Patterns of Initial Opioid Prescribing to Opioid-Naive Patients

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Objective: To determine the proportion of initial opioid prescriptions for opioid-naive patients prescribed by surgeons, dentists, and emergency physicians. We hypothesized that the percentage of such prescriptions grew as scrutiny of primary care and pain medicine opioid prescribing increased and guidelines were developed.

Summary of Background Data: Data regarding the types of care for which opioid-naive patients are provided initial opioid prescriptions are limited.

Methods: A retrospective cross-sectional study using a nationwide insurance claims dataset to study US adults aged 18 to 64 years. Our primary outcome was a change in opioid prescription share for opioid-naive patients undergoing surgical, emergency, and dental care from 2010 to 2016; we also examined the type and amounts of opioid filled.

Results: From 87,941,718 analyzed lives, we identified 16,292,018 opioid prescriptions filled by opioid-naive patients. The proportion of prescriptions for patients receiving surgery, emergency, and dental care increased by 15.8% from 2010 to 2016 ($P < 0.001$), with the greatest increases related to surgical (18.1%) and dental (67.8%) prescribing. In 2016, surgery patients filled 22.0% of initial prescriptions, emergency medicine patients 13.0%, and dental patients 4.2%. Surgical patients' mean total oral morphine equivalents per prescription increased from 240 mg (SD 509) in 2010 to 403 mg (SD 1369) in 2016 ($P < 0.001$). Over the study period, surgical patients received the highest proportion of potent opioids (90.2% received hydrocodone or oxycodone).

Conclusions: Initial opioid prescribing attributable to surgical and dental care is increasing relative to primary and chronic pain care. Evidence-based guideline development for surgical and dental prescribing is warranted in order to curb iatrogenic opioid morbidity and mortality.

Keywords: opioid epidemic, opioid prescribing, opioids, pain management, pain medicine, perioperative opioids

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Opioid abuse is a major contributor to mortality in the United States, with 42,249 deaths attributed to opioid overdose in 2016.[1] Opioid prescribing has come under considerable scrutiny as an iatrogenic driver of the opioid crisis; however, attention has centered upon prescribing by primary care and chronic pain physicians for conditions such as headache and low back pain.[2–6] Prescribing related to non-longitudinal care such as surgery, dentistry, and emergency medicine has received comparably little study. This issue is particularly relevant given data demonstrating that new persistent opioid use after surgery is a common postoperative complication.[7,8] A recent study found that among teens and young adults, filling an opioid after wisdom tooth extraction was associated with a nearly 3 times greater risk of becoming a new persistent opioid user after adjustment when compared with patients not filling a postoperative opioid.[9]

The academic focus on opioid prescribing for primary care and chronic pain patients has also extended to the development of prescribing guidelines. The Centers for Disease Control (CDC) guidelines released in 2016 focus on prescribing to these populations[4]; they were preceded by a number of state guidelines with a similar focus.[10] Although guidelines for postoperative opioid prescribing have been proposed recently, these recommendations have yet to attain widespread acceptance.[11] Dental prescribing guidelines are in a similarly early stage of dissemination.[12]

To date, studies on opioid prescribing by specialty have chiefly examined chronic opioid users[13–15] or patients with adverse outcomes.[16–19] Specialty-specific prescribing pattern data are lacking, especially for first-start opioid prescriptions. Given that recent research and prescribing guidelines have focused on opioid prescribing by primary care and pain physicians, we hypothesized that the proportion of initial prescriptions written to surgical, emergency medicine, and dental patients increased over the 7-year period from 2010 through 2016.

METHODS

The Truven Health MarketScan Commercial and Dental databases comprise a national, employer-based dataset of insurance and pharmacy claims. We queried pharmacy claims for prescription opioids from January 1, 2010, to December 31, 2016 among adults aged 18 to 64 years to identify prescriptions filled by opioid-naive patients (defined as no opioid prescriptions filled during the 365 days before the index fill, a definition used in several other studies of opioid use following procedural care).[8,20,21] The study was exempt

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from review by the University of Michigan Institutional Review Board; informed consent was waived due to the dataset's deidentified nature.

