ORIGINAL REPORT: HEALTH SERVICES RESEARCH

Prescription Drug Monitoring Program Use: National Dental PBRN Results

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Abstract: ***Introduction:*** *The American Dental Association recommends that dentists use a prescription drug monitoring program (PDMP) prior to prescribing an opioid for acute pain management.*

Objective: *The objective of this study was to examine dentists' experiences using their state PDMP, as well as the impact that state-mandated registration policies, mandated use policies, and practice characteristics had on the frequency with which dentists used their PDMP.*

Methods: *We conducted a web-based cross-sectional survey among practicing dentist members of the National Dental Practice-Based Research Network (*n = *805). The survey assessed prescribing practices for pain management and implementation of risk mitigation strategies, including PDMP use. Survey data were linked with network Enrollment Questionnaire data to include practitioner demographics and practice characteristics.*

Results: *Nearly half of respondents (*n = *375, 46.6%) reported having never accessed a PDMP, with the most common reasons for nonaccess being lack of awareness (*n = *214, 57.1%) and lack of knowledge regarding registration and use (*n = *94, 25.1%). The majority of PDMP users reported the program to be very helpful (58.1%) or somewhat helpful (31.6%). Dentists reported that PDMP use most often did not change their intended prescribing behavior (40.2%), led them not to prescribe an opioid (33.5%), or led them to prescribe fewer opioid doses (25.5%). Presence of a mandated use policy was significantly associated with increased frequency of PDMP use across a variety of situations, including prior to 1) prescribing any opioid for pain management, 2) issuing refills, 3) prescribing to new patients, and 4) prescribing to patients deemed high risk.*

Conclusion: *Findings suggest that the majority of dentists find PDMPs helpful in informing their opioid-prescribing practices. Whereas the existence of a state-mandated use policy is a consistent predictor of dentists' PDMP use, outreach and education efforts may overcome key barriers to use identified in this study.*

Knowledge Transfer Statement: *Findings from this national survey suggest that the majority of practicing dentists find PDMPs helpful in informing their opioid-prescribing practices; however, consistent PDMP use was not common. Whereas the existence of a state-mandated use policy is a consistent predictor of dentists' PDMP use, outreach and education efforts may overcome key barriers to use identified in this study.*

Keywords: behavior and behavior mechanisms, dentistry, substance-related disorders, substance abuse, prescription drug abuse, education

Introduction

Recent evidence supports the effectiveness of nonsteroidal

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anti-inflammatory analgesics for the management of most postoperative dental pain (Wong et al. 2016), and the American Dental Association's (2016) "Statement on the Use of Opioids in the Treatment of Dental Pain" recommends that dentists consider nonsteroidal anti-inflammatory drugs as first-line therapy for acute pain. However, opioids have traditionally been a standard component of acute pain management in dentistry and account for nearly one-third of prescriptions issued by US dentists (Levy et al. 2015). The majority of dental opioid prescriptions are for immediate-release medications with a high potential for abuse and diversion, including hydrocodone and oxycodone (McCauley, Hyer, et al. 2016; Cassidy et al. 2017). Furthermore, some data suggest that dentists typically prescribe more opioids than necessary or recommended for the management of acute postprocedural pain (Maughan et al. 2016).

The American Dental Association (2016) also recommends that dentists register with and use their state's prescription drug monitoring program (PDMP) to "promote the appropriate use of controlled substances for legitimate medical purposes, while deterring the misuse, abuse and diversion of these substances." To date, 49 states have a functional PDMP that collects data from pharmacies on dispensed controlled substances and makes that data available to authorized prescribers and dispensers. Although the direct impacts of PDMPs are difficult to isolate from the numerous concurrent efforts to curb overprescribing of opioids, program implementation and use have been associated with decreases in opioid prescribing, doctor shopping, and opioid-related overdose deaths (Delcher et al. 2015; Bao et al. 2016; Patrick et al. 2016; Ali et al. 2017; Brown et al. 2017; Finley et al. 2017; Deyo et al. 2018). Despite the potential benefits of PDMPs, rates of PDMP registration and use by dentists have been low (Rutkow et al. 2015; McCauley, Leite, et al. 2016; McCauley et al. 2018).

