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The Impact of a PDMP-EHR Data Integration combined with Clinical Decision Support on Opioid and Benzodiazepine Prescribing Across Clinicians in a Metropolitan Area

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Abstract

Introduction—Despite inconclusive evidence that prescription drug monitoring programs (PDMP) reduce opioid-related mortality, guidelines recommend PDMP review with opioid prescribing. Some reported barriers to use include time-consuming processes to obtain data and workflow disruptions.

Methods—We provided access to a PDMP-electronic health record (EHR) integrated program to 123 clinicians in one healthcare system. Remaining clinicians within the healthcare system and metropolitan area did not receive PDMP-EHR integration program access. We identified changes in opioid prescribing by linking prescription data available in the state PDMP database to individual clinicians. The primary outcome was change in receipt of high dose opioid prescriptions (>90 milligram morphine equivalents) by Colorado residents before and after program integration. Secondary outcomes included changes in long-acting opioid receipt and overlapping opioid and benzodiazepine prescription days. Next, we surveyed clinicians to assess their perspectives on PDMP data acquisition before and after PDMP-EHR integration program access.

Results—High-dose opioid receipt decreased significantly across all three clinician groups (PDMP-EHR integration program access [27.6%, to 6.9%, $p < 0.001$]; no program access in the same healthcare system [4.8% to 2.9%, $p < 0.001$], and no program access across the metropolitan area [13.5% to 6.1%, $p < 0.001$]). Clinicians reported improved access to PDMP data using the PDMP-EHR integrated program compared to the state PDMP website (98.6%).

Conclusions—Further study of PDMP-EHR integration programs on patient and clinician outcomes may illuminate the role of this technology in public health and in clinical practice.

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Conflicts of Interest: None

Keywords

PDMP; prescription drug monitoring; opioid; benzodiazepine

Introduction

To address the increase in prescription opioid overdose deaths over the past decades, many states enacted laws authorizing the creation of prescription drug monitoring programs (PDMP).¹ The intended outcomes of PDMP implementation included promotion of appropriate opioid prescribing, reduction in opioid diversion, misuse, and reduced opioid-related mortality.² While opioid prescribing rates have declined across the United States,^{3,4} whether these PDMP review reduce hazardous opioid use or overdose remains unclear.⁵⁻⁹ Nevertheless, PDMP programs have been associated with reductions in opioid¹⁰ and benzodiazepine prescribing.¹¹

In 2016, the Centers for Disease Control and Prevention released a guideline intended for primary care clinicians treating chronic pain with opioids.¹² A key recommendation includes the review of PDMP data prior to opioid prescribing. If the PDMP review reveals receipt of high opioid dosages, dangerous combinations of medications, or controlled substance prescriptions from multiple clinicians, the guideline recommends clinicians discuss this information with their patients and take additional precautions to reduce adverse outcomes.¹² Clinicians may use the guideline to make informed and patient-centered decisions around opioid prescribing; however, clinicians may feel increased liability risks related to opioid prescribing¹³ and unilaterally reduce or discontinue effective pain-reducing medications.¹⁴

Barriers may limit widespread PDMP usage, including a lack of usability across various platforms such as multi-step log-in processes, provision of extraneous data, cumbersome interfaces, and time-consuming processes to input patient demographic data into the website.¹⁵⁻¹⁷ Integrating applications which gather and report PDMP data within the electronic health record (EHR) may reduce barriers to PDMP review. In Colorado, prescribers are required to check the PDMP prior to prescribing a “second opioid fill”.¹⁸ We identified changes in opioid and benzodiazepine prescribing practices among primary care prescribers in Denver, Colorado following the implementation of a PDMP-EHR integration program paired with clinical decision support, an innovative approach to access PDMP data rarely used at the time of our study initiation.¹⁹ We also examined changes in opioid and benzodiazepine prescribing practices among prescribers in metropolitan Denver, Colorado without access to the PDMP-EHR integration program to evaluate for unmeasured local, state, and national efforts to address the opioid epidemic. Practice change was described as change in opioid and benzodiazepine receipt among patients cared for by prescribers with or without access to the PDMP-EHR integration program. Lastly, we assessed clinician’s perceptions and satisfaction with PMDP usage before and after access to the PDMP-EHR integration program.

