Factors influencing opioid prescribing after tooth extraction

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ABSTRACT

Background. Tooth extractions account for most opioid prescriptions from dentists, but specific characteristics that influence likelihood are less established. Improving understanding can facilitate development of tailored interventions to reduce unnecessary opioid prescribing.

Methods. The authors performed a retrospective review of patients 12 years and older undergoing tooth extraction at the College of Dentistry at the University of Kentucky from 2013 through 2020. The primary end point was issuance of an opioid prescription related to the encounter.

Results. In 44,387 eligible records analyzed, 10,628 (23.9%) patients received an opioid prescription. Results of multivariable logistic regression found that the factors associated with an opioid prescription included receipt of a nonopioid analgesic prescription (adjusted odds ratio [aOR], 11.36; 95% CI, 10.37 to 12.44), receipt of an antibiotic prescription (aOR, 8.29; 95% CI, 7.57 to 9.08), procedural sedation (aOR, 2.11; 95% CI, 1.93 to 2.31), surgical extraction (aOR, 1.96; 95% CI, 1.84 to 2.10), and third molar extractions (1 tooth: aOR, 1.14; 95% CI 1.04 to 1.25; 2 teeth: aOR, 2.09; 95% CI, 2.87 to 2.34; 3 teeth: aOR, 2.73; 95% CI, 2.36 to 3.15; 4 teeth: aOR, 3.45; 95% CI, 3.10 to 3.83). Factors that decreased risk included having an appointment in 2018 or later (aOR, 0.31; 95% CI, 0.29 to 0.33), in a student (aOR, 0.57; 95% CI, 0.51 to 0.65) or resident (aOR, 0.33; 95% CI, 0.31 to 0.36) clinic, and on any day other than Friday (Monday: aOR, 0.83; 95% CI, 0.76 to 0.91; Tuesday: aOR, 0.90; 95% CI, 0.83 to 0.99; Wednesday: aOR, 0.89; 95% CI, 0.81 to 0.97; Thursday: aOR, 0.88; 95% CI 0.81 to 0.97).

Conclusions. Opioid prescriptions after tooth extraction were common in patients undergoing more extensive procedures. Provider perceptions, habits, and several clinical factors appeared to influence prescribing patterns.

Practical Implications. The decision to prescribe an opioid appears to be associated with habits and factors perceived to modulate postoperative pain, which may serve as targets for opioid reduction strategies.

Key Words. Opioid; tooth extraction; oral surgery; pain management.

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A prescription from a dentist is often a person's first exposure to opioids,[1-4] which can begin a trajectory toward prolonged or problematic opioid use.[5] Although nonopioid analgesics like acetaminophen and ibuprofen are recommended for dental pain,[6-10] US dentists continue to prescribe opioids at rates several times higher than those in other countries.[11-13] This is particularly concerning, given the prevalence of adolescent and young adult patients receiving opioids from dentists[1,14] and the risk of opioid misuse, abuse, and overdose in that population.[15-17]

The commonality of unused opioids after a dental procedure[18,19] also supports the conclusion that opioids are prescribed too often. However, inherent in the authority of dentists to prescribe opioids is that there are times when opioid therapy is warranted.[20] Interventions to blindly reduce dental opioid prescriptions may therefore cause harm; a better understanding of when opioid therapy is appropriate is needed.

Development of this understanding begins with evaluating how dentists decide to prescribe an opioid. Several investigators have analyzed dental opioid prescriptions and determined that a

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limited number of indications account for most prescriptions issued.[21-23] For example, Chua and colleagues[23] found that 5 indications accounted for more than 95% of dental opioid prescription claims in the United States from 2013 through 2018. Tooth extraction alone accounted for nearly two-thirds of all prescriptions written in that study and almost 70% of 12,000 opioid prescriptions from our institution during a 6-year period.[22] However, one-half of the patients who underwent an extraction in the study by Chua and colleagues[23] did not receive an opioid prescription, and the differences between patients who received an opioid and those who did not are unclear.

