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Title of Project:

The Effect of a Non-Opioid Order Set on Opioid Use in a Community Hospital Emergency Department

Course title: Research Project II (PhPr898B)

Date: April 11, 2021

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ABSTRACT

Specific Aims: To describe trends in opioid ordering and prescribing within a community hospital emergency department (ED). To determine if a non-opioid order set influences opioid prescribing within the ED.

Subjects: Providers who ordered opioids in the ED or prescribed opioid prescriptions upon discharge to adult patients.

Methods: A retrospective analysis was conducted of the prescribing habits of ED providers before (April 1, 2019, to September 30, 2019) and after (April 1, 2020, to September 30, 2020) implementation of a non-opioid order set. Primary outcomes of interest were the number of opioid orders and the average opioid MME before and after the non-opioid order set implementation. ‘

Main Results: 35 providers were included in this study, with 71% (n=25) female and 29% (n=10) male. The group was composed of 22% physician assistants (n=8), 26% nurse practitioners (n=9), 46% doctors of medicine (n=16), and 6% doctors of osteopathic medicine (n=2). The studied providers accounted for 60% of all opioid orders administered within the ED. Opioid orders administered decreased from 8,608 in 2019 to 6,072 in 2020 (p=0.03). There were no significant changes to the average MME of opioid orders per patient seen in the ED.

Conclusions: The analysis suggests that a non-opioid order set can decrease the number of opioids ordered in an ED. The data collected did not show significant changes in discharge prescriptions after implementation of the non-opioid order set.

INTRODUCTION

Opioid analgesics are narcotics indicated to treat moderate to severe pain. This class of medications includes morphine, oxycodone, hydrocodone, and fentanyl, among others. It is not uncommon for opioid prescriptions to be diverted for nonmedical use because they are highly addictive, but these drugs are potent and can cause fatal overdoses.[1] The risk of a patient becoming a chronic user of opioids increases with every day of treatment added to their first opioid prescription.[2] Other risk factors include number of refills on the prescription, having more than one opioid prescription, initial day supply of 10 or 30-days, and the cumulative morphine milligram equivalents (MME) of their prescription being over 700 MME.[3]

In 2017, the U.S. Department of Health and Human Services (HHS) declared that the national opioid crisis was a public health emergency.[4] The Center for Disease Control (CDC) named this phenomenon an opioid epidemic to describe the systemic and wildly increasing opioid abuse, dependence, and overdose rates, causing the nation to collectively call for action.[1] The economic burden in 2013 was estimated to be $78.5 billion, with over one-third of this cost stemming from increased health care costs and substance abuse treatment programs.[5]

The ED is uniquely positioned to make a difference related to opioids because of its proximity to both providers prescribing opioids and patients seeking treatment for opioid overdoses. Across the U.S., ED visits for opioid overdoses increased by 30% between July 2016 and September 2017.[6] One proposed solution is to work toward an opioid-free ED by increasing the use of non-opioids to provide analgesia.[7] An opioid-free ED may be impractical at this time and there are still risks associated with non-opioid use or the under-prescribing of opioids for certain patient populations. The implementation of a non-opioid order set may provide utility in efforts to decrease opioid use in an ED. The purpose of this study was to analyze the effect of a non-opioid order set on the number of opioids ordered and the average MME per patient seen at a community hospital ED visit and upon discharge.

METHODS

Design

This study was a retrospective analysis of all ED opioid medication orders and discharge opioid prescriptions written for patients within the ED during two separate time frames before and after order set

implementation (4/1/19-9/30/19 and 4/1/20-9/30/20).

Subjects

Providers who ordered opioids in the ED or prescribed opioid prescriptions for their patients upon discharge were the independent variable in this study. The patient population included adults aged ≥18 years who received opioid analgesics while visiting the ED and were not subsequently admitted to the hospital. All patients who had been intubated or were admitted to the hospital from the ED were excluded from the study. The University of Arizona's IRB Counsel approved IRB exemption and TMC's research office for internal operational review granted approval to conduct this project.

The time periods compared April 1, 2019 to September 30, 2019 and April 1, 2020 to September 30, 2020, which were prior to and after implementation of the non-opioid order set, respectively. This time period was selected to focus on the spring, summer, and autumn months. The authors decided that this period would best capture the local community, as Arizona has a large influx of out-of-state visitors in the winter months.

