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The Effect of Rescheduling of Hydrocodone on Prescription Writing Among University of Kentucky Dentists

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Robert Taylor, Student

Dr. Sarah Wackerbarth, Committee Chair

Dr. Sarah Wackerbarth, Director of Graduate Studies

The Effect of Rescheduling of Hydrocodone on Prescription Writing Among University of Kentucky Dentists

CAPSTONE PROJECT PAPER

A paper submitted in partial fulfillment of the
requirements for the degree of
Master of Public Health
in the
University of Kentucky College of Public Health
By
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Lexington, KY

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ABSTRACT

Opioid abuse has become a public health crisis over the last two decades. Hydrocodone is the most frequently prescribed opioid to patients whose deaths are related to prescription drug abuse. On October 6, 2014, Federal law changed hydrocodone, an opioid-based analgesic, from Schedule III to Schedule II. This limits the number of ways it can be prescribed, including eliminating refills. This study examined hydrocodone and oxycodone prescriptions written across all dental clinics associated with the University of Kentucky College of Dentistry and analyzed three different dental disciplines that perform procedures that require pain management. Prescription data was obtained through axiUm, the College of Dentistry's electronic health record. The amount of hydrocodone as morphine milligram equivalents, number of pills, and number of prescriptions were assessed via a two-sided t-test to determine whether or not the legislation had a significant impact on hydrocodone and oxycodone prescription writing. Significant reductions of 27.4% of prescriptions per procedure and 26.0% of pills per procedure were noted among all UKCD faculty. No significant changes were seen with oxycodone prescription writing. Oral Surgery saw a significant reduction in two of the three categories: prescriptions per procedure and pills per procedure. General Dentistry saw a significant rise in decision to change hydrocodone from a Schedule III to Schedule II drug impacted the prescription writing habits of University of Kentucky College of Dentistry providers by reducing the overall amount of hydrocodone written across the college, however the impact within different specialties varied.

Key Words: opioids, dentistry, hydrocodone, DEA schedule

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ACRONYMS AND ABBREVIATIONS

CDC.....	Center for Disease Control
KASPER.....	Kentucky All Schedule Prescription Electronic Reporting
HB1.....	House Bill 1 of the 2012 Kentucky General Assembly
DEA.....	United States Drug Enforcement Administration
IMS Health.....	Intercontinental Marketing Services
IRB.....	University of Kentucky Institutional Review Board
UKCD.....	University of Kentucky College of Dentistry
CDT Code.....	Code on Dental Procedures and Nomenclature
MME.....	Morphine Milligram Equivalent

INTRODUCTION

Opioid abuse has become a public health crisis over the last two decades (1). Studies have shown that hydrocodone is the most frequently prescribed opioid to patients whose deaths are related to prescription drug abuse (2). On October 6, 2014, federal law changed hydrocodone, an opioid-based analgesic, from Schedule III to Schedule II (3). This changed the number of ways it can be prescribed, including eliminating refills. Preliminary data shows that it has helped reduce the number of hydrocodone prescriptions nationally among most medical services (4). However, the impact of the change failed to curb hydrocodone prescriptions by dentists at a similar level to other medical specialties (4). This is significant, as dentists account for 9.8% of opioid prescriptions (4). Questions exist concerning the long-term effect the schedule change has had on hydrocodone prescription writing in dentistry and whether the change in hydrocodone scheduling has had an effect on prescribing oxycodone. This study examined hydrocodone and oxycodone prescriptions written across all dental clinics associated with the University of Kentucky College of Dentistry, identifying any change in prescription writing before and after the change in scheduling. The study also provided the opportunity to analyze prescription writing practices across the dental specialties.

Prescription data was obtained through axiUm, the College of Dentistry's electronic health record. The amount of hydrocodone, number of pills, and number of prescriptions were assessed via a two-sided t-test to determine if the difference between hydrocodone prescription writing before and after the schedule change was significant. Any change in oxycodone prescriptions were noted as well. Provider numbers were used to establish the specialty of the prescribing doctor. Results of each were compared to address the research questions.

Background

Opioids

Opioids are a class of drugs derived from opium that are most frequently used as pain killers.

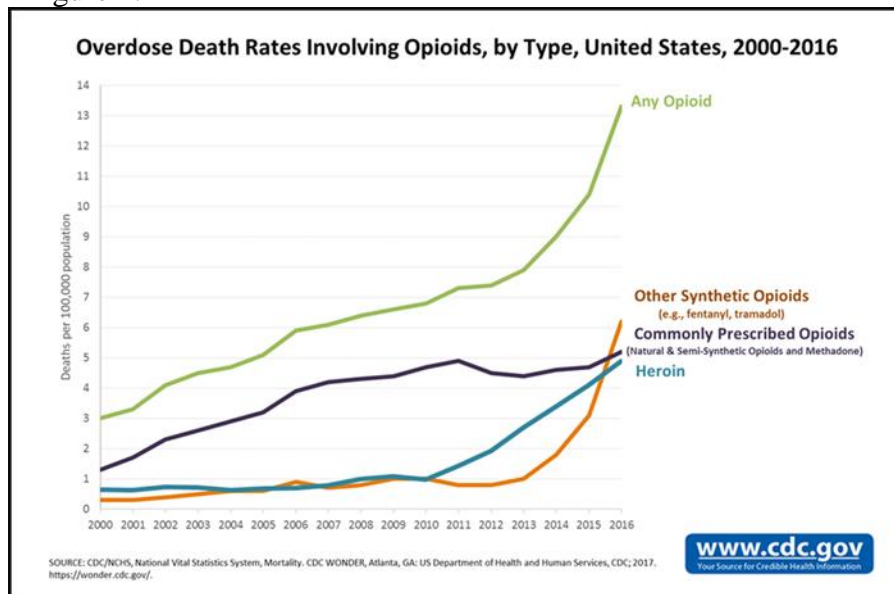
This includes commonly used prescription drugs such as fentanyl, hydrocodone, and oxycodone, as well as illegal drugs such as heroin (5). Morphine is the prototype opioid analgesic.