Materials and Methods

Study Design and Setting

In this real-world implementation study, we distributed 123 licenses allowing for access to software which integrated data available in the Colorado PDMP database to our healthcare system's EHR to allow for immediate PDMP data assess (henceforth described as "PDMP-EHR integration program") to 123 primary care Internal Medicine and Family Medicine physicians and advanced practice providers working at Denver Health and Hospital Authority, a safety-net healthcare system located in Denver, Colorado. These 123 clinicians comprised our intervention group and included all of the primary care clinicians working in the community health centers within our institution at the time of enrollment. The enrolled clinicians cared for patients seen in one of nine federally qualified community health centers located across Denver County. Our control groups did not receive PDMP-EHR integration program access and included the remaining clinicians who worked at Denver Health during the study period and non-Denver Health clinicians with a valid DEA licenses practicing in metropolitan Denver. The population served at Denver Health is approximately 25 percent of Denver's residents across all ages, with a patient population of approximately 48% Latinx, 14% African American, and 32% White.²⁰

We used an ecological cohort study design to assess changes in opioids and benzodiazepines prescribing by reviewing Colorado PDMP data over two time periods, before (July 1, 2017 to December 31, 2017) and after the PDMP-EHR integration program implementation (July 1, 2018 to December 31, 2019). January 1, 2018 to June 30, 2018 was a washout period while the PDMP-EHR integration program was implemented with clinician trainings and uptake. Our 18-month post integration assessment was longer than our 6-month pre-integration assessment time period to account for sustained prescribing practice changes. To assess clinician's impression of access to Colorado PDMP data before and after implementation of the PDMP-EHR integration program, we distributed a pre- and post-PDMP-EHR integration program implementation survey to primary care physicians and advanced practice providers working at Denver Health.

This study was exempt per the Colorado Multiple Institutional Review Board.

PDMP-EHR Integration Program Implementation

The PDMP-EHR integration program queries PDMP data without a clinician prompt. The program requires that the clinician initially manually enroll the patient into the system. The first time the clinician links the patient to the PDMP database, the clinician sees the patient's name, date of birth, and prescription history. For subsequent queries, the PDMP-EHR integration program automatically presents the data to the clinician. The PDMP-EHR integration program allows clinicians to bypass several steps to review Colorado PDMP data, including manual PDMP website login, locating and inputting patient's demographic information, manually narrowing the PDMP search to the correct patient, and awaiting the results. The PDMP-EHR integration program eliminates this stepwise approach and reduces clerical workload. Additionally, the PDMP-EHR integration program imports patient's PDMP data, searches for nicknames and aliases to avoid potentially missed prescriptions

and reformats the information into a visually clearer and easily sortable table. The program performs clinical decision support by reviewing PDMP data at scheduled intervals set by the clinician with emailed updates and alerts when patients fills scheduled prescriptions. Clinicians in our control groups did not receive PDMP-EHR integration program access and retrieved PDMP data using the standard approach via the state supported website.

JB was responsible for training each clinician to use the PDMP-EHR integration program in their clinical setting. Live educational sessions were hosted during departmental meetings between July 2017 and September 2017, and the first clinic enrolled also received two half-days of “at-elbow” support from the PDMP-EHR integration program staff. A total of 43 clinicians attended one of seven trainings. Clinicians unable to attend live sessions could utilize an emailed instruction booklet which included a series of screenshots for use. Clinicians unable to enroll in the program could reach out to JB for individual telephone support. Ten clinicians received this assistance. The majority of clinicians, even those not trained by JB, adopted the program because of ease of use.

Data Sources

Colorado Prescription Drug Monitoring Program data.—The PDMP is a secure database managed by the Colorado State Board of Pharmacy which collects information on patients, prescribers, pharmacies, and Scheduled II – V controlled medications dispensed by Colorado pharmacies.^{21–23} We identified all scheduled II – IV opioid or benzodiazepine prescriptions dispensed from July 2017 to December 2019. Drug Enforcement Agency (DEA) or the National Provider Index (NPI)²⁴ numbers for Denver Health clinicians were linked to prescription data to identify prescriptions from Denver Health clinicians. To identify non-Denver Health clinicians practicing in metropolitan Denver, we pulled prescriptions from 132 Denver metropolitan zip codes as a proxy for practice location within Denver county. The final analytic dataset divided clinicians into three groups: Denver Health clinicians 1) with access (n = 116 [seven clinicians left the healthcare system]) and 2) without access to the PDMP-EHR integration program (n = 466) and 3) all other clinicians within the 132 metropolitan zip codes²⁵ without access to the program (n = 13,526) (Figure 1; Appendix 1). Prescription and clinician data (DEA or NPI numbers associated with prescriptions) were identified at time points and compared across time.

