

## Opioid Utility and Hospital Outcomes among Inpatients admitted with Osteoarthritis and Spine Disorders

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## Abstract

**Objective:** To evaluate opioid analgesic utilization and predictors for adverse events during hospitalization and discharge disposition among patients admitted with osteoarthritis (OA) or spine disorders.

**Design:** This is a retrospective study of 12,747 adult patients admitted to 6 private community hospitals from 2017 to 2020. Opioid use during hospitalization and risk factors for hospital-acquired adverse events and non-home discharge were investigated.

**Results:** The total number of patients using opioids decreased, however, the daily morphine milligram equivalent (MME) use for patients on opioids increased from 2017 to 2020. Increased odds of non-home discharge were associated with older age, Medicaid, Medicare insurance, and increased lengths of stay (LOS), increased body mass index, daily MME, and electrolyte replacement in the OA group. In the spine group, older age, black race, Medicaid, Medicare, no insurance, increased Charlson comorbidity index (CCI), LOS, polypharmacy, and heparin use were associated with non-home discharge. Adverse events were associated with increased age, LOS, Medicare, polypharmacy, antiemetic, and benzodiazepine use in the OA group and increased CCI, LOS, and electrolyte replacement in the spine group.

**Conclusions:** Despite the decreasing number of patients using opioids over the years, patients on opioids had an increased daily MME over the same time period.

**Key words:** opioids; osteoarthritis; spine disorders; adverse events; discharge

What is Known/What is New:

- **What is Known:** Opioid analgesics are frequently used by patients with osteoarthritis (OA) and spine disorders. However, the overall utilization of opioids decreased in recent years. Opioid analgesics are associated with worse outcomes after hospitalization.
- **What is New:** Among 12,747 patients admitted with OA or spine disorders, the total number of patients using opioids decreased. However, the daily morphine milligram equivalent (MME) use for patients on opioids increased from 2017 to 2020. Additionally, results show increased daily MME is associated with non-home discharge among patients with OA.

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Spine disorders and osteoarthritis (OA) are the most commonly encountered musculoskeletal disorders within medicine<sup>1</sup>, impacting more than 500 million people worldwide<sup>2</sup> and are the leading cause of adult disability in the United States (US).<sup>3</sup> OA and spondylopathies/spondyloarthropathy both ranked within the top 20 principal diagnoses for all inpatient stays in U.S. Hospitals (3<sup>rd</sup> and 13<sup>th</sup> respectively) and accounted for 13.5% of all hospital stays.<sup>4</sup> A higher percentage of patients with painful OA and spine disorders are prescribed opioids in comparison to those with other diagnoses in the US.<sup>5</sup> Opioid prescriptions in the US are more than double that of countries within the European Union and Australia/New Zealand,<sup>6,7</sup> despite limited evidence to support their clinical efficacy and increased awareness of the risks associated with their use. The percentage of patients being prescribed opioid medication for OA pain relief within the US continues to be highest in the acute care hospital setting.<sup>8</sup>

Following the recent trends to reduce opioid prescribing, there have been few studies looking at opioid prescribing practices within the acute hospital setting for patients with OA and spine disorders as the primary admitting diagnosis.<sup>9</sup> Investigating the similarities and differences in the utilization of pain medications and their impact on the hospital outcomes between two of the most common disabling musculoskeletal disorders can enhance our understanding of the impact and burden of opioid prescribing within the U.S. healthcare system.<sup>10</sup>

This study aims to evaluate the trends of opioid and non-opioid analgesic utilization among patients admitted to the acute care hospital setting with OA and spine disorders in order to reveal associations between demographic and clinical characteristics, including the use of opioid and

non-opioid analgesics, hospital-acquired complications (HAC), patient safety indicators (PSI), and discharge disposition.

## Methods

Patient data for this study was drawn from 6 private community hospitals in 6 states within a private health care system in the United States spanning the time period January 1<sup>st</sup>, 2017 to December 31<sup>st</sup>, 2020. Inclusion criteria for this study were adults aged 18 years of age and older, admission to an acute inpatient unit, length of stay involving at least one overnight stay, and patients who received International Classification of Disease, Ninth and Tenth Revision, Clinical Modification (ICD-10-CM) diagnoses of OA (M15-M19) and spine disorders (M40-54) as their primary admitting diagnoses. Excluded from the study were patients who were discharged from the emergency room or who were discharged on the day of admission, had missing demographic variables, and those that were admitted to inpatient rehabilitation units.

This study was reviewed and approved as exempt by the Institutional Review Board (IRB) at the author's institution, and the patient consent was waived by the IRB as this study used a de-identified dataset. The study findings are in accordance with STROBE guidelines (see Supplementary Checklist, Supplemental Digital Content 1, <http://links.lww.com/PHM/B822>).

## Variables

The demographic variables assessed included age, gender, race, ethnicity, medical insurance coverage, length of hospitalization, and discharge destination. Spine disorders and OA diagnoses were determined using ICD-10-CM diagnostic codes.