Oxycodone and hydrocodone are semisynthetic congeners of morphine and share its ability to produce analgesia and some level of sedation and anxiety relief (6). Both drugs are very effective at treating moderate to severe pain, especially aching-type pain that is often produced post-dental surgery. Opioid-based analgesics come with significant side effects. Side effects are dose dependent and include respiratory depression, constipation, gastrointestinal spasm, and dependence (6). Opioid toxicity can involve an altered mental state, central nervous system depression, peripheral vasodilation, pulmonary edema, hypotension, bradycardia, and seizures (7). Respiratory depression is the most serious side effect. Tidal volume and respiratory rate both decrease under the influence of opioids. A respiratory rate of 16 to 18 breaths per minute can drop to 3 to 4 shallow breaths per minute. This is a life-threatening situation. Respiratory depression is typically the cause of death in opioid overdoses (6). Overuse can lead to both physical and mental dependence, as well as tolerance. As tolerance increases it takes a higher dose of the drug to achieve the same effect. The lethal dose can be significantly higher in a tolerant patient. However, there is always a lethal dose regardless of the tolerance level of the person. (6).

U.S. drug overdoses have been on the rise for four decades, and opioid overdoses have played a significant role in their rise (1). U.S. sales of prescription opioids quadrupled from 1999 to 2010

(7). Data shows that opioid analgesics were involved in 30% of all drug overdose deaths in 1999, and that number increased to 60% by 2010 (1). Over the last decade the crisis has intensified. Total opioid overdoses have nearly doubled. This includes overdose increases in natural and semisynthetic opioids such as hydrocodone, synthetic opioids like fentanyl, and heroin (see Figure 1). In 2015, 33,000 Americans died of an opioid overdose (8).

Figure 1.



The cause of the epidemic of opioid abuse and overdose is multifactorial. At the provider level, clinical practices and insufficient oversight fail to curb inappropriate prescribing habits. Many insurance policies do not cover safer, more expensive alternatives. At the patient level, many people maintain a view that prescription drugs are not harmful, thus leading to overuse (1). In reality, as many as 21% to 29% of chronic pain patients misuse opioids (9). Prescription opioids have also been identified as a gateway drug for heroin, as 80% of heroin users first misused opioids (10).

