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Comparative-Effectiveness Research/HTA

Clinical Effectiveness of Decision Support for Prescribing Opioids for Chronic Noncancer Pain: A Prospective Cohort Study

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ABSTRACT

Objectives: This prospective cohort study examines the clinical effectiveness of electronic medical record clinical decision support (EMR CDS) for opioid prescribing.

Methods: Data analysis included primary care patients with chronic opioid therapy for noncancer pain seen within an integrated health delivery system in Louisiana between January 2017 and October 2018. EMR CDS incorporated an opioid health maintenance tool to display the status of risk mitigation, and the medication order embedded the morphine equivalent daily dose (MEDD) calculator and a hyperlink to the Louisiana pharmacy drug monitoring program. Outcome measures included change in the average MEDD and rates of opioid risk mitigation, hospitalization, and emergency department use.

Results: Among 14 221 patients, 9% had prescriptions with an average MEDD ≥90 mg. There were no significant changes in MEDD after EMR CDS implementation. Increasing age, Charlson Comorbidity Index score, female sex, black non-Hispanic race, non-opioid pain medication co-prescriptions, and specialty referrals were associated with a lower odds of MEDD ≥90 (high-dose threshold). Medicare or self-pay, substance abuse history, and pain agreements were associated with increased odds of prescribing above this high-dose threshold. After incorporation of EMR CDS, patients had higher rates of urine drug screens (17% vs 7%) and naloxone prescriptions (3% vs 1%, all $P < .001$). In addition, specialty referrals to physical or occupational therapy, orthopedics, neurology, and psychiatry or psychology increased in the postintervention period. Although emergency department use decreased (rate ratio 0.92; 95% confidence interval 0.89-0.95), hospitalization rates did not change.

Conclusions: EMR CDS improved adherence to opioid risk mitigation strategies. Further research examining which practice redesign interventions effectively reduce high-dose opioid prescribing is needed.

Keywords: chronic pain, clinical decision support systems, electronic medical records, opioid analgesic, primary healthcare.

VALUE HEALTH. 2020; 23(2):157–163

Introduction

Opioid prescription drug abuse is a major public health concern in the United States, with mortality rates from fatal overdoses exceeding the rates of deaths from motor vehicle accidents.[1,2] This crisis is compounded by ever-growing increases in medical expenditures related to prescription costs and increased healthcare service utilization among opioid abusers.[3] Younger age, having a history of prescription diversion or drug substitution, doctor or pharmacy shopping, having a history of psychiatric conditions, or use of psychotropic medications are major risk factors for misuse and abuse.[4] Healthcare provider opioid-prescribing patterns (eg, higher daily dosage of opioids) further increase patients' risk for abuse, addiction, and overdose.[4,5] The risk of overdosing is 1.9 to 4.6 times higher among patients prescribed 50 to 100 mg morphine equivalent daily dose (MEDD) and 2 to 8.9 times higher for prescription doses >100 MEDD.[5] Recent evidence-based practice guidelines provide recommendations on safe prescribing of opioids.[5-8] Nevertheless, they do not provide specific guidance on how to translate these recommendations into practice. We must urgently find ways to accelerate guideline adherence in the face of an overdose crisis.

Improving provider awareness or familiarity with practice recommendations while enhancing self-efficacy and motivation is a prerequisite to provider behavior change.[9] Practice guidelines that are evidence based, plausible, goal oriented, user friendly, and easily accessed at the point of care are likely to be adopted quickly. Organization-level use of computerized decision support systems,

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https://doi.org/10.1016/j.jval.2019.09.2748

reminders, and standing orders as well as standardization of processes, procedures, and protocols within the context of quality management improves practice adherence.

To promote patient safety, quality of care, and adherence to practice guidelines for safely prescribing opioids for chronic noncancer pain, Louisiana's largest integrated delivery system implemented a multicomponent electronic medical record clinical decision support (EMR CDS) in accordance with the 2016 Centers for Disease Control and Prevention (CDC) guideline.[5] This prospective cohort study examines the clinical effectiveness of the EMR CDS for reducing rates of prescribing high-dose opioid medications, increasing rates of administering risk mitigation strategies, and reducing rates of hospitalization and emergency department (ED) use among the targeted population. The main study hypothesis is that EMR CDS that prompts providers to assess risk for aberrant drug behavior and employ risk mitigation strategies within the context of routine health maintenance and prescription writing workflows will improve adherence to clinical practice guidelines and reduce rates of high-dose opioid prescribing.