Survey development and data collection.—The survey intended to understand baseline perceptions of PDMP usage and was informed by a literature review of clinician’s perceptions and usage of state PDMPs.^{15–17,26,27} Survey development intended to obtain information on four domains: frequency and circumstance of PDMP use, perceived liability related to opioid prescribing, approach to concerns for opioid misuse or diversion, and respondent characteristics. SLC and KO developed the survey instrument which was iteratively refined with feedback from practicing clinicians at Denver Health. We distributed the pre- and post-implementation surveys in July 2017 and March 2020, respectively, to all Family Medicine and Internal Medicine physicians and advanced practice providers practicing in community health clinics within Denver Health. The post-implementation survey included additional questions about the PDMP-EHR integration program and was only sent to clinicians who received program access. Surveys were in English and were sent

via an anonymous, online link over four weekly waves to increase response rate. Survey data were collected and managed using REDCap (Research Electronic Data Capture) electronic data capture tools.^{28,29}

Outcomes

Colorado Prescription Drug Monitoring Program data.—We measured four outcomes informed by the 2016 Centers for Disease Control and Prevention (CDC) guidelines for opioid prescribing.¹² Outcomes were assessed before and after PDMP-EHR integration program implementation. Our primary outcome was percent of patients who filled a high dose opioid prescription (>90 milligram morphine equivalents (MME) per day). Secondary outcomes included percent of opioid intolerant patients who filled a long acting/extended release (LA/ER) opioid where “opioid intolerant” is defined as not having filled an opioid prescription in the previous 45 days; percent of patient prescription days with overlapping opioid prescriptions, and percent of patient prescription days with overlapping opioid and benzodiazepine prescriptions. Data were limited to Colorado residents who filled a scheduled II - IV opioid or benzodiazepine. Methadone for pain management was included because it is reported in Colorado’s PDMP while methadone for opioid use disorder treatment is not. Buprenorphine for opioid use disorder treatment was excluded, buprenorphine for pain management was included. We compared each outcome by assessing the outcome percent for the pre- and post-implementation time period within each group.

Survey data.—The survey questions included 1) awareness of CDC recommendation for PDMP review with opioid prescribing, 2) frequency of PDMP checks in clinical practice, 3) approach to concerns for prescription diversion, 4) perception of the medico-legal ramifications of opioid or benzodiazepine prescribing, and 5) opinions on the PDMP-EHR integration program (Appendix 2,3).

Statistical Analysis

We calculated each outcome percent listed above and compared the difference in proportions before and after PDMP-EHR integration program implementation. For outcome 1, the numerator was number of patients with receipt of >90 MME opioids / day; the denominator was total number of patients who received an opioid prescription during the pre or post implementation time frame (July 1, 2017 to December 31, 2017 and July 1, 2018 to December 31, 2019). For outcome 2, the numerator was number of patients who received at least one LA/ER opioid prescription who were opioid intolerant (not dispensed an opioid in the previous 45 days); the denominator was total number of patients who filled a LA/ER opioid during the pre or post implementation time frame. For outcome 3, the numerator was number of days any patient had more than one opioid prescription, the denominator was total number of opioid prescriptions (the sum of prescribed opioid days for all patients) during the pre or post implementation time frame. For outcome 4, the numerator was number of days any patient had more than one opioid prescription and at least one benzodiazepine prescription, the denominator was total number of opioid prescription days (sum of prescribed opioid days for patients) during the pre or post implementation time frame. To compare prescription fill data pre and post implementation, difference of

proportions was assessed using Z-test. Chi-square tests were used to compare pre and post implementation survey response data. Data were analyzed using SAS v9.4.

Results

From July 2017 to December 2017, there were approximately 3.8 million opioid prescriptions dispensed for pain management to 1 million Coloradans prescribed by 22,672 prescribers for an average of 3.8 opioid prescriptions per person. From July 2018 to December 2019, there were approximately 10.8 million opioid prescriptions dispensed to 2.4 million Coloradans prescribed by 30,275 prescribers for an average 4.5 opioid prescriptions per person (Figure 1).

PDMP Data

Results are presented as percentages before and after PDMP-EHR integration program implementation.