To identify opioid prescriptions, we examined pharmacy claims for opioid fills. We defined opioids as medications within the therapeutic class of ''Analg/Antipyr, Opiate Agonists,'' as well as buprenorphine and tramadol. A full list of queried opioids can be found in the Supplemental Digital Content, http://links.lww.com/SLA/B474. To ensure only opioid-naive patients filling initial prescriptions were included in our cohort, we carried out a 365-day lookback from the date of the index fill and excluded the queried fill if any other opioid prescription had been filled during this time period.

Subsequently, we examined inpatient, outpatient, and dental billing data from $\leq$ 3 days before the remaining index fills. We selected the 3-day cutoff to minimize the chance that delayed filling of a prescription (due to subsidence of a regional anesthetic or a failed trial of nonopioid analgesics, for example) would lead to misclassification of its prescriber. Billing claims on the same date as a particular fill were linked with that fill. We classified prescriptions sequentially into the following groups using Current Dental Terminology (CDT), Current Procedural Terminology (CPT), and *International Statistical Classification of Diseases and Related Health Problems* (ICD-9) codes, as well as the Surgery Flag software of the Agency for Healthcare Research and Quality (AHRQ; Rockville, MD): dental, surgery, emergency medicine, and ''other.'' To do this, we first identified dental prescriptions (including oral surgery) by CDT codes commonly associated with opioid prescribing. After dental prescriptions had been classified and removed from the pool of undifferentiated prescriptions, we classified prescriptions into the ''surgery'' group if they met 1 of 3 separate criteria: (1) the presence of CPT codes listed in the American College of Surgeons National Surgical Quality Improvement Program's code inclusion list; (2) the ''BROAD'' or ''NARROW'' classifications of the Surgery Flag software of the AHRQ, which identified additional surgery prescriptions based on CPT and ICD-9 codes[22]; and (3) the presence of anesthesia CPT codes for surgical procedures. Remaining undifferentiated opioid prescriptions were classified into the ''emergency medicine'' group if an emergency medicine revenue code was present, or into the ''other'' group if one was not.

For each fill, we extracted the opioid prescribed, amount, and days of opioid supplied. We also calculated total and daily oral morphine equivalents (OMEs) using established conversion measures.[23]

Comprehensive methodological details, including lists of queried opioids and procedure codes, are in the Supplemental Digital Content, http://links.lww.com/SLA/B474.

Statistical Analysis

Our primary outcome was the change in proportion of initial opioid prescriptions provided to opioid-naive surgery, emergency medicine, and dental patients per year. This outcome was defined a priori before data extraction. We examined proportions of initial prescriptions per group rather than absolute numbers to account for variation in the number of opioid-naive patients ''eligible'' to receive an initial prescription each year. Secondary outcomes included total OMEs filled per group per year, daily OMEs filled per group per year, days of opioid supplied per group per year, and percentage of potent opioids—defined as hydrocodone and oxycodone—prescribed per group. Although other potent oral opioids exist, they are not commonly prescribed to opioid-naive patients.

We calculated descriptive statistics using SAS version 9.4 (SAS Institute, Cary, NC). We tested the difference in proportion between groups using a χ^2 test and assessed yearly trend through the Cochran-Armitage trend test. We transformed total OMEs, daily OMEs, and days of opioid supplied per prescription into natural logarithmic scale to account for the skewness of the data. Finally, we used analysis of variance (ANOVA) to compare yearly trends among groups. P values were 2-tailed, with significance set at $P < 0.05$.

RESULTS

From 87,941,718 analyzed lives, we identified 22,023,714 unique subjects (25.0%) who filled at least 1 opioid prescription over our 7-year study period. Of these subjects, 1,644,290 (7.5%) did not meet our criteria of opioid-naivete for at least one fill. Of the remaining 20,379,424 subjects, 13,365,255 (65.6%) had continuous enrollment over the 365-day lookback period before at least 1 fill. After accounting for subjects with multiple initial prescription fills over the study period, we identified a total of 16,292,018 initial individual opioid prescriptions filled by opioid-naive patients between 2010 and 2016 (Fig. 1).

