response to the aging "baby boomer" population.[1,2] Both medical and surgical complications can occur, particularly because patients undergoing these procedures tend to be older and have preexisting medical comorbidities. Due to this increased demand, surgeons and patients must identify and understand risk factors responsible for the development of complications following TKA.

Factors that may predispose a patient to complications after TKA have been

well described.[3,4] Previous studies have shown that a wide range of conditions and factors, including psychiatric disorders, obesity, advanced age, smoking, and length of hospitalization, are associated with an increased complication rate after TKA.[5-10] One variable that has become particularly relevant is that of insurance status. Despite the Affordable Care Act, passed in 2010 and allowing for Medicaid expansion in the United States, insurance status has been implicated in not only patient inaccessibility to both hip and knee arthroplasty treatment but also worse outcomes after total joint arthroplasty.[11-16]

Although prior studies have examined the impact of insurance status on complications after total joint arthroplasty, they have either involved small cohorts or focused on limited insurance types, such as Medicaid and Medicare populations.[14,17] The purpose of this study was to evaluate the effect of patient insurance status (Medicare vs private) and other patient factors on the in-hospital complication rate following TKA using a large all-payer inpatient health care database with a matched cohort. The authors hypothesized that patients with public insurance (Medicare or Medicaid) would have more complications than patients with private insurance.

MATERIALS AND METHODS

This study was deemed not human subjects research by the authors' institutional review board. This study used the data collected in the Healthcare Cost and Utilization Project Nationwide Inpatient Sample from 2004 through 2011. The Nationwide Inpatient Sample is the largest publicly available all-payer inpatient health care database in the United States, with data from more than 7 million hospital stays each year. Patients were identified using the *International Classification of Diseases, 9th Revision, Clinical Modification* procedural codes (total knee replacement, 81.54; revision total knee replacement, 81.55).

Patient demographics (sex, age, race/ethnicity, and admission type) and comorbidities (Charlson comorbidity index) were analyzed and stratified based on insurance type (Medicare, private insurance, Medicaid/uninsured, and other).[18] "Other" insurance types included workers' compensation, Civilian Health and Medical Program of the Uniformed Services, Civilian Health and Medical Program of the Department of Veterans Affairs, Maternal and Child Health Services Block Grant (Title V of the Social Security Act), and other governmental programs.[19] Age was divided into 4 ordinal categories (younger than 40, 40 to 64, 65 to 79, and 80 years and older). Medical complications, surgical complications, and mortality during the same hospitalization period were the primary outcomes. Medical complications included acute cardiac event, pulmonary edema, venous thromboembolic event, cerebrovascular event, acute kidney injury, pneumonia, sepsis, and urinary tract infection. Surgical complications included shock, hematoma, accidental puncture, wound dehiscence, retained foreign body, postoperative injection, and nonhealing surgical wound. Pearson's chi-square test was used for comparison of baseline characteristics on each insurance cohort. Multivariable logistic regression was also used to assess the influence of insurance type on the aforementioned complications.

A matched-cohort comparison of patients with Medicare (public insurance) vs private insurance was performed as a secondary analysis. To control for different baseline demographics, each Medicare patient was matched one-to-one with a repeated sampling of private insurance patient on the basis of age, sex, and other demographics/comorbidities using the coarsened exact matching algorithm. By reducing the imbalance in demographics between groups, matching improved the estimation of covariates in predicting outcomes. The matching algorithm worked by sorting patients based on matching demographics, then discarding patients who did not have any matching demographics with a corresponding Medicare patient. All analysis was performed using R version 3.0.3 software (R Foundation, www.r-project.org).

RESULTS

Demographics

Overall, 1,352,505 patients were included in this study. Demographic information is presented in **Table 1**. For race/ethnicity, most patients were white, followed by black and then Hispanic. Predictably, more than 87% of the patients with Medicare who had a knee arthroplasty were 65 years or older.

The payer mix included 57.8% (781,255) of patients with Medicare, 35.6% (481,054) with private insurance, 2.6% (35,537) with Medicaid or no insurance, and 3.1% (42,580) from other insurance programs. Approximately 0.2% (2891) of patients had unknown payer status and were excluded from further analysis. Most patients with Medicaid and private insurance were younger than 65 years (83.1% and 85%, respectively). In all insurance groups, between 89% and 93% of surgeries were elective in nature. Patients with government-sponsored insurance (Medicare or Medicaid) tended to be less healthy than those who were privately insured, as indicated by a higher comorbidity index (comorbidity index ≥ 3: Medicare, 3.5%; Medicaid, 3.3%; private, 1.6%).