Percentage of state residents who filled a high dose (> 90 MME) opioid prescription.—There was a significant decrease in high-dose opioid receipt among patients who received care from all three clinician groups, regardless of PDMP-EHR integration program access. High-dose opioid receipt decreased among residents who received care from clinicians with (27.6% to 6.9%, $p < 0.001$) and without PDMP-EHR integration program access in one healthcare system (4.8% to 2.9%, $p < 0.001$), and among metropolitan area residents who received care from clinicians without PDMP-EHR integration program access (13.5% to 6.1%, $p < 0.001$).

Percentage of opioid intolerant state residents who filled a long-acting (LA) or extended-release (ER) opioid prescription.—There was no significant difference in LA/ER opioid prescription dispensed to opioid intolerant patients who received care from clinicians with (36.6% to 28.0%) or without PDMP-EHR integration program access in one healthcare setting (63.9% to 67.6%). There was a significant increase in LA/ER opioid prescriptions dispensed to opioid intolerant residents by metropolitan area clinicians without access to the PDMP-EHR integration program (32.3% to 52.7%, $p < 0.001$).

Percentage of overlapping opioid prescription days.—There was a significant decrease in overlapping opioid prescription days for residents prescribed opioids by clinicians with PDMP-EHR integration program access (17.3% to 16.3%, $p < 0.001$). There was no difference among residents who received care from clinicians within one healthcare system without PDMP-EHR integration program access (12.3% to 12.3%). There was a significant decrease for residents who received care from clinicians without PDMP-EHR integration program access in the metropolitan area (20.0% to 19.2%, $p < 0.001$).

Percentage of overlapping opioid and benzodiazepine prescription days.—There was a significant decrease in overlapping opioid and benzodiazepine prescription days across all clinician groups, regardless of PDMP-EHR integration program access. Overlapping days decreased in all groups, patients who received care from clinicians with (6.9% to 5.7%, $p < 0.001$) and without PDMP-EHR integration program access in

one healthcare system ([4.4% to 3.6%, $p < 0.001$) and patients who received care from metropolitan area clinicians without PDMP-EHR integration program access ([8.8% to 7.9%, $p < 0.001$).

Survey Data

The pre-implementation survey was distributed to 134 clinicians with a response rate of 66%; the post implementation survey was sent to 123 clinicians with a response rate of 59%. For both surveys, most clinicians were physicians (pre: 78.7%, post: 84.7% [$p = 0.001$]). Clinicians were more likely to report awareness of CDC guidelines to check the PDMP prior to opioid prescribing in the post-implementation survey (pre: 80.9%, post: 98.6%, $p < 0.001$). Many clinicians reported checking the PDMP every time with opioid prescribing, even when there *was no concern* for medication misuse or diversion (pre: 40.5%, post 66.7%, [NS]). Most clinicians reported checking the PDMP every time when there *was concern* for medication misuse or diversion (pre: 55.1%, post: 87.5%, [NS]). In both surveys, most clinicians reported that they discussed concerns of medication misuse or diversion with their patients (pre: 93.3%, post: 97.2%, $p < 0.001$). In the post implementation survey, most clinicians reported using the PDMP-EHR integration program after receiving access (95.8%). Clinicians reported that the program was useful (97.1%), it provided satisfactory data (100%), and it helped them access PDMP data in their workflow (98.6%). Most clinicians would recommend the PDMP-EHR integration program to their peers (97.1%) (Table 2).

Discussion

We examined changes in opioid and benzodiazepine prescribing by examining PDMP data before and after the implementation of a PDMP-EHR integration program within primary care clinics in a safety-net hospital. We also assessed changes in prescribing among clinicians without access to the program to evaluate for unmeasured efforts to address the opioid epidemic. Lastly, we measured clinician's perceptions and usage of the PDMP before and after implementation of the PDMP-EHR integration program. Receipt of high dose opioids and overlapping opioid and benzodiazepine prescriptions significantly declined among residents who received care from clinicians with and without access to the program. When comparing prescribing changes across groups, there was a marked decrease in high-dose opioid receipt by patients who received care from clinicians with PDMP-EHR integration program access. There was also a large increase in LA/ER opioids dispensed to opioid intolerant patients among prescribers without program access in metropolitan Denver. Lastly, clinicians reported that the PDMP-EHR integration program was useful, provided easily accessible PDMP data, and improved workflow in primary care practice.

