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Opioid Analgesic Prescribing Practices of Dental Professionals in the United States

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Abstract

The prescription of opioid analgesics by dental professionals is widespread in the United States. Policy makers, government agencies, and professional organizations consider this phenomenon a growing public health concern. This study examined trends in the prescription of opioid analgesics for adults by dental professionals and associated factors in the United States. Data from the Medical Expenditure Panel Survey (1996-2013) were analyzed. Descriptive statistics were calculated separately for each year. Logistic regression analyses were conducted to estimate the overall trend during the period with and without adjusting for dental procedures and personal characteristics. Survey weights were incorporated to handle the

sampling design. The prescription of opioid analgesics following dental care increased over time. After adjusting for sociodemographic factors, source of payment, and type of dental procedure, the odds ratio (OR) of prescribing opioid analgesics following a dental visit per each decade difference was 1.28 (95% confidence interval [CI], 1.19–1.38). Surgical, root canal, and implant procedures had the highest rates of opioid prescriptions and the greatest increases in rates over the study period. After adjusting for personal characteristics and type of dental procedure, the OR of receiving a prescription for opioids comparing blacks, Asians, and Hispanics to whites was 1.29 (95% CI, 1.17–1.41), 0.57 (95% CI, 0.47–0.70), and 0.84 (95% CI, 0.75–0.95), respectively. Opioid analgesic prescriptions following dental visits increased over time after adjusting for personal characteristics and type of dental procedure. The odds of receiving a prescription for opioids were higher for certain racial/ethnic minority groups.

Knowledge Transfer Statement: This study highlights dental professionals prescribing practices of opioid analgesics by following dental treatments in the United States. With this knowledge, appropriate guidelines, protocols, and policies can be developed and implemented to address any inappropriate prescribing practices of opioid analgesics. In addition, this information could lead to an improvement in the prescribing practices of dental professionals and to evidence-based therapeutic decision making.

Keywords

dental care, adults, dental health services, opioid analgesics, drug prescriptions, dental offices

Introduction

Prescription painkillers and the risk of opioid addiction and overdose have reached epidemic proportions in the United States. More than 165,000 people died from overdoses related to the prescription of opioids from 1999 to 2014 in the United States (Centers for Disease Control and Prevention 2016; National Institute on Drug Abuse 2016). In 2014, the death toll due to opioid analgesic overdoses was more than a 4-fold increase from 2000, and this was greater than the total number of deaths due to all illicit drug overdoses combined in that same year (Centers for Disease Control and Prevention 2016). Emergency department physicians treat over 1,000 people every day due to prescription opioid misuse (Substance Abuse and Mental Health Services Administration 2013). Dentists sometimes prescribe opioid analgesics as temporary relief for toothache or postoperative pain following definitive dental care. However, dentists' prescribing practices for opioid analgesics over time are not well studied and are poorly understood.

Prescription opioid analgesic misuse and abuse are public health problems requiring urgent attention in the United States (Executive Office of the President of the United States 2016). Bohnert et al. (2016) reported that many factors contribute to the opioid analgesic abuse epidemic, such as easier access to opioids from rural communities and other nonmedical sources. In addition, the low cost of opioid analgesics to the insured consumer may sometimes tempt some patients to resell their medication to abusers for a large profit (Paulozzi et al. 2011). Furthermore, opioid analgesics are not nearly as stigmatized or contaminated as illicit drugs, which make them seem safer. These facts sometimes prevent health care professionals from anticipating the overlap between mental illness, substance abuse, and chronic pain (Paulozzi et al. 2011). This overlap and availability of nonmedical sources of opioid analgesics create additional burdens for not only dentists but also all approved prescribers of the medication. This study stems from the desire to better understand how dentists prescribe opioid analgesics for the management of dental pain.

