Characteristics Associated with Persistent Opioid Use Following Total Joint Arthroplasty

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Background

Total joint arthroplasties are widely performed elective surgical procedures in the United States, providing pain relief and improved quality of life for individuals with end-stage joint arthritis. However, opioid use following these surgeries has been associated with various risks, including postoperative complications, increased healthcare costs, and opioid dependence.[1,2,3] This study aims to determine the incidence of persistent opioid use after total hip, knee, and shoulder arthroplasty in opioid-naïve patients and to identify the clinical characteristics associated with this outcome to develop predictive models for preventing persistent opioid use.

Methods

A retrospective observational cohort study design was employed, utilizing a large US Electronic Health Record dataset in the Observational Medical Outcomes Partnership (OMOP) Common Data Model (CDM) format from Northern New England. The study included patients who underwent total knee, hip, or shoulder replacement at the institution between December 1, 2015, and December 1, 2020. Inclusion criteria comprised patients aged ≥18 years, opioid-naïve individuals (no opioid prescription in the 365 days prior to surgery), and those receiving an opioid prescription at hospital discharge. Patients with revision arthroplasty, malignant neoplasms (excluding non-melanoma skin cancer), or death during the index hospitalization were excluded. The first surgical procedure performed during the study period was considered the index event for analysis. Statistical analyses were conducted using R version 4.0.0, including use of the OHDSI FeatureExtraction and PatientLevelPrediction packages.[4] Data was analyzed using a 2 tailed t-test and p-value <0.05 was considered statistically significant. Subsequent analysis will use 3-fold cross-validation on a 75% train set to select the optimal hyper-parameter variance (amount of regularization) that maximizes the area under the receiver operating characteristic curve (AUC) and use a 25% test set for internal validation performance estimation. The overall model performance will be evaluated using the AUC. Sensitivity, specificity, and positive predictive value will be calculated at different predicted risk cut-offs.

Results

A total of 6,397 patients met the inclusion criteria for our target cohort definition, with 1,116 individuals experiencing persistent opioid use over the one-year period following surgery (our primary outcome cohort definition). Women accounted for a larger proportion of total joint arthroplasty patients during the study period. Among the evaluated pre-operative comorbidities, anxiety and chronic back pain were the most frequently identified as seen in Table 1.

Table 1 Patient Demographics and clinical characteristics stratified by persistent opioid use

		Persistent Opioid Use	
	n (%)	Yes, n (%)	No, n (%)
Total	6397 (100.0)	1116 (17.5)	5281(82.5)
Demographics			
Age > 65	3810 (59.6)	644 (16.9)	3166 (83.1)
White	6213 (97.1)	1105 (17.8)	5108 (82.2)
Male Sex	2688 (42.0)	461 (17.2)	2227 (82.8)
BMI > 25	5736 (89.7)	1065 (18.6)	4671 (81.4)
Preoperative comorbidities			
Alcohol Dependence	292 (4.6)	86 (29.5)	206 (70.5)
Anxiety Disorder	2359 (36.9)	514 (21.8)	1845 (78.2)
Cannabis Dependence	25 (0.39)	11 (44.0)	14 (56)
Psychotic Disorder	51 (0.8)	16 (31.4)	35 (68.6)
Opioid Dependence	159 (2.5)	48 (30.2)	111 (69.8)
Bipolar Disorder	44 (0.7)	15 (34.1)	29 (65.9)
Psychoactive Substance Dependence	373 (5.8)	105 (28.2)	268 (71.8)
Nicotine Dependence	691 (10.8)	171 (24.7)	520 (75.3)
Chronic pain	2976 (46.5)	615 (20.7)	2361 (73.3)
Chronic Kidney Disease	896 (14.0)	204 (22.8)	692 (77.2)
Congestive Heart Failure	624 (9.8)	150 (24.0)	474 (76.0)
Coronary Artery Disease	1389 (21.7)	305 (22.0)	1084 (78.0)

Patients with a history of alcohol misuse, cannabis use, or prior opioid dependence were more likely to receive an opioid prescription one year after surgery as seen in Table 2. Additional factors associated with persistent opioid use included nicotine dependence, anxiety, and chronic back pain. However, age over 65 and sex did not show significant associations with persistent opioid use.

Table 2 Odds Ratios for persistent opioid use in total joint arthroplasty patients

Characteristic	Odds Ratio (CI)	p-value
Age >65	0.9 (0.78-1.04)	0.177
Male sex	0.965 (0.834-1.096)	0.611
Alcohol Dependence	2.057 (1.797-2.317)	<0.001
Anxiety Disorder	1.59 (1.459-1.721)	<0.001
Cannabis Dependence	3.745 (2.953-4.537)	0.003
Opioid Dependence	2.093 (1.748-2.438)	<0.001
Nicotine Dependence	1.657 (1.471-1.843)	<0.001
Chronic pain	1.52 (1.39-1.65)	<0.001

Conclusion

Preliminary findings from this study uncovered clinical and demographic characteristics associated with persistent opioid use in patients undergoing total joint arthroplasty. A board certified anesthesiologist (AQ) reviewed the results presented in this analysis and is actively adjudicating individual characterization results for clinical plausibility. These insights will be incorporated into a larger predictive model with more covariates to aid in identifying individuals at risk of persistent opioid use after surgery. The use of the OMOP CDM allowed our study team to develop a standardized prediction model that can be extended to other clinical data across the OHDSI community. As we finish the initial analysis within our local OMOP

CDM, we look forward to extending this model outward and inviting other OHDSI collaborators to help us understand its utility across other healthcare systems.

References

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