To address inconsistent PDMP use, many states are investing in improved PDMP functionality to address identified utilization barriers and adopting policies that mandate PDMP registration and/or PDMP use in circumscribed situations (Rasubala et al. 2015; Soelberg et al. 2017; Wen et al. 2017). The current study examined dentists' experiences with the state PDMP. It also investigated the impact that state-mandated registration and use policies, as well as practice characteristics, had on dentists' PDMP registration and frequency of PDMP use.

Materials and Methods

Participants

This study was conducted in partnership with the National Dental Practice-Based Research Network. The network is a consortium of dental practices and dental organizations focused on improving the scientific basis for clinical decision making (Gilbert et al. 2013). Detailed information about the network is available on its website (https://www.nationaldentalpbrn.org). The Institutional Review Board at the Medical University of South Carolina and Institutional Review Boards associated with the network approved this project. A total of 1,428 network members were randomly selected to participate in this cross-sectional survey study. Members were invited if they 1) had completed a network Enrollment Questionnaire; 2) were dentists licensed in the United States who maintained an active practice email address at which they could be contacted; and 3) indicated practicing primarily in general dentistry, endodontics, periodontics, dental public health, prosthodontics, or oral/maxillofacial surgery. Member dentists were excluded from selection if they did not provide a practice email address in the Enrollment Questionnaire or if they endorsed a specialty practice in only orthodontics, oral pathology, or pediatric dentistry.

Survey

The development and test-retest reliability of this survey are described in detail elsewhere (McCauley et al. 2018). The final survey was administered online via REDCap and consisted of 137 potential items (http://nationaldentalpbrn.org/study-results/reducing-prescription-opioid-misuse-dental-provider-intervention-development-survey.htm). Survey data were paired with practitioner and practice characteristics from the network's Enrollment Questionnaire items (http://nationaldentalpbrn.org/study-results/), which were taken from previous work in a practice-based study of dental care and a PBRN that ultimately led to the current network (Gilbert et al. 2011; Gilbert et al. 2013). Test-retest reliability estimates of the practice characteristics questionnaire were done with 10 dental faculty at the University of Florida and 10 dentists in private practice outside the 4-county area of the Florida Dental Care Study (http://nersp.nerdc.ufl.edu/~gilbert/). Depending on the measurement scale, kappa values exceeded 0.70 and intraclass correlation coefficients exceeded 0.83 for all items.

Survey Recruitment Methodology

Study recruitment took place between August 29, 2016, and December 5, 2016. Dentists received an invitation email explaining the study and inviting them to participate via a unique electronic link to the questionnaire. Although dentists could complete the survey in multiple visits, completion in a single sitting was recommended. Dentists received 3 weekly email reminders: 2 from the principal investigator and a third from their network regional coordinator. Dentists who had not responded after 4 wk (and 3 reminders) received up to 2 additional reminder contacts (via telephone, fax, email, or postal mail) from their regional coordinator. Dentists who had not completed the survey within a 10-wk time frame were considered nonrespondents, and their survey link was deactivated. Dentists were offered a $50 remuneration code for their time spent completing the survey.

Statistical Analysis

The following variables were assessed: 1) dentist demographics; 2) practice

Table 1.
States with Legislation Regarding Mandated PDMP Registration and Use.

Mandated PDMP	State
Registration	AL, AZ, AK, CA, CO, CT, DE, GA, HI, ID, IL, KY, ME, MA, MS, NV, NH, NJ, NM, OH, RI, TN, TX, UT, VT, VA, WV, DC
Use	AK, CO, CT, DE, GA, IN, KY, LA, MA, MN, MS, NV, NH, NJ, NY, NC, ND, OH, OK, PA, RI, SC, TN, UT, VT, VA, WA, WV

As of December 31, 2016, according to the National Association for Model State Drug Laws.
PDMP, prescription drug monitoring program.

characteristics, including specialty, practice type, self-reported rural/nonrural location, percentage of patients visiting only once, and percentage of patients visiting only for emergent situations; and 3) registration, access, and experiences with a state PDMP. To be asked questions regarding PDMP use, dentists had to indicate holding a current Drug Enforcement Administration (DEA) license to prescribe controlled substances. Dentists' self-reported state of practice was matched with data from the National Alliance for Model State Drug Laws (www.namsdl.org) regarding state policies of mandated PDMP registration and mandated PDMP use. To be considered a state with an active mandated registration or use policy, a state had to have enacted the policy as of December 2016. Specific criteria around mandated use vary from state to state (e.g., frequency of use, prescribing situations triggering mandated use, implicated practitioners). Twenty-eight states met criteria for "mandated use states," and 28 met criteria for mandated registration (see Table 1).