Most of the knee arthroplasties performed were primary TKAs (1,296,469; 96.1%), with 3.9% (53,145) being revision TKAs. In all insurance groups, primary TKA was the most common procedure, accounting for more than 90% of the surgeries.

Summary of Complications

Among all reported surgical and medical complications, cardiac events were the most common and occurred in 8.0% of the Medicare patients, which is more

Table 1

Demographics of the Total Knee Arthroplasty Patients

Characteristic	No. (%)				P
	Medicare	**Medicaid/Uninsured**	**Private Insurance**	**Other**	
Total	781,255	42,580	481,054	44,725	
Procedure type					<.001
Revision total knee replacement	33,374 (4.3)	1948 (4.6)	14,918 (3.1)	2905 (6.5)	
Total knee replacement	747,881 (95.7)	40,632 (95.4)	466,136 (96.9)	41,820 (93.5)	
Age group					<.001
<40 y	1220 (0.2)	1898 (4.5)	5286 (1.1)	896 (2.0)	
40-64 y	98,708 (12.6)	33,444 (78.6)	403,095 (83.9)	36,703 (82.3)	
65-79 y	540,623 (69.2)	6180 (14.5)	64,539 (13.4)	6241 (14.1)	
≥80 y	140,346 (18.0)	1006 (2.4)	7707 (1.6)	734 (1.6)	
Race					<.001
White	523,025 (66.9)	18,221 (42.8)	306,347 (63.7)	26,583 (59.4)	
Black	37,010 (4.7)	6027 (14.2)	27,017 (5.6)	3761 (8.4)	
Hispanic	28,313 (3.6)	5543 (13.0)	15,372 (3.2)	2913 (6.5)	
Asian/Pacific Islander	6108 (0.8)	994 (2.3)	3400 (0.7)	357 (0.8)	
Sex					
Male	271,772 (34.8)	10,523 (24.8)	188,910 (39.3)	22,422 (50.1)	
Comorbidity index					<.001
0	478,594 (61.3)	23,884 (56.1)	329,062 (68.4)	30,479 (68.1)	
1	212,060 (27.1)	13,193 (31.0)	118,689 (24.7)	11,132 (24.9)	
2	63,092 (8.1)	4101 (9.6)	25,410 (5.3)	2411 (5.4)	
≥3	27,509 (3.5)	1402 (3.3)	7893 (1.6)	703 (1.6)	
Hospital annual volume					<.001
1-173	267,262 (34.2)	20,017 (47.0)	142,984 (29.7)	17,745 (39.7)	
174-370	257,402 (32.9)	13,328 (31.3)	156,671 (32.6)	14,004 (31.3)	
≥371	256,591 (32.8)	9235 (21.7)	181,399 (37.7)	12,976 (29.0)	

than twice the rate of patients with private insurance (3.5%; **Figure**). Urinary tract infections and surgery-related complications were the next two most frequent complications overall, and both were more commonly seen in those patients with government-sponsored insurance (Medicaid/Medicare). Urinary tract infection was seen in 3.2% of Medicare patients and 2.8% of Medicaid/uninsured patients, compared with 1.8% of the privately insured patients. The overall highest complication rates were found in the Medicare population, followed by the

Medicaid/uninsured, other insurance, and privately insured patient populations.

Medical Complications

The multivariable logistic regression analysis revealed that white patients had significantly more medical complications than black, Hispanic, or Asian patients (P<.001). Increasing age and comorbidity index were also substantially associated with medical complications. Compared with patients younger than 40 years, patients 40 to 64 years old had 2 times (odds ratio [OR], 2.68; 95% confidence interval