The Charlson Comorbidity Index (CCI), a validated, weighted scoring system was used to quantify medical comorbidities. CCI was previously used to predict the severity of illness and 1-year mortality risk.<sup>11,12</sup> The CCI has been used widely to stratify risk following medical conditions, including physically disabling conditions such as stroke,<sup>13</sup> osteoarthritis<sup>14</sup>, and spine disorders.<sup>15</sup>

HAC and PSI events used in the analysis include pulmonary complications, venous thromboembolic disease (deep venous thrombosis and pulmonary embolism), falls, cardiovascular disease, gastrointestinal complications, acute kidney injury, and intraoperative and postoperative complications.<sup>16</sup>

Medications received during the acute hospitalization were organized using the therapeutic classification system from the United States Pharmacopeia Drug Classification System.<sup>17</sup> The 15 most frequently used medications were analyzed among the group with OA and Spine disorders.

Morphine milligram equivalents (MME) of oral, intravenous, and transdermal opioid analgesics were calculated for standardization and comparison using the conversion factors from the Centers for Disease Control and Prevention.<sup>18,19</sup>

## Statistics

Descriptive statistics were used to analyze demographic and clinical characteristics. A T-test was used to validate the normal distribution of samples based on the demographic and

clinical variables; then Chi-square was performed to examine the independence of demographic and clinical variables and the categorical variables. A stepwise logistic regression model was used to evaluate significant relationships between predictive variables (demographic and clinical variables including frequently used medications, and surgical vs nonsurgical) and the outcome variables of home discharge (0: home discharge vs. 1: other than home discharge [facility based post-acute care]), HAC, and PSI event (1: the presence of either HAC or PSI). While performing stepwise selection, an attempt was made to remove any insignificant variables from the model before adding a significant variable to the model.<sup>20</sup> A p-value of < .05 was considered significant. Analyses were performed using SAS, version 9.4 (SAS Institute, Inc., Cary, NC) and Stata version 12 (StataCorp, College Station, TX).

## Results

There were 12747 unique patient admissions that met the inclusion criteria between January 1<sup>st</sup>, 2017 to December 31<sup>st</sup>, 2020. Seven thousand one hundred and ninety-five or 56% of the patients were diagnosed with OA, while 5552 or 44% were diagnosed with spine disorders. The mean age  $\pm$  standard deviation of all patients was  $65.38 \pm 11.98$  years. Patients with spine disorders were slightly younger than those with OA ( $62.31 \pm 13.93$  vs  $67.74 \pm 9.58$ ,  $P < .0001$ ). The length of stay for both diagnostic groups was  $2.27 \pm 2.35$  days, while patients with spine disorders had a slightly longer duration than those with OA ( $2.92 \pm 3.18$  vs  $1.77 \pm 1.20$ ,  $P < .0001$ ). Table 1.

Opioid analgesics were the single most utilized medication (n=11,737, 92.94% of 12692 patients without missing medication information, slightly higher in the group with spine disorders, 93.32%

vs. 91.83%,  $P=.002$ ) followed by laxatives ( $n=10,347$ , 81.93%). Short-acting opioids with acetaminophen were prescribed at a higher rate for patients with chronic spine disorders (5,592, 77.84%) vs. 4,385, 79.61%,  $P=.0160$ ), while tramadol (with/without acetaminophen) was utilized at a significantly higher rate within the OA group (2447, 34.06% vs. 307, 5.57%,  $P=<.0001$ ). From 2017 to 2020, the rate of opioid use among patients decreased in both groups (OA group: 93.10% in 2017 to 91.05% in 2020,  $P=.028$ , spine group: 94.89% to 92.06%,  $P=.008$ ). Figure 1. Opposite to the decrease in the rate of opioid use, daily MME increased over the same time period ( $47.08 \pm 42.83$  vs  $50.74 \pm 41.42$ ,  $P$  value = .0001). Figure 1. For 1,107 (8.7%) of the patients prescribed opioids during hospitalization, opioid analgesics were not prescribed within the first 24 hours of admission but were initiated prior to discharge. This occurred at a slightly higher rate in the OA group compared to the spine disorder group (9.24% vs. 8.01%,  $P=.015$ ). From 2017 to 2020, there was an increase in the number of patients who were started on an opioid after the first 24 hours of admission in the OA group (7.11% in 2017 to 9.81% in 2020,  $P<.0001$ ), while new opioid use among the spine disorder group showed a declining trend that was not statistically significant (9.04% in 2017 to 7.04% in 2020,  $P=.173$ ).

Other frequently used analgesics include acetaminophen ( $n=6,476$ , 51.28%), Meloxicam/Other nonsteroidal anti-inflammatory drugs (NSAIDs,  $n=5441$ , 43.09%), anticonvulsants ( $n=3,477$ , 27.53%), and muscle relaxants ( $n=2909$ , 23.03%). Acetaminophen and NSAID, including meloxicam were more frequently used in the group with OA, while anticonvulsants and muscle relaxants were more frequently used in the group with spine disorders. Table 2. Figure 2 illustrates the various trends in medication use between 2017 and 2020.