Intervention

The primary intervention in this study was the implementation of a non-opioid order set in the ED. This order set or "quick list" included appropriate non-opioid alternatives for pain management within a range of conditions, including neuropathic pain, musculoskeletal pain, gastroparesis-associated or chronic abdominal pain, sore throat, renal colic, and headache/migraine pain. Guidance was derived from the 2017 Opioid Prescribing and Treatment Guideline, published by the Colorado Chapter of the American College of Emergency Physicians, and supporting primary literature. This list of medications was compiled by the ED Medical Director and ED Pharmacist, revised and approved for use through several hospital committees, and made available for provider use in March 2020. ED providers were sent email alerts informing them of the order set availability and informational flyers to educate the staff were posted and displayed in various ED charting areas immediately after the order set went live.

Measures

Data was collected using custom reports within the electronic medical record that was compiled into spreadsheets by the Business Intelligence Office at TMC. The medication data included in the study were filtered for adult patients who were 1) treated in the ED, 2) were not subsequently admitted to the hospital, 3) were not intubated, and 4) were discharged from the ED. Two separate medication reports were generated for each study

time frame, one for ED opioid orders and one for ED opioid discharge prescriptions. The extracted data was exported to password-protected Excel workbooks. All identifiable elements were removed from the data set by the project advisor prior to giving the students access to the information. The data available for analysis included the medication name, dose, unit of measurement, quantity ordered, quantity administered, and the name of the ordering provider. No data collection form was required because data was compiled by the Business Intelligence Office. A data dictionary was created to assist in understanding the contents of the Excel workbooks, as seen in Appendix A.

The primary independent variable of the study were the providers who ordered or prescribed opioids to ED patients. The primary dependent variable was the provider opioid ordering rate, for both orders within the ED and prescriptions upon discharge. Opioid prescription rates were calculated based on the number of opioid prescriptions a provider wrote divided by the number of patients for whom they provided care. These rates were used to measure and rank TMC provider opioid prescription rates among their colleagues. Additional data related to medication counts and total morphine equivalents (TME) were also extracted. TME was calculated based on the 2018 CDC compilation of MME conversion factors found in Appendix B with the following formula: strength per unit x number of units x MME conversion factor = total morphine equivalents.

Data Collection

Data for the project was extracted from the electronic medical record, then compiled into a custom report built by the Business Intelligence office at TMC, using a reporting software called Business Intelligence Launchpad.

Data analysis

Paired t-tests were used to evaluate any difference in the number of opioids ordered before and after implementation of a non-opioid order set. Percentages were calculated to represent the number of providers who prescribed opioids for patients discharged from the ED. All providers included in the study were present for both the before and after periods and served as their own controls. Average MME per patient who were prescribed opioids was calculated for the ED encounters and for patients discharged from the ED with an opioid prescription; the means were compared using a two-sample t-test assuming equal variances. The a priori p-value was 0.05.

RESULTS

The final analysis of this study included 35 providers composed of physician assistants, nurse practitioners, doctors of medicine, and doctors of osteopathic medicine. The studied providers accounted for 60% of all opioid orders administered within the ED. The medications of interest included tramadol, hydromorphone, morphine, fentanyl citrate, oxycodone and hydrocodone. Mixed analgesics such as oxycodone-acetaminophen and hydrocodone-acetaminophen were also included in the analysis and were grouped based on their opioid component. Fentanyl patches were removed from analysis as the medication was likely ordered for a patient who needed a replacement until a primary care provider could be seen. The total number of opioid orders administered decreased from 8,608 in 2019 to 6,072 in 2020 (p=0.03) (Table 1). The average TME for opioid orders administered within the ED increased between the two time periods (5.67 to 6.07, p=0.47) (Table 2).

Figure 1 depicts the number of opioid discharge prescriptions between the two time periods. An upward trend is seen in 2020, as opioid prescriptions written per month increased consistently, although the average number of prescriptions written decreased (231 to 230, p=0.93). The average TME per opioid discharge prescription in 2019 was 83.27 and decreased to 80.60 in 2020 (p=0.36) (Table 3). On average in 2019, 25% of patients discharged from the ED were given a prescription for opioids, which decreased to 23% in 2020 (Figure 2).