Experts point to the prescribing practices of health care providers as a critical area for improvement, coupled with the appropriate implementation of clinical guidelines for opioid analgesic prescription practices. For example, based on research findings that there is no clear threshold at which the risk for overdoses is eliminated, Bohnert et al. (2011) recommended lowering the clinical guidelines of 100 morphine-equivalent mg. While most of the attention and responsibility for the opioid epidemic have

focused on physicians, the role of dentists in prescribing, facilitating, or preventing opioid abuse is poorly understood both at the state and national levels. To the best of our knowledge, there is limited documentation on national trend estimates of dentists' prescription practices of opioid analgesics in the United States. Therefore, this study examined trends, patient characteristics, and factors associated with the opioid analgesic prescription practices of dentists in the United States. The study is based on a nationally representative sample, and the findings will address the gaps in knowledge related to opioid analgesic prescription practices of dentists, especially with emerging evidence of the opioid epidemic in the United States.

Methods

The data source was the household component of the Medical Expenditure Panel Survey (MEPS) for the years 1996 to 2013. The survey uses complex sample designs including stratification, clustering, multiple stages of selection, and oversampling techniques to provide nationally representative estimates of the civilian noninstitutionalized population of the United States. Data analyses were based on the recommendations laid out by the National Health Interview Survey and Agency for Healthcare Research and Quality for pooling data from multiple years. The person weights for each survey were appropriately adjusted so that the sum of the weights for the pooled datasets provided nationally representative estimates.

Drug and Procedure Coding Extraction

Prescribed drug data from the MEPS were used to assess whether opioids had been prescribed for a specific visit using the Multum Lexicon variables. In this study, opioids were defined as narcotic analgesics prescribed alone or in combination with other analgesics. The prescription data were then linked to visit data to determine the type of procedures performed and the method of payments at each visit and further linked to the full consolidated data files to determine personal characteristics such as age, gender, race/ethnicity, and socioeconomic status including education, marital status, and poverty level.

The types of dental procedures included are diagnostic, preventive, restorative, periodontal, surgical, orthodontic, implant, temporomandibular disorder/temporomandibular joint (TMD/TMJ), root canal, or other procedures. Diagnostic procedures include x-rays and general examinations or consultations. Preventive procedures include sealants, fluoride treatments, and cleanings. Restorative treatments include crowns, inlays, fillings, dentures, bridges, and repairs. Periodontal treatments include gum surgery and periodontal recall visits. Surgical procedures include oral surgery, tooth extraction, and abscess treatment. Other procedures include teeth whitening and any other dental procedures that do not fit in the other categories. Since multiple types of procedures could be present at each visit, the presence/absence of each procedure type was coded as a binary variable.

Statistical Analyses

For descriptive analysis, we calculated the proportion of dental visits at which opioids were prescribed in each year and showed the nonparametric fit of the change in the proportion over the last 2 decades for all visits and visits when specific procedures had been performed. Logistic regression analyses were conducted to estimate the overall linear trend of the proportion of opioid analgesic prescriptions per visit throughout the study period with and without adjusting for procedures (whether diagnostic, preventive, restorative, periodontal, surgical, orthodontic, implant, TMD/TMJ, root canal, or other procedure had been performed) and personal characteristics. Procedure-specific analysis was also performed with or without adjusting for personal characteristics. All analyses were adjusted for the

survey design by incorporating survey weights in the analysis. All analyses were performed with the SURVEYFREQ, SURVEYMEANS, SURVEYREG, and SURVEYLOGISTIC procedures using SAS 9.4 (SAS Institute). An alpha level of 0.05 was used throughout to denote statistical significance. This study was approved by Marquette University's Institutional Review Board.

Results

In total, there were 335,164 dental visits from the MEPS respondents that had complete information, representing 3,949,014,433 dental visits in the United States. Opioid analgesics were prescribed in 9,230 visits (2.75%), representing 96,171,770 dental visits in the United States. Table 1 displays information on study population characteristics, including sources of payment, different types of procedures, and estimates of the proportion among the United States population receiving a prescription for opioids. The most common procedures were diagnostic, preventive, and restorative, and the most common sources of payment were private insurance and out of pocket. Women made up a majority of the sample, as did whites and married participants.

Table 1.
Participant Characteristics and Dental Procedures.