All three sites had a significant decline in high dose opioid prescribing over the study period. When comparing across groups, the largest decline was noted among clinicians with PDMP-EHR integration program access. While it is possible the program contributed to a portion of the decline in high dose opioid prescribing, the decline in all groups is likely due to unmeasured interventions related to the opioid epidemic during the study period. Our findings demonstrated that opioid intolerant patients who received care from metropolitan-

area clinicians without PDMP-EHR integration program access had a significant increase in ER/LA opioid receipt. High dose opioid prescribing and use of long-acting opioids in opioid intolerant patients are major contributors to opioid-related overdose.^{30,31} Previous qualitative work demonstrated a lack of perceived risk of overdose by patients on high dose opioid therapy.³² Long-acting opioid prescribing and high dose opioid prescribing, especially to opioid intolerant patients, can be particularly dangerous and should always be preceded by a PDMP review and a patient-clinician discussion regarding the risk of dependence and overdose. Future research should study if expanded access to a PDMP-EHR integration program reduces risky prescribing to opioid intolerant patients.

Following the PDMP-EHR integration program implementation, 98% of clinicians surveyed reported being aware of the CDC guideline for PDMP review prior to opioid prescribing. Whether awareness of guideline recommendations translates into opioid prescribing practice change remains unclear. A survey of 420 primary care physicians reported awareness of their state's PDMP, however clinicians reported that time-consuming data retrieval was a barrier to regular use.¹⁷ A PDMP-EHR integration program could reduce this barrier to routine use. Among our respondents, the great majority of prescribers were satisfied with the program due to its ease of data access and reduced workflow disruptions. Most respondents reported that they would recommend the PDMP-EHR integration program to another healthcare worker. Increasingly, state laws require clinicians to consult the PDMP when prescribing opioids with penalties for noncompliance.³³ These laws may ultimately harm patients because clinicians may choose to stop prescribing opioids to avoid such penalties, or to taper patients off of opioid medications, even when patients demonstrate improved quality of life and pain stability on opioid therapy.³⁴ A PDMP-EHR integration program could reduce the time and effort required by clinicians to access PDMP data while simultaneously tracking patient's PDMP data for unexpected opioid or benzodiazepine fills or aberrancies. Such integrated programs could protect the clinicians from noncompliance and may allow for more meaningful patient-clinician discussion about the pros and cons of opioid use.

The general trend in decline of opioid and benzodiazepine receipt among state residents who received care from clinicians with or without access to the PDMP-EHR integration program may have been influenced by various local,³⁵ state,³⁶ and national³⁷⁻⁴⁰ factors to address opioid prescribing. Such programs included efforts to reduce overlapping opioid and benzodiazepine prescribing days,³⁵ requirements to limit payment of opioid prescriptions by state³⁶ and private insurers,³⁷ recommendations for opioid dose reductions,³⁷ education to expand use of alternatives to opioid medications for pain management,^{12,39} and funds to increase PDMP usage.^{38,40} In this study, disentangling the singular impact of the PDMP-EHR integration program on prescribing amid statewide and national policies to limit opioid prescribing is challenging due to many unmeasured confounders. However, improving ease of PDMP data acquisition for busy primary care clinicians could inform opioid prescribing decisions and may avoid unnecessary discontinuation or reduction in opioid medications when patients receive benefit from these medications to improve their function and quality of life.

Studies report mixed findings on the efficacy of PDMP usage to reduce opioid-related morbidity and mortality.^{1,4,7,41,42} For this reason, the CDC guidelines for prescribing opioids for chronic pain list PDMP review as a “recommendation”.¹² Despite a lack of definitive findings that PDMPs reduce morbidity and mortality, states have invested large amounts of money to develop PDMP systems and governmental bodies support their use in clinical practice.^{33,42–44} To increase PDMP review, one next step may be to provide clinicians increased access to PDMP-EHR integration programs. We identified a clinician champion (JB) to provide motivation and support to use the program, as well as multiple opportunities and modalities for training, which we believed facilitated widespread adoption. Providing clinicians with access to similar programs, while identifying a clinical champion to facilitate its use, could support expanded PDMP data review. Future studies should evaluate if and how integrated PDMP-EHR programs impact clinical work flow, administrative burden, and clinical decision making when prescribing scheduled medications.