[CI], 2.39-3.01; P<.001), patients 65 to 79 years old had 4 times (OR, 4.06; 95% CI, 3.62-4.56; P<.001), and patients 80 years and older had 6 times (OR, 6.25; 95% CI, 5.56-7.03; P<.001) higher odds of having postoperative medical complications. The trend was similar for those with a higher comorbidity index. Patients with a comorbidity index of 3 or greater had 22 times higher odds of having a medical complication postoperatively compared with patients without any preoperative comorbidity. Revision knee arthroplasty also had increased odds of medical complications (OR, 1.19;
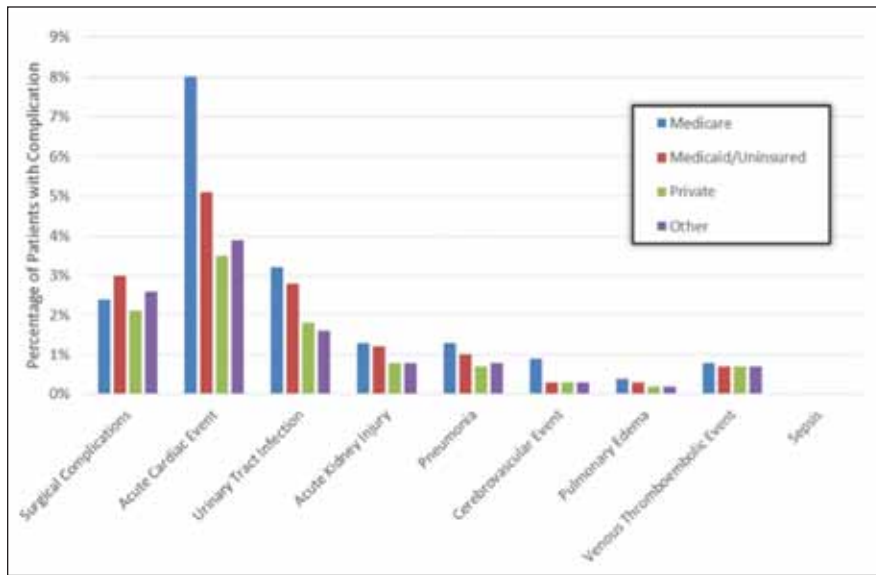
Figure: Types of medical and surgical complications for total knee arthroplasty.

95% CI, 1.16-1.23; *P*<.001) compared with primary total knee replacements.

In terms of differences related to insurance status, privately insured patients were associated with lower risk of overall medical complications compared with Medicare patients (OR, 0.82; 95% CI, 0.81 to 0.84; *P*<.001) (**Table 2**). Patients with Medicaid or no insurance also had fewer complications compared with Medicare patients; however, this difference was not statistically significant (OR, 0.96; 95% CI, 0.93-1.0; *P*=.06).

Surgical Complications

In contrast to medical complications, black, Hispanic, and Asian patients had significantly more surgical complications than white patients. There was also a significant increase in surgical complications in patients who were younger than 40 years (*P*<.001) and male patients (*P*<.001). Revision knee arthroplasty cases also had almost a 2-fold greater odds (OR, 1.87; 95% CI, 1.79-1.96; *P*<.001) of surgical complications compared with primary TKA surgery cases. Patients with preoperative comorbidities had an increased risk of surgical complications, although this was only significant if the comorbidity index was greater

than 2. On comparison of reported surgical complications (**Table 2**) across insurance types, patients with private insurance had a statistically significant lower risk of surgical complications (OR, 0.93; 95% CI, 0.9-0.96; *P*<.001), whereas patients who had Medicaid or no insurance had an increased risk (OR, 1.23; 95% CI, 1.15-1.32; *P*<.001).

Mortality

The overall mortality rate for patients undergoing knee arthroplasty was 0.12% (n=1577). Women (OR, 0.59; 95% CI, 0.53-0.66; *P*<.001) had a lower mortality risk compared with men. Older patients, patients with a higher comorbidity index, and those undergoing revision TKAs all had a significantly greater risk of mortality (**Table 2**). Compared with Medicare patients, patients with Medicaid or no insurance had no significant difference in mortality (OR, 0.95; 95% CI, 0.66-1.37; *P*=.779). Those with private insurance had the lowest mortality risk (OR, 0.67; 95% CI, 0.56-0.8; *P*<.001) compared with all other insurance types.

Matched-Cohort Analysis of Medicare Versus Private Insurance

Demographics for the matched cohort of Medicare and private insurance patients

are listed in **Table 3**, revealing similar baseline characteristics and comorbidities. **Table 4** provides a comparison of the risks of individual complications between the 2 groups when controlling for other risk factors. Patients with Medicare had statistically significant higher risks of central nervous system complications (relative risk [RR], 1.16; 95% CI, 1.01-1.33; *P*=.030), gastrointestinal complications (RR, 1.13; 95% CI, 1.08-1.19; *P*<.001), wound dehiscence (RR, 1.32; 95% CI, 1.16-1.49; *P*<.001), postoperative anemia (RR, 1.06; 95% CI, 1.05-1.07; *P*<.001), and mortality (RR, 1.34; 95% CI, 1.16-1.54; *P*<.001). On the contrary, the risk of cardiac complications was lower in Medicare patients (RR, 0.93; 95% CI, 0.89-0.97; *P*=.003) compared with privately insured patients. The authors found no statistical difference in the risk of other medical or surgical complications.