	<i>n</i> (<i>N</i> = 335,164) ^a	Sample %	Weighted % ^b
Visits with an opioid prescription	9,230	2.75	2.44
Procedure			
Diagnostic only ^c	34,842	10.4	9.9
Preventive only ^d	140,138	41.8	43.9
Restorative	90,009	26.9	26.7
Periodontal	9,747	2.9	2.9
Other	7,691	2.3	2.4
Surgical	31,282	9.3	8.0
Orthodontic	11,892	3.5	3.2
Implant	2,968	0.9	0.9
Temporomandibular disorder/temporomandibular joint	790	0.2	0.3
Root canal	14,137	4.2	4.1
Age			
18–29 y	52,199	15.6	15.7
30–39 y	55,197	16.5	16.0
40–49 y	67,734	20.2	19.7
50–59 y	67,439	20.1	20.2
60–69 y	49,074	14.6	15.1
≥70 y	43,521	13.0	13.4
Gender			
Male	134,556	40.1	41.9
Female	200,608	59.9	58.1
Race/ethnicity			
Hispanic	44,520	13.3	7.0
Black	34,473	10.3	6.7
Asian and Pacific Islander	16,286	4.9	3.7
White	235,249	70.2	81.4
Other	4,636	1.4	1.2
Marital status			
Married	203,072	60.6	60.7
Widowed	22,442	6.7	6.7
Divorced	37,723	11.3	11.2
Separated	5,867	1.8	1.4
Never married	66,060	19.7	20.0
Federal poverty level			
<100%	29,744	8.9	6.2
100%–124%	11,014	3.3	2.5
125%–199%	34,824	10.4	8.8
200%–399%	97,962	29.2	28.5
≥400%	161,620	48.2	54.0
Education			
Less than high school	42,436	12.7	9.2
High school diploma or equivalent	151,177	45.1	44.5
College education	100,756	30.1	32.7
Advanced degree	40,795	12.2	13.6
Primary source of payment			
Family/out of pocket	141,267	42.1	42.7
Medicaid	19,618	5.9	3.7
Medicare	2,517	0.8	0.7
Private insurance	150,856	45.0	47.4
Other	10,486	3.1	2.8
Unclassified	10,420	3.1	2.8

^aExcluding sample with 0 weight (i.e., data collected beyond survey design).

^bWeighted version *N* = 3,949,014,433; weighted percentage represents the estimated proportion of the covariate distribution among the whole United States population rather than the surveyed subsample.

^cExcluding all other procedures.

^dExcluding all other procedures except diagnostic procedures.

The unadjusted and adjusted regression results are shown in Table 2. The odds ratio (OR) of being prescribed opioids at a dental visit associated with each decade difference changed from 1.04 (95% confidence interval [CI], 0.97–1.13) to 1.28 (95% CI, 1.19–1.38) after adjusting for personal characteristics and dental procedures. Figure 1 shows the opioid prescriptions for all dental visits and for each dental visit with the type of dental procedure. The top panel represents the overall proportion, and the bottom panel represents the yearly relative proportion for the various types of dental procedures with opioid prescriptions (1 represents the overall average for the given procedure type).

Table 2.
Year Effect of Opioid Analgesics Prescribed with and without Adjusting for Personal Characteristics and/or Dental Procedures.

	Opioid Prescription per Visit, Odds Ratio per Decade (95% Confidence Interval)
Unadjusted	1.04 (0.97–1.13)
Adjusted for personal characteristics	1.17 (1.08–1.27)
Adjusted for dental procedures	1.18 (1.09–1.26)
Adjusted for both	1.28 (1.19–1.38)

Figure 1. Proportion of opioid prescriptions for all dental visit types (top) and yearly opioid prescriptions for each type of dental procedure provided (bottom).