Initial Opioid Prescribing to Opioid-Naive Patients by Patient Group

The combined percentage of surgery, emergency medicine, and dental prescriptions increased from 33.9% in 2010 to 39.3% in 2016, a 15.8% increase ($P < 0.001$; Fig. 2; Table 1 in the Supplemental Digital Content, http://links.lww.com/SLA/B474). Surgery patients received the majority of prescriptions in the combined group each year, followed by emergency medicine and dental patients. The emergency medicine prescription share remained relatively constant, while the surgery and dental prescription shares increased. The surgical initial prescribing share grew from 18.7% in 2010 to 22.0% in 2016 (an 18.1% increase), while the dental share grew from 2.5% to 4.2% over the same time period (a 67.8% increase).

Amount of Initial Opioid Prescribed by Patient Group

Surgical patients were prescribed the highest total opioid amounts in all years studied (Fig. 3A; Table 2 in the Supplemental Digital Content, http://links.lww.com/SLA/B474). Mean total OMEs per prescription for surgery increased from 240 mg (SD 509) in 2010 to 403 mg (SD 1369) in 2016. In addition, surgery patients received the highest average daily opioid dose in all years studied (Fig. 3B; Table 3 in the Supplemental Digital Content, http://links.lww.com/SLA/B474); mean daily dose increased from 56 mg OMEs (SD 156) in 2010 to 82 mg (SD 273) in 2016. Total opioid amount per prescription among the ''other'' group reached a peak mean of 380 mg OMEs (SD 1179) in 2014, before falling to 283 mg OMEs (SD 1105) in 2016. In contrast, emergency medicine and dental prescription total opioid amounts exhibited flatter trajectories with lower OMEs. Dental patients received the lowest daily dosages of opioid throughout the study period. The difference in yearly trends for all comparisons between groups was statistically significant for both total and daily amount prescribed ($P < 0.001$ for both analyses).

Days Supplied in Initial Opioid Prescriptions by Patient Group

Days of opioid supplied remained relatively constant across the study period, with patients in the ''other'' group receiving the most days [mean 6.4 (SD 7.0) in 2016], followed by surgery [5.4 (SD 3.4)], dental [3.8 (SD 2.8)], and emergency medicine [3.7 (SD 2.6)] (Table 4 in the Supplemental Digital Content, http://links.lww.com/SLA/B474).

Specific Opioid Prescribed in Initial Opioid Prescriptions

Potent opioids (hydrocodone and oxycodone) were most commonly prescribed by all provider types over the study period

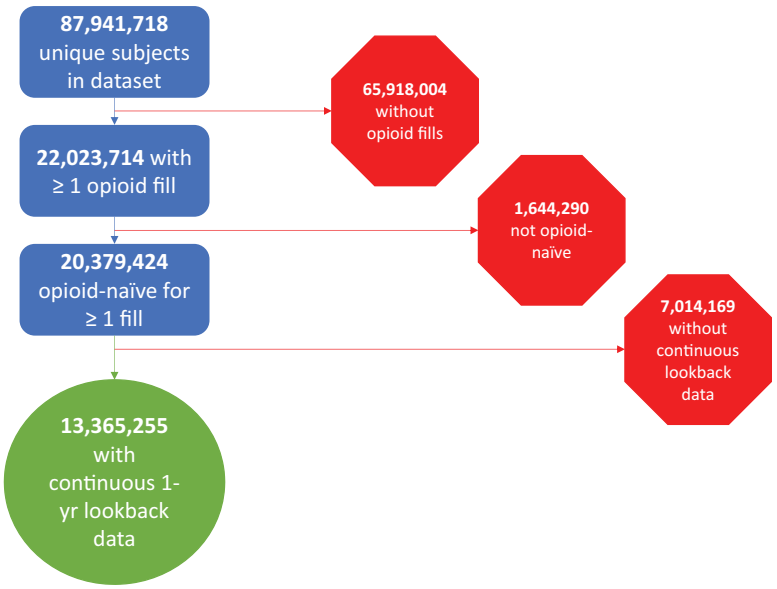

FIGURE 1. STROBE figure showing inclusion and exclusion of studied subjects.