DISCUSSION

This study found that a non-opioid order set decreases the number of opioid orders made by providers in a community hospital ED. The decrease in opioid orders may be related to increased utilization of the non-opioid order set. Duncan and colleagues showed that implementation of a diagnosis-specific non-opioid order set, along with comprehensive training on new protocols and treatment pathways, reduced intravenous opioid administration in the ED by more than 20% without compromising patient pain control or satisfaction. They found that morphine equivalents used decreased by 25% with no significant difference in patient satisfaction scores.[2] While there was a decrease in number of opioid orders in the ED, the MME per patient did not change significantly. In addition, analysis identified a trend of increasing opioid discharge prescriptions in both time periods. While this may be related to volume of ED visits, it also may indicate that there were other factors impacting opioid ordering in 2020, such as the coronavirus disease 2019 (COVID-19) pandemic.

Similar results have been reported in quality improvement literature. Burton and colleagues instituted a quality improvement initiative to decrease variability of opioid analgesic prescribing among ED physicians. Opioid prescribing rates were calculated, then shared with physicians so that they could understand how their rate compared to that of their peers, with the intent of correcting misconceptions of opioid-prescribing norms. After the dissemination of this information, prospective data showed a decrease in variability and mean quantity of pills per prescription. A major limitation of this study was the Hawthorne effect: physicians beginning to prescribe differently once they knew they were being studied and tracked.[8] This effect may have impacted prescribing rates after implementation of the non-opioid order set, as some providers were aware that data was being collected on providers' opioid prescribing.

Several implications for opioid prescribing practices in the ED were found. Implementation of the order set had a positive impact to reduce opioid prescribing for steady providers that were present before and after implementation. Opioid orders decreased significantly for steady providers however not in the total population, this may indicate a problem with education for providers who are not routinely in this ED. To further expand this impact to all providers who are not consistent in the ED, education and knowledge of the existence of the order set is strongly encouraged.

A strength of this study is the retrospective design allowing the primary investigators to match providers between two time periods. Matched providers ordered 60% of the opioids within the ED, which allowed observers to evaluate if opioid orders or discharge prescriptions influenced the providers' habits. The data demonstrates a change in opioid ordering within the ED but does not demonstrate the same effect for discharge prescribing. Future studies may consider exploring the impact of patient demographics on opioid prescribing, such as gender, race, ethnicity, and socioeconomic status. Further exploration could analyze differences of MME and prescribed opioids between patients of different zip codes or income levels. The effects of this study's non-opioid order set may be assessed further from implementation by assigning contact serial numbers to each patient to further evaluate encounters to one patient. Differences in results of all providers may be seen when education of the order set is incorporated in new hire training.

This study was impacted by several limitations. First, the order set was implemented concurrently with the World Health Organization's declaration of COVID-19 as a global pandemic in March 2020.[9] This unforeseen

event may have influenced the ordering and prescribing actions of the providers in 2020. Second, data was collected two weeks after the non-opioid order set was implemented. This short duration between go live and data collection may cause the data to be less significant. Third, inherent differences in providers' preferences for prescribing or adoption of change may have influenced the outcome. Although offering tools like a non-opioid order set may influence providers, this does not guarantee a change in prescribing habits. The analysis of this study could not determine how prescribing preferences affected the likelihood of providers to utilize the novel non-opioid order set. Research studies with more controlled conditions would be needed to explore these differences further. A number of the total number of discharges from the ED was another limitation of this study, therefore could not calculate the proportion of discharged patients who received opioid prescriptions. Lastly, the results of this study were based on data collected from a single hospital and may not be generalizable to other hospitals or different settings.

CONCLUSIONS

The purpose of this study was to analyze the effect of a non-opioid order set on providers' opioid prescribing and the average MME per patient. The non-opioid order set in this study decreased the number of opioids ordered in a community hospital ED. The order set had no effect on the average MME per patient, nor discharge opioid prescriptions. The true extent of the non-opioid order set's influence was not demonstrated in this study, although improved education on its availability may prove to further decrease opioid use and prescribing in the future.

