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A Dental School Survey Assessing Dental Student Knowledge, Attitudes and Prescribing Behavior Regarding Opioid Use and Abuse

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ABSTRACT

Purpose/Objectives: While improvements have been made in the amount of opioid prescriptions written by dentists, studies continue to show wide variability in opioid prescribing practices among dentists, suggesting additional education in this area is needed. The purpose of this study was to evaluate opioid knowledge, attitudes and prescribing behaviors among dental school students.

Methods: The authors conducted a web-based survey of dental students at the University of Minnesota School of Dentistry from 2016 through 2018. The survey was comprised of demographic information, student knowledge of clinical and regulatory interventions to reduce prescription opioid abuse, student attitudes and knowledge regarding the magnitude and causes of opioid misuse and abuse, and student opioid prescribing patterns. Statistical analysis was conducted to determine whether calendar time or progression in the dental program were associated with differences in survey responses.

Results: The response rate was 43.67% for a total of 586 dental student participants over the course of this study. The knowledge, attitudes, and behaviors regarding opioid use and abuse among dental students was influenced by both the dental school program curriculum as well as the passage of time during which the evolution of students views and awareness about opioids impacted their responses.

Conclusions: Misperceptions and a lack of knowledge influence dental student attitudes and behaviors related to prescription opioids. Understanding the influence of the dental school curriculum and the passage of time on dental students' knowledge, attitudes, and prescribing behavior may assist in guiding the development of dental curriculum to improve best practices in pain management and prevent the misuse, abuse, and diversion of prescription opioids. Academic dentistry plays a significant role in targeting gaps in student knowledge and understanding that will lead to the development and consistent implementation of best practices for pain management and safe opioid prescribing in dentistry.

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Introduction

The crisis of opioid misuse, addiction, and overdose is an ongoing public health crisis in the United States. While the overall national opioid prescribing rate has declined, in 2017 there were still nearly 59 opioid prescriptions written for every 100 Americans. Studies suggest ongoing non-medical use of prescription opioids is highly correlated with medical use of prescription opioids [1-6].

Dentists are among the top prescribers of immediate-release opioid analgesics in the United States7. Improvements have been made in opioid prescribing by dentists, yet studies continue to show wide variability in opioid prescribing behavior. This variance reflects the need for quality improvement measures and risk mitigation strategies aimed at optimizing prescribing practices [8-12]. Studies at the University of Minnesota School of Dentistry demonstrate significant benefit from developing and implementing clinical decision support systems designed to modify dental providers' opioid prescribing behavior toward evidence-based recommendations for acute pain management [13,14]. However, recent studies suggest dental practitioners do not always align with proposed guidelines for opioid prescribing [15]. Among the reasons given are insufficient information, inconsistent guidelines,

and lack of training and education on the risks of addiction and diversion [16,17].

To identify potential opportunities for optimizing prescribing practices among dentists, information regarding the development of dentists' knowledge, attitudes, and prescribing behavior related to opioids is necessary. The primary aim of the present study was to evaluate opioid knowledge, attitudes and prescribing behaviors among dental students at the University of Minnesota School of Dentistry. To our knowledge, this is the first report of a dental school-based survey, completed over a three-year time period, assessing information from dental students related to opioid use and abuse.

Materials and Methods

Participants

We conducted a web-based survey of dental students at the University of Minnesota School of Dentistry from 2016-2018. During this three-year period, all dental students were asked to participate in the survey. Responses were collected from the first year (D1), second year (D2), third year (D3) and fourth year (D4) classes. Participation was voluntary and no compensation was offered. Each potential study participant was provided with a Project Information Sheet explaining the study background, procedures, confidentiality, voluntary nature, study contacts and questions, and statement of consent. The University of Minnesota Human Research Protection Program reviewed this project and approval for this research was obtained (IRB Approval #1606E89381).

Survey Design and Fielding

Using the Qualtrics platform (SAP), we developed a confidential, anonymous, and encrypted survey of dental students at the University of Minnesota School of Dentistry. The survey was comprised of 34 questions to identify demographic information, explore attitudes and knowledge regarding the magnitude and causes of opioid misuse and abuse, assess knowledge of clinical and regulatory interventions to reduce prescription opioid abuse, and determine opioid prescribing patterns. An email providing a brief explanation and survey link was distributed to potential dental student participants. Appropriate settings were used to ensure only one submission per link. The survey link remained open for completion for 30 days. Up to three reminder email messages were sent to non-respondents beginning seven days after the initial mailing.