All data were consolidated in an SPSS 19 database (IBM) for analysis. Frequency distributions and descriptive statistics were computed for all outcome variables of interest. Associations of practitioner- and practice-level characteristics, as well as state policy regarding mandated use and registration, with frequency of PDMP use were examined with logistic regression analysis (ever used PDMP) and linear regression analysis (frequency of PDMP use). For these analyses, ever accessing the PDMP was assessed with the question "Have you ever accessed your state's prescription drug monitoring program database?" with answer responses of yes (1) and no (2). Frequency of PDMP use was assessed with "Please indicate how often you typically use your PDMP in the following situation: Prior to any prescribing of an opioid for pain management." Answer options were presented in a 7-point Likert scale and included never (1), almost never, few times, sometimes, most of the time, almost always, and always (7). Additional situations assessed included "prior to prescribing to patients I deem high risk," "prior to prescribing to new patients," and "prior to issuing an opioid refill." The "dentist-reported frequency of PDMP use" variable summed items regarding frequency of checking the PDMP prior to any opioid prescription, prescribing to high-risk patients, prescribing to new patients, and prescribing refills. Higher scores (range, 4 to 28; mean = 18.2; median = 18) on this item represented more frequent use of the PDMP.

Results

Sample Demographics

A total of 822 dentists (58% of invited) completed the survey. Of the remaining invited dentists, the majority did not ever access the survey (n = 508, 36%); however, a minority accessed but did not complete it (n = 49, 3%), refused participation (n = 10, 0.7%), no longer met eligibility criteria (n = 6, 0.4%), or provided an inactive email address (n = 33, 2%). The majority of participants were Caucasian (80%) and male (71%), reported practicing in a nonrural location (86%) and general practice setting (77%), and cited being an owner or employee of a private practice (79%). Participants did not differ from nonrespondents with respect to sex, race, Hispanic/Latino ethnicity, or self-reported rural practice location status. Participants were more likely to report being a general practitioner versus a specialist (χ^2 = 15.3, n = 1,428, df = 1, $P < 0.001$; 61% of general practitioners participating vs. 49% of specialists) and were significantly younger, $F(1, 1{,}408) = 12.6$ ($P < 0.001$), than nonrespondents by a mean of 2 y. Table 2 presents descriptive information about participating dentists and their practice characteristics.

Dentists' Experiences with PDMP Use

Given that Missouri did not have an operable PDMP at the time of the survey, data from dentists practicing in Missouri were removed for subsequent analyses (n = 17; revised total, N = 805). Slightly less than half (n = 375, 46.6%) of respondents reported that they had never accessed their state PDMP. Three individuals responded "no" to the survey item regarding ever accessing their state PDMP and endorsed responses to follow-up items regarding frequency of use that indicated at least minimal PDMP use. These 3 individuals were recoded to "yes" for the item regarding ever accessing their state PDMP, and their data regarding reasons for nonuse were not included in reported results. The most oft-reported reasons for not accessing were lack of awareness of the program's existence (n = 214, 57.1% of nonusers) and lack of knowledge regarding how to register with or access the program (n = 94, 25.1% of nonusers). Dentists practicing in states without mandated registration policies were no more likely than those in states with such policies to endorse lack of awareness (χ^2 = 0.37, df = 1, n = 375, P = 0.54) or lack of knowledge (χ^2 = 0.01, df = 1, n = 161, P = 0.93) as their reason for nonuse. Similarly, dentists practicing in states without mandated use policies were no more likely than those in states

Table 2.
Descriptive Characteristics for Participating Dentists and Their Practices for the Full Sample of Respondents and for PDMP Users.