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Table 1. T-Test Paired Two Sample for Means TME for Sample Providers

	2019	***2020***
Mean	1434.666667	1012
Variance	2202179.067	1286808.4
Observations	6	6
Pearson Correlation	0.9981477512	
Hypothesized Mean Difference	0	
df	5	
t Stat	2.888670489	
P(T<=t) one-tail	0.01711992943	
t Critical one-tail	2.015048342	
P(T<=t) two-tail	0.03423985887	
t Critical two-tail	2.570581835	

Table 2. Average TME Paired Two Sample for Means

	2019	***2020***
Mean	5.671507352	6.073361075
Variance	13.11021442	10.88074337
Observations	6	6
Pearson Correlation	0.9381386583	
Hypothesized Mean Difference	0	
df	5	
t Stat	-0.7827228912	
P(T<=t) one-tail	0.2346101979	
t Critical one-tail	2.015048342	
P(T<=t) two-tail	0.4692203959	
t Critical two-tail	2.570581835	

Figure 1. Opioid Prescriptions Written by ED Providers

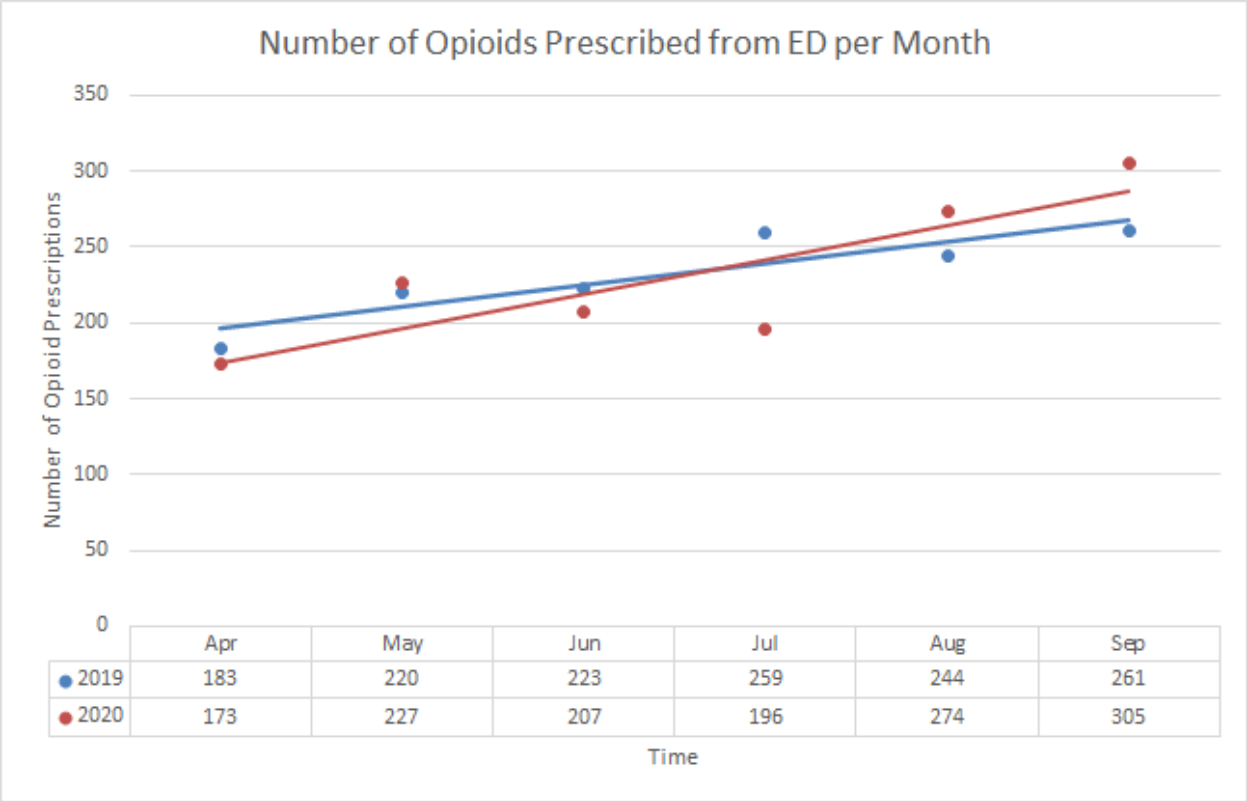

Table 3. Paired Two Sample for Means Group TME per Opioid Prescription

	2019	***2020***
Mean	83.2653551	80.5893582
Variance	742.9367298	562.9632966
Observations	35	35
Pearson Correlation	0.7770790843	
Hypothesized Mean Difference	0	
df	34	
t Stat	0.9128173033	
P(T<=t) one-tail	0.1838831228	
t Critical one-tail	1.690924198	
P(T<=t) two-tail	0.3677662456	
t Critical two-tail	2.032244455	

