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Original Research

Payor Type is Associated With Increased Rates of Reoperation and Health-care Utilization Following Unicompartmental Knee Arthroplasty: A National Database Study

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ABSTRACT

Background: Unicompartmental knee arthroplasty (UKA) is a common orthopedic procedure with overall good clinical outcomes; however, more recent literature has identified disparities in treatment access and outcomes based on sociodemographic factors. There is a paucity of literature examining whether payor type, including Medicare, Medicaid, and commercial insurance types, impacts early medical complications and rates of reoperation following a UKA.

Methods: Patients with Medicare, Medicaid, or commercial payor type who underwent primary medial or lateral UKA between 2010 and 2019 were identified using a large national database. Ninety-day incidence of emergency department visit and 1-year incidence of revision, revision to arthroplasty, reimbursement, and cost of care were evaluated. Propensity score matching was used to control for patient demographic factors and comorbidities as covariates.

Results: Medicaid insurance was associated with an increased risk of emergency room visit (odds ratio [OR] 2.77; $P < .001$), revision surgery (OR 1.85; $P < .001$), and conversion to total knee arthroplasty (OR 1.50; $P = .0292$) compared to commercially insured patients. Medicaid insurance was associated with an increased risk of emergency room visit (OR 3.58; $P < .001$), revision surgery (OR 1.97; $P < .001$), and conversion to total knee arthroplasty (OR 1.80; $P = .003$). Medicaid patients were associated with a higher overall cost of care and lower reimbursement than commercial and Medicare patients ($P < .001$ and $P < .001$, respectively).

Conclusions: These findings demonstrate that payor type is associated with increased rates of reoperation and health-care utilization following UKA despite controlling for covariates. Additional work is required to understand the complex relationship between socioeconomic status and outcomes to ensure appropriate health-care access for all patients and pursue appropriate risk stratification.

Level of Evidence: III, retrospective chart review.

Introduction

The Medicaid program was officially launched in 1965 along with the passage of the Social Security Amendment of 1965 to expand access to health care for low-income and disadvantaged individuals within the United States [1]. With the initiation of the Patient Protection Affordable Care Act, the Medicaid program substantially expanded to include more than 38 states as of March 2022 [2,3]. This expansion has important implications for how physicians and health-care providers are able to deliver health care to all patients, regardless of payor type or socioeconomic status.

Several studies have demonstrated that different payor types are associated with different rates of complication following various orthopedic procedures and surgeries. For example, a systematic review of spine surgeries determined that patients with Medicaid insurance were associated with decreased access to surgery, lower reimbursement rates, and worse health-care outcomes than non-Medicaid patients [4]. Furthermore, a study by Kim et al. concluded that Medicaid patients could only schedule an appointment 20% of the time compared to 89% for Medicare and 97% for Blue Cross Blue Shield [5]. A study by Rogers et al. demonstrated that patients with Medicaid insurance were also less

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likely to have access to rehabilitation services following anterior cruciate ligament reconstruction than Medicare or commercially insured patients [6]. These findings highlight the complex interplay between payor type, socioeconomic status, and outcomes following an orthopedic procedure, but there is scarce literature on how payor status impacts outcomes following unicompartmental knee arthroplasty (UKA).

There is a paucity of data on how payor type, specifically commercial, Medicaid, and Medicare insurance, impacts early postoperative outcomes following UKA. Moreover, the incidence of various medical comorbidities among different payor type groups has never been formally evaluated in the UKA patient population. Therefore, the purpose of this study was to evaluate the rate of medical comorbidity, conversion to arthroplasty, and health-care utilization following UKA among different payor types. The authors hypothesized that, despite controlling for known risk factors for adverse medical and surgical events as covariates, Medicaid payor type would be associated with an increased risk of adverse events and increased health-care utilization compared to Medicare and commercial payor types.