DISCUSSION

To the authors' knowledge, this study is the largest and most comprehensive assessment of medical and surgical complications after TKA and of specifically how patients' insurance status affects overall complication rates. This multivariable regression analysis showed that increased postoperative complications after TKA were associated with having nonprivate or Medicare insurance status. After both demographics and comorbidities were matched and controlled for between Medicare and private insurance patients, patients with Medicare or public insurance had significantly higher risks of developing central nervous system complications, gastrointestinal complications, wound dehiscence, and postoperative anemia and also had an increased rate of mortality compared with patients with private insurance. There was no difference in both the medical and the surgical complications between publicly insured patients with Medicare vs Medicaid.

Multivariable regression analysis in this study included more than 1 mil-

	Table 2								
Medical Complications, Surgical Complications, and Mortality After Total Knee Arthroplasty on Multivariable Logistic Regression Analysis									
	Medical Complications			**Surgical Complications**			**Mortality**		
Characteristic	**Adjusted OR (95% CI)**	**_P_a**	**_P_b**	**Adjusted OR (95% CI)**	**_P_a**	**_P_b**	**Adjusted OR (95% CI)**	**_P_a**	**_P_b**
Payer: Reference= Medicare			<.001			<.001			<.001
Medicaid/uninsured	0.96 (0.93-1.00)	.060		1.23 (1.15-1.32)	<.001		0.95 (0.66-1.37)	.779	
Private insurance	0.82 (0.81-0.84)	<.001		0.93 (0.90-0.96)	<.001		0.67 (0.56-0.80)	<.001	
Other	0.86 (0.82-0.89)	<.001		1.08 (1.01-1.16)	.026		0.77 (0.51-1.17)	.223	
Female: F vs M	0.84 (0.83-0.86)	<.001	<.001	0.79 (0.77-0.81)	<.001	<.001	0.59 (0.53-0.66)	<.001	<.001
Race Reference=white			<.001			<.001			.041
Black	0.90 (0.88-0.92)	<.001		1.56 (1.49-1.64)	<.001		1.09 (0.87-1.37)	.436	
Hispanic	0.74 (0.72-0.77)	<.001		1.37 (1.29-1.47)	<.001		0.87 (0.62-1.23)	.434	
Asian/Pacific Islander	0.67 (0.61-0.73)	<.001		1.29 (1.11-1.51)	.001		1.49 (0.80-2.79)	.211	
Age groups Reference=<40 y			<.001			<.001			<.001
40-64 y	2.68 (2.39-3.01)	<.001		0.70 (0.63-0.79)	<.001		1.49 (0.55-4.02)	.430	
65-79 y	4.06 (3.62-4.56)	<.001		0.76 (0.67-0.86)	<.001		2.64 (0.98-7.15)	.055	
≥80 y	6.25 (5.56-7.03)	<.001		0.83 (0.73-0.94)	.003		6.32 (2.33-17.14)	<.001	
Procedure type Reference=total knee replacement									
Revision total knee replacement	1.19 (1.16-1.23)	<.001	<.001	1.87 (1.79-1.96)	<.001	<.001	1.68 (1.39-2.04)	<.001	<.001
Comorbidity Index Reference=0			<.001			<.001			
1	4.50 (4.43-4.56)	<.001		1.03 (1.00-1.06)	.056		2.24 (1.97-2.55)	<.001	
2	12.31 (12.09-12.53)	<.001		1.11 (1.06-1.16)	<.001		4.65 (4.00-5.41)	<.001	
≥3	21.91 (21.38-22.45)	<.001		1.11 (1.04-1.19)	.002		10.22 (8.75-11.92)	<.001	

Abbreviations: CI, confidence interval; F, female; M, male; OR, odds ratio.
[a]Wald's test.
[b]Likelihood ratio test.

lion patients and indicated that patients with Medicare, Medicaid, or no insurance were more likely to have medical complications, increased mortality, and surgical complications compared with those with private insurance. These findings are similar to those of previous studies that found worse clinical outcomes in patients with Medicaid insurance.[13-15] A study performed by Browne et al[16] using the Nationwide Inpatient Sample database evaluated complications in a matched group of Medicaid vs non-Medicaid patients who underwent primary hip and knee arthroplasty. Consistent with the current study's findings, they found a higher rate of wound dehiscence, infection, and anemia but a lower risk of cardiac complications in the Medicaid patient population.[16] Additionally, no statistical differences were found between the various insurance types in all other complications. Similar large database studies in the general surgery trauma literature show a similar increased complication rate among uninsured patients after trauma, suggesting that this association is not exclusive to

