

# Smart Implantable device and Digital Care Management Platforms associated with Reduced Complications Following Primary Total Knee Arthroplasty

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INTRODUCTION:

Total knee arthroplasty (TKA) complications significantly increase the cost and clinical burden, impacting both individual patients and healthcare systems. Health technologies like smart implantable devices (SID) combined with digital care management platforms (DCMP) enable passively collected data directly from the patient that may provide post-operative recovery insights to improve care management, allowing care teams to monitor and personalize the TKA patient experience. The aim of this claims database study was to compare post-operative TKA complications between patients with and without the use of these technologies (SID + DCMP).

## METHODS:

Patient data (Q42018–CY2023) was securely linked with clearing house's open claims database using a privacy-preserving, token-based matching process. The control group was identified from claims database. We applied 1:4 propensity score matching with replacement using age, gender, payer type, comorbidities, and setting of care as covariates, optimizing caliper size to balance bias reduction and sample retention. Covariate balance was assessed using standardized mean differences (SMD) or Cohen's D, with thresholds of <0.2 or <0.1. SID + DCMP patients (n=1,231, median age 66, IQR 59,72; 58% female) and matched controls (n=3,484, median age 66, IQR 59,72; 61% female) were included. Complications compared at 90-day and one-year included inpatient admissions, revision surgery, manipulation under anesthesia (MUA), incidence of opioid prescriptions filled, peri-prosthetic joint infection (PJI), emergency room (ER) visits, and urgent care (UC) visits. Outcomes were compared between the groups using Fisher's Exact test and Chi-squared test as applicable. Statistical significance was set at p<0.05.

## RESULTS:

The patient characteristics and demographic distribution between the two groups are presented in Table 1. 90-day complication rate comparisons are presented in Table 2. SID + DCMP had a significantly lower revision rate (0% vs. 0.4%, p=0.018; Figure 1) and lower incidence of opioid prescriptions filled (18.9% vs. 24%, p<0.001) within 90-days post-surgery. Inpatient readmission rate, MUA rate, PJI rate, ER visit rate and UC visit rate were lower at 90-day for SID + DCMP group but were not statistically significant (all p>0.05). Among patients with at least one ER visit within 90-days post-discharge, patients in the SID + DCMP group had on average a lower number of ER visits (1.2 vs. 1.4, p=0.027). Similar complication trends were observed at one-year post-surgery. One-year complication rate comparisons are presented in Table 3. At one-year; revision rate (0.4% vs. 1.1%, p=0.025; Figure 1), incidence of opioid prescriptions filled (23.9% vs. 28.7%, p=0.006), PJI rate (0.2% vs. 1.1%, p=0.002) and the proportion of patients with UC visits (5.4% vs. 7.3%, p=0.020) all significantly lower in the SID + DCMP group. Among patients with at least one ER visit within one-year post-discharge, patients in the SID + DCMP group had on average a lower number of ER visits (1.4 vs. 1.7, p=0.018).

## DISCUSSION AND CONCLUSION:

### Limitations:

This study is subject to limitations associated with claims databases and procedure and diagnosis code limitations. It is expected that the limitations would apply to both groups similarly.

### Conclusion:

The most important finding in this claims analysis was lower complications in patients undergoing primary TKA with SID + DCMP health technologies compared to non-SID + DCMP assisted controls. These technologies allow for more direct patient monitoring and management of patients post-operatively, which can potentially enhance patient recovery and outcomes. However, further analysis is needed, including prospective studies, to determine the mechanisms behind the lower complication rates.

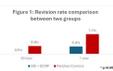


Table 1. Patient demographics and characteristics.