(Fig. 4; Table 5 in the Supplemental Digital Content, http://links.lww.com/SLA/B474). Surgery patients received the highest proportion of hydrocodone and oxycodone prescriptions (90.2%; $P < 0.001$) and the highest share of oxycodone prescriptions (38.1%; $P < 0.001$) overall, as well as for each individual year studied (Table 6 in the Supplemental Digital Content, http://links.lww.com/SLA/B474).

DISCUSSION

Our findings illustrate the rising contribution of surgical and dental prescribing to opioid exposure among opioid-naive patients and underscore the need for greater attention to these important episodes of care. The percentage of new opioid prescriptions written by the "other" group (likely composed of primary care and subspecialty providers) over the course of our study period decreased substantially, with a concomitant 15.8% increase in prescribing to surgical, emergency medicine, and dental patients driven principally by changes in the surgical and dental groups (Fig. 2). Taken together, these data underscore the prominent—and growing—role that procedural care and acute pain management play in the current opioid epidemic, and the need for heightened focus on developing initiatives to encourage safe opioid prescribing across all episodes of care.

We observed the largest increases in prescribing share during the last 2 years examined: 2015 and 2016. One contributor to this change may be the lead-up to and dissemination of the CDC's primary care guidelines for opioid prescribing, which were released in March 2016.[4] These guidelines, along with the widespread attention paid to the opioid epidemic in both the scholarly and lay literature over the past several years, may have made primary care physicians more hesitant to prescribe opioids to opioid-naive

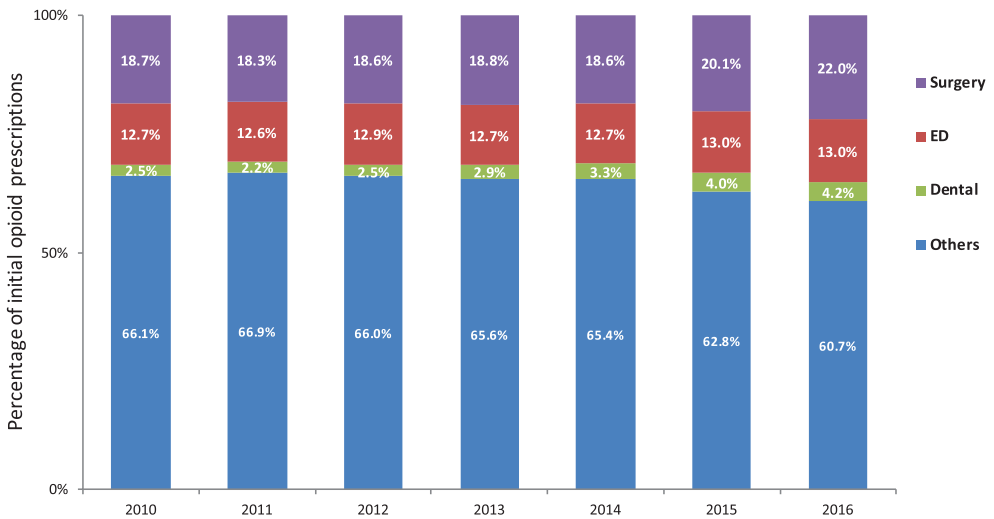

FIGURE 2. The combined percentage of initial opioid prescriptions to surgical, emergency medicine, and dental patients is increasing.