The objective of our study was to examine specific patient, procedural, and clinic-related characteristics that increase or decrease a person's risk of receiving an opioid prescription after tooth extraction. These findings may inform subsequent targeted interventions to reduce unnecessary opioid prescribing by dentists.

METHODS

Our study was a retrospective analysis of electronic health record (axiUm) data from the University of Kentucky College of Dentistry, a safety net institution for Eastern Kentucky, under the approval of the University of Kentucky institutional review board. Encounter records were included if a person 12 years or older underwent tooth extraction from January 1, 2013, through September 30, 2020. Records were identified using American Dental Association Code on Dental Procedures and Nomenclature Codes D7111(S), D7140(A), D7210, D7220, D7230, D7240, D7241, D7250, or D7251.[24,25]

Variables extracted from the dental record were categorized as demographic, procedure, or appointment characteristics. Demographic characteristics collected were age, sex, residential ZIP code, and primary insurance. Race data were collected but missing in 79.2% of records and were therefore not considered. Procedure characteristics included extraction type and number, sedation administered, concomitant alveoloplasty, and whether nonopioid analgesic or antibiotic prescriptions were issued. Appointment characteristics included treatment day, time, and year as well as provider type (faculty, resident, student).

Age groups were assigned using modified Medical Subject Headings classifications, with patients aged 12 through 24 years categorized as adolescent and young adult, 25 through 44 years as adult, 45 through 64 years as middle-aged, and 65 years and older as senior. Distance traveled was calculated as linear distance between the clinic address and the central point of the patient's residential ZIP code. Rural-urban classification was assigned using the US Department of Agriculture Rural-Urban Continuum Codes[26] on the basis of the county where the residential ZIP code was located. Treatment year was categorized as before 2018 (that is, 2013-2017) or 2018 and later owing to legislation passed in the state in 2017 limiting the days' supply of initial opioid prescriptions.[27]

Complete prescription history was extracted for all included records. Prescriptions were reviewed manually and categorized as opioid analgesic, nonopioid analgesic, or antibiotic. For opioid prescriptions, daily morphine milligram equivalents (MME) were calculated using established conversion factors, assuming the patient took the total number of pills prescribed per day.[28,29] For example, a prescription for 1 to 2 tablets every 4 to 6 hours as needed was calculated as 12 total dosage units per day (2 tablets every 4 hours).

A logistic regression model was used to analyze the categorical primary outcome of whether patients received an opioid prescription. Among patients who received an opioid prescription, secondary logistic regression models were used to analyze 2 additional categorical outcomes: whether patients received a prescription for 50 or more MME per day and whether patients received a prescription for more than 3 days' supply. These secondary end points were selected on the basis of guidance from the Centers for Disease Control and Prevention's opioid prescribing guidelines and state regulations regarding days' supply of prescribed opioids.[27,30] For all models, explanatory variables were selected by means of backward selection with a threshold P value of .05. Age group and sex were included in all models regardless of significance. Demographic, procedure, and appointment characteristics were compared using independent t test and χ^2 test or Fisher exact test for continuous and categorical variables, respectively.

RESULTS

Approximately 1 in 4 patients who underwent a tooth extraction received an opioid prescription (n = 10,628 of 44,207). Patients who received an opioid prescription were younger (mean [SD],

ABBREVIATION KEY

MME: Morphine milligram equivalents.

Table 1. Characteristics for patients undergoing dental extraction, 2013 through 2020.