Variable	Full Sample ($N = 822$)		PDMP ($n = 419$)	
	n	%	*n*	%
Practitioner sex				
Male	582	71	299	71
Female	231	28	117	28
Practitioner ethnicity				
Hispanic	42	5	13	3
Non-Hispanic	771	94	401	96
Practitioner race				
White	660	80	349	83
Non-White	162	20	66	16
Practitioner type				
General practice	635	77	333	79
Specialist	187	23	85	20
Practice type				
Private	647	79	312	74
Managed care	64	8	48	11
Public[a]	46	5	25	6
Academic	58	7	31	7
Practice location				
Nonrural	705	86	345	82
Rural	112	14	72	17
Age, y, mean ± SD	53 ± 11.7		52 ± 11.7	

PDMP, prescription drug monitoring program.
[a]Public setting includes public health, community, and government practice settings.

with such policies to endorse lack of awareness ($\chi^2 = 0.50$, $df = 1$, $n = 375$, $P = 0.48$) or lack of knowledge ($\chi^2 = 3.66$, $df = 1$, $n = 161$, $P = 0.06$) as their reason for nonuse. Additional reasons included perceiving the process as too time-consuming ($n = 16$, 4.3% of nonusers), believing that the information would have no impact on prescribing ($n = 12$, 3.2% of nonusers), concerns about the timeliness or accuracy of the program data ($n = 11$, 2.9% of nonusers), and not knowing how to discuss the information with patients ($n = 10$, 2.7%).

Dentists' reported frequency of PDMP use prior to any prescribing of an opioid for pain management, initial prescribing to patients deemed as high risk, new patients, and issuing refills are presented in Table 3. A within-subjects analysis of variance was conducted to assess for significant differences in dentists' mean self-reported PDMP use across the 4 clinical scenarios (any pain management, new patient, refill, and high risk). The Mauchly W test revealed a violation of the assumption of sphericity ($\chi^2 = 103.32$, $df = 5$, $P < 0.001$); thus, the Huynh-Feldt correction was applied to subsequent within-subjects analysis of variance results. Dentists' self-reported frequency of PDMP use varied significantly across clinical scenarios, $F(2.675, 1{,}104.69) = 181.21$ ($P < 0.001$). Subsequent pairwise comparisons revealed significant mean differences among scenarios such that dentists reported the most frequent PDMP access when prescribing to patients deemed high risk (mean = 5.56, SD = 1.85), followed by prescribing refills (mean = 4.60, SD = 2.17), prescribing to new patients (mean = 4.23, SD = 2.18), and, finally, prescribing in any pain management situation (mean = 3.80, SD = 2.03).

The majority of users reported PDMP use to be very helpful ($n = 241$, 58.1%) or somewhat helpful ($n = 131$, 31.6%), whereas only 6% ($n = 25$) reported program use as not very helpful or not helpful at all. Dentists reported that program use most often did not change their intended prescribing behavior ($n = 167$, 40.2% of users), led them to not prescribe an opioid ($n = 139$, 33.5%), or led them to prescribe fewer doses of an opioid for pain management ($n = 106$, 25.5%). Only 2 dentists reported that program use most often led them to prescribe more doses of opioids than initially intended.

Factors Associated with Ever Accessing a PDMP

Among dentists reporting having never accessed their state PDMP, 41% (vs. 49% of PDMP users) practiced in a state without a mandated registration policy ($\chi^2 = 4.45$, $df = 1$, $n = 789$, $P = 0.04$). Among dentists reporting having never accessed their state PDMP, 67% (vs. 39% of PDMP users) practiced in a state without a mandated use policy ($\chi^2 = 62.65$, $df = 1$, $n = 790$, $P < 0.001$). Practitioner characteristics (i.e., sex, age [median split at age 55 y]), Hispanic ethnicity, specialist status [vs. generalist]), practice characteristics (i.e.,

Table 3.
Dentists' Reported Frequency of Using Their State PDMP prior to Prescribing an Opioid in Various Practice Scenarios.