Data Analysis

Demographic characteristics of survey respondents were summarized using counts and percentages. In order to determine whether calendar time or progression in the dental program were associated with differences in Likert scale survey responses, we fit linear regression models with the outcome of survey response and the categorical predictors of survey year (2016, 2017, or 2018) and dental class year (D1, D2, D3, or D4). Robust standard errors were used in joint significance tests to determine whether there was a statistically significant impact of survey year or dental class year. Additionally, we refit the models with the additional predictors of sex and age group (20-24, 25-34, and 35-45 years old) to determine whether survey responses varied significantly by sex or age. To account for multiple testing, we performed a Bonferroni correction for the total number of Likert scale survey questions, and p-values less than 0.0026 (=0.05/19) were considered statistically significant. All analyses were performed in R version 3.6.1 (R Foundation for Statistical Computing, Vienna, Austria).

Results

Respondent Demographic Characteristics

A total of 1342 dental students received the survey during the study period. We received 586 completed surveys for a response rate of 43.67%. In 2016, there were 214 respondents: 47 (22%) were first year dental students, 45 (21%) were second year dental students, 65 (30%) were third year dental students and 57 (27%) were fourth year dental students. In 2017, there were 241 respondents: 80 (33%) were first year dental students, 50 (21%) were second year dental students, 65 (27%) were third year dental students and 46 (19%) were fourth year dental students. In 2018, there were 131 respondents: 58 (44%) were first year dental students, 42 (32%) were second year dental students, 18 (14%) were third year dental students and 13 (10%) were fourth year dental students. The gender of the participants in this study was 51% male and 49% female. Eighty-one percent of students responded being non-Hispanic white across the three survey years. The age of the participants was as follows: 45% were between the ages of 20-24 years, 51% were between the ages 25-34 years, and 4% were between the ages of 35-54 years. Survey respondents were more likely to be earlier in their dental school training and younger in later survey years (Table 1).

Table 1: Respondent Demographic Characteristics

	2016 (n = 214)	2017 (n = 241)	2018 (n = 131)
Class year			
D1	47 (22%)	80 (33%)	58 (44%)
D2	45 (21%)	50 (21%)	42 (32%)
D3	65 (30%)	65 (27%)	18 (14%)
D4	57 (27%)	46 (19%)	13 (10%)
Gender			
Male	107 (52%)	113 (51%)	54 (47%)
Female	98 (48%)	108 (49%)	62 (53%)
Age			
20-24 years old	77 (38%)	99 (44%)	70 (60%)
25-34 years old	120 (59%)	114 (51%)	44 (38%)
35-54 years old	7 (3%)	10 (4%)	3 (3%)

Attitudes Regarding the Magnitude and Causes of Opioid Related Misuse and Abuse

Students were more likely to respond that over the last 12 months they had heard a lot about prescription opioid abuse as their class year increased ($p<0.001$) and in later survey years ($p<0.001$) (Figure 1). Almost all respondents (96%) indicated prescription opioid abuse is a problem in their community. Significantly more students in later survey years indicated prescription opioid abuse was a bigger problem than those responding in earlier years ($p<0.001$). The number of students with this belief increased significantly over the course of their dental school program ($p<0.001$). On average, students in all class years responded that insufficient state regulation contributes to prescription opioid abuse some to a little. Students in later survey years were more likely to respond that insufficient state regulation contributes to prescription opioid abuse ($p<0.001$). In later survey years, students thought that aggressive marketing and promotion contributed more greatly to prescription opioid abuse ($p<0.001$). Student class year or survey year were not significantly associated with respondents' belief that rogue prescribers and pill mills contribute to prescription opioid abuse. Almost all respondents (96%) indicated the addictive potential of prescription opioids contributes at least some to prescription

opioid abuse. However, we identified no significant differences in responses among class years or survey years for this item. Over the course of their education, significantly fewer students indicated they believe that the lack of safe and effective alternatives to opioids contributes to prescription opioid abuse ($p<0.001$) (Figure 2). As students advanced through the dental school curriculum, they were more likely to strongly disagree that pain is commonly under treated in the United States today ($p=0.002$). Respondents in later survey years were more likely to disagree more strongly that laws reducing prescription opioid abuse unfairly limit patients' access to prescription opioids ($p=0.002$). Students more advanced in their educational program, and those in later survey years were more likely to agree that opioids are overused to treat acute dental pain ($p<0.001$). Different class years and different survey years were not associated with significant differences in the belief that patients commonly embellish or fabricate their pain symptoms to obtain prescription opioids. Students in later survey years were more likely to respond that physical dependence often occurs when prescription opioids are used long term ($p<0.001$). Additionally, female students were more likely than male students to believe that addiction, physical dependence, tolerance, and hypersensitivity occurs when opioids are used long term (all $p<0.001$).

