Disparity in Preoperative Patient Factors Between Insurance Types in Total Joint Arthroplasty

Christopher T. Martin, MD; John J. Callaghan, MD; Steve S. Liu, MD; Yubo Gao, PhD; Richard C. Johnston, MD

abstract

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Equity in health care has become a focal point of debate. However, the disparity between insurance payer types in total joint arthroplasty is poorly defined. The authors identified 1312 consecutive patients who underwent elective primary total hip or knee arthroplasty with available preoperative Short Form 36 and Western Ontario and McMaster University Osteoarthritis Index surveys and stratified them into groups based on insurance type (Iowa Care [a state-run insurance program for patients who are indigent], Medicare, Medicaid, or private insurance) to compare demographics, access to care, and functional data. Significance was a P value less than .05 after a Turkey-Kramer adjustment for multiple comparisons. A multivariate analysis identified independent predictors of Short Form 36 and Western Ontario and McMaster University Osteoarthritis Index preoperative functional status. Few differences existed between patients with Iowa Care and Medicaid, but both groups had significantly lower Short Form 36 and Western Ontario and McMaster University Osteoarthritis Index scores across every category compared with patients with Medicare or private insurance (P<.05 for each comparison). In addition, patients with Iowa Care and Medicaid had a higher incidence of current smoking and higher mean body mass index and traveled an average of 29 to 30 miles farther for access to care (P<.05 for each comparison). Payer type was an independent predictor of preoperative Short Form 36 and Western Ontario and McMaster University Osteoarthritis Index functional scores in the multivariate analysis (P<.02). Significant differences exist between payer types in total joint arthroplasty. Further research is necessary to better inform health policy decisions.

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Equity in access to health care has become a focal point of debate in recent years, and significant disparities exist between insurance payer types. Patients with private insurance are more likely than patients with public insurance to receive basic primary care services, such as childhood vaccinations and advanced cancer treatment, and are less likely to visit the emergency room for their care. Similar disparities exist when comparing Medicare with Medicaid, and decreased hospital and physician reimbursement have been speculated to be a primary cause.

Socioeconomic and sex-based disparities between insurance types have been a point of concern in recent debates. Studies reported in the general surgery literature have shown that racial, sex, and socioeconomic disparities are correlated with worse outcomes, including increased risk of mortality. Studies in total joint arthroplasty (TJA) have echoed those findings, showing that patients who are minorities have decreased rates of use and higher rates of postoperative complications, and that men have higher complication rates than women. However, variations in these factors between different insurance payer types in TJA are poorly defined.

Access to care is a second point of contention, and distance traveled is a frequently used metric for access to care. Longer travel distances have been correlated with poor outcomes in multiple medical specialties, including increased risk of mortality in prostate cancer, following kidney transplant and myocardial infarction, suboptimal therapy for bladder cancer, poor glycemic control in patients with diabetes mellitus, and reduced perinatal mortality, and reduced patient compliance with prescribed treatment plans. However, few studies have reported the effect of insurance payer type on access to care issues in TJA.

Lastly, improvement in function is the primary goal of TJA. Clinical functional surveys, including the Short Form 36 (SF-36) and Western Ontario and McMaster University Osteoarthritis Index (WOMAC), are commonly used indicators of patient functional status in TJA, but whether variation exists preoperatively in these functional measures between insurance payer types is unknown.

The current authors investigated the differences in preoperative patient factors, access to care, and functional status between 4 insurance payer types in patients undergoing TJA. A better understanding of these differences will be important for informing health policy discussions.

This article was compliant with the Health Insurance Portability and Accountability Act.

**Materials and Methods**

Institutional review board approval was obtained. The authors’ institution prospectively maintains a database that includes baseline patient demographic, functional, and social information. The authors searched this database to find deidentified patient age, race, marital status, body mass index (BMI), zip code, SF-36 scores, and WOMAC scores. For reporting simplicity, the authors’ WOMAC surveys are scaled as 0 to 100, with 100 being the best possible score. Self-reported tobacco, alcohol use, and diabetes mellitus status were reported independently. In addition, the total number of other medical comorbidities was recorded as a separate measurement, which included cardiac, pulmonary, hepatic, urologic, gastrointestinal, and systemic illness. An American Society of Anesthesia (ASA) class score was assigned during preoperative visits with the anesthesia team. Distance traveled was calculated using the patient’s reported home zip code and was used as a surrogate for access to care.