Limitations

This study had several important limitations. We used an ecological cohort study design thus the results and conclusions cannot show definitive association or causation. The results can give a useful indication of the impact of a PDMP-EHR integration program on prescribing practices and can be used to follow trends. This was a real-world study with the goal to increase PDMP review among busy primary care clinicians. As such, we distributed the PDMP-EHR integration program to primary care physicians and advanced practice providers. Remaining clinicians within our institution who comprised our control group included a variety of clinicians who may not have comparative prescribing practices to those of primary care clinicians. We were interested in evaluating changes in prescribing behaviors before and after the program implementation, we acknowledge that there were many unmeasured factors that could affect prescribing within our intervention group. Thus, we included across group comparisons, within the same institution and in the metropolitan area, to identify if the intervention group experienced more drastic changes in prescribing practices compared to the other groups. The difference in the intervention versus other groups may introduce selection bias into our results. The program was integrated into an EHR within a safety net hospital in Denver, Colorado. The patient and clinician populations studied may not be representative of clinicians and patients in rural or suburban areas. Clinicians were initially required to manually enter patient demographic data into the program upon first use. A subsequent upgrade of the PDMP-EHR integration program eliminated this step, making PDMP checking substantially quicker and more convenient. We studied the earlier, less integrated version which may have attenuated uptake and impact. We received our PDMP-EHR integration program licenses for free. Typically, there is a cost per license per year which depends on the size of the institution and other factors. Program integration took several days of work from our EHR build team. Once the initial integration was completed, program upgrades were much simpler to complete.

Conclusions

Our study demonstrated significant changes in opioid prescribing among clinicians with and without access to a PDMP-EHR integration program. The changes which were likely due to a combination of the PDMP-EHR integration program in the intervention groups and various unmeasured factors across all three clinician groups. Clinicians reported that the program improved ease of data access in their workflow compared to the PDMP website portal through the state supported website. Further study of PDMP-EHR integration programs on patient and clinician outcomes may illuminate the role of this technology in public health and in clinical practice.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments:

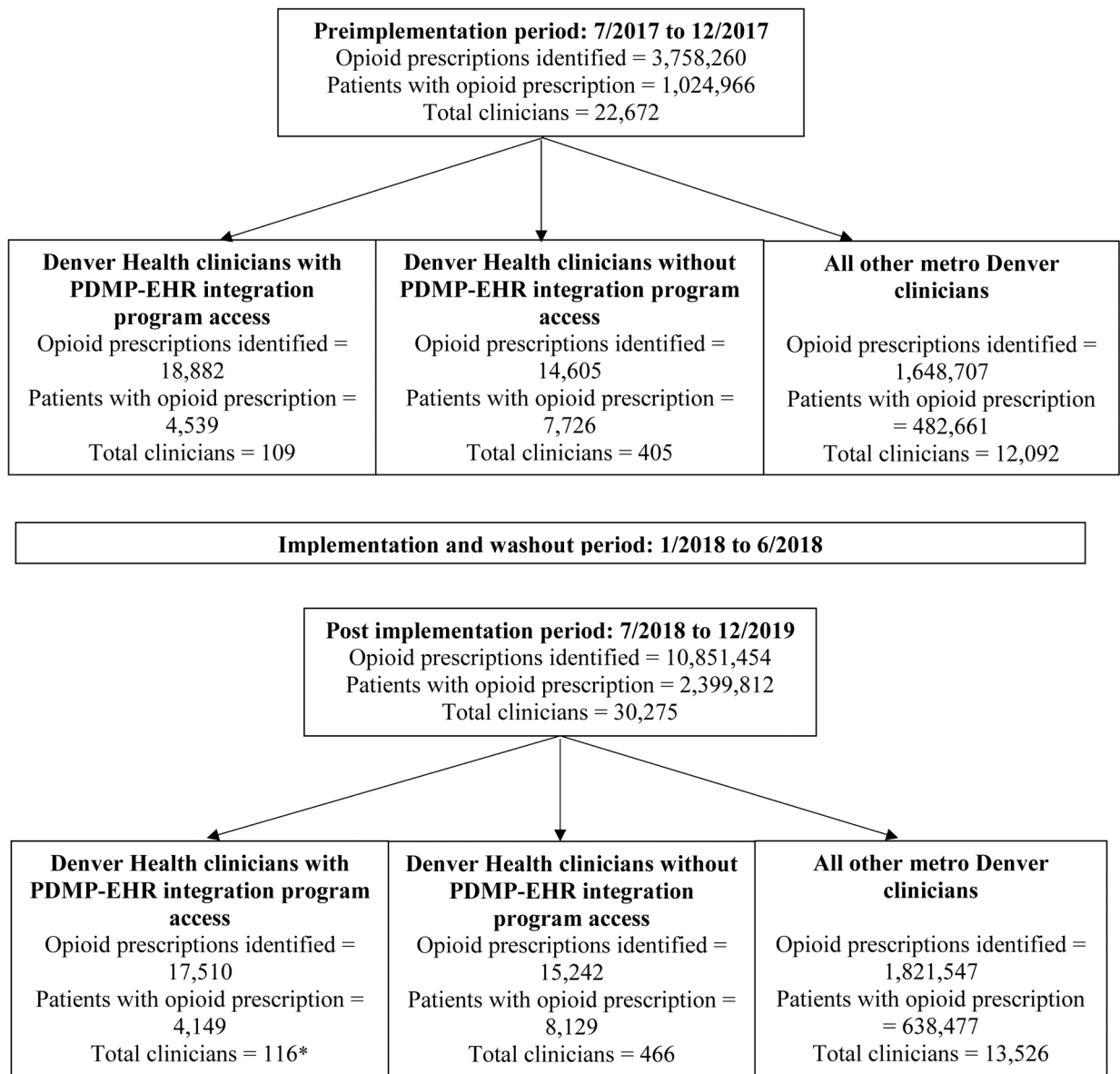
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*123 licenses were distributed; 7 prescribers left the healthcare system making the final n = 116