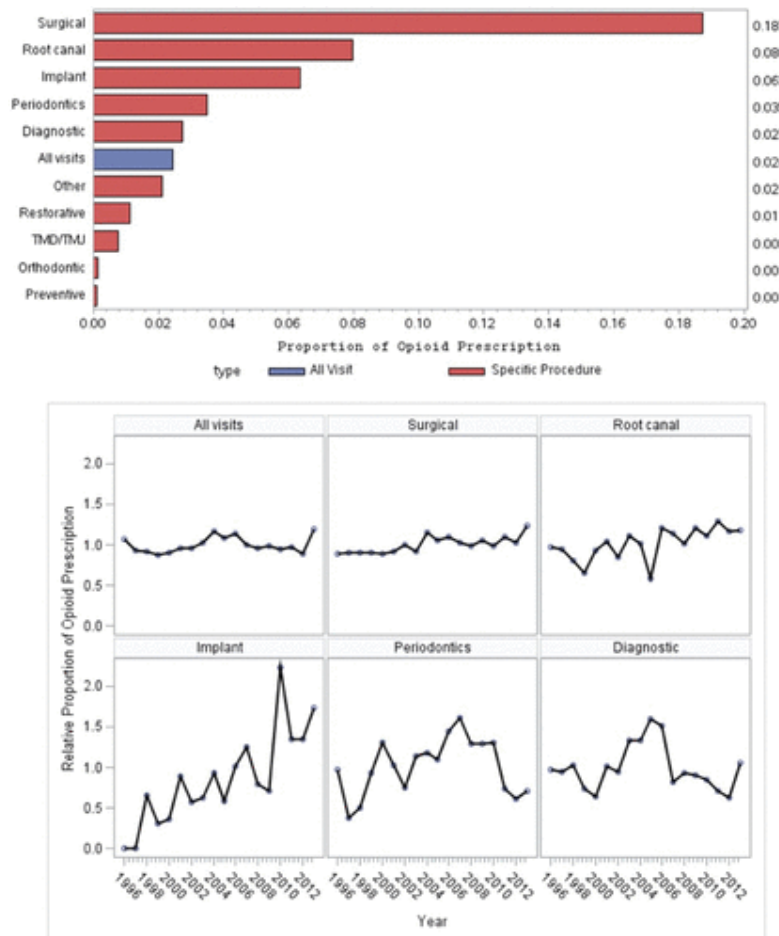


Table 3 presents unadjusted and adjusted analyses for the year effect on opioid analgesic prescriptions by procedure-specific analysis from 1996 to 2013. A somewhat increasing trend of opioid analgesic prescriptions was observed for most procedures. The 4 procedures with the highest opioid analgesic prescription rates were implant, periodontal, root canal, and surgical procedures. The OR of being prescribed opioid analgesics was significantly associated with each decade for the 4 different dental procedures after adjusting for personal characteristics: 3.75 (95% CI, 2.27–6.19), 1.35 (95% CI, 1.03–1.77), 1.31 (95% CI, 1.11–1.56), and 1.29 (95% CI, 1.17–1.42), respectively.

Table 3.