Table 3			
Baseline Demographics and Comorbidities Between the Matched Medicare and Private Insurance Total Knee Arthroplasty Patients			
Characteristic	**Medicare**	**Private Insurance**	**P**
Total No.	595,440	594,842	
Age, mean (SD), y	66.2 (17.3)	65.6 (17.5)	<.001
Sex, No. (%)			.999
Male	221,776 (37.2)	221,554 (37.2)	
Female	373,664 (62.8)	373,288 (62.8)	
Race, No. (%)			.923
White	383,601 (64.4)	383,001 (64.4)	
Black	32,168 (5.4)	32,201 (5.4)	
Hispanic	19,633 (3.3)	19,529 (3.3)	
Other	160,038 (26.9)	160,111 (26.9)	
Procedure, No. (%)			.924
Revision total knee replacement	16,137 (2.7)	16,104 (2.7)	
Total knee replacement	579,303 (97.3)	578,738 (97.3)	
Hospital teaching status, No. (%)			.416
Nonteaching	367,108 (61.7)	366,308 (61.6)	
Teaching	228,332 (38.3)	228,534 (38.4)	
Comorbidities, No. (%)			
Congestive heart failure	3553 (0.6)	3564 (0.6)	.862
Cardiac arrhythmia	27,639 (4.6)	27,611 (4.6)	.999
Vascular disease	8598 (1.4)	8589 (1.4)	.998
Pulmonary circulation disorder	157 (0)	158 (0)	.948
Peripheral vascular disease	2460 (0.4)	2441 (0.4)	.813
Hypertension	380,301 (63.9)	380,054 (63.9)	.797
Paralysis	40 (0)	38 (0)	.824
Neurologic disorders	7291 (1.2)	7323 (1.2)	.743

Table 3 (cont'd)			
Baseline Demographics and Comorbidities Between the Matched Medicare and Private Insurance Total Knee Arthroplasty Patients			
Characteristic	**Medicare**	**Private Insurance**	**P**
Chronic pulmonary disease	61,445 (10.3)	61,397 (10.3)	.967
Diabetes, uncomplicated	105,014 (17.6)	104,860 (17.6)	.907
Diabetes, with chronic complication	2442 (0.4)	2435 (0.4)	.948
Hypothyroidism	63,160 (10.6)	63,163 (10.6)	.843
Renal failure	4476 (0.8)	4443 (0.7)	.762
Liver disease	350 (0.1)	344 (0.1)	.830
Peptic ulcer disease	971 (0.2)	963 (0.2)	.873
AIDS	20 (0)	20 (0)	.823
Lymphoma	307 (0.1)	313 (0.1)	.997
Metastatic cancer	14 (0)	15 (0)	.800
Solid tumor without metastasis	193 (0)	200 (0)	.851
Rheumatoid arthritis/collagen vascular disease	17,602 (3)	17,657 (3)	.717
Coagulopathy	1805 (0.3)	1786 (0.3)	.694
Obesity	80,609 (13.5)	80,576 (13.5)	.774
Weight loss	19 (0)	19 (0)	.898
Fluid and electrolyte disorder	20,472 (3.4)	20,473 (3.4)	.998
Chronic blood loss anemia	3342 (0.6)	3309 (0.6)	.914
Deficiency anemia	1036 (0.2)	1025 (0.2)	.715
Alcohol abuse	669 (0.1)	682 (0.1)	.826
Psychosis	2702 (0.5)	2676 (0.4)	.710
Depression	43,985 (7.4)	43,939 (7.4)	.750
Smoking	22,104 (3.7)	22,128 (3.7)	.995

orthopedic surgery and knee arthroplasty patients.[20,21]

The current authors also found that social factors such as race/ethnicity contributed to increased risk of developing a surgical complication. Their analysis showed that black and Hispanic patients had an increased risk of surgical complications compared with white patients. Previous literature in the area of joint arthroplasty has primarily focused on the use of total hip and knee arthroplasty, specifically highlighting the low utilization rates of both for black and Hispanic patients.[14,22-28] This may be the result of limited access to high-volume private surgeons because of government insurance status or socioeconomic factors. Despite the fact that these

patient populations have a greater number of surgical complications while also using arthroplasty procedures less frequently, little is known about why these disparities exist. Perhaps more important, it is not known how to address this health care disparity. Paradoxically, although black and Hispanic patients had an increased risk of surgical complications, the current analysis also showed that white patients had an increased risk of medical complications. This finding was surprising, and this study highlights that further investigation into these unanswered questions of the relationship of race to complications is prudent.

