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APPENDIX

Consistent with standard practice, in order to avoid inappropriately classifying patients receiving a surgical opioid prescription for another surgery in the 6-month postoperative period as persistent users, any patients who underwent a second surgery were excluded using anesthesia codes.

Appendix Table 1. Primary anesthesia Common Procedure Terminology (CPT) codes used to determine second surgeries.

CPT Code	Surgical Body Area
00100-00299	Head
00300-00399	Neck
00400-00499	Thorax
00500-00599	Intrathoracic
00600-00699	Spine/Spinal Cord
00700-00799	Upper Abdomen
00800-00899	Lower Abdomen
00900-00999	Perineum
01000-01199	Pelvis (Except Hip)
01200-01299	Upper Leg (Except Knee)
01300-01444	Knee/Popliteal
01445-01599	Lower Leg
01600-01699	Shoulder/Axilla
01700-01799	Upper Arm & Elbow
01800-01899	Forearm, Wrist, Hand
01900-01950	Radiologic
01951-01953	Burn
01954-01989	Obstetric
01990-01999	Other

Adapted from: Hilliard PE, Waljee J, Moser S, et al. Prevalence of Preoperative Opioid Use and Characteristics Associated With Opioid Use Among Patients Presenting for Surgery. *JAMA Surg*. Published online July 11, 2018. doi:10.1001/jamasurg.2018.2102

Sensitivity Analysis

Given that there is not a strict definition for how long the perioperative window should extend postoperatively, we repeated our analyses extending the postoperative surgical opioid window to 30-days (**Appendix Tables 2 and 3**). Conclusions were unchanged. Inpatient-TJA patients were significantly more likely to receive surgical opioids (adjusted OR 2.19, 95% CI 2.06-2.33, $p < 0.001$). Outpatients were significantly more likely to receive oxycodone than inpatients (adjusted OR 1.08, 95% CI 1.02-1.14, $p = 0.008$). The rate of new persistent opioid use among patients who filled an opioid prescription in the perioperative window was 11.4%. This rate was more than triple the rate of patients filling opioids between 91-180 days postoperatively among patients who did not fill an opioid prescription in the perioperative window (3.6%). Inpatient-TJA remained associated with significantly higher rates of persistent opioid use (11.5% vs. 9.4%, $p < 0.001$; adjusted OR 1.1, 95% CI 1.01-1.21, $p = 0.03$).

Appendix Table 2. Characteristics of opioid prescribing overall and by surgical setting extending the perioperative window to 30-days postoperatively.

	Surgical Setting			p-value
	Inpatient	Outpatient	Total	
Received Surgical Opioids	75710 (88.9%)	5907 (80.5%)	81617 (88.2%)	<0.001
Total Perioperative OME (mg)	900.0 (560.0 - 1425.0)	900.0 (570.0 - 1375.0)	900.0 (560.0 - 1425.0)	0.39
Initial Opioid Prescribed				
Hydrocodone	27780 (36.7%)	1938 (32.8%)	29718 (36.4%)	<0.001
Hydromorphone	2175 (2.9%)	159 (2.7%)	2334 (2.9%)	
Oxycodone	35266 (46.6%)	2948 (49.9%)	38214 (46.8%)	
Tramadol	7119 (9.4%)	599 (10.1%)	7718 (9.5%)	
Other	3370 (4.5%)	263 (4.5%)	3633 (4.5%)	
"Heavy" Narcotic Prescribed				
Heavy	66830 (88.3%)	5214 (88.3%)	72044 (88.3%)	0.99
Tramadol/Codeine/Propoxyphene	8880 (11.7%)	693 (11.7%)	9573 (11.7%)	
Oxycodone	35266 (46.6%)	2948 (49.9%)	38214 (46.8%)	<0.001
Hydrocodone	27780 (36.7%)	1938 (32.8%)	29718 (36.4%)	<0.001

[†]Presented as median (interquartile range). OME = oral morphine equivalents; mg = milligrams. Numbers are among those who received perioperative opioids.

Appendix Table 3. Rates of persistent opioid use among undergoing inpatient and outpatient total joint arthroplasty with the perioperative window extended through the 30th postoperative day.

	Surgical Setting			p-value
	Inpatient	Outpatient	Total	
All Patients	9066 (10.6%)	603 (8.2%)	9669 (10.5%)	<0.001
Patients Receiving Perioperative Opioids	8728 (11.5%)	553 (9.4%)	9281 (11.4%)*	<0.001

*In contrast, 3.6% of patients who did not receive perioperative opioids filled an opioid prescription in the 90-180 days following surgery ($p < 0.001$).

In order to further increase the robustness of our results, we repeated our analyses using propensity-scores to match the outpatient total joint arthroplasty (TJA) patients to inpatient-TJA patients who had an effectively equal probability of being chosen for outpatient-TJA based on their baseline patient factors (i.e., age, sex, geography, procedure, year, and comorbidities). In this analysis of patients who had no significant difference in any baseline factors, the results held. Inpatient TJA was associated with significantly higher likelihood of patients receiving opioids (88.7% vs. 78.9%, $p < 0.001$), as well as becoming persistent opioid users (9.7% vs. 8.2%, $p = 0.001$).