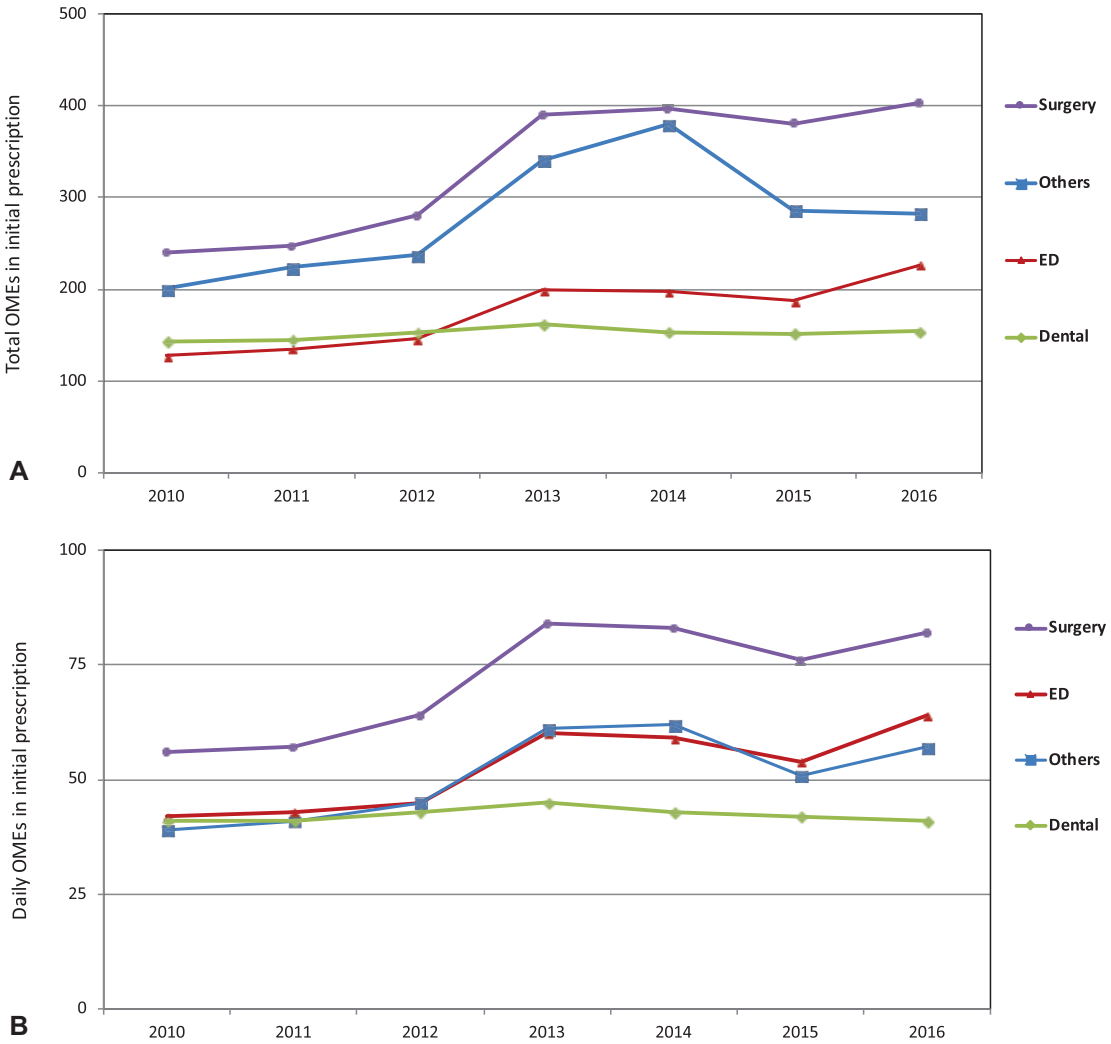

FIGURE 3. Surgical patients are prescribed the highest total (A) and daily (B) opioid amounts.

patients. Previously implemented state-level guidelines have been found to decrease opioid prescribing.[10] It is likely that opioid prescribing by primary care and pain physicians will continue to decline not only because of guideline development but also in light of multiple studies refuting the efficacy of opioids for the treatment of chronic pain.[4,6,24,25]

Similarly, the attention paid to opioid prescribing by emergency physicians, which led to the promulgation of national guidelines in 2013,[26] may be responsible for the relatively constant share of initial opioid prescriptions written to emergency medicine patients over our studied period. In contrast, until recently, relatively little attention has been paid toward opioid prescribing to surgical and dental patients. General guidelines on opioid prescribing to dental patients were not released until late 2017,[12] while specific guidelines for postoperative surgical prescribing have been proposed but not yet accepted nationally.[11,27] Postoperative opioids provide limited additional benefit when compared with nonsteroidal anti-inflammatory drugs and acetaminophen in both surgical[28,29] and dental[30–33] patients. Moreover, recent data for surgery[7,8] and dentistry[9] have demonstrated that new persistent post-procedural opioid use is common. Although short courses of opioids may provide appropriate and effective analgesia following major surgery, the potential for long-term morbidity calls into question the practice of liberal opioid prescribing after dental care and many minor surgeries.