Material and methods

This is a retrospective cohort study performed using the commercially available Mariner database via PearlDiver (PearlDiver Inc., Colorado Springs, CO) patient records database. Mariner is a large, anonymized insurance data set for 121 million patients in the United States. Patient records from 2010 through the second quarter of 2019 were searched using International Classification of Diseases and Current Procedural Terminology codes. All queried data were deidentified in accordance with the Health Insurance Portability and Accountability Act. Therefore, this study was deemed exempt from our institution's review board process.

Patients who underwent primary UKA with at least 90 days of postoperative follow-up in the database were identified using Current Procedural Terminology codes. Patients' demographics and pre-existing comorbidities were identified. Preoperative diagnoses of uncomplicated diabetes, chronic kidney disease, obesity, ischemic heart disease, tobacco abuse, and congestive heart failure were assessed using International Classification of Diseases 9/10 coding. The payor status of each patient was identified with the use of the internal classifier within the Mariner database. The payor status variable includes patients with Medicaid, Medicare, commercial insurance, government insurance, who self-pay, no charge, other, and missing.

Ninety-day incidence of readmission, emergency department (ED) visit, reimbursement, and 1-year cost of care were evaluated as hospital utilization outcomes. One-year incidence of conversion to arthroplasty and reoperation were evaluated as surgery-related complications.

In the aggregate, 26,351 Medicare, 2341 Medicaid, and 72,347 commercially insured patients who underwent primary UKA were identified for a subsequent analysis. Medicaid patients were matched in a propensity scoring methodology in a ratio of 1:10 and 1:30 to Medicare and commercial patients, respectively, based on age, sex, and various medical comorbidities including coronary artery disease, uncomplicated diabetes mellitus, obesity, tobacco abuse, chronic pulmonary disease, liver disease, peripheral vascular disease, renal disease, cancer, and congestive heart failure.

Statistical analysis

Adjusted odds ratio (OR) and 95% confidence intervals (CIs) were calculated for each variable independently using R statistical programming software (University of Auckland, New Zealand). Comparisons of continuous variables, including reimbursement and length of stay, were performed using student t-tests in R. A *P* value less than 0.05 was used to ascribe statistical significance.

Table 1
Patient demographics and comorbidities following propensity score matching.

Demographics	Payor status			
	Medicaid	Medicare	Commercial	*P* value
Age				
60-64	12.4	5.7	10.9	**.030**
65-69	23.2	16.4	21.1	.078
70-74	24.4	27.2	28.3	.588
75-79	20.9	25.0	23.2	.199
80-84	2.7	4.3	4.1	.115
Male	47.5	48.3	48.5	.573
Obesity	51.4	50.0	47.8	.424
ETOH	9.4	6.9	5.8	.083
Chronic kidney disease	14.0	15.1	13.9	.677
Chronic pulmonary disease	45.2	39.7	40.9	.591
Coronary artery disease	30.4	33.9	25.2	.176
Depression	56.1	43.2	47.4	.535
Diabetes mellitus	43.8	43.9	40.2	.712
HTN	82.4	82.9	78.4	.461
PVD	22.5	24.1	20.9	.331
Renal failure	8.2	9.7	8.8	.274
Tobacco use	54.7	31.6	34.4	**.012**

PVD, peripheral vascular disease; ETOH, alcohol use; HTN, hypertension.
Bold values indicate statistical significance.

Results

Following propensity score methodology, 2341 Medicaid patients were matched 1 to 10 to 26,351 Medicare patients, and 1 to 30 to 72,347 commercially insured patients. The resulting cohorts included 1393 Medicaid patients, 13,930 Medicare patients, and 41,564 commercially insured patients. Comparisons of baseline patient demographic and comorbidities both before and after propensity score matching can be found in Tables 1 and 2.

Patients with Medicaid had a higher rate of several medical comorbidities prior to propensity score matching, including obesity, alcohol abuse, chronic pulmonary disease, depression, diabetes mellitus, and tobacco use than Medicare and commercially

Table 2
Patient demographics and comorbidities prior to propensity score matching.