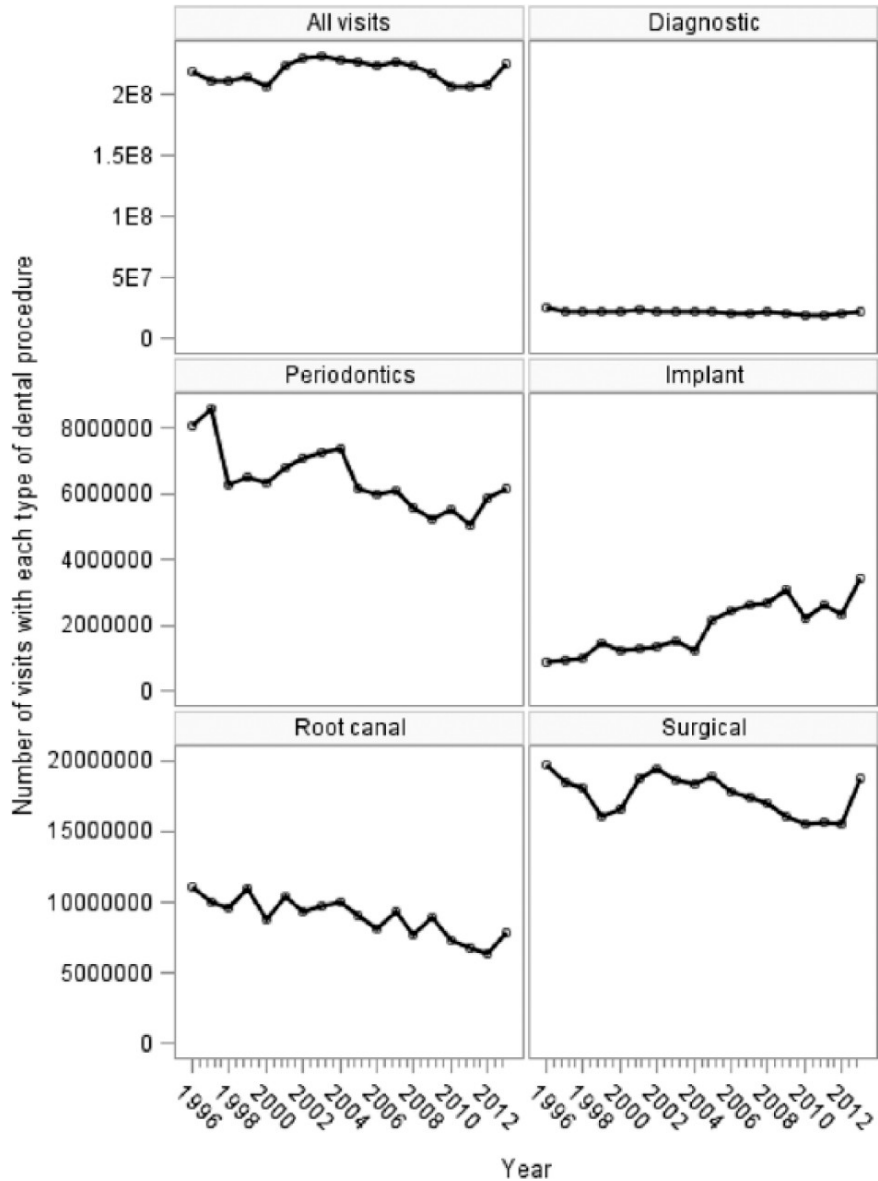
Year Effect of Opioid Analgesics Prescribed Following Dental Procedures with or without Adjusting for Personal Characteristics.

Dental Procedure	Opioid Prescription per Visit	
	Unadjusted OR per Decade (95% CI)	Adjusted OR per Decade (95% CI)
Diagnostic only	0.97 (0.83–1.13)	1.14 (0.97–1.34)
Preventive only (excluding diagnostic)	1.30 (0.91–1.87)	1.34 (0.93–1.93)
Implant	3.05 (1.99–4.67)	3.75 (2.27–6.19)
Restorative	1.14 (0.93–1.39)	1.22 (0.99–1.50)
Periodontal	1.19 (0.92–1.54)	1.35 (1.03–1.77)
Surgical	1.20 (1.09–1.31)	1.29 (1.17–1.42)
Root canal	1.27 (1.07–1.50)	1.31 (1.11–1.56)
Other	1.39 (0.85–2.28)	1.51 (0.88–2.58)
Temporomandibular disorder/temporomandibular joint	0.18 (0.04–0.80)	0.49 (0.09–2.79)
Orthodontic	0.72 (0.35–1.50)	0.47 (0.16–1.35)

CI, confidence interval; OR, odds ratio.

Figure 2 shows the dental utilization of each type of procedure over the years. We can see that the number of visits with implant procedures increased over time while the number of visits with periodontal, root canal, and surgical procedures decreased over time. This reflects approximately an expected 192,070 and 236,663 extra visits with opioid prescriptions in the United States population at 2013 compared to the prescription level a decade ago for implant and surgical procedures, respectively, while the total opioid prescriptions for periodontal and root canal procedures decreased by 9,085 and 21,760, respectively, per decade.

Figure 2. Weighted number of visits when each specific procedure was performed.