The details of medical comorbidities are described in Appendix 1 (Supplemental Digital Content 2, <http://links.lww.com/PHM/B823>). Patients with medical comorbidities that were recognized as having a contraindication to NSAID treatment (renal disease, peripheral vascular disease [PVD], cardiovascular disease/myocardial infarction/CHF, liver disease, and peptic ulcer disease) comprised 2187 patients or 29.11% of the total (slightly higher in spine group than OA group, 30.66% vs 27.92%,  $P=.001$ ).

Eleven thousand one hundred forty-four patients (87.42%) with either spine disorder or osteoarthritis were discharged home following acute hospitalization. Patient characteristics associated with home discharge included younger patients ( $64.33 \pm 11.77$  vs  $72.62 \pm 10.87$ ,  $P <.0001$ ) and male gender (44.75 vs 33.73%,  $P <.001$ ). The overall duration of hospitalization and percentage of intensive care unit care admission was significantly lower in the group discharged home ( $1.95 \pm 1.97$  vs.  $4.45 \pm 3.37$  days,  $P <.0001$  and 1.49% vs. 4.46%,  $P <.0001$ , respectively). Among the 1603 patients who were not discharged home, 1,238 (77%) patients were discharged to skilled nursing facilities, 283 (18%) patients went to inpatient rehabilitation units, 37 patients left against medical advice, and 6 patients expired.

A stepwise logistic regression analysis of the relationship between home discharge (dependent variable) and contributing factors (independent variables in tables 1 to 2 including the presence of surgery during hospitalization and the effect of NSAIDs) revealed the following associations. For both the OA and spine group, non-home discharge was associated with older age (OA: odds ratio [OR] 1.074, 95% confidence interval [CI] 1.058 to 1.090 and Spine: OR 1.045, CI 1.032 to 1.058), patients covered by Medicaid program (OR 2.230, CI 1.004-4.951 and OR 1.669, CI

1.026-2.716), patients covered by Medicare program (OR 2.443, CI 1.740-3.429 and OR 1.782, CI 1.298-2.445) and increased length of stay (OR 3.305, CI 3.020-3.616 and OR 1.309, CI 1.266-1.354). Table 3. For patients with OA diagnoses, non-home discharge was associated with increased body mass index (BMI, OR 1.021, CI 1.005-1.037), daily MME (OR 1.004, CI 1.001-1.007), and having received electrolyte replacement (OR 1.661, CI 1.272-2.168). For the spine group, non-home discharge was associated with black race (OR 1.426, CI 1.078-1.866), no insurance (OR 2.115, CI 1.046-4.277), increased CCI (OR 1.163, CI 1.095-1.235), increased number of medications (OR 1.039, CI 1.012-1.068), and heparin injection (OR 2.025, CI 1.612-2.543). Daily MME was not associated with home discharge in the spine group (P=.279). Overall hospital-acquired complications were relatively low (n=119, < 1%), with the most common complications identified as fractures (n=40), catheter-related urinary tract infection (UTI, n=21) and sepsis (n=17). For both OA and spine groups, length of stay was associated with HAC and PSI (OR 1.672, CI 1.190-2.347 and OR 1.162, CI 1.005-1.344). For the group with OA, Medicare (OR 6.012, CI 1.197-30.183) and benzodiazepine use (OR 26.108, CI 2.103-324.070) were associated with HAC and PSI. While for the spine group, increased CCI (OR 1.310, CI 1.031-1.665), increased length of stay (OR 1.162, CI 1.005-1.344), and having received electrolyte replacement (OR 2.868, CI 1.002-8.204) were associated with HAC and PSI. Table 4.

## Discussion

This study shows significantly high utilization (more than 90%) of opioid analgesics for the treatment of OA and spine disorders during acute hospitalization. A significantly higher rate of opioid use was observed than previously documented in other recent studies, including 13% for outpatient knee OA<sup>21</sup>, 24-39% for hospitalized pre-surgical hip and knee OA<sup>22,23</sup>, and between

20 – 55% for hospitalized pre-surgical spine patients.<sup>24,25</sup> One potential argument for this finding is a selection bias with the patients representing a subset more severely affected by pain than those previously studied. Post hoc analysis showed higher daily MME in the nonsurgical group ( $51.03 \pm 41.81$  of 11896 patients vs.  $41.55 \pm 26.60$  of 796 surgical patients,  $P < .0001$ ). Although this study did not assess pre-admission (at home) opioid use, less than 10% of admitted patients who were not initially on an opioid during the first 24 hours of hospital admission were subsequently prescribed an opioid during their hospitalization. This is comparatively less than the 15% of opioid naïve patients (defined as having no opioid prescription 60 days prior to admission) that were found to have continued opioid use post-discharge in a previous study.<sup>26</sup>