Demographics	Payor status			
	Medicaid	Medicare	Commercial	*P* value
Age				
60-64	14.6	3.9	12.6	**.022**
65-69	27.9	12.7	18.2	**<.001**
70-74	24.0	28.5	27.3	.384
75-79	18.4	25.4	22.2	.145
80-84	1.9	5.7	4.5	**.027**
Male	49.3	44.7	48.1	.430
Obesity	59.59	36.45	48.59	**.003**
ETOH	15.16	3.73	5.62	**<.001**
Chronic kidney disease	14.44	21.1	13.24	**.013**
Chronic pulmonary disease	50.83	34.13	31.03	**<.001**
Coronary artery disease	26.14	38.39	26.03	**.008**
Depression	62.11	33.03	37.74	**<.001**
Diabetes mellitus	45.84	42.99	39.06	.137
HTN	79.71	85.73	76.62	.199
PVD	19.31	26.79	18.31	**.044**
Renal disease	15.21	21.74	13.74	**.038**
Renal failure	6.11	10.42	6.38	**.017**
Tobacco use	58.74	35.67	37.11	**.004**

PVD, peripheral vascular disease; ETOH, alcohol use; HTN, hypertension.
Bold values indicate statistical significance.

Table 3
One-year return to surgery and health-care utilization following UKA in medicaid and commercial cohorts.

Complication	Medicaid (n = 1393)		Commercial (n = 41564)		Statistical analysis		
	N	%	N	%	OR	95% CI	*P*
90-D ED visit	302	21.67	21,493	5.186	**2.7661**	**2.4247 to 3.1557**	**<.001**
Revision	42	3.02	1742	0.420	**1.8498**	**1.3483 to 2.5378**	**<.001**
Conversion to TKA	31	2.23	32,706	7.891	**1.5006**	**1.0420 to 2.1611**	**.0292**
1-Y cost of care	$21177.21 ± 26,711.95	—	$10409.46 ± 18248.18	—	—	—	**<.001**
90-D reimbursement	$12842.48 ± 7382.11	—	$16116.84 ± 9736.62	—	—	—	**<.001**

Bold values indicate statistical significance.

insured patients ($P < .001$). Patients with Medicare had a higher rate of chronic kidney disease, renal failure, coronary artery disease, and peripheral vascular disease than Medicaid and commercial insured patients ($P < .001$).

Medicaid insurance was associated with an increased risk of conversion to arthroplasty compared to both commercial insurance (2.23% vs 1.49%; OR 1.50; 95% CI 1.04 − 2.16; $P = .0292$) and Medicare (2.23% vs 1.25%; OR 1.80; 95% CI 1.22 − 2.65; $P = .003$) (Tables 3-5). Medicaid insurance was associated with an increased risk of revision surgery compared to both commercial insurance (3.02% vs 1.49%; OR 1.85; 95% CI 1.04 − 2.16; $P = .0292$) and Medicare (2.23% vs 1.25%; OR 1.80; 95% CI 1.22 − 2.65; $P = .003$) (Tables 3-5).

Patients with Medicaid insurance were also more likely to return to the ED within 90 days (21.68% vs 9.10%; OR 2.77; 95% CI 2.42 − 3.16; $P < .001$) than commercially insured patients and Medicare patients (21.68% vs 7.19%; OR 3.58; 95% CI 3.10 − 4.12; $P < .001$) (Tables 3-5). Patients with Medicaid insurance were associated with a higher 1-year cost of care episode than both Medicare and commercially insured patients. Patients with Medicaid insurance were associated with a lower 90-day reimbursement than both Medicare ($12842.48 ± 7382.11 vs $15243.95 ± 11,827.48; $P < .001$) and commercially insured ($12842.48 ± 7382.11 vs $16116.84 ± 9736.62; $P < .001$) patients.