Figure 2. Opioid Ordering Rates By Provider

Provider	Opioid Ordering Rate 2019	Opioid Ordering Rate 2020
Paired Provider 1	41%	35%
Paired Provider 2	40%	50%
Paired Provider 3	39%	35%
Paired Provider 4	39%	47%
Paired Provider 5	36%	34%
Paired Provider 6	36%	28%
Paired Provider 7	32%	33%
Paired Provider 8	32%	39%
Paired Provider 9	32%	34%
Paired Provider 10	31%	13%
Paired Provider 11	30%	37%
Paired Provider 12	30%	30%
Paired Provider 13	29%	25%
Paired Provider 14	27%	41%
Paired Provider 15	25%	20%
Paired Provider 16	25%	17%
Paired Provider 17	25%	22%
Paired Provider 18	24%	14%
Paired Provider 19	24%	15%
Paired Provider 20	23%	22%
Paired Provider 21	23%	32%
Paired Provider 22	22%	22%
Paired Provider 23	21%	41%
Paired Provider 24	20%	18%
Paired Provider 25	19%	12%
Paired Provider 26	19%	24%
Paired Provider 27	19%	19%
Paired Provider 28	18%	17%
Paired Provider 29	17%	19%
Paired Provider 30	17%	24%
Paired Provider 31	16%	15%
Paired Provider 32	15%	14%
Paired Provider 33	14%	9%
Paired Provider 34	9%	13%
Paired Provider 35	5%	2%

* Total number of opioid prescriptions written by the provider / total number of patients seen by the provider = opioid prescribing rate

Appendix A.

Discharge Presciption Data Dictionary

Column	Data Type	Field Size	Description	Required
Discharge Date	Date	MM/DD/YYYY 00:00	Date and Timestamp	Y
Dose	Integer	9	Indicates the unit of measure	Y
Medication	Character	50	Medication name, Strength, Formulation	Y
Provider	Character	25	Provider's last name, first name, middle initial	Y
Quantity	Integer	20	Indicates number requested	Y
SIG	Chacter	250	directions for use	Y

Drug Utilization Report Data Dictionary

Column	Data Type	Field Size	Description	Required
Department	Character	35	Location of Order	
Dose	Integer	9	Indicates medication strength	
MAR Action	Character	9	Medication Administration Record Status	
Medication	Character	50	Medication Name, Strength, Formulation	Y
Order ID	Integer	9	Unique Order Number	Y
Order Time	Date	MM/DD/YYYY 00:00	Date and Timestamp	Y
Provider	Charcter	25	Provider's last name, first name, middle initial	
Route	Character	9	Route of administration	
Time Taken	Date	MM/DD/YYYY 00:00	Date and Timestamp	
Unit	Character	9	Indicates the unit of measure	

Appendix B.

Oral Morphine Milligram Equivalent (MME) Conversion Factors

Opioid (strength in mg except where noted)	Oral MME Conversion Factor
Buprenorphine, transdermal patch (MCG/HR)	N/A
Buprenorphine, tablet and film	N/A
Buprenorphine, film (MCG)	N/A
Butorphanol	7
Codeine	0.15
Dihydrocodeine	0.25
Fentanyl, buccal/SL tablet or lozenge/troche (MCG)	0.13
Fentanyl, film or oral spray (MCG)	0.18
Fentanyl, nasal spray (MCG)	0.16
Fentanyl, transdermal patch (MCG/HR)	7.2
Hydrocodone	1
Hydromorphone	4
Levomethadyl acetate	8
Levorphanol tartrate	11
Meperidine	0.1
Methadone	3
Morphine	1
Opium	1
Oxycodone	1.5
Oxymorphone	3
Pentazocine	0.37
Tapentadol	0.4
Tramadol	0.1