Scenario	Dentists ($n = 430$),[a] n (%)				
	Always/Almost Always	Most of the Time	Sometimes	Few of the Times	Almost Never/Never
Any prescribing of an opioid for pain management	110 (26)	23 (6)	60 (14)	81 (20)	141 (34)
Initial prescribing to patients deemed "high risk"	277 (67)	27 (6)	33 (8)	37 (9)	41 (10)
New patients	158 (38)	17 (4)	53 (13)	60 (14)	126 (30)
Issuing refills	184 (44)	29 (7)	59 (14)	45 (11)	97 (23)

PDMP, prescription drug monitoring program.
[a]Values do not sum to 430 due to dentists opting not to respond to items. Percentages presented are valid percentages; missing respondents are not included in the denominator.

Table 4.
Logistic Regression of Whether the Practitioner Reported Ever Having Accessed a PMDP.

	Odds Ratio	95% CI
Sex: male	1.02	0.7 to 1.5
Age: ≤55 y	1.53	1.1 to 2.1
Ethnicity: Non-Hispanic	2.74	1.3 to 5.7
Race: Caucasian	1.71	1.1 to 2.6
Specialist: yes	0.84	0.6 to 1.3
Practice location: rural[a]	1.9	1.2 to 3.1
Percentage of patients visiting only once: ≥6%	1.21	0.9 to 1.7
Percentage of patients visiting for emergencies: ≥11%	1.11	0.8 to 1.6
Mandated registration: yes	0.89	0.7 to 1.2
Mandated use: yes	3.35	2.4 to 4.6

Analysis, $n = 712$: 822 questionnaire respondents – 17 who practice in Missouri – 93 who had missing data and were eliminated listwise in the regression analysis. Outcome variable: 0 = the respondent did not report ever having accessed a PMDP, 1 = the respondent did report ever having accessed a PMDP.
PDMP, prescription drug monitoring program.
[a]"Rural" practice location based on dentist self-report along this continuum: inner city of urban area, urban (not inner city), suburban, rural—recoded into rural (1) vs. nonrural (0).

rural location, percentage of practice patients presenting for only 1 visit [median split at 5%], and percentage of practice patients presenting intermittently or for emergencies only [median split at 10%]), and state policy factors (i.e., presence of mandated registration and presence of mandated use policy) were examined for their association with having ever accessed their state PDMP (yes/no). Logistic regression results are presented in Table 4. The likelihood of ever accessing a PDMP was significantly higher among dentists who were younger, who were of non-Hispanic/Latino Caucasian race, who practiced in a rural location, and who practiced in a state that had a mandated PDMP use policy, with the last variable having the largest odds ratio. Mandated registration was no longer significantly associated with ever accessing a PDMP in the context of practice and practitioner characteristics.

Factors Associated with Dentist's Reported Frequency of PDMP Use

Immutable practitioner characteristics (i.e., sex, age [median split at age 55 y], Hispanic ethnicity, specialist status [vs. generalist]) and practice characteristics (i.e., rural location, percentage of practice patients presenting for only 1 visit [median split at 5%], and percentage of practice patients presenting intermittently or for emergencies only [median split at 10%]) were entered into block 1 of the linear regression model. State policy factors (i.e., presence of mandated registration and presence of mandated use policy) and dentists' perception of PDMP helpfulness (very helpful vs. somewhat, not very, or not at all helpful) were entered into block 2 of the regression model. The outcome of interest was dentist-reported frequency of PDMP use. Linear regression results, limited to persons who reported having ever accessed a PDMP, are presented in Table 5 and indicate that the presence of a state-level mandated use policy and the dentist's perception that PDMP use was

Table 5.
Linear Regression of Factors Associated with Dentist-Reported Frequency of PDMP Use among Those Who Reported Ever Having Used a PDMP: Final Model.

	Beta	95% CI
Block 1 variables		
Sex: male	0.000	–1.58 to 1.57
Age: ≤55 y	–0.004	–1.50 to 1.38
Ethnicity: Non-Hispanic	0.010	–3.76 to 4.60
Race: Caucasian	0.061	–0.73 to 3.04
Specialist: yes	–0.036	–2.51 to 1.18
Practice location: rural[a]	0.040	–1.07 to 2.52
Percentage of patients visiting only once: ≥6%	–0.052	–2.19 to 0.74
Percentage of patients visiting for emergencies: ≥11%	–0.068	–2.44 to 0.51
Block 2 variables		
Mandated registration: yes	–0.059	–2.19 to 0.57
Mandated use: yes	0.243	2.05 to 4.92
Perceived helpfulness of PDMP: very helpful	0.258	2.30 to 5.08