Discussion

Socioeconomic status has long been a risk factor for poor outcome following various orthopedic procedures with many studies using insurance type as a surrogate [7–9]. While the Medicaid program has made considerable progress since its birth in 1965 for disadvantaged patient populations, these patient populations still sustain poor outcomes following orthopedic procedures compared to other public and private insurance types, revealing that the association between payor type, socioeconomic status, and outcome following UKA is much more complex than what was initially thought. Our findings suggest that patients with Medicaid insurance were more likely to have several medical comorbidities than Medicare and commercially insured patients; additionally, Medicaid patients were at increased risk of revision surgery and increased health-care utilization despite controlling for demographic factors and comorbidities. In light of these findings, future work is necessary to better understand disparities that exist between these payor types and determine how best to optimize health-care delivery to patients of all backgrounds, regardless of socioeconomic status and payor type.

Patients with Medicaid insurance were more likely to have various medical comorbidities, including obesity, alcohol abuse, chronic pulmonary disease, depression, and tobacco use, than Medicare and commercially insured patients. These findings are consistent with previous literature on how payor status is associated with an increased rate of preoperative medical comorbidities [10]. Many of these comorbidities have been shown to negatively impact outcomes following arthroplasty procedures, including UKA [11]. These are important findings as they highlight a disparity among Medicaid patients that is not necessarily present in Medicare patients and likely does not exist in commercially insured patients. It may behoove surgeons performing UKAs in both Medicaid and Medicare cohorts to assemble a multidisciplinary team of primary care providers and medical specialists to preoperatively optimize these patients and monitor them in the postoperative period for medical adverse events. In a large survey study evaluating how to improve access to care for low-income and uninsured patient populations, initiatives like discounted program for ancillary services, like physical therapy in the postoperative period, and encouraging patient accountability through education by clinic administrators help to reduce the disparity of access to health care for these at-risk patients [12].

It was interesting to note that patients with Medicare insurance were more likely to have renal and cardiac comorbidities than Medicaid and commercially insured patients. This finding may be explained, in part, by the underdiagnoses of these comorbidities in the Medicaid cohort due to underappropriation of resources in the preoperative period for these at-risk patients. However, these findings may also be explained by the sheer age difference between the two different cohorts—both cardiac and renal comorbidity burden tend to exponentially increase as patients age [13–15]. Despite this, these findings should call for additional and more extensive preoperative evaluation of publicly insured patients. It is clear from these findings that patients with public insurance have an increased incidence of medical comorbidities and therefore should be closely scrutinized prior to undergoing UKA. Geographic factors and barriers may also impact the incidence of comorbidities and ability to schedule regular follow-up for patients. Especially in

Table 4
One-year return to surgery and health-care utilization following UKA in medicaid and medicare cohorts.

Complication	Medicaid (n = 1393)		Medicare (n = 13930)		Statistical analysis		
	N	%	N	%	OR	95% CI	*P*
90-D ED visit	302	21.67	1001	7.19	**3.5753**	**3.0997 to 4.1239**	**<.001**
Revision	42	3.02	216	1.55	**1.9738**	**1.4116 to 2.7599**	**<.001**
Conversion to TKA	31	2.23	174	1.25	**1.7994**	**1.2230 to 2.6474**	**.003**
1-Y cost of care	$21177.21 ± 26,711.95	—	$9050.95 ± $22825.58	—	—	—	**<.001**
90-D reimbursement	$12842.48 ± 7382.11	—	$15243.95 ± 11827.48		—	—	**<.001**

Bold values indicate statistical significance.

Table 5
One-year return to surgery and healthcare utilization following UKA in medicare and commercial cohorts.