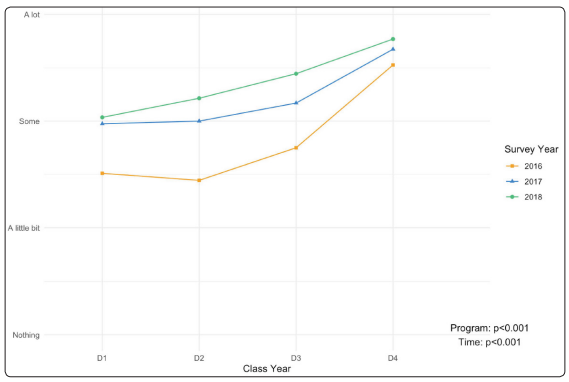

Figure 1: Plot summarizing scaled responses to the survey question, "Over the last 12 months how much have you heard about prescription opioid abuse?" The mean response is plotted by class year (D1-D4) and survey year (2016-2018). Each line of connected dots on the plot represents the responses for a given survey year. The program p-value assesses whether there are differences between the mean responses for different class years and the time p-value assesses whether there are differences between the mean responses for different survey years

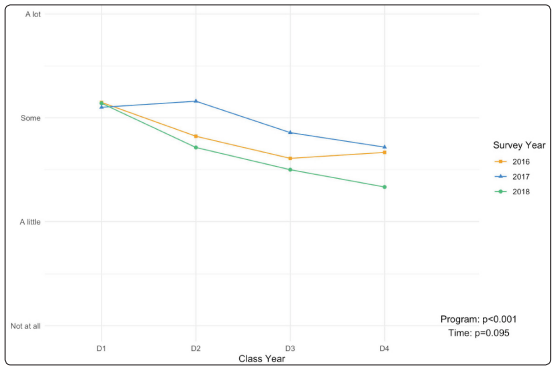

Figure 2: Plot summarizing scaled responses to the survey question, "How much do you think that the lack of safe and effective alternatives to opioids contributes to prescription opioid abuse?" The mean response is plotted by class year (D1-D4) and survey year (2016-2018). Each line of connected dots on the plot represents the responses for a given survey year. The program p-value assesses whether there are differences between the mean responses for different class years and the time p-value assesses whether there are differences between the mean responses for different survey years

Knowledge of Clinical and Regulatory Interventions To Reduce Prescription Opioid Abuse

Student respondents generally supported requiring prescribers to consult a centralized patient database before prescribing opioids to reduce prescription opioid abuse. However, we identified no significant differences in responses among class years or survey years for this item. Later survey years were associated significantly with respondents more strongly supporting limiting the number of prescription opioids for their first prescription to reduce prescription opioid abuse ($p<0.001$).

Prescribing Behavior

Across all survey years, respondents became significantly more confident in their opioid prescribing skills as they advanced in their curriculum ($p<0.001$) (Figure 3). By the fourth year, the students were somewhat confident on average in their opioid prescribing skills. Of those in the same class year, older students were significantly more confident in their opioid prescribing skills ($p<0.001$). Respondents in later survey years were less likely to prescribe an opioid in clinical practice today compared to a year ago ($p<0.001$) (Figure 4).

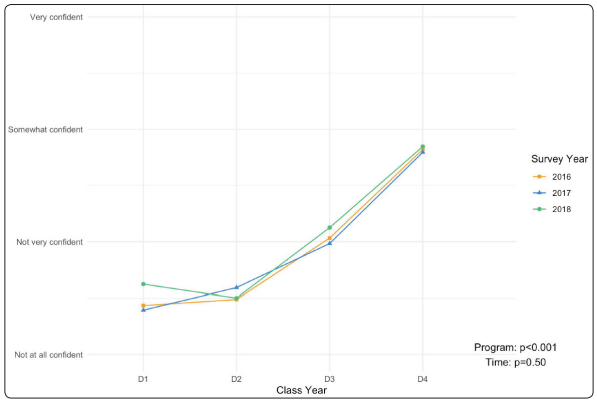

Figure 3: Plot summarizing scaled responses to the survey question, "How confident are you in your clinical skills related to prescribing opioids?" The mean response is plotted by class year (D1-D4) and survey year (2016-2018). Each line of connected dots on the plot represents the responses for a given survey year. The program p-value assesses whether there are differences between the mean responses for different class years and the time p-value assesses whether there are differences between the mean responses for different survey years.