Similar to other studies that followed the 2016 CDC's Guideline for Prescribing Opioids for Chronic Pain, there appears to be an overall decreasing trend in opioid prescribing amongst patients with all diagnoses, excluding cancer and palliative care.<sup>27</sup> This study, however, had the concerning finding of an upward trend of increasing MMEs prescribed for the treatment of OA and spine disorder-related pain from 2017 to 2020. Additionally, the average dose of opioid medication seen within this study population ( $> 50$  MME) has been shown to be associated with a higher risk of adverse effects.<sup>27</sup> This study showed that opioid analgesics were more frequently used in the treatment of spine disorders. Opioids with acetaminophen (AAP) were shown to be used twice as frequently in the spine group compared to the OA group, while treatment for patients in the OA group had 6 times the prescription rate of tramadol compared to the spine group. This was surprising, given the previous report of increased all-cause mortality with tramadol compared to NSAIDs in the patients with OA.<sup>28</sup> The use of tramadol did demonstrate a downward trend of use in the OA group from 2017 to 2020 (36.39% to 15.53%,  $P < .0001$ ).

Studies looking at opioid use as a risk factor for adverse hospital outcomes have previously shown conflicting results, though these studies were limited to surgical patients only.<sup>29</sup> When examining nonsurgical patients, hospitals with high opioid use rates have demonstrated an increased adjusted risk of a severe opioid-related adverse event per patient exposed.<sup>9</sup> Despite the fact that the majority of the patients in this study were nonsurgical, it failed to reveal any association between opioids and any severe hospital-acquired complications. Prior studies have failed to demonstrate functional improvement for patients receiving opioids in the inpatient setting.<sup>30</sup> Similar to these findings, high dose opioid use in the patient population studied was associated with less ideal hospital outcomes, defined as non-home discharge, with an increased odds of 1.004 per 1 MME increase among patients with OA. Overly aggressive treatment of pain by opioid analgesics may produce adverse outcomes not just captured by HAC and PSI but may have more subtle impacts on patients that extend beyond the hospital stay and should be studied further.

NSAID use for the treatment of similar conditions in the US and other countries ranged between 35-56.1%, while our study showed NSAIDs being used for less than 11% of patients in the spine group.<sup>31, 32</sup> Overall, the low rate of NSAIDs and acetaminophen use has been shown to be a persistent trend that continues to diverge from the spine and OA-related pain treatment guidelines.<sup>8</sup> Among the patients on opioids without a relative contraindication to use NSAIDs (3,367 out of 11,737 patients), either from medical comorbidities (n=3,711) or medications such as anticoagulants for DVT prophylaxis and antiplatelets (n=3,367), only 14.20% (658 out of 4,633) patients were prescribed NSAIDs. Additionally, the patients in the spine disorder group were prescribed NSAIDs at a significantly lower rate than the OA group despite having a lower

medical comorbidity index. This raises questions as to whether lower usage rates are being driven by medical decision-making and patient safety or by other factors such as lack of clear guidelines for NSAIDs use on the population at risk.<sup>33</sup> Although much has been accomplished in reducing opioid use in recent years, an increased effort to address the opioid epidemic in the inpatient setting is clearly needed. As more studies demonstrate the risks associated with opioid use, there appears to be a need to review, revise, and create better treatment algorithms and prescribing guidelines that more accurately model the patient comorbidity complexities in the acute hospital setting that can help and guide practitioners to judicious use of AAP and NSAIDs for the treatment of musculoskeletal pain in the inpatient setting.<sup>30</sup>

The volume of data gathered from 6 different community teaching hospitals across 6 different states, including precise MME dosages, demographic information, and a validated medical comorbidities index system for analysis is a strength of this study and had significant power to make meaningful analysis of the impact of the opioid analgesics and other identified patient factors on patient outcomes. This specific information can help clinicians to build specific guidelines based on the target population to help clinicians to prepare for discharge planning.

The study population was limited to 6 community-based private hospitals and may not be fully applicable to non-profit healthcare systems such as those within academic centers or the Veterans Health Administration. Some information, including hospital-acquired complications, relied on a retrospective review of hospital discharge-based data including ICD-10-CM codes that have limited accuracy in capturing all medical problems and events. Moreover, this study could not address the potential for unrecognized coding errors. This study was limited in

determining what percentage of the patients were on an opioid pain medication regimen prior to admission as it didn't use outpatient opioid tracking tools such as Prescription Drug Monitoring Programs. Therefore, the impact of opioid use prior to admission on the outcome variables was limited. The database used lacked certain baseline functional data including the level of independence and barriers to discharge, which can be important factors in determining functional outcome and discharge disposition. This study also is unable to determine causality and indications for medication prescriptions, including contraindications for the use of or discontinuation of NSAIDs for anticipated procedures due to concerns with regard to platelet function inhibition.