Promoting judicious opioid prescribing has been identified as a key step in combatting the opioid epidemic.[34] Our data suggest a need for increased focus on such prescribing to surgical and dental patients through education and evidence-based guideline development. We observed that surgical patients were prescribed the highest initial amount of opioid. This aligns with prior studies demonstrating that postoperative opioid overprescribing by surgeons is common and occurs across nearly all case types.[35–39] Potent opioids, which are responsible for more overdose deaths than weaker opioids,[40] were prescribed most frequently to surgical patients, who also received the highest proportion of oxycodone prescriptions.

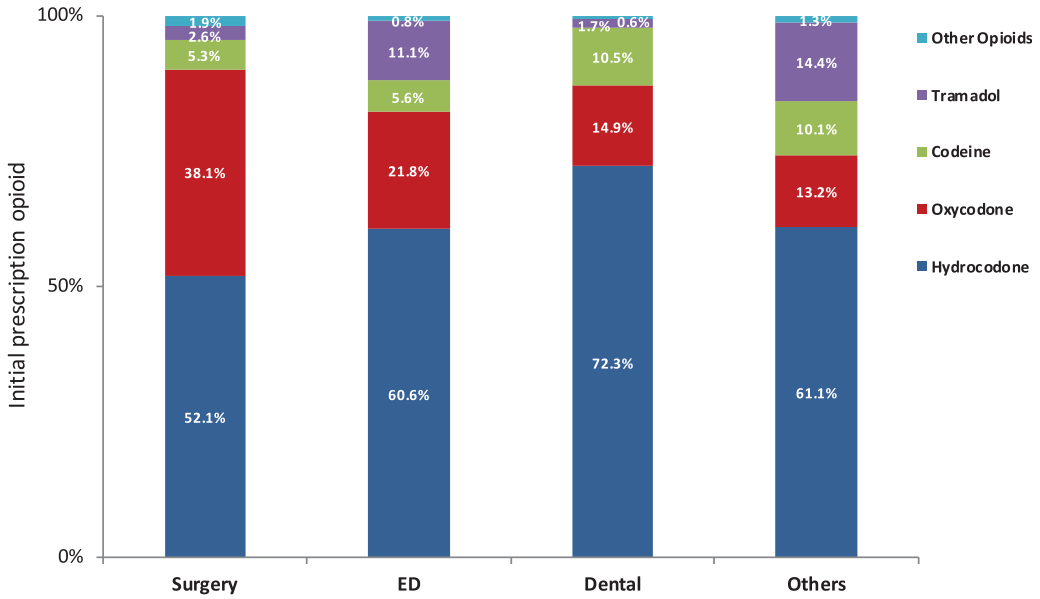

FIGURE 4. Most initial prescriptions are for potent opioids (hydrocodone and oxycodone). Surgical patients are prescribed the highest proportion of potent opioids and the highest proportion of oxycodone.

Limitations

Our study has several limitations. Our data were originally collected for administrative purposes. Although we queried pharmacy claims, we only captured filled prescriptions; prescriptions provided but not filled and prescriptions paid for with cash were not included. Furthermore, our database did not permit linking filled prescriptions with provider information, or with the indication for prescribing. In addition, we attributed specialty episodes of care based on billing codes, which may have inherent misclassification error. Finally, our data capture only employer-based insurance claims, and may not be representative of all patients, including the uninsured and underinsured.

CONCLUSIONS

The increase in initial opioid prescribing to surgical, emergency, and dental patients may relate to an increased focus on appropriate opioid prescribing by primary care and pain physicians. Our data emphasize the importance of developing evidence-based guidelines, particularly for surgeons, who prescribe the highest dosages of opioid to opioid-naive patients.

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