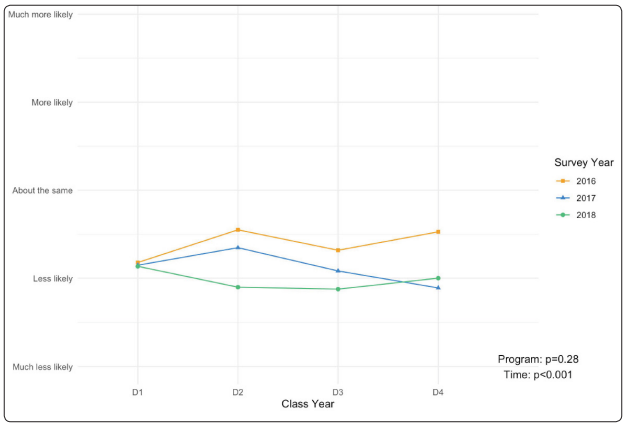

Figure 4: Plot summarizing scaled responses to the survey question, "How much more or less likely are you to prescribe an opioid in clinical practice today compared to a year ago?" The

mean response is plotted by class year (D1-D4) and survey year (2016-2018). Each line of connected dots on the plot represents the responses for a given survey year. The program p-value assesses whether there are differences between the mean responses for different class years and the time p-value assesses whether there are differences between the mean responses for different survey years.

Discussion

Prescription opioid misuse and abuse has increased significantly over the past two decades leading to dependence, overdoses, and deaths. Dentists are one of the leading prescribers of short-acting opioids for acute pain management7. In this study, we developed a novel dental school-based survey conducted over a three-year time period. The survey queried dental students regarding their opioid knowledge, attitudes, and prescribing behavior over time. The survey allowed us to note changes in these factors related to the impact of the dental school curriculum as well as the influence of the passage of calendar time.

Our results show that the dental school curriculum had a significant impact on student knowledge, attitudes, and behavior related to opioid use and abuse. One significant finding was that as students advanced in their dental curriculum, they were less likely to believe that a lack of safe and effective alternatives to opioids contributed to prescription opioid abuse. Over the course of their dental education, students became more aware of safe and effective alternatives to opioids for the management of acute dental pain such as acetaminophen and non-steroidal anti-inflammatory medications. Another significant finding related to the dental curriculum was that as dental students progressed in their education, they were less likely to agree that pain is commonly undertreated in the United States today. We also found the dental school curriculum significantly increased student confidence in their clinical skills related to prescribing opioids. These results reflect information gained through the dental school curriculum taught by faculty in clinical pharmacology and oral surgery. The curriculum in these courses covers topics in pain management, prescription writing, state legislation and regulations, opioid and chemical dependency, and addiction. Third-year dental students take these classes. This may explain the significant curriculum effect on student responses noted with advancing class year.

This study also demonstrated that the passage of time significantly influenced dental student respondents' opioid knowledge, attitudes, and prescribing behavior. Our results show that in later survey years, dental students were more likely to respond that insufficient state regulation contributes to prescription opioid abuse. We found that over the study period, more students acknowledged that aggressive marketing and promotion contributed to prescription opioid abuse. This finding is consistent with other studies showing false and misleading marketing campaigns by opioid manufacturers resulted in increasing rates of opioid addiction [18]. Several states have implemented counter-marketing through public service and outreach programs to educate the public about the risks and dangers associated with opioid abuse and addiction to combat the opioid crisis. Additionally, state and federal prosecutors have taken legal action against opioid manufacturers for fraudulent marketing practices in violation of the law [19].