CHARACTERISTIC	RECEIVED OPIOID PRESCRIPTION (n = 10,628)	DID NOT RECEIVE OPIOID PRESCRIPTION (n = 33,759)	*P* VALUE
Demographic			
Age,*† no. (%)			
Adolescent and young adult	3,593 (33.81)	6,176 (18.29)	<.001
Adult	3,806 (35.81)	12,351 (36.59)	
Middle-aged	2,325 (21.88)	10,721 (31.76)	
Senior	904 (8.51)	4,511 (13.36)	
Sex, no. (%)			
Female	4,540 (42.72)	15,229 (45.11)	<.001
Male	6,077 (57.18)	18,490 (54.77)	
Other/unspecified	11 (0.10)	40 (0.12)	
Rural Urban Continuum Code classification, no. (%)			
Metropolitan	5,943 (56.97)	17,810 (53.49)	<.001
Nonmetropolitan, metropolitan adjacent	3,771 (36.15)	13,255 (39.81)	
Rural	718 (6.88)	2,234 (6.71)	
Distance traveled (miles), mean (SD)	39.9 (71.8)	32.7 (71.7)	<.001
Medicaid as primary insurance, no. (%)	6,931 (65.21)	21,311 (63.13)	<.001
Procedure			
Extraction type, no. (%)			
Surgical	6,770 (63.70)	9,526 (28.22)	<.001
Nonsurgical	3,858 (36.30)	24,233 (71.78)	
No. of extraction sites, mean (SD)	4.8 (5.3)	3.2 (4.9)	<.001
No. of third-molar extraction, no. (%)†			
0	4,592 (43.21)	25,285 (74.90)	<.001
1	1,006 (9.47)	4,065 (12.04)	
2	1,058 (9.95)	1,592 (4.72)	
3	741 (6.97)	666 (1.97)	
4	3,213 (30.23)	2,002 (5.93)	
Dentition, no. (%)			
Primary/mixed	135 (1.27)	1,000 (2.96)	<.001
Permanent	10,492 (98.73)	32,757 (97.04)	
Alveoloplasty, no. (%)	1,128 (10.61)	1,992 (5.90)	<.001
Sedation administered, no. (%)	3,576 (33.65)	2,746 (8.13)	<.001
Nonopioid analgesic prescription issued, no. (%)	4,062 (38.22)	987 (2.93)	<.001
Antibiotic prescription issued, no. (%)	2,084 (19.61)	1,360 (4.03)	<.001
Appointment			
Treatment year, no. (%)			
2013-2017	6,616 (62.25)	19,469 (57.67)	<.001
2018-2020	4,012 (37.75)	14,290 (42.33)	

* Adolescent and young adult: 12-25 years, adult: 26-45 years, middle-aged: 46-65 years, senior: older than 65 years. † Data missing for ≥0.01% of the population.

Table 1. Continued

CHARACTERISTIC	RECEIVED OPIOID PRESCRIPTION (n = 10,628)	DID NOT RECEIVE OPIOID PRESCRIPTION (n = 33,759)	*P* VALUE
Afternoon appointment, no. (%)	1,465 (21.56)	6,059 (34.71)	<.001
Appointment day, no. (%)			
Monday	2,074 (19.51)	7,024 (20.81)	<.001
Tuesday	2,199 (20.69)	7,304 (21.64)	
Wednesday	2,008 (18.89)	6,118 (18.12)	
Thursday	2,293 (21.58)	7,257 (21.50)	
Friday	2,047 (19.26)	5,946 (17.61)	
Saturday or Sunday	7 (0.07)	110 (0.33)	
Clinic type, no. (%)			
Student	571 (5.37)	4,164 (12.34)	<.001
Faculty	4,699 (44.21)	7,283 (21.58)	
Resident	5,358 (50.41)	22,309 (66.09)	