The database was searched using current procedural terminology billing codes for elective cases of primary total hip arthroplasty and total knee arthroplasty. A consecutive series was included of all patients who completed the preoperative survey data and who were operated on by any of 4 senior TJA surgeons at the authors’ institution. The billing codes were cross referenced with the hospital billing system to identify the primary insurance payer. A total of 1312 patients met the inclusion criteria, of which 469 (36%) patients had private insurance, 614 (47%) had Medicare, 63 (5%) had Medicaid, and 166 (13%) had Iowa Care. Medicare patients had the oldest average age of any

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Private</th>
<th>Medicare</th>
<th>Medicaid</th>
<th>Iowa Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>469</td>
<td>614</td>
<td>63</td>
<td>166</td>
</tr>
<tr>
<td>Mean age±SD</td>
<td>55.8±9</td>
<td>70.1±9.8</td>
<td>51.6±9.9</td>
<td>53.8±7.2</td>
</tr>
<tr>
<td>Men, %</td>
<td>47</td>
<td>43</td>
<td>38</td>
<td>32</td>
</tr>
<tr>
<td>Caucasian, %</td>
<td>97</td>
<td>96</td>
<td>80</td>
<td>95</td>
</tr>
<tr>
<td>Non-Caucasian, %</td>
<td>3</td>
<td>4</td>
<td>20</td>
<td>5</td>
</tr>
</tbody>
</table>

*Medicare patients were older than any other group (P<.001 for each pairwise comparison).

*The observed differences are significant, with more women in each group (P=.008, chi-square analysis).

*The observed differences are significant, with more Caucasians in each group (P<.001, chi-square analysis).*

**Table 1**

Demographics
Table 2

<table>
<thead>
<tr>
<th>Comorbidity/Social Characteristic</th>
<th>Private</th>
<th>Medicare</th>
<th>Medicaid</th>
<th>Iowa Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body mass index&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>33.1±7.5</td>
<td>32.1±7.3</td>
<td>36.0±8.7</td>
<td>35.5±7.8</td>
</tr>
<tr>
<td>No. of medical comorbidities&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3.2±2</td>
<td>4±2.4</td>
<td>4.3±2.9</td>
<td>3.8±2.3</td>
</tr>
<tr>
<td>Diabetes mellitus status,&lt;sup&gt;d,e&lt;/sup&gt;</td>
<td>12</td>
<td>17</td>
<td>21</td>
<td>11</td>
</tr>
<tr>
<td>ASA class&lt;sup&gt;f,g&lt;/sup&gt;</td>
<td>2.2±0.58</td>
<td>2.5±0.56</td>
<td>2.5±0.57</td>
<td>2.3±0.54</td>
</tr>
<tr>
<td>Distance traveled, miles&lt;sup&gt;h&lt;/sup&gt;</td>
<td>75±119</td>
<td>74±114</td>
<td>99±148</td>
<td>104±75</td>
</tr>
<tr>
<td>Alcohol use,&lt;sup&gt;i&lt;/sup&gt; %</td>
<td>Never</td>
<td>26.5</td>
<td>54</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Occasional</td>
<td>60</td>
<td>37.5</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Regular</td>
<td>13</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Heavy</td>
<td>0.5</td>
<td>0.5</td>
<td>0</td>
</tr>
<tr>
<td>Smoking history,&lt;sup&gt;j&lt;/sup&gt; %</td>
<td>Current smoker</td>
<td>10</td>
<td>8</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>Quit &lt;6 mo ago</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Quit &gt;6 mo ago</td>
<td>29</td>
<td>42</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Never smoked</td>
<td>60</td>
<td>49</td>
<td>40</td>
</tr>
</tbody>
</table>

Abbreviations: ASA, American Society of Anesthesiologists.

<sup>a</sup>Higher mean body mass index was found for patients with Medicaid and Iowa Care than for patients with private insurance or Medicare (P<.02 for each pairwise comparison).