Complication	Medicare (n = 13930)		Commercial (n = 41564)		Statistical analysis		
	N	%	N	%	OR	95% CI	*P*
90-D ED visit	1001	7.19	21,493	5.186	**1.2925**	**1.2022 to 1.3897**	**<.001**
Revision	216	1.55	1742	0.420	1.0671	0.9147 to 1.2449	.4091
Conversion to TKA	174	1.25	32,706	7.891	**1.1991**	**1.0124 to 1.4202**	**.0355**
1-Y cost of care	$9050.95 ± $22825.58	—	$10409.46 ± 18248.18	—	—	—	**<.001**
90-D reimbursement	$15243.95 ± 11827.48	—	$16116.84 ± 9736.62	—	—	—	.351

Bold values indicate statistical significance.

rural areas, access to basic electronic services for communication may be limited, which may further contribute to health-care disparity among various insurance statuses.

Despite controlling for an increased incidence of medical comorbidities, payor type was still associated with an increased risk of surgical complication, namely revision surgery and conversion of UKA to total knee arthroplasty (TKA). This finding is not entirely unsurprising, especially when considering similar studies that found that Medicaid patients were more likely to undergo a revision surgery and sustain adverse surgical events [16–18]. It is hypothesized that the increased risk of revision surgery may be related, in part, to these patients presenting with a lower preoperative functional status at the time of surgery and demonstrating a more advanced disease. For example, Browne et al. found that patients with Medicaid were more likely to sustain deep infection following joint arthroplasty than non-Medicaid patients [10].

Patients with Medicaid insurance were more likely to return to the ED early in the postoperative period following UKA. A study on payor status and TJA determined that Medicaid patients were more likely to sustain longer lengths of stay and be discharged to an inpatient rehabilitation center [10]. Furthermore, Shau et al. found that Medicaid insurance was associated with higher health-care utilization than non-Medicaid patients following primary TKA [19]. Patients with Medicaid insurance may be more likely to return to the hospital and utilize health-care resources due to difficulty accessing health-care resources independently than Medicare and commercially insured patients. Indeed, studies suggest that patients with Medicaid insurance are less likely to be able to schedule appointments in the postoperative period and have poorer access to physical therapy than non-Medicaid patients. A recent study confirmed this assertion by demonstrating Medicaid patients are allotted fewer physical therapy visits following a musculoskeletal surgery than patients with commercial or Medicare insurance [20].

Medicaid patients were also associated with increased 1-year cost of care and UKA compared to Medicare and commercially insured patients. This finding is likely explained by the increased incidence of medical comorbidities of the Medicaid cohort, along with an increased rate of return to the ED, readmission, and conversion to TKA. Although no study has evaluated the difference in cost of care among payor types for patients following UKA, studies on other arthroplasty procedures determined that patients with Medicaid were associated with higher costs of care, attributable to their preoperative comorbidities and increased risk of adverse events following a surgery [10].

This study has limitations, most of which are inherent to the use of any large administrative insurance database. First, the use of such a database is contingent upon the accurate entry and coding of diagnoses, comorbidities, and procedures within the data. However, recent studies suggest that the incidence of inaccuracy in large databases is lower than 1% [21]. Additionally, we are unable to provide an explanation as to why Medicaid patients are associated with poor outcomes following UKA and, therefore, encourage future studies to further expound upon the complex interplay between socioeconomic status, payor type, and outcome following UKA. Nevertheless, this study provides key insight into how the Medicaid patient population is at risk of adverse medical and surgery-related complications following UKA compared to patients of other insurance types and may call for legislation to ensure that all patients have appropriate access to health care in the postoperative period.

Conclusion

Medicaid insurance is associated with increased rates of medical comorbidities, health care utilization, and reoperation following UKA despite controlling for covariates. Medicaid insurance is also associated with a higher 1-year cost of care. Additional work is required to understand the complex relationship between sociodemographic factors, like insurance status, and outcomes to ensure appropriate health-care access for all patients and to allow for appropriate risk stratification.

Conflicts of interest

H. R. Boucher receives royalties from Innomed and Aesculap/B. Braun and is a paid consultant for Globus Medical, Inc. S. B Sequeira declare no potential conflicts of interest.

For full disclosure statements refer to https://doi.org/10.1016/j.artd.2022.101074.

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