40.2 [17.8] years vs 46.8 [18.4] years; $P < .001$) and categorically more likely to be adolescents and young adults (33.81% vs 18.29%; $P < .001$). They were also twice as likely to undergo surgical extraction (63.70% vs 28.22%; $P < .001$) and 4 times more likely to receive sedation (33.65% vs 8.13%; $P < .001$). Patients who received opioids had more teeth extracted (mean [SD], 4.8 [5.3] vs 3.2 [4.9]; $P < .001$) and were more likely to undergo at least 1 third-molar extraction (56.79% vs 25.10%; $P < .001$). Patients who received opioid prescriptions were also more likely to receive concomitant prescriptions for nonopioid analgesics (38.22% vs 2.93%; $P < .001$) and antibiotics (19.61% vs 4.03%; $P < .001$). Finally, these patients were less likely to have an afternoon appointment (21.56% vs 34.71%; $P < .001$) and more likely to be seen in a faculty clinic (44.21% vs 21.58%; $P < .001$). Full demographic, procedure, and appointment characteristics of each cohort are listed in Table 1.

Results from the logistic regression considering receipt of an opioid prescription as the outcome (area under the curve [AUC], 0.861; 95% CI, 0.856 to 0.865) are presented in Table 2. Several procedure characteristics substantially increased the odds of receiving an opioid prescription, including surgical extraction (adjusted odds ratio [aOR], 1.96; 95% CI, 1.84 to 2.10) and receipt of sedation (aOR, 2.11; 95% CI, 1.93 to 2.31). Each additional extraction and third-molar extraction also increased substantially the odds of receiving an opioid prescription. Receipt of a concomitant nonopioid analgesic prescription increased the odds of an opioid prescription (aOR, 11.36; 95% CI, 10.37 to 12.44), as did receipt of an antibiotic prescription (aOR, 8.29; 95% CI, 7.57 to 9.08). Demographic characteristics associated with increased likelihood of opioid prescription were female sex (aOR, 1.08; 95% CI, 1.02 to 1.14) and metropolitan residence (aOR, 1.32; 95% CI, 1.16 to 1.49). Opioid prescriptions were less likely in patients undergoing extraction after 2018 (aOR, 0.31; 95% CI, 0.29 to 0.33), on any day other than Friday (Monday: aOR, 0.83; 95% CI, 0.76 to 0.91; Tuesday: aOR, 0.90; 95% CI, 0.83 to 0.99; Wednesday: aOR, 0.89; 95% CI, 0.81 to 0.97; Thursday: aOR, 0.88; 95% CI 0.81 to 0.97), and in a resident (aOR, 0.33; 95% CI, 0.31 to 0.36) or student clinic (aOR, 0.57; 95% CI, 0.51 to 0.65).

Logistic regression results for high-dose opioid prescription (≥50 MME/day) are presented in Table 3 (AUC, 0.723; 95% CI, 0.700 to 0.747). Of 6,781 patients who received an opioid prescription with complete data required for regression, 468 (6.9%) received a prescription for at least 50 MME per day. In this cohort, mean (SD) MME was 76.3 (16.3) per day. Each additional extraction performed increased the odds of a high-dose opioid prescription slightly (aOR, 1.06; 95% CI, 1.04 to 1.08), as did having an appointment at a resident clinic (aOR, 2.25; 95% CI, 1.79 to 2.84). Factors decreasing the likelihood of a high-dose opioid prescription included receipt of a nonopioid prescription (aOR, 0.43; 95% CI, 0.32 to 0.57), having Medicaid as primary insurance (aOR, 0.78; 95% CI, 0.62 to 0.97), and an encounter in 2018 or later (aOR, 0.73; 95% CI, 0.56 to 0.94). Having an appointment on any day other than Friday, than Friday (Monday: aOR, 0.64; 95% CI, 0.48 to 0.86; Tuesday: aOR, 0.64; 95% CI, 0.48 to 0.85; Wednesday: aOR, 0.47; 95% CI, 0.34

Table 2. Multivariate logistic regression results with an outcome of new opioid prescription (n = 43,514).