## **Conclusion**

In summary, opioids are widely used among patients with OA and spine disorders within the acute hospital setting despite ongoing efforts to decrease the reliance on and use of opioid medication in the treatment of non-cancer-related pain disorders. Opioid analgesics and non-opioid analgesics were used at varying rates for the conditions studied with appreciable differences in their usage pattern compared to prior studies. During the course of the study from 2017 to 2020 the rate of opioid usage declined, however during the same time period the daily MME being prescribed increased and was shown to be at a relatively high level on average (>50 MME). Several demographic and clinical characteristics were associated with hospital-acquired complications as well as disposition after hospitalization.

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## Figure Legends

Figure 1. Trends of the rate of overall and specific opioid analgesic utility among patients with osteoarthritis (Figure 1A) and spine disorders (Figure 1B)

Figure 2. Trends of the rate of overall and specific non-opioid analgesic utility among patients with osteoarthritis (Figure 2A) and spine disorders (Figure 2B)

## Appendix 1.

Medical Comorbidities and hospital-acquired complications (including patient safety index) of the patients with OA and spine disorders and hospital acquired complications

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Figure 1A

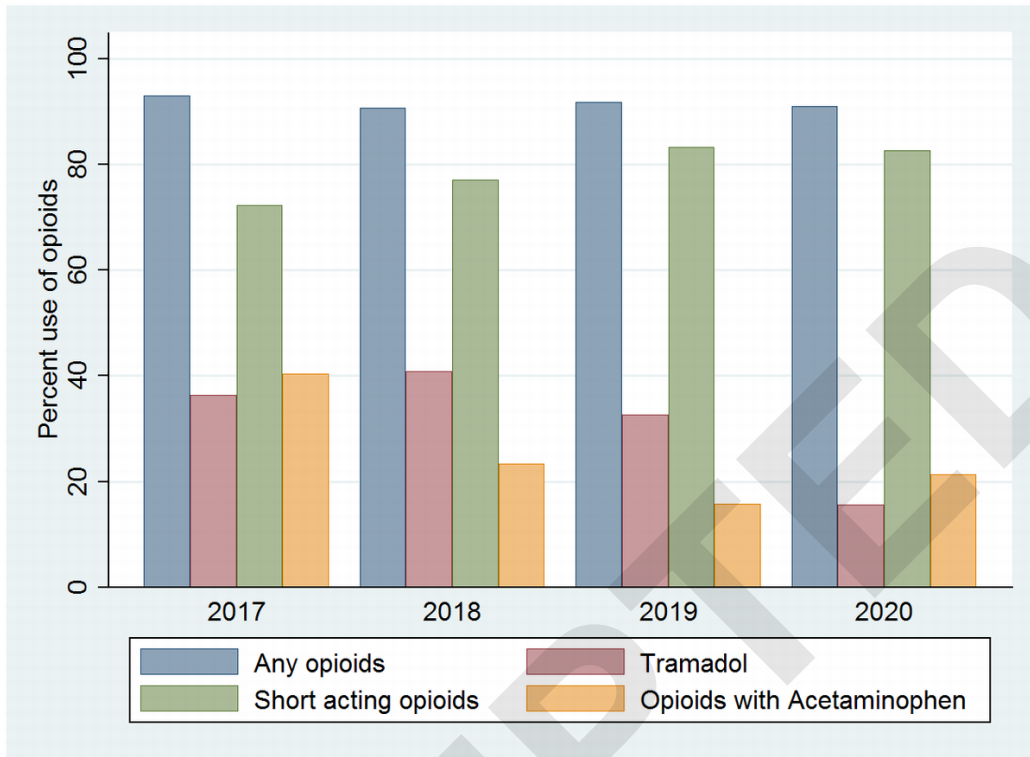


Figure 1B

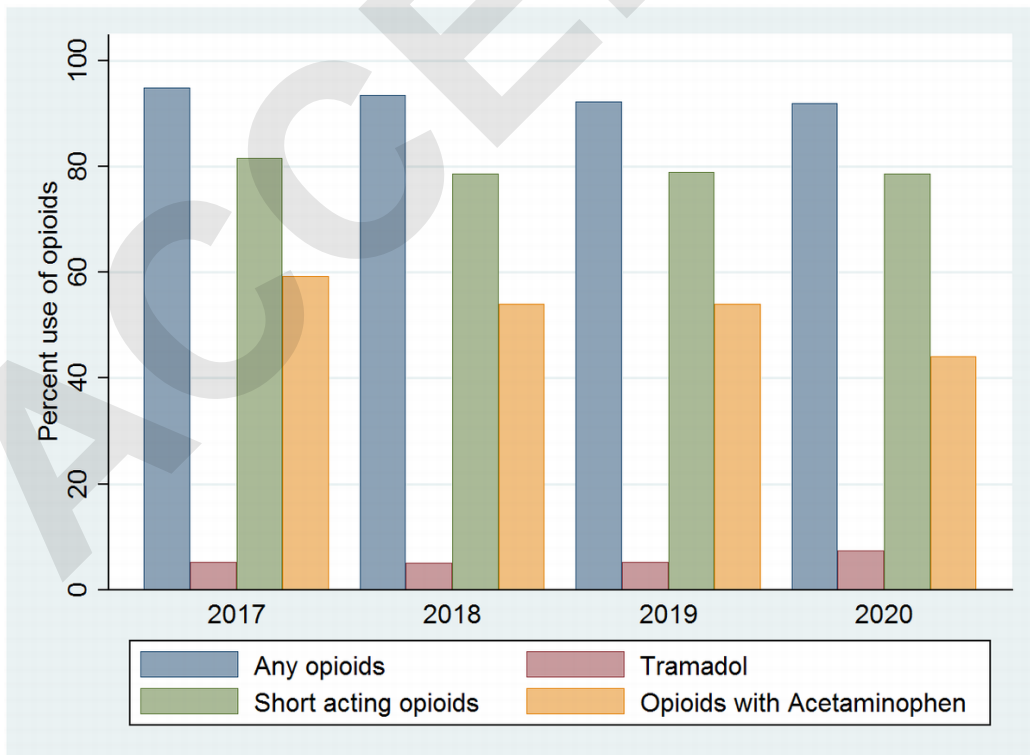


Figure 2A

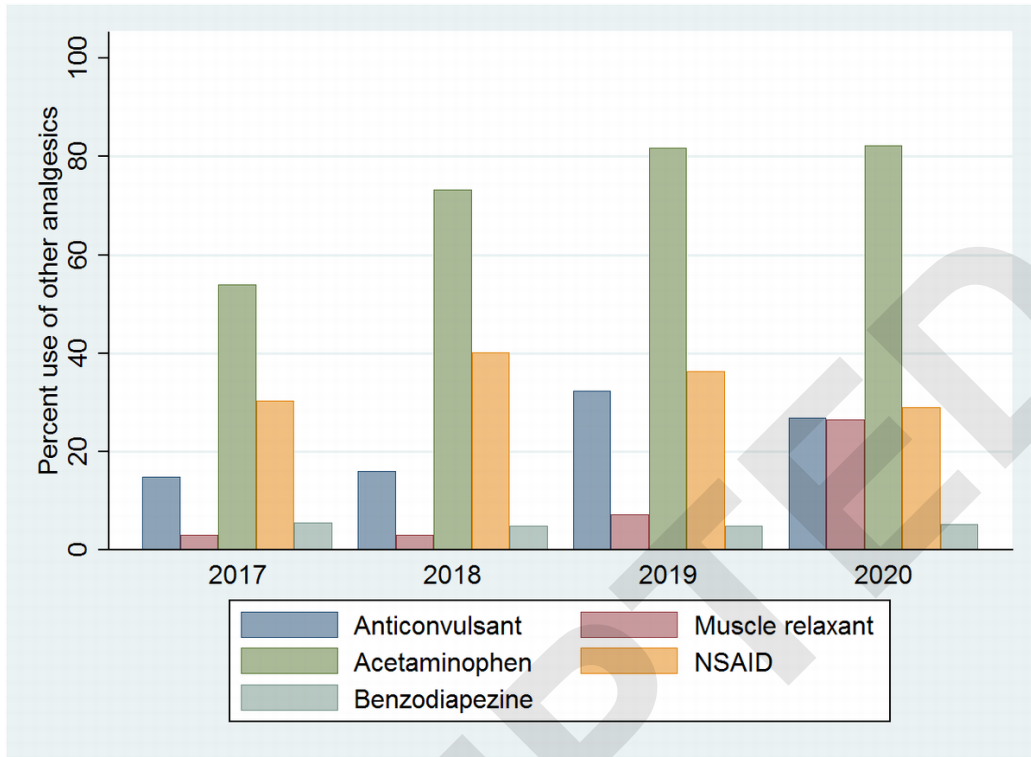


Figure 2B

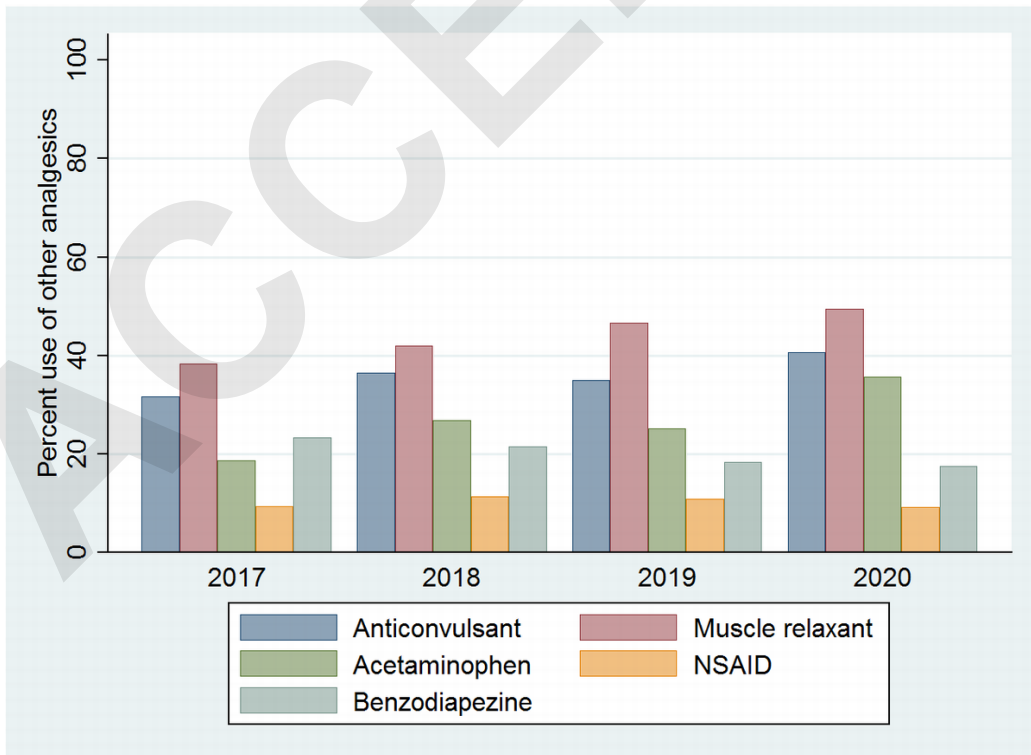


Table 1. Demographic and clinical information.

	Total, n= 12747	Osteoarthritis Group, n = 7195	Spine Disorders Group, n = 5552	P-value
Age, mean ± standard deviation (SD)	65.38 ± 11.98	67.74 ± 9.58	62.31 ± 13.93	<.0001
Male Sex	5,526 (43.35%)	2943 (40.90%)	2583 (46.52%)	<.0001
Race				
Black	1261 (9.89%)	640 (8.9%)	621 (11.19%)	<.0001
Other	691 (5.42%)	256 (3.56%)	435 (7.84%)	
White	10795 (84.69%)	6299 (87.55%)	4496 (80.98%)	
Insurance				
Medicaid	534 (4.19%)	115 (1.60%)	419 (7.55%)	<.0001
Medicare	7735 (60.68%)	4620 (64.21%)	3115 (56.11%)	
Uninsured	195 (1.53%)	33 (0.46%)	162 (2.92%)	
Other	971 (7.62%)	374 (5.20%)	597 (10.75%)	
Private	3312 (25.98%)	2053 (28.53%)	1259 (22.68%)	
Body mass index, mean ± SD	30.60 ± 6.28	31.15 ± 6.10	29.89 ± 6.43	<.0001
Length of Stay (days), mean ± SD	2.27 ± 2.35	1.77 ± 1.20	2.92 ± 3.18	<.0001