In Appendix Table 1, the OR of being prescribed opioid analgesics associated with a 10 years' difference in age was 0.75 (95% CI, 0.73–0.77). Compared to non-Hispanic whites, the OR of opioid prescriptions for Asians and Hispanics was 0.57 (95% CI, 0.47–0.70) and 0.84 (95% CI, 0.75–0.95), respectively. In contrast, the OR of opioid prescriptions for blacks and patients of other races/ethnicities was 1.29 (95% CI, 1.17–1.41) and 1.39 (95% CI, 1.09–1.76), respectively. Compared to married participants, the OR of being prescribed opioids at a dental visit for divorced participants was 1.28 (95% CI, 1.17–1.41) and for those who had never been married was 0.86 (95% CI, 0.78–0.95). Compared with the wealthiest group, the OR of opioid prescriptions for those with incomes below the poverty level was 1.25 (95% CI, 1.09–1.42). Those with advanced degrees had lower odds of receiving opioids than those with lower education levels. Although not statistically significant, people with Medicaid and Medicare were more likely to receive a prescription for opioid analgesics than those with private insurance after adjusting for other personal characteristics and dental procedures. Appendix Table 1 confirms that having a surgical procedure was associated with the highest odds of being prescribed opioids (OR, 12.4; 95% CI,

11.2–13.7), followed by root canal (OR, 4.7; 95% CI, 4.1–5.3), implant (OR, 2.8; 95% CI, 2.2–3.7), and periodontal (OR, 2.1; 95% CI, 1.8–2.5) procedures.

Discussion

We sought to understand trends in opioid analgesics prescribed by dentists to adults following dental care in the United States. Dentists' prescriptions of opioid analgesics following dental care increased from 1996 to 2013. This trend is alarming but also fairly consistent with reported increases of emergency department physicians' prescribing practices of opioids as a temporary treatment for nontraumatic dental conditions (Okunseri et al. 2012, 2015). The prescription of opioid analgesics by dentists and emergency department physicians for dental pain is clearly an unwarranted clinical practice, given that nonsteroidal anti-inflammatory drugs (NSAIDs) could be equally effective and with fewer adverse side effects (Hall et al. 2008). To the best of our knowledge, this is the first attempt at providing national estimates on the prescriptions of opioids by dentists to date. Based on these findings and reports from other agencies, dentists and emergency department physicians must exhibit caution in prescribing opioid analgesics for nontraumatic dental conditions because of the documented potential for misuse, abuse, or addiction and associated dangers of overdose (Coalition Against Insurance Fraud 2007; Maxwell 2011; Center for Lawful Access and Abuse Deterrence 2015).

We found increased odds of receiving a prescription of opioids at a dental visit: the OR ranged from 1.04 to 1.28 per decade after adjusting for personal characteristics and dental procedures. This finding clearly signifies a need to provide appropriate and timely scientific evidence to dentists regarding the potential dangers of inappropriate prescriptions of opioids when managing dental pain. In addition, the increased trend is a concern, given that the majority of the prescriptions of opioids were associated with a definitive dental procedure. This trend information clearly adds to the list of reasons why the judicious use of NSAIDs as an alternative to routine prescriptions of opioids following dental care must be promoted within and outside the dental community. Specifically, there were increased rates of opioid prescriptions with surgical, root canal, and implant procedures. Implant procedures were associated with the highest odds for the prescription of opioids among the various dental procedures examined. This finding is in sharp contrast to reports by Datta et al. (2015) in which the majority of dentists (85.8%) prescribed NSAIDs for implant surgery.

The dental community is well aware that the literature's evidence to support the use of prescription opioids following postoperative pain in fairly invasive procedures such as surgical extractions, root canals, and implant placements is not robust. Therefore, these increased odds of opioid prescriptions each year were surprising, particularly for root canal and implant procedures, given that greater efficacy could be achieved by targeting the etiology of pain, which in these cases are related to tissue injury and inflammation and not the central nervous system (Dionne et al. 2016). Clearly, there is an urgent need to raise awareness among dentists that the prescription of opioids following implant procedures could fuel the opioid epidemic, particularly with the increased number of implants placed in the United States. In this study, there was a lack of significant trend increases in prescribing opioids for diagnostic and preventive procedures. This is a welcomed finding and something that should be encouraged in light of the concerns by government agencies, professional organizations, health advocates, and news media about providers' prescription practices of opioid analgesics and the associated potential for misuse and death from drug overdose in the United States.