CHARACTERISTIC	ADJUSTED ODDS RATIO ESTIMATES	95% CI
Demographic		
Age group [Reference: adolescent and young adult]		
Adult	1.02	0.94 to 1.11
Middle-aged	1.02	0.92 to 1.12
Senior	0.84	0.74 to 0.95
Sex		
Female	1.08	1.02 to 1.14
Rural Urban Continuum Code classification [Reference: rural (7-9)]		
Metropolitan adjacent (4-6)	1.00	0.89 to 1.13
Metropolitan (1-3)	1.32	1.16 to 1.49
Miles traveled, each additional	1.00	1.00 to 1.00
Insurance (binary)		
Medicaid	0.89	0.83 to 0.95
Encounter year (binary)		
2018 or later	0.31	0.29 to 0.33
Procedure		
Extraction type (binary)		
Surgical	1.96	1.84 to 2.10
Extractions performed, each additional	1.02	1.01 to 1.03
No. of third-molar extractions performed [Reference: 0]		
1	1.14	1.04 to 1.25
2	2.09	1.87 to 2.34
3	2.73	2.36 to 3.15
4	3.45	3.10 to 3.83
Dentition (binary)		
Permanent	1.65	1.31 to 2.07
Alveoloplasty	1.72	1.50 to 1.97
Sedation administered	2.11	1.93 to 2.31
Nonopioid analgesic prescription issued	11.36	10.37 to 12.44
Antibiotic prescription issued	8.29	7.57 to 9.08
Appointment		
Appointment day [Reference: Friday]		
Thursday	0.88	0.81 to 0.97
Wednesday	0.89	0.81 to 0.97
Tuesday	0.90	0.83 to 0.99
Monday	0.83	0.76 to 0.91
Clinic type [Reference: faculty]		
Resident	0.33	0.31 to 0.36
Student	0.57	0.51 to 0.65

to 0.64; Thursday: aOR, 0.42; 95% CI 0.31 to 0.57), as well as in the afternoon (aOR, 0.65; 95% CI, 0.51 to 0.83), also decreased the likelihood of a high-dose prescription.

Results from logistic regression considering more than 3 days' supply as the outcome (AUC, 0.829; 95% CI, 0.816 to 0.841) are presented in Table 4. Of 6,643 patients who received an opioid prescription with complete data required for regression, 1,535 (23.1%) received a prescription for more than 3 days' supply. Mean (SD) days' supply in this cohort was 4.7 (1.3) days. Variables associated with an increased likelihood of receiving more than 3 days' supply resembled those

Table 3. Multivariate logistic regression results, with an outcome of opioid prescription with at least 50 morphine milligram equivalents per day (n = 6,781).

CHARACTERISTIC	ADJUSTED ODDS RATIO ESTIMATES	95% CI
Demographic		
Age group [Reference: adolescent and young adult]		
Adult	0.94	0.73 to 1.20
Middle-aged	0.99	0.75 to 1.30
Senior	0.94	0.65 to 1.35
Sex		
Female	1.05	0.86 to 1.28
Insurance (binary)		
Medicaid	0.78	0.62 to 0.97
Encounter year (binary)		
2018 or later	0.73	0.56 to 0.94
Procedure		
Extractions performed, each additional	1.06	1.04 to 1.08
Nonopioid analgesic prescription issued	0.43	0.32 to 0.57
Appointment		
Day [Reference: Friday]		
Thursday	0.42	0.31 to 0.57
Wednesday	0.47	0.34 to 0.64
Tuesday	0.64	0.48 to 0.85
Monday	0.64	0.48 to 0.86
Time (binary)		
Afternoon	0.65	0.51 to 0.83
Clinic type [Reference: faculty]		
Resident	2.25	1.79 to 2.84
Student	0.77	0.43 to 1.37