Top 5 admitting diagnoses		Unilateral 1° knee OA: 3649 (50.72%) Unilateral 1° hip OA: 2379 (33.06%) 1° shoulder OA: 509 (7.07%) Bilateral 1° OA of knee: 389 (5.41%) 1° OA of ankle, and foot: 142 (1.97%)	L. Spinal Stenosis: 1726 (31.09%) L. Radiculopathy: 631 (11.37%) C. Spinal Stenosis: 619 (11.15%) L. Spondylolisthesis: 372 (6.7%) C. Disc Disease: 336 (6.05%)	

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Charlson Comorbidity Index (mean ± SD)	2.826 ± 1.759	2.983 ± 1.550	2.622 ± 1.978	<.0001
Discharge Destination				
Home	11144 (87.42%)	6293 (87.46%)	4851 (87.37%)	
SNF	1238 (9.781%)	807 (11.22%)	431 (7.76%)	
IRF	283 (2.22%)	86 (1.2%)	197 (3.55%)	
Discharge AMA	37 (0.29%)	0	37 (0.67%)	
Other	35 (0.27%)	6 (0.08%)	29 (0.52%)	
Expired	6 (0.05%)	3 (0.04%)	3 (0.05%)	
Hospice	4 (0.03%)	0	4 (0.07%)	<.0001

COPD: chronic obstructive pulmonary disease; L: lumbar; C: cervical; UTI: urinary tract infection; DVT/PE: deep vein thrombosis/pulmonary embolism; AMA: against medical advice; SNF: skilled nursing facility; IRF: inpatient rehabilitation facility

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Table 2. Frequently used medication classes during hospitalization. AAP= acetaminophen