<sup>b</sup>Data missing for 27 patients.

<sup>c</sup>Privately insured patients had the fewest medical comorbidities (P<.05 for each pairwise comparison).

<sup>d</sup>Chi-square analysis (P=.033).

<sup>e</sup>Patients with Medicare and Medicaid had higher mean ASA class than patients with Iowa Care or private insurance (P<.001 for each pairwise comparison).

<sup>f</sup>Data missing for 22 patients.

<sup>g</sup>Patients with Iowa Care traveled farther than patients with Medicare or private insurance (P<.02 for each pairwise comparison).

<sup>h</sup>Patients with Iowa Care traveled farther than patients with Medicare or private insurance (P<.02 for each pairwise comparison).

<sup>i</sup>Chi-square analysis (P=.004). Ninety-four patients did not report alcohol use. Values rounded to the nearest percent.

<sup>j</sup>Oberved differences are statistically significant (P<.0001, chi-square analysis). One hundred five patients did not report smoking status. Values rounded to the nearest percent.

No difference existed in distance traveled between patients with Medicaid and

Results

The mean BMI was obese in each group (Table 2). Patients with Iowa Care and Medicaid had no significant difference in BMI (P=.98), but both groups had higher mean BMIs than patients with private insurance or Medicare (P<.02 for each pairwise comparison). The observed differences in diabetes mellitus and self-reported alcohol use were significant based on chi-square analysis (P=.033 and .004, respectively). Patients with Medicare and Medicaid had higher average ASA classes than patients with private insurance or Iowa Care (P<.001 for each pairwise comparison). The observed differences in smoking history were statistically significant, with patients with Iowa Care and Medicaid having a higher incidence of reported current smoking (P<.0001, chi-square analysis).
Iowa Care ($P=.99$). However, patients with Iowa Care traveled 29 to 30 miles farther on average than patients with Medicare or private insurance ($P<.02$ for each pairwise comparison). Patients with Medicaid had a similar trend, traveling roughly 24 to 25 miles farther on average than patients with Medicare or private insurance, but this trend did not reach statistical significance ($P=.35$ and .38 for each pairwise comparison, respectively) (Table 2).

Patients with Medicaid and Iowa Care had no significant differences in preoperative SF-36 or WOMAC scores in any category ($P>.22$ for each pairwise comparison). However, both groups had significantly lower SF-36 (Table 3) and WOMAC (Table 4) scores than patients with private insurance or Medicare across every category measured ($P<.02$ for each pairwise comparison). In the current multivariate analyses, sex, current smoking history, patient age, the total number of medical comorbidities, ASA score, and insurance payer type were significant predictors of preoperative WOMAC functional scores ($P<.001$ for each factor). In addition, sex, payer type, patient age, total number of medical comorbidities, and ASA scores were each significant predictors of SF-36 preoperative functional scores ($P<.002$ for each factor).

**Discussion**

Few data exist regarding differences between insurance payers for patients undergoing TJA. Further elucidation of these differences would be useful in informing health policy decisions. Thus, the purpose of the current study was to determine whether differences exist in patient factors, access to care, and preoperative functional status between 4 common insurance payer types at a single institution.

This study had several weaknesses. Ideally, the authors would have used a national database and incorporated data from multiple institutions. However, they used a database from a single institution and made comparisons with an insurance program unique to their state, which limited the generalizability of the data. However, the currently available national databases, such as Medicare Part A or B or The American College of Surgeons National Quality Improvement Program, do not incorporate functional data, such as SF-36 and WOMAC scores, and the database from Medicare does not include information from privately insured patients. Thus, the analysis would not be possible to do using those databases. Additional studies at different institutions would be necessary to confirm that the current data is true across different regions or other insurance plans. In addition, the current surveys incorporated self-reported diabetes mellitus, smoking, and alcohol use. Self-reporting likely underrepresents the true rate due to patient concern over being stigmatized, and the true rates are presumably higher than what is reported here. It is unknown whether willingness to report varies between insurance types; if it did, this could be a source of bias in the analysis. Lastly, the authors cannot say whether the preoperative data correlated with postoperative outcomes, which would be an interesting point for future study. The authors plan to investigate this in a subset of the current patients with postoperative follow-up in a separate study.