associated with an increased likelihood of receiving an opioid prescription. These included surgical extraction (aOR, 2.38; 95% CI, 1.97 to 2.87), number of extractions performed (aOR, 1.07; 95% CI, 1.05 to 1.09 for each additional extraction), alveoloplasty (aOR, 2.36; 95% CI, 1.13 to 3.21), sedation administration (aOR, 1.46; 95% CI, 1.18 to 1.81), and receipt of a nonopioid analgesic prescription (aOR, 1.32; 95% CI, 1.11 to 1.57). Patients were also more likely to receive a long-term opioid prescription if they had an afternoon appointment (aOR, 1.48; 95% CI, 1.26 to 1.75) or, compared to Friday, an appointment on Tuesday (aOR, 1.54; 95% CI, 1.23 to 1.93) or Wednesday (aOR, 1.97; 95% CI, 1.58 to 2.44). Having an appointment in 2018 or later reduced the likelihood of a long-duration opioid prescription considerably (aOR, 0.06; 95% CI, 0.05 to 0.08).

DISCUSSION

In this retrospective analysis over 8 years, approximately 25% of 44,387 patients who underwent a tooth extraction received an opioid prescription. In general, these prescriptions were more likely to be issued after more invasive procedures (for example, surgical extractions, extractions with sedation, extractions of greater numbers of teeth), with specific coprescriptions, and on certain days of the week. This suggests that providers actively consider a variety of procedural characteristics to guide their opioid-prescribing decisions, rather than prescribing solely as a matter of routine. The implications of this finding are that provider-focused interventions that consider clinical context, motivations, and available evidence could help amplify the impact of systems-focused interventions (for example, adjusting prescription default quantities, adapting legislation).

Table 4. Logistic regression results, with an outcome of opioid prescription with at least 4 days' supply (n = 6,643).

CHARACTERISTIC	ADJUSTED ODDS RATIO ESTIMATES	95% CI
Demographic		
Age group [Reference: adolescent and young adult]		
Adult	1.05	0.88 to 1.25
Middle-aged	0.79	0.61 to 1.02
Senior	0.89	0.63 to 1.25
Sex		
Female	0.92	0.80 to 1.05
Rural Urban Continuum Code classification [Reference: rural (7-9)]		
Metropolitan adjacent (4-6)	1.07	0.81 to 1.41
Metropolitan (1-3)	1.57	1.18 to 2.10
Miles traveled, each additional	1.01	1.01 to 1.01
Encounter year (binary)		
2018 or later	0.06	0.05 to 0.08
Procedure		
Extraction type (binary)		
Surgical	2.38	1.97 to 2.87
Extractions performed, each additional	1.07	1.05 to 1.09
No. of third-molar extractions performed [Reference: 0]		
1	0.94	0.71 to 1.25
2	1.72	1.33 to 2.23
3	2.60	1.95 to 3.48
4	2.90	2.29 to 3.66
Alveoloplasty	2.36	1.13 to 3.21
Sedation administered	1.46	1.18 to 1.81
Nonopioid analgesic prescription issued	1.32	1.11 to 1.57
Appointment		
Day [Reference: Friday]		
Thursday	1.10	0.89 to 1.37
Wednesday	1.97	1.58 to 2.44
Tuesday	1.54	1.23 to 1.93
Monday	1.23	0.95 to 1.55
Time (binary)		
Afternoon	1.48	1.26 to 1.75

Nonopioid analgesics represent an evidence-based first-line recommendation for management of acute dental pain.[31,32] However, despite wide acknowledgment that opioids "may be needed for certain patients and after certain procedures,"[20] there is little guidance available for identifying those patients and procedures. Findings from our study suggest that more extensive and invasive procedures may warrant opioid prescriptions. In 2020, Nalliah and colleagues[32] described similar distributions of patient-reported pain severity after surgical and nonsurgical extractions. Although slightly more opioids were prescribed after surgical extraction in that study (12 vs 10 hydrocodone 5-mg equivalents), the number of pills consumed was similar (5.0 vs 5.7). However, the number of teeth extracted and need for procedural sedation were not assessed in that study. In contrast, Chua and colleagues[23] observed an increased rate of opioid prescription as the number of extractions increased from 1 to 5 or more. It is therefore possible that more extractions are associated with the perception that opioid therapy is required.