	Total (N=12692)	OA	Spine	P-value
Polypharmacy (mean ± SD)	9.68 ± 3.82	10.64 ± 3.79	8.43 ± 3.48	<.0001
Laxative	10347 (81.93%)	6300 (87.69%)	4047 (73.47%)	<.0001
Opioids	11737 (92.94%)	6597 (91.83%)	5140 (93.32%)	0.002
Opioid short acting	9977 (79.00%)	5592 (77.84%)	4385 (79.61%)	.0160
Opioid+AAP	4862 (38.50%)	1913 (26.63%)	2949 (53.54%)	<.0001
Tramadol (with or without AAP)	2754 (21.81%)	2447 (34.06%)	307 (5.57%)	<.0001
Daily Morphine Milligram Equivalent (mean ± SD)	50.31 ± 40.77	50.10 ± 37.30	50.57 ± 44.85	.5240
Acetaminophen	6476 (51.28%)	5053 (70.34%)	1423 (25.84%)	<.0001
NSAID	3038 (24.06%)	2479 (34.51%)	559 (10.15%)	<.0001
Meloxicam	2403 (19.03%)	2357 (32.81%)	46 (0.84%)	<.0001
Anticonvulsant	3477 (27.53%)	1518 (21.13%)	1959 (35.57%)	<.0001
Muscle relaxant	2909 (23.03%)	510 (7.10%)	2399 (43.55%)	<.0001
Benzodiazepine	1,490 (11.74%)	365 (5.08%)	1,125 (20.42%)	<.0001
Electrolyte replacement	9212 (72.94%)	6079 (84.62%)	3133 (56.88%)	<.0001
Antibiotic	7922 (62.73%)	6012 (83.69%)	1910 (34.68%)	<.0001
Gastrointestinal prophylaxis	6612 (52.36%)	4061 (56.53%)	2551 (46.31%)	<.0001
Antiemetic	4720 (37.37%)	3117 (43.39%)	1603 (29.10%)	<.0001
Platelet inhibitor	4713 (37.32%)	4427 (61.62%)	286 (5.19%)	<.0001
Antihypertensive	4107 (32.52%)	2313 (32.20%)	1794 (32.57%)	0.6550
Statin	3965 (31.40%)	2560 (35.63%)	1405 (25.51%)	<.0001
Heparin	1448 (11.47%)	674 (9.38%)	774 (14.05%)	<.0001

Table 3. Stepwise logistic regression analysis of relationship between discharge destination (home vs others) and contributing factors

Group with OA R2=.435				Group with Spine disorder R2=.334			
Independent Variables	Odds Ratio	P	[95% Conf. Interval]		Odds Ratio	P	[95% Conf. Interval]
Demographic variable							
Age	1.074	<b>.000</b>	1.058-1.090	Age	1.045	<b>.000</b>	1.032-1.058
Male gender	.655	<b>.000</b>	.535-.800				
Other race (than black and white)	.395	<b>.001</b>	.231-.675	Black	1.426	<b>.013</b>	1.078-1.866
Medicaid	2.230	<b>.049</b>	1.004-4.951	Medicaid	1.669	<b>.039</b>	1.026-2.716
Medicare	2.443	<b>.000</b>	1.740-3.429	Medicare	1.782	<b>.000</b>	1.298-2.445
Other insurance	1.692	.099	.905-3.163	No insurance	2.115	<b>.037</b>	1.046-4.277
Body mass index	1.021	<b>.010</b>	1.005-1.037				
Hospital course							
Any HAC	.388	.090	.130-1.160	CCI	1.163	<b>.000</b>	1.095-1.235
Length of stay (day)	3.305	<b>.000</b>	3.020-3.616	Length of stay (day)	1.309	<b>.000</b>	1.266-1.354
Daily MME per 1 MME	1.004	<b>.009</b>	1.001-1.007	Polypharmacy	1.039	<b>.005</b>	1.012-1.068
Electrolyte replacement	1.661	<b>.000</b>	1.272-2.168	Antibiotic	.771	<b>.026</b>	.614- .969
Platelet inhibitor	.710	<b>.000</b>	.586-.860	Heparin	2.025	<b>.000</b>	1.612-2.543
Antiemetic	.830	.055	.686-1.004	Acetaminophen	1.217	.067	.986-1.503
Heparin	1.298	.061	.988-1.707	Statin	.844	.121	.681-1.046

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Table 4. Stepwise logistic regression analysis of relationship between hospital-acquired complications, patient safety index events, and contributing factors

Patients with OA R2=.388				Patients with Spine disorders R2=.376			
Independent Variables	Odds Ratio	P	[95% Conf. Interval]	Independent Variables	Odds Ratio	P	[95% Conf. Interval]
Age	.876	<b>.001</b>	.808-.950				
Medicare	6.012	<b>.029</b>	1.197-30.183	Charlson comorbidity index	1.310	<b>.027</b>	1.031-1.665
Length of stay (day)	1.672	<b>.003</b>	1.190-2.347	Length of stay (day)	1.162	<b>.043</b>	1.005-1.344
Polypharmacy	.818	<b>.010</b>	.703-.953	Electrolyte replacement	2.868	<b>.049</b>	1.002-8.204
Antiemetic	.263	<b>.018</b>	.087-.796	Insulin	7.481	.070	.848-65.961
Benzodiazepine	26.108	<b>.011</b>	2.103-324.070				
Muscle relaxant	8.223	.102	.659-102.609				