The Center for Medicaid and Medicare Services advocated for pay-for-performance models in a push toward rewarding quality outcomes, and orthopedics is a commonly tested model domain for these systems.32,33 Currently, these models incorporate no patient-specific factors. The current authors showed that patients with Iowa Care or Medicaid insurance have higher mean BMIs and are more likely to be current smokers. Because large state-run or university-

**Table 3**

<table>
<thead>
<tr>
<th>Preoperative SF-36 Component Score</th>
<th>Insurance Payer Type, Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Private</td>
</tr>
<tr>
<td>Physical</td>
<td>32.1 ± 9</td>
</tr>
<tr>
<td>Mental</td>
<td>51 ± 10.7</td>
</tr>
</tbody>
</table>

Abbreviation: SF-36, Short Form 36.

* Patients had lower preoperative SF-36 mental and physical scores than did those with Medicare or private insurance ($P<.02$ for each pairwise comparison).

**Table 4**

<table>
<thead>
<tr>
<th>Preoperative WOMAC Score</th>
<th>Insurance Payer Type, Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Private</td>
</tr>
<tr>
<td>Pain</td>
<td>47.7 ± 19.6</td>
</tr>
<tr>
<td>Function</td>
<td>49.9 ± 20</td>
</tr>
<tr>
<td>Stiffness</td>
<td>43.8 ± 21.5</td>
</tr>
</tbody>
</table>

Abbreviation: WOMAC, Western Ontario and McMaster University Osteoarthritis Index.

* Scores are scaled from 0 to 100, with 100 being the best score.

* Patients with Medicaid and Iowa Care had lower mean preoperative function, pain, and stiffness scores than did patients with Medicare and private insurance ($P<.0001$ for each pairwise comparison).
based institutions see a larger percentage of these patients, implementation of the current Center for Medicaid and Medicare Services model might make the results from those institutions seem artificially low. Previous studies have long advocated for the incorporation of patient-specific factors into pay-for-performance models. The current data should be viewed as an interesting starting point with regard to the effect of insurance payer type on patient factors and further emphasizes for the need to incorporate patient-specific information to prevent bias against institutions that see a large percentage of indigent patients.

Increased access to care has been a major focus of recent health care reform. Multiple studies have correlated increased travel distance with poor patient outcomes, and travel distance has been widely used as a surrogate for access to care. In the current study, patients with Iowa Care traveled an average of 29 to 30 miles farther for access to care than patients with private insurance or Medicare. A trend also existed toward patients with Medicaid traveling an average of 24 to 25 miles farther, but this did not reach statistical significance. Previous studies have shown that patients with Medicaid are highly concentrated among large state- or university-based institutions. Furthermore, hospital participation in Iowa Care is optional, and only 2 locations in the state accept patients with Iowa Care for procedures, such as TJA, that require inpatient hospital care. Thus, the provider choice is limited for patients with Medicaid and Iowa Care in Iowa, which likely contributed to the limited available providers may contribute to a delay in seeking care, allowing patients to present with worse functional capabilities.

**Conclusion**

Overall, although few differences existed between patients with Iowa Care and Medicaid, both groups had significantly lower SF-36 and WOMAC scores across every category compared with patients with Medicare or private insurance. In addition, patients with Iowa Care and Medicaid were more likely to be current smokers and have higher BMIs, and patients with Iowa Care traveled significantly farther for access to care. Insurance payer type was an independent predictor of functional survey scores, which indicated that indigent patients face barriers in access to care for TJA. Significant differences exist between patients with different insurance payer types, and the limited availability of providers who accept patients with Medicaid or Iowa Care in Iowa likely plays a role. These data should be viewed as a preliminary analysis of a previously poorly understood issue and are an interesting starting point on disparity between insurance payer types in TJA. Further investigation into these differences across multiple institutions and insurance payer types is necessary to better inform health policy decisions.

**References**

14. Morgan RC Jr, Slover J. Breakout session: ethnic and racial disparities in joint