Figure 1.
 PDMP Data and Prescriber Pre and Post Implementation of the PDMP-EHR Integration Program

Table 1.

Percentages in Key Outcome Measures Compared Across Prescribers Pre and Post PDMP-EHR Integration Program Access

	Integrated healthcare system		Metropolitan Denver
	PDMP-EHR integration program access (n = 116)	No PDMP-EHR integration program access (n = 466)	No PDMP-EHR integration program access (n = 13,526)
Colorado residents who filled a high dose opioid prescription MME > 90^{1,2} (%)			
Preimplementation	27.6	4.8	13.5
Post Implementation	6.9*	2.9*	6.13*
Opioid intolerant Colorado residents subsequently prescribed a LA/ER opioid^{3,4} (%)			
Preimplementation	36.6	63.9	32.3
Post Implementation	28.0	67.6	52.7*
Colorado residents with overlapping opioid prescriptions⁵ (%)			
Preimplementation	17.30	12.3	20.0
Post Implementation	16.3*	12.3	19.2 ³
Colorado residents with overlapping opioid and benzodiazepine prescriptions⁶ (%)			
Preimplementation	6.9	4.4	8.8
Post Implementation	5.7*	3.6*	7.8*

* p < 0.001; comparisons were made using Z-tests

¹Limited to schedule II-IV opioid prescriptions dispensed to Colorado residents, excludes buprenorphine use to treat opioid use disorder

²Numerator is number of patients with an average of >90 MME of opioids, denominator is number of patients who received an opioid prescription

³Opioid intolerant defined as no opioid fill in the previous 45 days

⁴Numerator is number of patients prescribed 1 LA/ER opioid who were opioid intolerant, denominator is number of patients who filled a LA/ER prescription

⁵Numerator is number of days any patient had for overlapping opioid prescription, denominator is summed overlap days for all patients

⁶Numerator is number of days any patient had for overlapping opioid and benzodiazepine prescriptions, denominator is summed overlap days for all patients

Table 2.

Pre/Post PDMP-EHR Integration Program Implementation Survey

	Pre-integration (n=89)	Post-integration (n=72)	p-value*
Gender, n (%)			
Female	63 (70.8)	40 (57.1)	0.05
Practice type, n (%)			
MD, DO132 to	70 (78.7)	61 (84.7)	0.001
Nurse Practitioner	9 (10.1)	5 (6.9)	
Physician Assistant	10 (11.2)	6 (8.3)	
Years post training, n (%)			
<1	3 (3.4)	0	0.12
1–5	26 (29.2)	16 (22.2)	
6–10	18 (20.2)	17 (23.6)	
11–20	26 (29.2)	18 (25.0)	
>20	16 (18.0)	21 (29.2)	
I am aware of the 2016 CDC guidelines to check PDMP when starting opioids for chronic pain and then periodically thereafter ranging from every opioid prescription to every three months (Yes), n (%)	72 (80.9)	71 (98.6)	<0.001
Ease of PDMP use, n (%)			
Very easy	15 (16.9)	N/A	-
Somewhat easy	43 (48.3)		
Somewhat difficult	19 (21.3)		
Very difficult	9 (10.1)		
I do not use the PDMP	3 (3.4)		
Barriers to PDMP use (not mutually exclusive), n (%)			
Difficult to log on	40 (44.9)	N/A	-
Website is difficult to navigate	32 (36.0)		
Support for website (i.e., inadequate registration, password recovery)	17 (19.1)		
Lack of training on how to access / interpret / use PDMP data	7 (7.9)		
Unable to designate some to access PDMP on my behalf	21 (23.6)		
PMPD data is too difficult to interpret or lacks important detail	5 (5.6)		
Inaccurate information	9 (10.1)		
Rarely prescribe controlled substances	5 (5.6)		
Uncomfortable confronting patients when PDMP provides conflicting data from what the patient says	1 (1.1)		
Formatting of patient and prescriber information is a barrier to use	15 (16.9)		
Uncomfortable using the computer or Internet to conduct the search	1 (1.1)		
Other	28 (31.5)		
I do not use the PDMP in my clinical practice	3 (3.4)		
PDMP would be more useful with (not mutually exclusive, n (%))			
Training	11 (12.4)	N/A	-
Faster entry and display of prescription in database	54 (60.7)		