|  | SID + DCMP   | Control        | P-Value* |
|--|--------------|----------------|----------|
| <b>Patient Demographics</b>  |              |                |          |
| Patient Count  | 1,231        | 3,484          |          |
| Patent Age median [Q1, Q3]   | 66 [59,72]   | 66 [59,72]     | 0.8105   |
| Patent Age, mean [SD]  | 65.23 [8.88] | 64.68 [11.49]  |          |
| <b>Sex, n (%)</b>  |              |                |          |
| Male   | 715 (58.08%) | 2,116 (60.73%) |          |
| Female   | 516 (41.92%) | 1,368 (39.27%) | 0.110    |
| <b>Insurance, n (%)</b>  |              |                |          |
| Commercial   | 497 (40.37%) | 1,333 (38.28%) |          |
| Medicare   | 684 (55.58%) | 2,094 (59.92%) |          |
| Medicaid   | 2 (0.16%)    | 21 (0.60%)     | 0.1367   |
| VA/GOV/Other Govt.   | 4 (0.32%)    | 25 (0.72%)     |          |
| Other/Unknown  | 34 (2.76%)   | 100 (2.83%)    |          |
| <b>Associated Comorbidities &amp; Charlson Comorbidity Index (CCI)</b> |              |                |          |
| ANEMIA, n (%)  | 46 (3.74%)   | 167 (4.79%)    | 0.146    |
| CHRONIC KIDNEY DISEASE, n (%)  | 56 (4.55%)   | 138 (3.95%)    | 0.418    |
| COPD, n (%)  | 14 (1.14%)   | 70 (2.01%)     | 0.003    |
| DEPRESSION, n (%)  | 64 (5.20%)   | 170 (4.88%)    | 0.713    |
| DIABETES, n (%)  | 120 (9.75%)  | 392 (11.25%)   | 0.16     |
| LIVER DISEASE, n (%)   | 14 (1.14%)   | 66 (1.91%)     | 0.301    |
| OBESITY, n (%)   | 138 (11.21%) | 384 (11.02%)   | 0.898    |
| OSTEOPOROSIS, n (%)  | 18 (1.46%)   | 60 (1.72%)     | 0.060    |
| PERIPHERAL VASCULAR DISEASE, n (%)                                     | 36 (2.92%)   | 118 (3.39%)    | 0.489    |
| RHEUMATOID ARTHRITIS, n (%)  | 13 (1.06%)   | 64 (1.84%)     | 0.084    |
| <b>RinalCCI Score, n (%)</b>   |              |                |          |
| 1 - Score of 0   | 867 (70.55%) | 2,618 (75.14%) |          |
| 2 - Score of 1   | 100 (8.12%)  | 470 (13.49%)   | 0.066    |
| 3 - Score of 2   | 65 (5.28%)   | 251 (7.20%)    |          |
| 4 - Score of 3+  | 49 (3.98%)   | 170 (4.92%)    |          |

\*Statistical significance at p < 0.005

## complication

Table 2. Post-TKA complications comparison at 90-days.

|  | SID + DCMP  | Control     | P-Value* |
|--|-------------|-------------|----------|
| <b>Total (n)</b>   |             |             |          |
| Post-Surgery Revision Rate, n (%)                                    | 0 (0.0%)    | 14 (0.4%)   | 0.201    |
| Manipulation under Anesthesia (MUA), n (%)                           | 0 (0.0%)    | 14 (0.4%)   | 0.201    |
| Inpatient Hospital Readmission                                       |             |             |          |
| Patients with inpatient admission (%)                                | 21.9%       | 23.4%       | 0.314    |
| Average number of inpatient visits per patient (n)                   | 1.7         | 2.0         | 0.224    |
| <b>Emergency Room (ER) Care</b>                                      |             |             |          |
| Patients with Emergency Care visits (%)                              | 7.6%        | 8.6%        | 0.210    |
| Average number of visits per patient (n)                             | 1.2         | 1.4         | 0.027    |
| <b>Urgent Care (UC)</b>  |             |             |          |
| Patients with Urgent Care visits (%)                                 | 1.3%        | 1.9%        | 0.210    |
| Average number of visits per patient (n)                             | 1.1         | 1.2         | 0.162    |
| Opioid prescriptions filled in pharmacy or mail-order setting, n (%) | 233 (18.9%) | 830 (24.0%) | <0.001   |
| Peri-prosthetic joint infection (PJI), n (%)                         | 2 (0.16%)   | 20 (0.57%)  | 0.087    |

\*Statistical significance at p < 0.05

Table 3. Post-TKA complications comparison at one-year.

|  | SID + DCMP  | Control     | P-Value* |
|--|-------------|-------------|----------|
| <b>Total (n)</b>   |             |             |          |
| Post-Surgery Revision Rate, n (%)                                    | 5 (0.4%)    | 36 (1.1%)   | 0.025    |
| Manipulation under Anesthesia (MUA), n (%)                           | 3 (0.2%)    | 107 (3.0%)  | 0.330    |
| Inpatient Hospital Readmission                                       |             |             |          |
| Patients with inpatient admission (%)                                | 26.6%       | 28.3%       | 0.260    |
| Average number of inpatient visits per patient (n)                   | 2.1         | 2.5         | 0.209    |
| <b>Emergency Room (ER) Care</b>                                      |             |             |          |
| Patients with Emergency Care visits (%)                              | 14.8%       | 16.8%       | 0.150    |
| Average number of visits per patient (n)                             | 1.4         | 1.7         | 0.018    |
| <b>Urgent Care (UC)</b>  |             |             |          |
| Patients with Urgent Care visits (%)                                 | 5.4%        | 7.3%        | 0.020    |
| Average number of visits per patient (n)                             | 1.5         | 1.9         |          |
| Opioid prescriptions filled in pharmacy or mail-order setting, n (%) | 294 (23.9%) | 899 (25.7%) | 0.006    |
| Peri-prosthetic joint infection (PJI), n (%)                         | 3 (0.2%)    | 31 (0.9%)   | 0.002    |

\*Statistical significance at p < 0.05