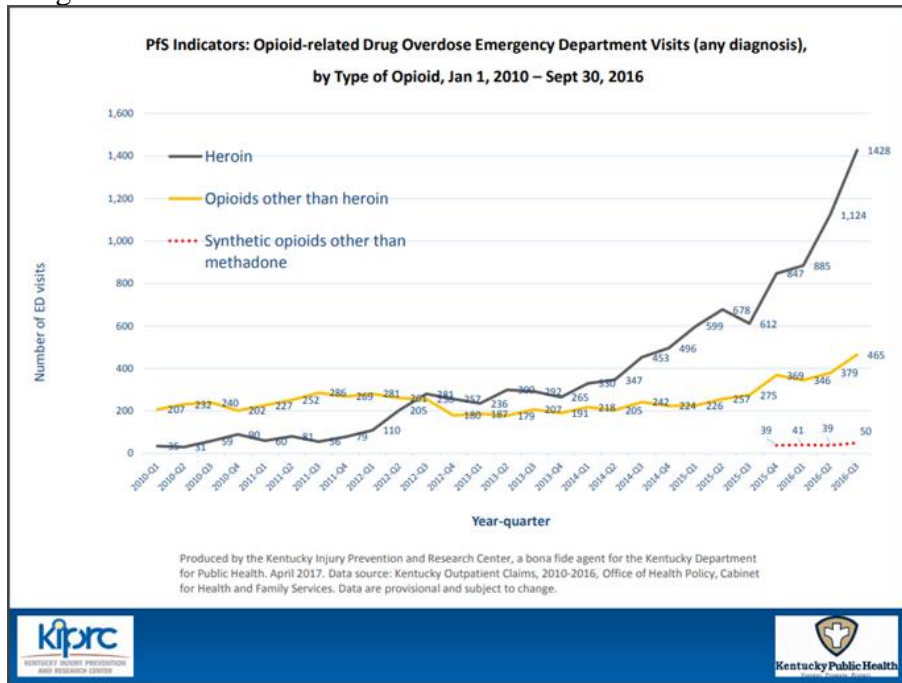
Opioids in the Commonwealth of Kentucky

Kentucky continues to be heavily affected by opioid abuse. Current opioid abuse and overdoses have reached a level of crisis (11). Kentucky has taken steps to prevent opioid abuse. In 2012, the Kentucky General Assembly passed House Bill 1 (HB1) mandating the use of Kentucky All Schedule Prescription Electronic Reporting (KASPER). KASPER is a statewide electronic prescription tracking system that allows providers to access the patient's prescription history to better identify potential abuse and drug seeking behavior, focusing on abuse of Schedule II and III narcotics (12). In 2015, the Kentucky Cabinet for Health and Family Services submitted an overview of the effects of House Bill 1 (13). The impact evaluation aimed to evaluate HB1 on reducing prescription drug abuse and unlawful transfer in Kentucky, identify unintended consequences associated with implementation of HB1, and develop recommendations to improve effectiveness of HB1 and mitigate unintended consequences (13).

The impact evaluation deemed KASPER was successful. Opioid prescriptions decreased from 2012 to 2015 (13). "Doctor shopping" behavior dropped by 50% (13). "Doctor shopping" was defined as a patient receiving multiple prescriptions from four or more different prescribers or from four or more different pharmacies within a three-month period. Despite the improvements, Kentucky is still dealing with an opioid crisis. Figure 2 shows that in the first quarter of 2010, there were 242 emergency department visits related to opioid overdose. Opioids such as hydrocodone and oxycodone accounted for 207 overdoses and heroin accounted for 35 overdoses. By the third quarter of 2013 heroin accounted for 281 overdoses and other opioids accounted for 256. The last reported data in the 3rd quarter of 2016 revealed 1428 heroin overdoses and 465 overdoses from other opioids. In seven years, the overdose rate for heroin has

gone up 40-fold and other opioids 2.25-fold. Overall, emergency department opioid overdoses went from 242 to 1893 (14). As previously stated, 80% of heroin users first misuse opioids. It is clear that more extensive measures need to be implemented to curb access to prescription opioids.

Figure 2.



Federal Regulations of Opioids

The opioid epidemic isn't isolated to Kentucky. It exists to some extent in all regions of the U.S., both urban and rural. Before October 2014, the United States Drug Enforcement Administration (DEA) had the two major sources of over-the-counter prescription opioids scheduled differently. Oxycodone was a Schedule II, while hydrocodone was a Schedule III. There are significant differences between Schedule II and Schedule III drugs as seen in Table 1.

(15). The major differences are that Schedule II drugs have a higher abuse potential, require a written prescription, and cannot be refilled.

Table 1.

Schedule II	Schedule III
High abuse liability	Lower abuse liability
Require a written prescription	Can be called in with a DEA number
No refills	Up to 5 refills in 6 months
Oxycodone, Hydrocodone and combinations currently	Hydrocodone and combinations prior to October 6 th , 2014

On October 6, 2014, the DEA changed hydrocodone and hydrocodone combination analgesics from Schedule III to Schedule II in an effort to curb the amount of hydrocodone being prescribed

(3). The overall effect on the medical community has been positive by reducing opioid prescriptions (4). In 2016, Jones et al. published “Effect of US Drug Enforcement Administration’s Rescheduling of Hydrocodone Combination Analgesic Products on Opioid Analgesic Prescribing.” This brief article in the Journal of the American Medical Association analyzed prescription data from an IMS Health Inc. national prescription audit. It accounted for 80% of the retail-filled prescriptions of hydrocodone combination drugs in the United States during the time frame of the study. The authors charted both the number of prescriptions and tablets filled quarterly from 10/1/2011 through 9/30/2015 (3 years prior and 1 year after rescheduling). Nationally, within the medical community, there was an increase in oxycodone prescription writing although it wasn’t enough to offset the impact of the reduction in hydrocodone prescriptions (4). Nine medical specialties saw an average reduction in the number of hydrocodone prescriptions of 19.3%. The number of pills prescribed was reduced by an average of 15.0%. However, dentistry only reported reductions of 5.7% and 2.0%,

respectively (4). The scope of the paper did not include an explanation for the difference with dentistry, but it did identify a trend that needed to be further studied.

Purpose

This study assessed hydrocodone combination prescriptions and oxycodone combination prescriptions written across all dental clinics associated with the University of Kentucky College of Dentistry. The primary goal of this study was to identify any significant changes in prescription writing before and after the change in scheduling. The secondary goal of the study was to assess prescription writing practices across the dental specialties.

Literature Review

The following review of the literature is a summary of the current status of opioid prescription writing in the dental field with interest in the appropriateness of opioid prescription writing within general dentistry and its effectiveness, its impact on the public, and information on opioid legislation. This foundation is key in understanding the effect of legislation changes, as well as establishing a gap in literature where this study can contribute information. Works cited were collected from peer reviewed journals searched on PubMed in addition to official statements from national and state public health authorities (i.e. the Center for Disease Control or Kentucky

The PubMed terms searched were: "'dentistry" and "opioids"'. The search yielded 258 journal articles (n = 258). Articles were eliminated based on a number of requirements: 133 did not directly relate to dental opioid management (n = 125), 97 were older than 10 years (n = 28), and 3 were not published in English (n = 25). The search yielded 25 relevant articles.