Methods

Study Design, Setting, and Participants

This prospective cohort study targeted primary care providers (internal medicine or family medicine) practicing in 36 clinic locations across southeast Louisiana in an integrated delivery system and their patients for whom opioid therapy was prescribed for chronic noncancer pain between January 1, 2017, and October 31, 2018. Patients were included in the data analysis if they met the following inclusion criteria: age 18 years and older, have a primary care provider within the health system, received opioid prescriptions for 3 of the previous 4 months (chronic opioid therapy), and no active diagnosis of cancer on their problem list. Patient exclusion criteria included age <18 years, active cancer diagnosis, undergoing cancer treatment, having a terminal illness, or receiving hospice care. The Ochsner Health System Institutional Review Board approved this study.

Louisiana 2017 State Legislation on Schedule II Pharmacy Practice

Effective June 12, 2017, the Louisiana state legislature amended its Title 40 Controlled Substance Law for 3 purposes.[10] Upon renewal of controlled drug substance licenses, prescribers are automatically issued access to the state prescription monitoring program. Prescribers are required to view the prescription-monitoring program before any new prescriptions and every 90 days if therapy exceeds 90 days. This requirement does not apply to patients with terminal illnesses or cancer-related pain or those being treated as an inpatient. Finally, 3 hours of continuing education on chronic opioid therapy is required for license renewal.

Opioid EMR CDS

Ochsner Health System's population health strategy for chronic opioid therapy was designed in alignment with Louisiana state legislation and the CDC practice guidelines. The opioid stewardship team developed a systemwide quality improvement plan, educated providers (primary care and specialists) about best practices for safe opioid prescribing, built clinical decision support tools in the Epic electronic medical record system, and optimized data analytics for performance feedback.

The EMR CDS for safe opioid prescribing is described in detail in a previous publication.[11] The health system launched its opioid EMR CDS in October 2017 using Epic's registry and health maintenance tools in accordance with its primary care population health management strategy for chronic conditions and preventive health maintenance. First, an opioid use registry was created with the following inclusion logic: (1) patient is alive, (2) age 18 years and older, (3) prescribed a schedule II opioid for at least 14 days in the past 2 years, and (4) does not have cancer or is not enrolled in hospice or palliative care. The health maintenance inclusion logic was then defined as patients who are on the opioid use registry and have been prescribed an opioid for the equivalent of 3 of the past 4 months (eg, 90-day supply or 3 refills). The retrospective prescription query looks back 4 months to account for natural variations in the time intervals during which patients might request refills.

The health maintenance tool prompts the providers to complete overdue risk mitigation tasks including pain management agreement, urine drug screening, and naloxone prescriptions for patients with moderate to high risk for displaying aberrant drug behavior as defined by the Opioid Risk Tool (ORT) score. The ORT measures the presence or absence of risk factors associated with substance abuse (age, personal and family history of substance abuse, history of preadolescent sexual abuse, and certain psychological conditions).[12] The ORT score stratifies patient risk as low (0-3), medium (4-7), or high (>7). In addition, the EMR CDS flags patients as high risk if 1 of the following criteria are met: (1) co-prescriptions for benzodiazepines, (2) active diagnosis of substance abuse in the past 12 months, or (3) MEDD ≥90 mg.

The ORT items were automatically checked affirmatively if patients had appropriate diagnosis codes in the active problem list or past medical or social history. The score, however, was not considered "valid" unless the care team indicated verification of item responses. Patients without a validated ORT score were automatically classified as "unknown risk," and their health maintenance only indicated that the ORT and pain management agreement were overdue.

The ORT score, MEDD, and hyperlinks to the Louisiana prescription-monitoring program are visible in the prescription writer. If MEDD ≥90 mg, the calculated MEDD is displayed in red font to alert the prescribing provider of high dosage. An opioid management tool also provides quick links to the Pain, Enjoyment, General Activity (PEG) 3-item pain scale[13,14]; Patient Health Questionnaire (PHQ)–4; PHQ-9; and Generalized Anxiety Disorder–7.[15-17] Finally, an Epic banner appears in the charts to alert other providers of existing pain management agreements.

Cohort Identification and Data Collection

Given the dynamic nature of prescription refill orders, patients can drop on and off the chronic opioid health maintenance list over time. Therefore, the patient cohort was generated by running a report each month to accumulate a list of eligible patients. Clinical data were extracted from the health system's Enterprise Data Warehouse on a quarterly basis for the patient cohort. Multiple cross-sectional data extractions facilitated collection of longitudinal data for patients with repeat measures documented in the EMR during the study period. All analyses were restricted to the 14 221 patients with opioid prescriptions in both the pre–EMR CDS intervention and postintervention periods.

