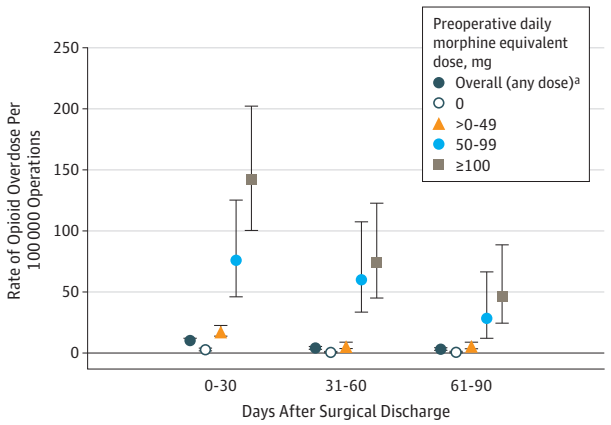
Figure. Rate of Postoperative Opioid Overdose in Entire Cohort and Stratified by Preoperative Daily Morphine Equivalent Dose




Error bars indicate 95% CIs.

[a] Overall opioid overdose rate per 100 000 operations within 30 days of hospital discharge.

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## Persistent Opioid Use After Wisdom Tooth Extraction

In 2004, wisdom tooth extraction was performed in an estimated 3.5 million patients.[1] Patients undergoing wisdom tooth extraction are predominantly young and healthy and routinely receive a postoperative opioid prescription.[2]

Opioid-naive patients are at risk for persistent opioid use after elective surgery[3,4]; to our knowledge, the risk following dental procedures has not been assessed. We investigated the association of filled perioperative opioid prescriptions with persistent use of prescription opioid medications following wisdom tooth extraction.

**Methods** | The University of Michigan institutional review board deemed this study of deidentified data exempt from review and informed consent. Patients aged 13 to 30 years who underwent wisdom tooth extraction defined by tooth number were examined in the Truven Health MarketScan Commercial and Dental database (July 1, 2009-December 31, 2015).

The MarketScan database contains deidentified insurance claims for enrollees of self-insured employers and health plans and includes 43 million to 55 million beneficiaries annually from 50 states. Patients were excluded for lapse in enrollment, having an opioid prescription filled within 6 months preoperatively, or having an additional anesthetic or dental procedure within the year after surgery.[3,4] Filled prescriptions were identified from pharmacy claims by matching generic drug names with National Drug Codes.

The exposure was a filled perioperative opioid prescription (≥1 opioid prescription filled from 7 days before the procedure to 3 days following tooth extraction) and the primary outcome was persistent opioid use (≥1 opioid prescription filled during postprocedure days 4-90 and 91-365).[3] Any opioid prescriptions filled after 3 days are unlikely to represent the perioperative prescription. All estimated models controlled for patient demographics, tooth impaction, medical comorbidities, mental health and chronic pain diagnoses,[4] and prescriptions filled within the past year. Dry socket was excluded due to low event rate.

Statistical analyses were performed using $\chi^2$ analyses and multivariable logistic regression to estimate the association between a perioperative opioid prescription filled and persistent opioid use using 2-sided tests with $P$ value less than .05 for significance (SAS software [SAS Institute], version 9.4). For clinical interpretability, the predicted rate of persistent opioid use was estimated for patients who filled or did not fill opioid prescriptions using the regression model that was adjusted for all known patient characteristics.

**Results** | Among 70 942 patients who underwent wisdom tooth extraction, 56 686 patients filled and 14 256 patients did not fill a perioperative opioid prescription. Hydrocodone was the most common (70.3%), followed by oxycodone (24.3%). Compared with patients who did not fill an opioid prescription, patients who filled an opioid prescription were more often younger and female with higher rates of chronic pain, depression, anxiety, preoperative prescription use, and tooth impaction (**Table**).