A second literature search containing terms “dentistry” AND “opioid” AND “legislation” tallied 18 articles (n = 18). Articles eliminated included: Seven papers older than ten years (n = 13), and 3 papers not directly related to dental opioid management and policy regulation (n = 10).

In summary, the literature reviews identified 35 total relevant articles. The first search yielded 25 articles dealing with prescription writing habits, appropriateness, and its effect on patients and the public. This ranged from the role and impact of dentists in prescribing opioids (16 - 17) to the value of opioids versus NSAIDs post oral surgery (18). Ten additional articles identified in the second literature search generally cover opioid management and legislation within dentistry. This includes topics such as how to apply laws in your practice (19) to the impact of prescription drug monitoring programs (20 - 22).

The literature review established the appropriateness of opioid prescription writing in dentistry (23) with key articles that discuss the actual opiate prescription writing habits of dentists (24) and the role dentists play in the opioid crisis (25). The review of the literature articulates the important role dentists play in opioid prescription writing, and it affirms the topic is worth investigation in the face of an opioid abuse crisis within the U.S.

Gaps in the literature exist. The difference between the role of hydrocodone and oxycodone in the prescription writing habits of dentists isn't thoroughly discussed. None expounded upon the trend identified in the foundation article (4) that the DEA rescheduling of hydrocodone had less of an impact on dentistry than other specialties. Lastly, there is no information on the impact of policy on the prescription writing habits of different specialties within dentistry. The gaps in the

literature provide a place for a study that looks at the impact of legislation on dental opioid prescription writing among general dentists and dental specialties. This research project can fill that gap assessing the impact of the rescheduling of hydrocodone on a small scale, via study of the dental practitioners at the University of Kentucky College of Dentistry (UKCD).

METHODS

The collection of data required approval from the University of Kentucky Institutional Review Board (IRB). IRB number 44700 “UKCD Opioid Prescription Writing” was approved and a Medical Expedited IRB through the University of Kentucky Office of Research Integrity was granted on 7/22/2018. The information was gathered by designing a custom report on axiUm, UKCD’s electronic health record. The needed report was run in axiUm through the following steps:

"Actions" tool bar option

“Info Manager” drop down option

“Clinical” tab

“Prescription” category

“Predefined” option

Select “Taylor Rx Search”

Data in the following fields were collected:

“Rx date” 10/4/12 – 10/4/17

“Rx drug” all brand and generic versions of hydrocodone and oxycodone

“Rx dose” the amount of hydrocodone and oxycodone

“Rx total” the number of pills prescribed

“Dr. provider number” The provider’s identification number in axiUm

“Dr. first name”

“Dr. last name”

Prescription data were collected, exported into Microsoft Excel, and sorted to assess the needed information. Initial data tested included all UKCD providers sorted into types according to their practice. The following categories were used: General Dentistry (included all general dentists, prosthodontists, and endodontists), Oral Surgery, Periodontal Surgery, and Orofacial Pain. The data was analyzed by quarter spanning Q4 of 2012 through Q3 of 2017. Total pills written and total prescriptions written per quarter were analyzed. This revealed sharp rises in opioid prescription writing throughout that time. The data were reassessed for other potential variables.

It was hypothesized that, due to a change in administration, the number of clinic procedures and patients seen at the school had increased substantially as a way to financially compensate for continued cuts in state funding. A second report was run to identify the total number of procedures likely to require opioid analgesia per quarter. The procedures were identified through the billing Code on Dental Procedures and Nomenclature (CDT code). This included all oral surgery procedures, periodontal surgical procedures, endodontic procedures, and implant-related procedures. This change required dropping Orofacial Pain as a provider type, because they charge through medical codes as opposed to CDT codes. Medical codes cannot be tracked through axiUm. This cut represented 5.4% of all the prescriptions written in the given time

frame. However, the elimination of Orofacial Pain makes practical sense as its practice functions under a medical model to treat chronic pain issues. Very few dentists practice within this model of care. Most orofacial chronic pain patients are treated at universities where a specially-trained dentist works in conjunction with physical therapy, neurology, psychology, and psychiatry to treat patients. All collected data was reanalyzed without Orofacial Pain for consistency. References to “all UKCD faculty” reflects this change.