In this study, the odds of being prescribed opioids by dental professionals differed by socioeconomic status and race/ethnicity. The rates of opioid prescriptions were higher for patients who were low

income, had less education, and were Medicaid insured. Our finding is consistent with reported characteristics of the sociodemographics and race/ethnicity of individuals with higher mortality rates due to opioid overdose (Okie 2010). It is important to note that a report by the Centers for Disease Control and Prevention (CDC) claimed that the prescription of opioids including heroin was responsible for the death of more than 28,000 people and at least half of opioid overdose deaths (Nelson et al. 2015). In addition, our findings of higher prescription rates by dental professionals for blacks and members of other races/ethnicities compared to whites differed from national statistics for opioid poisoning deaths, for which whites have much higher rates than all other racial/ethnic groups (National Center for Health Statistics 2016). These findings may indicate a difference in opioid prescribing practices by dentists and physicians.

Due to the impact of opioid prescriptions in the United States, many reports have been released. For example, Rasubala et al. (2015) reported that prescription drug monitoring programs reduce the prescriptions of opioids by dentists. The Institute of Medicine's (2011) report, *Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and Research*, suggested major changes to education and health policy in this regard. In 2016, the CDC issued a guideline to primary care clinicians who prescribe opioids for chronic pain outside of active treatment, palliative care, and end-of-life care (Dowell et al. 2016). Recently, the senate passed the Comprehensive Addiction and Recovery Act to raise awareness about the dangers of opioid misuse as well as training in pain management and improved drug monitoring programs (Community Anti-Drug Coalitions of America 2016). In addition, the CDC is working towards preventing opioid overdose death through improving data collection, strengthening state efforts on effective intervention, and equipping health care providers with the necessary tools and data required (Community Anti-Drug Coalitions of America 2016). Furthermore, Denisco et al. (2011) reported that dentists should be encouraged to incorporate practical safeguards when prescribing opioid analgesics. These should include educating their patients about how to secure leftover opioids, screening patients for substance abuse, and developing a referral network for the treatment of substance abuse (Denisco et al. 2011).

The findings in this study should be considered in light of some limitations. First, investigators were unable to verify prescription dosages and whether patients actually filled their prescriptions and took the medications as prescribed. Second, our study relies on self-reported dental service use, which has the potential for underreporting by participants. Finally, in secondary data analysis, there is the possibility that not all potential confounding factors are available for inclusion in the analysis. Nonetheless, some of the strengths of the study include the fact that the MEPS oversamples for Hispanics, blacks, and Asians, thus providing the statistical power to examine these minority groups (Wang et al. 2008). Also, the project provides insight into the prescribing habits of dentists who happen to be frequent prescribers of pain medication including opioid analgesics for acute dental pain. Finally, the study identifies prospective risk factors to minimize opioid abuse and misuse in prescriptions for dental pain.

This study is significant and timely, given the varied prescription practices in the management of acute dental pain by dentists and emergency department physicians. In addition, this study clearly highlights the opportunity for further training of dentists in this area and for the conduct of rigorous research in the use of NSAIDs for pain in dental care, given the increases in the prescriptions of opioid analgesics. Taken together, the data offer a compelling argument to address the inappropriate prescriptions of opioids by some dentists in light of the growing trend of misuse and overdose. In conclusion, opioid analgesic prescriptions following dental visits increased over time after adjusting for personal

characteristics and dental visit types. The odds of receiving a prescription for opioids were higher for certain racial/ethnic groups and vulnerable populations.

Author Contributions

C.N. Steinmetz, contributed to data acquisition, analysis, and interpretation, drafted the manuscript; C. Zheng, contributed to conception, design, and data acquisition, drafted and critically revised the manuscript; E. Okunseri, contributed to conception and data interpretation, drafted and critically revised the manuscript; A. Szabo, C. Okunseri, contributed to conception, design, and data interpretation, drafted and critically revised the manuscript. All authors gave final approval and agree to be accountable for all aspects of the work.

A supplemental appendix to this article is available online.

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