Table. Patient Demographics and Multivariable Logistic Regression for Persistent Opioid Use

| | Opioid Prescription, No. (%) | | | |
|---|---|---|---|---|
| | Filled (n = 56 686) | Not Filled (n = 14 256) | *P* Value | Adjusted Odds Ratio (95% CI) |
| Primary outcome: persistent opioid use | 737 (1.3) | 71 (0.5) | | 2.69 (2.10-3.44) |
| Age group, y | | | | |
| 13-15 | 5684 (10.0) | 1213 (8.5) | <.001 | 1 [Reference] |
| 16-18 | 25 778 (45.5) | 5619 (39.4) | | 1.39 (1.01-1.91) |
| 19-24 | 20 539 (36.2) | 5597 (39.3) | | 2.13 (1.55-2.92) |
| 25-30 | 4685 (8.3) | 1827 (12.8) | | 2.85 (1.87-4.34) |
| Male sex | 26 125 (46.1) | 6951 (48.8) | <.001 | 0.65 (0.56-0.76) |
| Insurance policy holder[a] | 4946 (8.7) | 1920 (13.5) | <.001 | 1.29 (0.96-1.73) |
| Median income, $[b] | | | | |
| <40 000 | 134 (0.2) | 46 (0.3) | <.001 | 1.05 (0.26-4.27) |
| 40 000-69 999 | 25 208 (44.5) | 6294 (44.2) | | 1 [Reference] |
| ≥70 000 | 26 905 (47.5) | 6660 (46.7) | | 0.91 (0.79-1.06) |
| Unknown | 4439 (7.8) | 1256 (8.8) | | 1.14 (0.89-1.46) |
| Type of chronic condition[c] | | | | |
| Neurological or neuromuscular | 112 (0.2) | 35 (0.3) | .26 | 1.90 (0.68-5.25) |
| Cardiovascular | 330 (0.6) | 71 (0.5) | .23 | 0.84 (0.31-2.28) |
| Respiratory | 26 (0.1) | 7 (0.1) | .87 | 2.33 (0.31-17.71) |
| Renal and urological | 31 (0.1) | 10 (0.1) | .49 | 2.05 (0.27-15.44) |
| Gastrointestinal | 92 (0.2) | 19 (0.1) | .43 | 2.09 (0.66-6.68) |
| Hematologic or immunologic | 117 (0.2) | 29 (0.2) | .94 | 1.09 (0.27-4.43) |
| Metabolic | 635 (1.1) | 174 (1.2) | .31 | 0.54 (0.24-1.22) |
| Other congenital or genetic defect | 269 (0.5) | 60 (0.4) | .40 | 1.14 (0.52-2.50) |
| Malignancy | 625 (1.1) | 135 (1.0) | .11 | 1.06 (0.56-1.99) |
| Diagnoses | | | | |
| Chronic pain | 2489 (4.4) | 493 (3.5) | <.001 | 2.26 (1.78-2.88) |
| Depression | 599 (1.1) | 107 (0.8) | .001 | 1.87 (1.16-3.01) |
| Anxiety | 1055 (1.9) | 197 (1.4) | <.001 | 2.00 (1.40-2.86) |
| Substance use disorder | 271 (0.5) | 81 (0.6) | .17 | 3.86 (2.27-6.57) |
| Other mental health diagnosis | 440 (0.8) | 92 (0.6) | .11 | 1.60 (0.88-2.89) |
| Preoperative prescription by medication class | | | | |
| Benzodiazepines | 1831 (3.2) | 159 (1.1) | <.001 | 1.35 (0.98-1.86) |
| Stimulants | 1748 (3.1) | 253 (1.8) | <.001 | 2.02 (1.50-2.72) |
| Sedative or hypnotics | 341 (0.6) | 30 (0.2) | <.001 | 2.92 (1.80-4.73) |
| Antidepressants | 2416 (4.3) | 353 (2.5) | <.001 | 1.28 (0.97-1.69) |
| Third molar impaction status | | | | |
| None | 1946 (3.4) | 1806 (12.7) | <.001 | 1 [Reference] |
| Soft tissue | 2702 (4.8) | 1125 (7.9) | | 0.64 (0.42-0.96) |
| Partial bony | 12 055 (21.3) | 3094 (21.7) | | 0.73 (0.53-0.99) |
| Complete bony | 39 983 (70.5) | 8231 (57.7) | | 0.83 (0.62-1.12) |

[a] Indicates that the patient was the employee with the primary plan coverage.