The new data were collected quarterly. Pills per procedure, prescriptions per procedure, and morphine milligram equivalents (MME) were analyzed. MMEs represent the equivalent amount of morphine written by taking prescription type and dosage into account. They are calculated for hydrocodone and oxycodone as follows:

$$\text{Hydrocodone MME} = (\text{dosage} \times 1) \times \# \text{ of pills}$$

$$\text{Oxycodone MME} = (\text{dosage} \times 1.5) \times \# \text{ of pills}$$

In this study, MMEs per prescription were calculated. This was accomplished by taking the sum of the MMEs of all prescriptions written per quarter and dividing by the total opioid prescriptions written per quarter:

$$\text{MMEs per prescription} = \frac{\text{Total quarter MMEs}}{\# \text{ of quarter opioid prescriptions}}$$

Graphical evaluation of the data revealed consistent prescriber patterns that continued through the end of 2015. Trends in prescription writing rose considerably after the beginning of 2016 skewing the data beyond what the scope of this paper is attempting to analyze, i.e. a significant

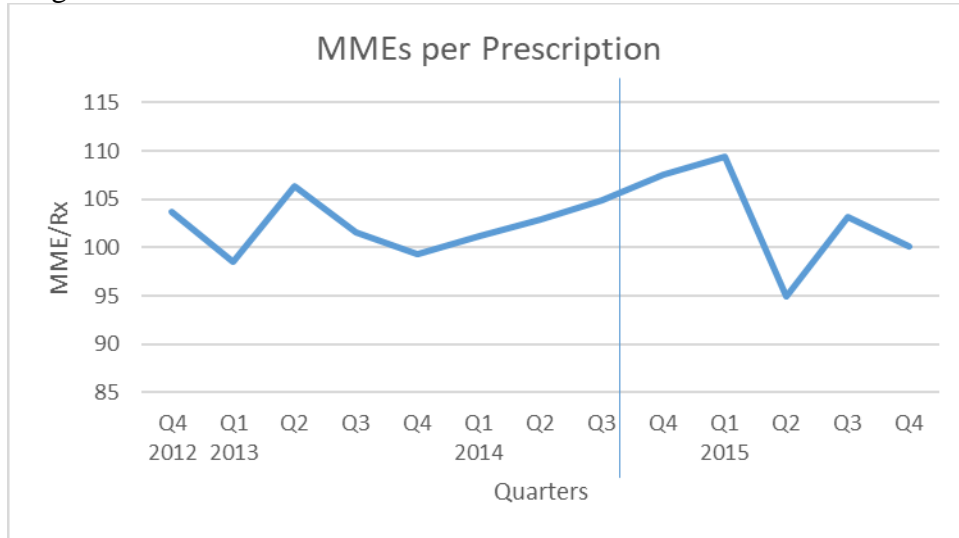
change in payer type due to Medicaid expansion. For the purposes of analyzing the 2014 rescheduling of hydrocodone, data were considered through year end 2015.

Total pills per procedure, prescriptions per procedure, and MMEs per prescription from 10/4/2012 through 10/4/14 (date of the schedule change) and 10/5/14 through 12/31/15 were calculated quarterly. Total UKCD faculty data were compared as well as the previously defined General Practice, Oral Surgery, and Periodontal Surgery disciplines. Data were analyzed via a two-tailed t-test. Significance was defined as a p-value of $< .05$. The null hypothesis was that there will not be a significant change in prescription writing practices. This was tested for both a significant increase or decrease.

RESULTS

The following Figures 3, 4, and 5 are graphical representations of prescription writing for all UKCD faculty. The vertical line on each graph represents the date of the DEA schedule change. Figure 3 is the graphical representation of MMEs per prescription. Table 2 summarizes the results of the two-tailed t-test comparing MMEs before and after the schedule change. The test produced a p-value of .8045. The result failed to reject the null hypothesis that there would not be a significant change in MMEs after the change in scheduling. This is consistent with the 0.71% increase described by the raw data.

Figure 3.



Figures 4 and 5 represent the trends in hydrocodone prescriptions per procedure and hydrocodone pills per procedure respectively for all UKCD faculty. Both prescriptions per procedure and pills per procedure were analyzed via a two-tailed t-test producing p-values of .0349 and .0039 respectively. The results of the tests are listed in Table 2. Here, the null hypothesis that there would be no change in prescription writing behavior is rejected. Both p-values are less than .05 indicating significance. The numerical raw data and graphic evidence confirms that there was a significant reduction. Prescriptions per procedure were reduced by 27.4%, while pills per procedure were reduced by 26.0%

Figure 4.

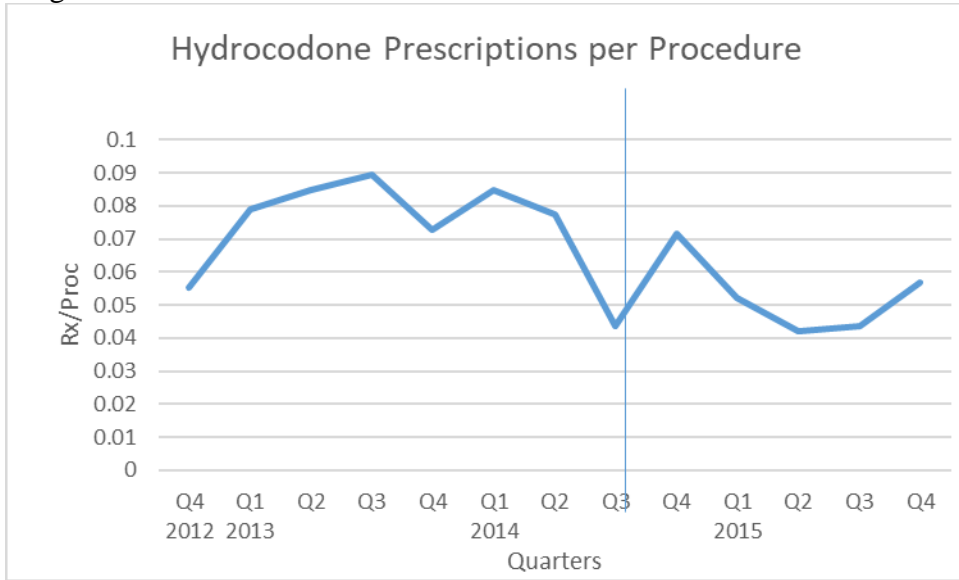


Figure 5.