Appendix Table 4. Demographic and outcome data from propensity-matched analysis of inpatient vs. outpatient total joint arthroplasty patients.

	Surgical Setting		Total (N = 14684)	p-value
	Inpatient (n = 7342)	Outpatient (n = 7342)		
Surgery				
Total Hip Arthroplasty	3147 (42.9%)	3148 (42.9%)	6295 (42.9%)	0.99
Total Knee Arthroplasty	4195 (57.1%)	4194 (57.1%)	8389 (57.1%)	
Gender				
Female	3535 (48.1%)	3515 (47.9%)	7050 (48.0%)	0.74
Male	3807 (51.9%)	3827 (52.1%)	7634 (52.0%)	
Age of Patient				
18 to 34 years	39 (0.5%)	43 (0.6%)	82 (0.6%)	0.8
35 to 44 years	250 (3.4%)	265 (3.6%)	515 (3.5%)	
45 to 54 years	1880 (25.6%)	1906 (26.0%)	3786 (25.8%)	
55 to 64 years	5173 (70.5%)	5128 (69.8%)	10301 (70.2%)	
Region				
North Central	2303 (31.4%)	2314 (31.5%)	4617 (31.4%)	0.93
Northeast	949 (12.9%)	942 (12.8%)	1891 (12.9%)	
South	2634 (35.9%)	2618 (35.7%)	5252 (35.8%)	
West	1426 (19.4%)	1431 (19.5%)	2857 (19.5%)	
Unknown	30 (0.4%)	37 (0.5%)	67 (0.5%)	
Chronic Back Pain				
No	5562 (75.8%)	5572 (75.9%)	11134 (75.8%)	0.85
Yes	1780 (24.2%)	1770 (24.1%)	3550 (24.2%)	
Chronic Neck Pain				
No	6761 (92.1%)	6720 (91.5%)	13481 (91.8%)	0.22
Yes	581 (7.9%)	622 (8.5%)	1203 (8.2%)	
Other Chronic Pain				
No	6124 (83.4%)	6080 (82.8%)	12204 (83.1%)	0.33
Yes	1218 (16.6%)	1262 (17.2%)	2480 (16.9%)	
Mood Disorder				
No	6458 (88.0%)	6438 (87.7%)	12896 (87.8%)	0.61
Yes	884 (12.0%)	904 (12.3%)	1788 (12.2%)	
Disruptive Disorder				
No	7295 (99.4%)	7277 (99.1%)	14572 (99.2%)	0.09
Yes	47 (0.6%)	65 (0.9%)	112 (0.8%)	
Substance Use Disorder				
No	7165 (97.6%)	7127 (97.1%)	14292 (97.3%)	0.05
Yes	177 (2.4%)	215 (2.9%)	392 (2.7%)	
Suicide or Self-harm				
No	7258 (98.9%)	7232 (98.5%)	14490 (98.7%)	0.06
Yes	84 (1.1%)	110 (1.5%)	194 (1.3%)	
Malignancy				
No	7090 (96.6%)	7078 (96.4%)	14168 (96.5%)	0.59
Yes	252 (3.4%)	264 (3.6%)	516 (3.5%)	
Received Surgical Opioids				
No	826 (11.3%)	1546 (21.1%)	2372 (16.2%)	<0.001
Yes	6516 (88.7%)	5796 (78.9%)	12312 (83.8%)	
Total Perioperative OME (mg)†	763.8 (500.0 - 1200.0)	750.0 (450.0 - 1140.0)	750.0 (486.3 - 1200.0)	0.046
Persistent Opioid Use				
No	6627 (90.3%)	6739 (91.8%)	13366 (91.0%)	0.001
Yes	715 (9.7%)	603 (8.2%)	1318 (9.0%)	

†Among patients who received surgical opioids, presented as median (interquartile range).
 SD=standard deviation; OME = oral morphine equivalents; mg = milligrams.

With respect to opioid prescribing and consumption, total knee arthroplasty (TKA) patients were significantly more likely to fill an opioid prescription compared to total hip arthroplasty patients in adjusted analysis. TKA patients were also significantly more likely to become persistent opioid users across all patients, as well as just among the subset of patients who filled a surgical opioid prescription. To further assess whether surgical setting had a differential effect based on procedure (TKA/THA) we repeated these models while adding an additional surgical setting*procedure interaction. For both persistent use outcomes, the effect of surgical setting was consistent across TKA and THA. For opioid prescribing, however, the odds of filling an opioid prescription for inpatient vs. outpatient TKA patients was OR 2.43 (95% CI 2.25-2.62, $p<0.001$), compared to OR 1.78 (1.62-1.96, $p<0.001$) for inpatient vs. outpatient THA patients.

Appendix Table 5. Total knee arthroplasty vs. total hip arthroplasty and opioid outcomes.

Outcome	Odds Ratio (95% CI)	p-value	p-interaction
Opioid prescription	1.15 (1.1-1.19)	<0.001	<0.001
Persistent use (all patients)	2.17 (2.06-2.29)	<0.001	0.34
Persistent use (opioid patients)	2.17 (2.06-2.29)	<0.001	0.98

CI=Confidence Interval.