R^2 = .157, adjusted R^2 = .131. Analysis, n = 367: 822 questionnaire respondents – 17 who practice in Missouri – 375 who reported never having accessed a PDMP – 63 who had missing data for a variable included in the analysis and were excluded listwise.
PDMP, prescription drug monitoring program.
[a]"Rural" practice location based on dentist self-report along this continuum: inner city of urban area, urban (not inner city), suburban, rural—recoded into rural (1) vs. nonrural (0).

very helpful were significantly associated with higher frequency of PDMP use.

Discussion

To our knowledge, this is the first national study of the impact of mandated registration and use policies on dentists' PDMP use. A statewide survey conducted in 2014 found that 38% of dentists had ever accessed their state's PDMP, while our national study conducted in 2016 observed a 47% usage rate (McCauley, Leite, et al. 2016). In the current study, mandated use policies (not registration policies) were associated with a greater likelihood of dentists reporting having ever accessed their PDMP, and mandated use policy remained a significant predictor of the frequency of PDMP use in the context of other practice and practitioner factors.

The predominance of mandated use as a significant factor associated with ever using a PDMP and frequency of PDMP use (see Tables 4 and 5) underscores the role that policy can play in encouraging PDMP use. Mandating use of the PDMP is a strategy recommended by the Centers for Disease Control and Prevention, and dentists' use of the PDMP was recently (March 2018) recommended by the American Dental Association; however, the literature evaluating the opioid-related outcomes of PDMP implementation remains inconsistent, likely due in part to variations in the opioid-related outcomes examined and the variations in PDMP programs across states (Brady et al. 2014; Finley et al. 2017; Deyo et al. 2018). Our data suggest that for a differential impact on PDMP uptake among dentists, one such policy-level distinction to consider is that between mandated registration and mandated use.

The key reasons for never having accessed a PDMP as reported by responding dentists were lack of awareness of the system and lack of knowledge regarding how to access it. These factors of awareness and system access are not surprising, because they have been identified as barriers among other practitioner populations (Irvine et al. 2014; Rasubala et al. 2015; Blum et al. 2016). It is encouraging that these factors are modifiable. However, neither lack of awareness nor lack of knowledge regarding the PDMP was associated with applicable state-mandated registration and use policies, suggesting that these factors remain notable barriers to dentists ever accessing a PDMP, even in states that have enacted such policies.

Many respondents reported that the PDMP was helpful, and perceived helpfulness of the PDMP was a significant associate of more frequent total PDMP use. Consistent with previous research, dentists indicated that PDMP use most often confirmed their original prescribing decision or led them to prescribe fewer opioids than originally planned (Reifler et al. 2012; Rasubala et al. 2015; McCauley, Leite, et al. 2016; Lin et al. 2017). Respondents in this study cited the highest levels of PDMP usage when they were treating patients whom they judged to be at high risk for opioid abuse. Intuitively, it seems optimal for dentists to target high-risk patients, but there have been calls for a universal-precautions approach instead (Jones et al. 2014), as no single risk assessment tool can discern aberrant drug-taking behavior with high accuracy (Moore et al. 2009; Radnovich et al. 2014). Multiple barriers to consistent prescriber PDMP use were identified by previous studies, including accessibility, quality and interpretability of data, uncertainty regarding how to respond in instances of suspected diversion or abuse, fear of legal retribution, and privacy and data security concerns (Islam and McRae 2014; Griggs et al. 2015). Even in the presence of registration and use mandates, dentists will still likely benefit from addressing the aforementioned

barriers to consistent PDMP use, with additional instruction on how to optimize that usage and apply it to the patients in their practices.