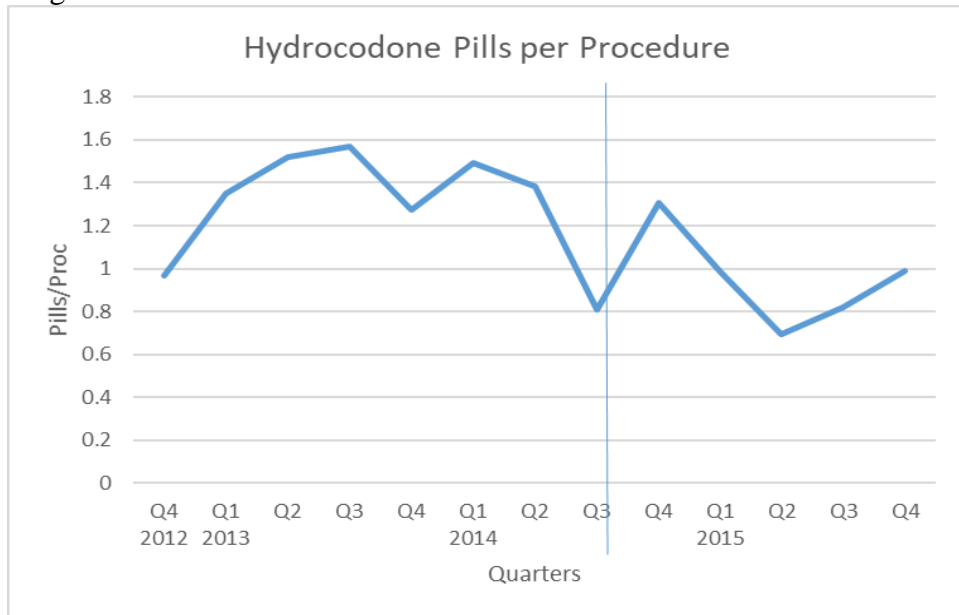


Table 2.

UKCD Total	P-value	Percent Change
MMEs per prescription	.8045	+0.7
Prescriptions per procedure	.0349	-27.4
Pills per procedure	.0039	-26.0

Oxycodone prescriptions were also analyzed for all UKCD faculty. Oxycodone prescriptions accounted for 8.7% of the total hydrocodone and oxycodone prescriptions and 7.9% of total hydrocodone and oxycodone pills. There was no significant change in number of prescriptions or pills of oxycodone written after the DEA schedule change of hydrocodone through year-end 2015.

MMEs per prescription, prescriptions per procedure, and pills per procedure were assessed across the applicable dental specialties: General Dentistry, Oral Surgery, and Periodontal Surgery. A two-tailed t-test was performed for each category comparing the change in prescription writing habits from Q4 of 2012 to the schedule change and from the schedule change to year-end 2015. P-value results failed to reject the null hypothesis in the following circumstances identified in Table 3: General Dentistry, Periodontal Surgery, and Oral Surgery MMEs per prescription, Periodontal Surgery prescriptions per procedure, and General Dentistry and Periodontal Surgery pills per procedure. All presented with a p-value > .05. Table 3 shows the null hypothesis was rejected in the following circumstances: Oral Surgery pills per prescription and General Dentistry and Oral Surgery prescriptions per procedure. All presented with a p-value < .05. The raw data supports that there was a significant difference in prescription writing habits in the aforementioned categories. General Dentistry prescriptions per procedure increased by 31.2%. Oral Surgery prescriptions per procedure and pills per procedure were reduced by 38.3% and 31.8% respectively.

Table 3.

	MMEs per prescription p-value	Prescriptions per procedure p-value	Pills per procedure p-value
General Dentistry	.1151	.0459 (+31.2%)	.4265
Oral Surgery	.1347	.0151 (-38.3%)	.0343 (-31.8%)
Periodontal Surgery	.4759	.3094	.4808

When statistically significant, % change listed in parentheses

DISCUSSION

It is apparent that the legislation had an effect on the prescription writing habits of University of Kentucky dentists. The data suggests providers wrote fewer prescriptions per procedure and fewer total pills per procedure. However, there was no significant change in the MMEs per prescription. This would indicate that of the prescriptions that were written, the dosages and pills were consistent despite the schedule change.