The relationship between coprescribed medications, particularly nonopioid analgesics, and receipt of an opioid prescription is concerning. Although coprescription of antibiotics and opioids

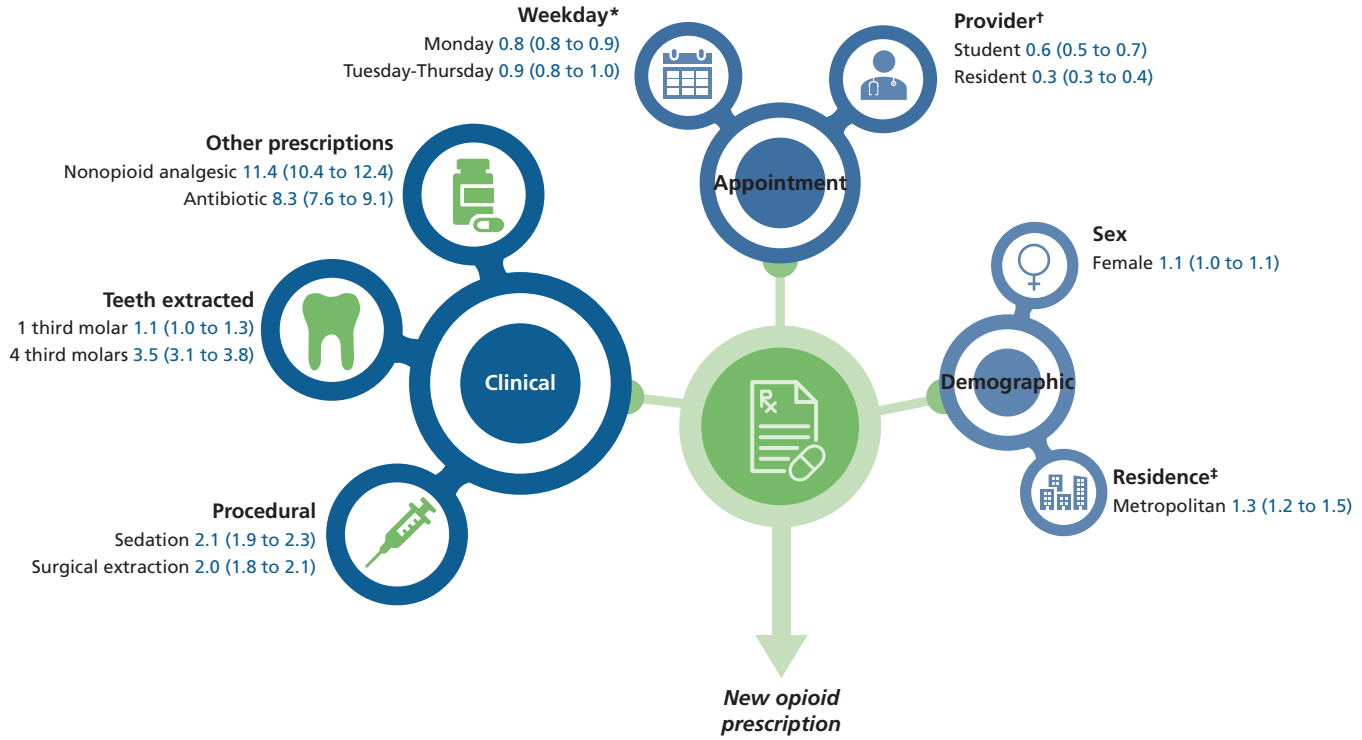

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Figure. Clinical, appointment, and demographic variables associated with an opioid prescription after dental extraction. Values are presented as adjusted odds ratio (95% CI). * Compared with Friday. † Compared with faculty. ‡ Compared with rural.

has been evaluated at population and provider levels,[33] the results of our study suggest that receipt of an antibiotic prescription increases a patient's likelihood of receiving an opioid. Receipt of a separate nonopioid analgesic prescription was associated with an 11-fold increased risk of receiving an opioid prescription, and the clinical rationale for this is unclear. It is possible that providers issued opioid prescriptions as secondary analgesics, which—as a potential source of diversion when unused—may represent a strategy to reduce unnecessary opioid prescribing. However, as we assessed prescriptions only, and common nonopioid analgesics like ibuprofen and acetaminophen are available over the counter, these findings may warrant additional investigation.