Although this study has important strengths, its limitations should be taken into account as inferences are made from it. Although we observed an important association with state policies regarding PDMP registration and use, we did not have state-specific measures of enforcement, which could affect dentists' behavior. Even among states that mandate registration and use of PMDP, there is substantial interstate variation that has a practical impact on dentistry. For example, some states exempt prescriptions that are written for <7-d supply, which represents the bulk of opioid prescriptions in dentistry to prevent or treat acute pain (McCauley et al. 2018). This study is based on self-reports and is retrospective; as such, no prescribing data were available. This study limited its recruitment sample in an attempt to maximize the relevance of the survey and capture data from the intended dental demographic. It did not recruit dentists whose primary practice specialty was orthodontics, oral pathology, or pediatric dentistry, given the anticipated lower rates of DEA licensure among these dental practice groups and/or low rates of prescribing opioids. However, because DEA licensure data are not available for dentists not participating in the survey, we cannot definitively state that no orthodontist, pediatric dentist, or oral pathologist had a DEA license or did not prescribe opioids. As such, results may not generalize beyond participating practitioner groups. Although analyses demonstrated only minor differences between participating and nonparticipating dentists, unmeasured variables may have influenced the representativeness of our sample, and our 58% response rate should be noted as a potential limitation. Network members were not recruited randomly, and factors possibly associated with network membership, such as an interest in clinical research, may make network clinicians unrepresentative of dentists at large. However, analyses demonstrated that network practitioners have much in common with the profession at large (Makhija, Gilbert, Rindal, Benjamin, Richman, and Pihlstrom 2009; Makhija, Gilbert, Rindal, Benjamin, Richman, Pihlstrom, et al. 2009), and network studies found that network dentists report patterns of diagnosis and treatment that are similar to patterns determined from nonnetwork dentists (Gordan et al. 2009; Rindal et al. 2012; Norton et al. 2014; Gilbert, Gordan, et al. 2015; Gilbert, Riley, et al. 2015; Heaven et al. 2015). Finally, this study did not examine specific features of the PDMP, such as data-reporting intervals, capacity to integrate into electronic health records, or other user-friendly features, which may reduce barriers reported in previous clinician surveys (Blum et al. 2016; Lin et al. 2017).

In light of national calls by dental professional organizations for increased PDMP use, the results from this study suggest that additional efforts are needed to ensure that all dentists who prescribe opioids become fully aware that such programs exist and learn how to register, log into the system on a recurring and nonburdensome basis, and best make use of the information in the program databases. Future research should investigate how best to implement PDMP use in the dental office, focusing on barriers to use, how to communicate findings to patients, how to customize nonopioid alternatives to pain control, and how to integrate PDMP access into an existing clinic workflow via electronic dental record software.

Author Contributions

J.L. McCauley, G.H. Gilbert, contributed to conception, design, data acquisition, analysis, and interpretation, drafted and critically revised the manuscript; D.L. Cochran, contributed to data interpretation, drafted and critically revised the manuscript; V.V. Gordan, contributed to conception, design, data acquisition, and interpretation, drafted and critically revised the manuscript; R.L. Leite, contributed to design, data interpretation, critically revised the manuscript; R.B. Fillingim, contributed to conception and design, critically revised the manuscript; K.T. Brady, contributed to conception and design, data interpretation, provided feedback and editorial comments. All authors gave final approval and agree to be accountable for all aspects of the work.

Acknowledgments

This research was supported by the National Institute on Drug Abuse (grant K23-DA036566) and the National Institute of Dental and Craniofacial Research (grant U19-DE-22516). Opinions and assertions contained herein are those of the authors and are not to be construed as necessarily representing the views of the respective organizations or the National Institutes of Health. The informed consent of all human subjects who participated in this investigation was obtained after the nature of the procedures had been explained fully. An Internet site devoted to details about the nation's network is located at http://NationalDentalPBRN.org. We are very grateful to the network's regional coordinators who followed up with network practitioners to improve the response rate: Midwest Region—Tracy Shea, RDH, BSDH; Western Region—Stephanie Hodge, MA; Northeast Region—Christine O'Brien, RDH; South Atlantic Region—Hanna Knopf, BA, Deborah McEdward, RDH, BS, CCRP; South Central Region—Claudia Carcelén, MPH, Shermetria Massingale, MPH, CHES, Ellen Sowell, BA; Southwest Region—Stephanie Reyes, BA, Meredith Buchberg, MPH, Colleen Dolan, MPH). The authors declare no potential conflicts of interest with respect to the authorship and/or publication of this article.

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