Significant reductions in prescribing by provider type varied. Oral Surgery saw a significant reduction in two of the three categories: prescriptions per procedure and pills per procedure. General Dentistry saw a significant rise in prescriptions per procedure, while Periodontal Surgery saw no significant changes. Oral Surgeons account for 53.4% of hydrocodone and oxycodone prescriptions written and 62.8% of the hydrocodone and oxycodone pills dispensed at UKCD. Their behavior change would have the most impact on the total data for the college. Opioid prescription writing is also a larger part of their practice than Periodontal Surgeons and

General Dentists due to the nature of the procedures they perform and how frequently they perform them. Jones hypothesized that the major reduction in opioid prescriptions written in medical practices nationwide is due to fewer refills (4). While most dental procedures are outpatient and don't require long term pain management, oral surgeons also perform operating room procedures that would necessitate opioid refills. Therefore, the regulation of these refills could have a greater effect on Oral Surgery than other specialties. While some general dentists treat long term pain issues, long term pain management is not a day-to-day part of most general dental practices.

Periodontal Surgery did not show a significant change in any of the categories. This is likely because many of their procedures are focused on small areas of the oral cavity and do not require the same amount of pain management as procedures typically done by oral surgeons. It's reasonable to conclude that Periodontal Surgery was already prescribing the minimal amount of opioids that is practical for the procedures they perform.

General Dentistry prescriptions per procedure increased by 31.2%. Identifying the cause for this increase could be beyond the scope of this paper, however some speculative causes have been identified. While it is possible that general dentists at UKCD are writing more opioid prescriptions since the rescheduling, the lack of increase in pills per procedure makes this assumption less likely. The scheduling change eliminated the ability to write refills or call in prescriptions for hydrocodone, and this could encourage a provider to write prescriptions more often to avoid additional follow up appointments. Also at UKCD during the time frame of the study, there was an increase in the number of extractions covered by general dentists in the

student and urgent care clinics. This led to general dentists covering more procedures that require post-operative pain control with opioids. For example, the percent of surgical extractions covered by general practitioners increased from 8.5% of extractions before the schedule change to 11.6% after the schedule change. Finally, for acute pain that cannot be treated by a general dentist, a referral to an oral surgeon is often the protocol. It is common practice for general practitioners to prescribe an opioid to manage a patient's pain until an appointment with an oral surgeon can be arranged. Each of these factors could be contributing to the increase in prescriptions per procedure by general dentists at UKCD.

It is possible that the overall reductions evidenced by the data are not singularly due to the stricter management of prescription writing habits created by the legislation. The change in scheduling is part of a larger, multifaceted effort to increase the awareness of the role providers play in the escalating opioid crisis. This may have led to a change in provider behavior through a change in their perspective on the drug and its dangers. This indicates that UKCD dentists possibly changed their opioid prescribing habits as a public service, not due to the effects of added regulation.

CONCLUSION

The DEA's decision to change hydrocodone from a Schedule III to Schedule II drug impacted the prescription writing habits of University of Kentucky College of Dentistry providers by reducing the amount of hydrocodone per procedure written across the college. It is possible that this is due to UKCD providers being more cognizant of the need for a public health intervention as opposed to the effects of the regulation change itself. Future studies need to address the

discrepancy in MMEs versus the number of pills and prescriptions being written at that time. As previously mentioned in the paper, there is an increasing trend in opioid prescription writing from 2016 to the present among UKCD providers. There are many variables that need to be assessed, such as a changes in payer base associated with Medicaid expansion and its effects on treatment planning and procedures. Much could also be learned by assessing changes in provider attitude toward prescribing opioids over time within the college and at the state and national level.

LIMITATIONS

The sample size is small so the impact on the scheduling change could be masked by other variables, i.e. changes in administration, payer base, new faculty, faculty calibration, and procedure type. We were unable to analyze Orofacial Pain due to their billing procedures. The timeframe was also shortened due to an unexplained spike in opioid prescriptions written in 2016 and 2017.

IMPLICATIONS FOR PUBLIC HEALTH

This empirical study utilized primary data to fulfill essential public health services in the following ways: Primarily, it supported essential public health service #9, by evaluating the effectiveness and quality of personal and population-based health services (26). It did this by identifying opioid prescription writing habits of a sizable provider population during what has been described by the media and health authorities as an opioid crisis. It also supported essential public health service #5 by analyzing policy intended to support community health efforts (26).

The study assessed the prescriptions, pills written, and morphine milligram equivalents, before and after a federal policy change.

REFERENCES

- 1) US Department of Health and Human Services. Addressing prescription drug abuse in the United States: Current activities and future opportunities.
https://www.cdc.gov/drugoverdose/pdf/hhs_prescription_drug_abuse_report_09.2013.pdf
. Last Access 6/27/18
- 2) Castillo M, Vike GM, Coyne CJ. Who is prescribing controlled medication to patient who die of prescription drug abuse? The American Journal of Emergency Medicine, Jan 2016, Volume 34 Issue 1, Pgs 30-35.
- 3) Drug Enforcement Administration. Department of Justice. Schedule of controlled substances: rescheduling of hydrocodone combination products from schedule III to schedule II: Final rule. Fed. Regist. 2014; 79(163): 49661-49682.
- 4) Jones CM, Laurie PG, Throchmorton DC. Effect of US Drug Enforcement Administration's Rescheduling of Hydrocodone Combination Analgesic Products on Opiate Analgesic Prescribing. JAMA Internal Medicine. March 2016 Volume 176, No 3
- 5) NIH National Institute on Drug abuse. <https://www.drugabuse.gov/drugs-abuse/opioids>.
Last Access 11/4/18
- 6) Yagiela, JA, Dowd FJ, Johnson BS, Mariotti AJ, Neidle EA. Pharmacology and Therapeutics for Dentistry 5th Edition. 2004, St. Louis: Elsevier Mosby.