The association of various appointment characteristics with the likelihood of an opioid prescription, as well as high-dose and long-duration opioid prescriptions, is also concerning. In a national analysis of privately insured patients, Priest and colleagues[34] established that filled opioid prescriptions were more likely (OR, 1.27; 95% CI, 1.26 to 1.28) on Fridays or days before holidays. Our findings support this claim and raise additional concerns, as high-dose prescriptions, although generally uncommon, were also more likely on Fridays. In addition, prescriptions for more than 3 days' supply were more likely in the middle of the week, suggesting providers may write longer, "just-in-case" prescriptions[35] to last through the weekend.

The noted decrease in likelihood of an opioid prescription in 2018 or later, after additional state legislation regulating opioid prescribing went into effect,[27] is encouraging and suggests a role for policy interventions from an authoritative body. This aligns with existing literature supporting general reductions in opioid prescribing associated with various state-level interventions; however, these findings are mixed[36-41] and may be difficult to implement.[42] In addition, this specific legislation limited the days' supply of an initial Schedule II opioid prescription to 3 days or fewer, but did not address whether an opioid was prescribed; a mandatory prescription drug monitoring program query has been in place in Kentucky since 2012[43] and would have affected all patients in this study equally. Therefore, a reduction in overall opioid prescriptions after 2018 represents an unintended (although still potentially beneficial) consequence of that specific policy intervention. Although the marked reduction in more than 3 days' supply after 2018 suggests this intervention had the desired effect in this cohort, the mean 4.7 days' supply in the target population must also be considered.

Finally, the finding that resident and student clinics were associated with lower likelihood of an opioid prescription is encouraging, considering ongoing efforts from dental schools to combat the opioid crisis.[44-46] That said, the corollary increase in likelihood of an opioid prescription from a faculty clinic may be indicative of the challenge in changing established behaviors,[47] which may serve as a potential barrier to reducing unnecessary opioid exposure. Also, opioid prescriptions from resident clinics were more likely to be written for at least 50 MME per day; the reason for this phenomenon is unclear and could be investigated in future studies.

Our study has limitations. First, we did not assess opioid use, only opioid prescriptions. It is possible that the opioid prescriptions were not filled, although this underscores the importance of not issuing unnecessary prescriptions. If filled but not used, opioids can increase the risk of overdose for family members,[15] which also emphasizes the need to reduce prescribing. Second, we only assessed whether prescriptions were issued, and therefore we do not make claims about the appropriateness of a given prescription. Third, we did not assess patient systemic health, as these variables were not consistently available in the health record. It is possible that specific comorbid diseases (for example, psychiatric diagnoses or organ dysfunction) could influence prescribing by dentists. Fourth, we did not assess patient satisfaction, pain control, or over-the-counter analgesic use after extraction, as these have been reported on previously and do not appear to be influenced by an opioid prescription.[32] Fifth, our study was conducted in an academic institution and the findings may not be generalizable to community or private practice settings. Finally, this was a retrospective analysis of health record data, which carries inherent limitations.

CONCLUSIONS

Opioid prescribing appears to be associated with a variety of clinical and nonclinical factors (Figure). After tooth extraction, an opioid prescription appears to be more likely in patients undergoing more extensive procedures, suggesting dentists consider procedural characteristics when deciding to prescribe opioids. However, the association with several appointment- and provider-related variables suggests that there is continued opportunity for practice improvement. Future studies should evaluate barriers and facilitators to behavior change, as well as effective strategies to reduce unnecessary opioid prescriptions from dental practices. ■

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