We also found that over the passage of time, students disagreed more strongly that laws reducing prescription opioid abuse unfairly limit patients' access to prescription opioids. We also noted that over time, students were more likely to respond that physical dependence often occurs when prescription opioids are used long term. During the study period, an increasing number of students more strongly supported limiting the number of prescription opioids for their first prescription to reduce prescription opioid abuse. While the dental faculty approves the final prescription, student prescriber behavior is reflected in the pain assessment of their patient and their treatment approach to pain that may include the use of short acting opioids. During the passage of time, more students responded they were less likely to prefer prescribing an opioid in clinical practice today compared to a year ago. These findings, reflecting an increasing awareness over time, may be related to the public nature of the opioid crisis, state rules and regulations, national opioid prescribing guidelines, and various initiatives implemented during the study period to address opioid use and misuse including the University of Minnesota Opioid Prescribing Protocol [13,14]. By the end of the study period in 2018, many initiatives were underway nationally, statewide, and locally informing on the problem of prescription opioid abuse and evidence-based pain management. This change in prescribing behavior is consistent with a 2016 study showing 75% of surveyed dentists indicated they prescribed opioids [12]. A follow-up study in 2018 showed 11% of dentists prescribed opioids only, and 18% prescribed opioids in combination with an NSAID or acetaminophen [17]. While change over time is a main principle or belief in developmental psychology, the influence of sense of time on human behavior is beyond the scope of the present study [20].

We also found that the combination of both the dental school curriculum and change over time significantly influenced dental student respondents' opioid knowledge, attitudes, and prescribing behavior. Our results show statistically significant passage of time and curriculum effects on how much responding dental students heard about prescription opioid abuse over the last 12 months. Both the curriculum and the passage of time significantly influenced the opinion of dental students that prescription opioid abuse is a moderate to big problem in their community. This study also revealed the combination of the dental curriculum and the passage of time resulted in students more strongly agreeing that opioids are overused to treat acute dental pain.

In the present study, an early cohort of dental student respondents believed the lack of safe and effective alternatives to opioids contributes to prescription opioid abuse. The literature reveals similar misperceptions among other provider groups. A 2016 study showed 66% of primary care physicians knew the most common route of opioid abuse was swallowing pills whole, but 46% reported incorrectly that abuse-deterrent formulations were less addictive than conventional opioids. Only 25% were concerned about the potential for opioid diversion, and 33% responded that interventions to reduce prescription opioid abuse affected patients clinically appropriate access to pain treatment [23]. The initial misperception among dental students and other provider groups reveals a lack of awareness of evidence-based safe and effective acute pain management strategies. However, our study demonstrates that as respondents advanced in school, fewer third- and fourth-year dental students believed pain is commonly under treated in the United States today or that the lack of safe and effective alternatives to opioids contributes to prescription opioid abuse. Our study revealed the apprised student responses were due to a statistically significant effect of the dental curriculum.

The problem of prescription opioid abuse is complex and multifactorial. There are several limitations to the present study. Factors beyond those investigated in this study influence the opioid epidemic and deserve further investigation. All data in this study were derived from a survey conducted at a single institution and

the study sample is not geographically diverse. The prevalence of opioid abuse and opioid mortality varies greatly between regions and states. States experiencing a higher level of opioid mortality may have more students who know someone or have treated a patient affected by opioid abuse. Students may vary in their experience and knowledge regarding the opioid crisis based on the differences from state to state in the prevalence of opioid abuse and mortality. Different states may have more funding directed toward opioid research (and education), resulting in more educational (delete educational) opportunities for students to learn about opioids. We cannot generalize our results to a larger multicenter population. Since the information provided by the respondents was self-reported, validating the generalizability of our findings will require additional studies across targeted diversified populations. The brief and closed-ended response options in the survey limited the amount and depth of information collected. Only a minority of the responses to the survey items revealed statistical significance relative to the school curriculum, the passage of time, or both. The sample size was relatively small; however, the response rate in this study is within the range of reported response rates to surveys among dental professionals [22]. Response rates decreased for more advanced students suggesting participants in the format of serial surveys may have encountered survey respondent fatigue during the course of this study [23]. Since the survey was anonymous, we do not have data on the non-responders and we are unable to assess for the presence of nonresponse bias. In the future, the generalizability of findings and representativeness would be improved by conducting a collaborative multifactorial cross-institutional study with multi-state nationwide recruitment.

Conclusion

Our survey is the first multi-year study examining the influence of dental school curriculum and the passage of time on dental students' knowledge, prescribing behavior, and attitudes regarding prescription opioids as the students progress through a four-year dental curriculum. Both the dental school curriculum and the passage of time influence dental students' knowledge, attitudes, and prescribing behavior regarding opioids. The knowledge gained from this study can assist dental educators in designing dental curriculum to improve best practices in pain management and interventions to prevent misuse, abuse, and diversion of prescription opioids.

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