Independent of insurance status, the current analysis also found that both increased age and increased comorbidity index were risk factors for medical complications. Patients 80 years and older had 6 times the complication rate of patients younger than 40 years. This finding is consistent with previous studies that have found a higher complication rate in patients 80 years and older compared with younger patients.[7,8,29,30] Furthermore, a comorbidity index of 3 or greater resulted in 22 times the odds of a postoperative medical complication developing, compared with patients with a comorbidity index of 0. Previous studies have also found that high comorbidity index is a risk factor for compromised patient outcomes after TKA; therefore, optimizing patient health status should be an important preoperative consideration.[31-33] Also, as expected, compared with primary knee arthroplasty, revision knee arthroplasty will increase the odds of medical complications. The risk factors mentioned above were also associated with increased mortality after TKA.

The authors analyzed a large number of patient records to find statistical trends that might not otherwise be discernible in a smaller retrospective study. This study had limitations. The database is a nationwide sampling of all knee arthroplasties, so the findings can be broadly applicable on a national level. However, due to the

Table 4
Comparison of In-Hospital Complications After Total Knee Arthroplasty Between the Matched Medicare and Private Insurance Patients

Complication	No. (%)		P	Relative Risk (95% Confidence Interval)
	Medicare	Private Insurance		
Central nervous system	463 (0.1)	399 (0.1)	.030[a]	1.16 (1.01-1.33)
Cardiac	3287 (0.6)	3532 (0.6)	.003[a]	0.93 (0.89-0.97)
Peripheral vascular	1151 (0.2)	1144 (0.2)	.903	1.01 (0.93-1.09)
Respiratory	3900 (0.7)	3828 (0.6)	.437	1.02 (0.97-1.06)
Gastrointestinal	3308 (0.6)	2924 (0.5)	<.001[a]	1.13 (1.08-1.19)
Genitourinary	3742 (0.6)	3799 (0.6)	.483	0.98 (0.94-1.03)
Hematoma/seroma	4563 (0.8)	4397 (0.7)	.087	1.04 (0.99-1.08)
Wound dehiscence	573 (0.1)	434 (0.1)	<.001[a]	1.32 (1.16-1.49)
Postoperative infection	1062 (0.2)	1123 (0.2)	.191	0.94 (0.87-1.02)
Deep venous thrombosis	1542 (0.3)	1614 (0.3)	.190	0.95 (0.89-1.02)
Pulmonary embolism	598 (0.1)	652 (0.1)	.122	0.92 (0.82-1.02)
Postoperative anemia	96,717 (16.2)	91,277 (15.3)	<.001[a]	1.06 (1.05-1.07)
Mortality	429 (0.1)	321 (0.1)	<.001[a]	1.34 (1.16-1.54)

[a]*Significant.*

nature of a retrospective study, the authors are limited in their ability to analyze causality. The data also only have information on a single hospital discharge. The authors were unable to assess patient outcomes, readmission rates, or delayed complications that occurred after a patient was discharged. Additionally, the authors examined both primary and revision TKAs in these results, which contributed some heterogeneity to their findings. However, the authors did address this by using multivariable regression to adjust for the above variables along with age, sex, and comorbidities. Additionally, the authors performed a matched-cohort analysis of patients with Medicare insurance compared with private insurance status using the coarsen exact matching algorithm to confirm their findings. Although statistical significance can be seen in a large database study such as this, the clinical relevance of small but significant

differences is an area of debate and many of these findings should not be evaluated based on statistical significance but rather clinical significance.

CONCLUSION

These findings showed that, in general, patients with government-sponsored (Medicare and Medicaid) or no insurance were at a higher risk of developing medical complications, including having higher mortality. Additionally, older patients and patients with an increased comorbidity index were also associated with a higher complication rate and mortality following knee arthroplasty. When a matched cohort was used to directly compare Medicare patients with private insurance patients on individual complications, Medicare patients had a significantly higher risk of mortality, complications related to the central nervous system and gastrointestinal system, wound dehiscence, and post-

operative anemia. These data suggest that insurance status may be considered as an independent risk factor for increased complications when stratifying patients preoperatively for total knee replacement. Further research is needed to investigate the disparities in these findings to optimize patient outcomes following TKA.

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