[b] Estimated as the median income within the patient's Metropolitan Statistical Area.

[c] Defined using version 2 of the pediatric Complex Chronic Conditions classification system.

Persistent opioid use occurred at an adjusted rate of 13 (95% CI, 9-19) per 1000 patients with a filled opioid prescription compared with 5 (95% CI, 3-7) per 1000 patients without a filled perioperative prescription. Controlling for patient characteristics, a filled perioperative opioid prescription was independently associated with persistent opioid use (adjusted odds ratio [OR], 2.69; 95% CI, 2.10-3.44).

Compared with patients aged 13 to 15 years, older age was associated with persistent opioid use (ages 16-18 years: adjusted OR, 1.39 [95% CI, 1.01-1.91]; ages 19-24 years: adjusted OR, 2.13 [95% CI, 1.55-2.92]; ages 25-30 years: adjusted OR, 2.85 [95% CI, 1.87-4.34]). Soft tissue impaction (adjusted OR, 0.64; 95% CI, 0.42-0.96) and partial bony impaction (adjusted OR, 0.73; 95% CI, 0.53-0.99) were negatively associated, whereas complete bony impaction was not associated with persistent opioid use (Table).

**Discussion** | A filled perioperative opioid prescription after wisdom tooth extraction was associated with higher odds of persistent opioid use among opioid-naive patients. Consistent with

prior work showing no association with major or minor surgery, persistent use was not explained by patient characteristics or tooth impaction alone.[3]

Limitations include that the amount of opioid prescriptions filled may not reflect actual consumption. The reasons for opioid prescription refills (eg, whether for pain or a nonprescribed reason, storage for later use, or diversion to another person) were unknown. Persistent opioid use based on prescription claims may underestimate overall and nonmedical use.

Dentists were the second-leading opioid prescribers for children and adolescents in 2012.[5] The American Dental Association recently mandated an opioid prescribing limit of 7 days or less.[6] However, nonopioid analgesics may have equivalent or superior efficacy for postextraction pain.[2] The practice of any routine opioid prescribing must be questioned in the face of the potential morbidity and long-term consequences of opioid use.

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COMMENT & RESPONSE

## Opioids vs Nonopioids for Chronic Back, Hip, or Knee Pain

**To the Editor** Dr Krebs and colleagues[1] compared opioid with nonopioid medications in improving pain-related function in patients with chronic back pain or hip or knee osteoarthritis pain. We have several concerns about the study design and generalizability of the results.

First, potentially eligible patients were identified by searching the electronic health record for back, hip, or knee pain diagnoses at a primary care visit. It is not clear that the patients with knee or hip pain were truly painful due to osteoarthritis. Osteoarthritic radiographic changes are common, but these radiographic manifestations of osteoarthritis often are not the cause of the pain described by the patient. Many other conditions can cause knee and hip pain. It would be helpful if more detailed description of inclusion criteria was given.

Second, other treatment modalities may confound the results. Patients were allowed to participate in nonpharmacological pain therapies. Injections and surgery are effective methods of treating hip and knee osteoarthritis. The 2 groups could be different from each other with regard to utilization of other treatment modalities. Could the authors provide more detailed information regarding other treatment modalities used in each group?

Third, patient outcomes were improved in both groups. The result may suggest that the patients did not get sufficient nonopioid treatments before being enrolled in this study.

Fourth, treatment of chronic back pain is more complicated and controversial than treatment of hip and knee osteoarthritis. Many conditions can cause chronic low back pain, such as failed back surgical syndrome. Such patients may have a history of multiple back surgeries and have failed multiple nonopioid options and interventional procedures. Closely monitored low-dose narcotics may be an option to improve