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	Pre-integration (n=89)	Post-integration (n=72)	p-value*
Unique patient identifiers to avoid mistaken identity or aliases	31 (34.8)		
Linkage of Colorado PDMP to other state systems	68 (76.4)		
Other	18 (20.2)		
I do not use the PMDP in my clinical practice	4 (4.5)		
When do you check the PDMP, n (%)			0.91
Initial patient encounter	43 (48.3)	37 (51.4)	
Suspect diversion, addiction, misuse	67 (75.3)	49 (68.1)	
Early refill request of a controlled medication	58 (65.2)	48 (66.7)	
Upon consideration of opioid prescribing	38 (42.7)	60 (83.3)	
Upon consideration of benzodiazepine prescribing	34 (38.2)	47 (65.3)	
Frequency of PDMP check when there is no concern for medication misuse or diversion, n (%)			0.15
Never	5 (5.6)	1 (1.4)	
Rarely	22 (24.7)	3 (4.3)	
Sometimes	26 (29.1)	20 (27.8)	
Often	36 (40.5)	48 (66.7)	
Frequency of PDMP check when there is concern for medication misuse or diversion, n (%)			0.03
Never	3 (3.4)	0 (0)	
Rarely	1 (1.1)	0 (0)	
Sometimes	8 (9.0)	1 (1.4)	
Often	28 (31.5)	8 (11.4)	
Every time	49 (55.1)	63 (87.5)	
Approach to a concern for medication misuse or diversion, n (%)			<0.001
Discuss concern with patient	83 (93.3)	70 (97.2)	
Prescribe alternative therapies	49 (55.1)	49 (68.1)	
Refer the patient to a specialist	34 (38.2)	19 (26.4)	
Discharge the patient from my practice	1 (1.1)	4 (5.6)	
Require the patient enters into a medication contract	39 (43.8)	36 (50.0)	
Consult a pharmacist	9 (10.1)	10 (13.9)	
Refuse to fill the prescription	38 (42.7)	34 (47.2)	
Do feel that law enforcement or your professional licensing board is scrutinizing your prescribing behavior (Yes), n (%)	34 (38.2)	28 (38.9)	0.93
How often do you worry about the medico legal ramifications of opioid or benzodiazepine prescribing?			0.07
Not at all	4 (4.5)	3 (4.3)	
Rarely	27 (30.7)	20 (27.8)	
Somewhat	39 (44.3)	43 (59.7)	
A lot	18 (20.5)	6 (8.3)	
I used the PDMP search feature offered in the pilot (Yes), n (%)	N/A	68 (95.8)	-
PDMP pilot feature is useful to my clinical practice (Yes), n (%)	N/A	68 (97.1)	-
The data provided in the PDMP is satisfactory [within the integration] (Yes), n (%)	N/A	71 (100)	-

	Pre-integration (n=89)	Post-integration (n=72)	p-value *
Patient PDMP data is easier to access now compared to before the pilot launch (Yes), n (%)	N/A	69 (98.6)	-
OpiSafe ** makes accessing PDMP data easier within my workflow (Yes), n (%)	N/A	68 (98.6)	-
I prefer checking PDMP data through OpiSafe compared to the standard PDMP website portal (Yes), n (%)	N/A	67 (94.4)	-
I wish to continue having access to OpiSafe (Yes), n (%)	N/A	68 (97.1)	-
I would recommend OpiSafe to another healthcare provider (Yes), n (%)	N/A	68 (97.1)	-

* Comparisons were analyzed using chi-square tests

** OpiSafe is the commercial name of the PDMP-EHR integration program product

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