- 7) Cobaugh DJ, Gainor C, Gston CL, Kwong TC, Magnani B, McPherson ML, Painter JT, Krenzelok EP. The Opioid Abuse and Misuse Epidemic: Implications for Pharmacists in Hospitals and Health Systems. *Am J Health System Pharm.* Sept 2014, 15;71(18): 1539-54.
- 8) NIH National Institute on Drug abuse. <https://www.drugabuse.gov/drugs-abuse/opioids/opioid-overdose-crisis#three>. Last access 11/4/18.
- 9) Vowles KE, McEntee ML, Julnes PS, Frohe T, Ney JP, van der Goes DN. Rates of opioid misuse, abuse, and addiction in chronic pain: a systematic review and data synthesis. *Pain.* 2015;156(4):569-576. doi:10.1097/01.j.pain.0000460357.01998.f1.
- 10) Muhuri PK, Gfroerer JC, Davies MC. Associations of Nonmedical Pain Reliever Use and Initiation of Heroin Use in the United States. *CBHSQ Data Rev.* August 2013.
- 11) Soelburg CD, Brown RE, Du Vivier D, Meyer D, Ramachandran J, Banu K. The US Opioid Crisis: Current Federal and State Legal Issues. *Anesthesia & Analgesia*, Vol 124, No 5, Nov 2017, pp. 1675-1681.
- 12) House Bill 1, Outlined in Kentucky Revised Statutes (KRS) 218A. 172
- 13) Freeman PR, Goodin A, Troske S, Talber J. Kentucky House Bill 1 Impact Evaluation prepared for The Kentucky Cabinet for Health and Family Services. March 2015
- 14) S. Slavova, J. Costich, D. Quesinberry, S. Eustice, T. Bunn. Overdose Indicator Definitions: Case Confirmation Study. CDC Prevention for States Grantee Meeting, Atlanta, GA, May 9-11, 2017.
- 15) Hupp JR, Ellis E, Tucker MR. *Contemporary Oral and Maxillofacial Surgery* 5th Edition. 2008. St. Louis: Elsevier Mosby.

- 16) Dionne R, Moore PA. Opioid Prescribing in Dentistry: Keys for Safe and Proper Usage. *Compend Contin Educ Dent*. 2016 Jan; 37(1):29-32.
- 17) Steinmetz CN, Zheng C, Okunseri E, Szabo A, Okenseri C. Opioid Analgesic Prescribing Practices of Dental Professionals in the United States. *JDR Clinical & Translational Research*, July 2017, Volume 2, Issue 3. 241-248.
- 18) Moore PA, Raymond DA, Cooper SA, Hersh EV. Why do We Prescribe Vicodin? *JADA*, July 2016, 147(7), 530-533.
- 19) Nack B, Haas S, Portnof J. Opioid Use Disorder in Dental Patients: The Latest on How to Identify, Treat, Refer and Apply Laws and Regulations in Your Practice. *Anesth Prog* 2017, 64: 178-187.
- 20) Rasubala, L, Pernapati, L, Ximena V, Burk, J, Ren YF. Impact of a Mandatory Prescription Drug Monitoring Program on Prescription of Opioid Analgesics by Dentists. *PLOS ONE*. August 14m 2015, DOI: 10.1371/journal.pone.0135957. 1-10
- 21) Keith DA, Thomas SA, Kulich R. The Prescription Monitoring Program Data, What it Can Tell You. *JADA* April 2018, 149(4). 266-272
- 22) McCauley J, Hyer M, Ramakrishnan VR, Leite R, Melvin CL, Fullingim RB, Frick C, Brady KT. Dental Opioid Prescribing and Multiple Opioid Prescriptions Among Dental Patients. Administrative Data From the South Carolina Prescription Drug Monitoring Program. *JADA*, July 2016, 147(7).
- 23) Hersh EV, Kane WT, O'Neil MG, Katz NP, Golubic D, Moor PA. Prescribing Recommendations for the Treatment of Acute Pain in Dentistry. *Compend Cont Educ Dent*. April 2011, 32(3):22, 24-30.

24) Gupta N, Vujicic M, Blatz A. Opioid Prescribing Practices From 2010 Through 2015 Among Dentists in the United States, What do Claims Data Tell us? JADA, April 2018 149(4).

25) Denisco RC, Kenna GA, O'Neil MG, Kulich RJ, Moore PA, Kane WT, Mehta NR, Hersh EV, Katz NP. Prevention of Prescription Opioid Abuse. The Role of the Dentist. JADA July 2011, 142(7)

26) The Public Health System & the 10 Essential Public Health Services.

<https://www.cdc.gov/stltpublichealth/publichealthservices/essentialhealthservices.html>.

Last access 11/7/18

BIOGRAPHICAL SKETCH

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