Outcome Measures

The main outcome of interest was the change in the average MEDD before and after launching the opioid EMR CDS in October 2017. Secondary outcomes included the following: (1) comparative rates of receiving guideline concordant care (pain management agreements, urine drug screening, naloxone prescriptions,

Table 1. Characteristics of health system primary care patients receiving chronic opioid therapy for noncancer pain between January 2017 and October 2018 (N = 14 221).

Patient characteristics	Total (N = 14 221)
Age, mean (SD)	56.5 (14.9)
Female sex, n (%)	8664 (60.9)
Race, n (%)	
White, non-Hispanic	9416 (66.2)
Black, non-Hispanic	4531 (31.9)
Insurance, n (%)	
Commercial	4041 (28.4)
Medicare	6363 (44.7)
Medicaid	1938 (13.6)
Self-pay/uninsured	1755 (12.3)
Charlson Comorbidity Index, mean (SD)	1.7 (2.5)
Pain syndromes, n (%)	
Back/neck/knee pain	7564 (53.2)
Rheumatoid arthritis/osteoarthritis	6822 (48.0)
Fibromyalgia/chronic pain and fatigue	7992 (56.2)
Mental health conditions, n (%)	
Depression	3420 (24.1)
Anxiety	3851 (27.1)
Substance abuse	2642 (18.6)
Opioid medication prescriber, n (%)	
Primary care physician only	4792 (33.7)
Other specialty only	4645 (32.7)
Primary care and specialty physician	4784 (33.6)
Opioid medications, n (%)	
Hydrocodone	9638 (67.8)
Oxycodone	6080 (42.8)
Tramadol	5569 (39.2)
Nonopioid medications, n (%)	
NSAID	4532 (31.9)
Gabapentin/pregabalin	5107 (35.9)
Tricyclic antidepressants/SSRIs/SNRIs	4935 (34.7)
Topical agents (lidocaine, capsaicin, NSAIDs)	1614 (11.4)
Benzodiazepine medications, n (%)	
Alprazolam	1890 (13.3)
Lorazepam	570 (4.0)
Temazepam	269 (1.9)

NSAID indicates nonsteroidal anti-inflammatory drug; SNRI, serotonin-norepinephrine reuptake inhibitor; SSRI, Selective serotonin reuptake inhibitor.

pain assessment, and screening for depression/anxiety) before versus after the EMR CDS launch, and (2) changes in the rates of inpatient and ED use before and after launching the opioid EMR CDS. The analysis explored associations between the main outcome and select opioid risk mitigation strategies: ORT completion, pain agreements, co-prescribing nonopioid medications, and specialty referrals (orthopedics, rheumatology, physical medicine and rehabilitation, physical/occupational therapy, psychiatry, psychology, addiction services, functional restoration services). Covariates of interest included patient characteristics (age, sex, race, insurance, number of comorbidities; presence of mental health condition) and co-prescription of benzodiazepines.

Data Analysis

Patient characteristics

Categorical measures are presented as percentages. Continuous measures are presented as means and standard deviations. Patients' average MEDDs were calculated across days on which they were prescribed opioid medications during the study period and are presented as <50, 50 to 89, or ≥90. Annual utilization rates per 1000 patients are presented as means and 95% confidence intervals estimated from Poisson regression models with an offset for length of follow-up in years.

Completion of risk mitigation strategies and functional assessment

Chi-square tests or Fisher exact tests where appropriate were used to compare the proportion of patients with documentation of guideline concordant risk mitigation strategies before and after opioid EMR CDS implementation.

Factors associated with prescribing high-dose opioids

To compare the odds of being prescribed opioid medications with an MEDD over a high-risk threshold (MEDD ≥50 or 90 mg), multivariable logistic regression models were used. These thresholds were defined based on the CDC guideline recommendations to carefully consider risks and benefits of prescribing MEDD >50 mg and to avoid prescribing >90 mg.[5] The outcome indicates whether average MEDD while prescribed opioid medications exceeded the thresholds during the study period (yes/no). The model included fixed effects to model the relationships between the outcome and opioid risk mitigation strategies along with each of the aforementioned covariates of interest to restrict issues of confounding. Acknowledging that differences in prescribing patterns among providers practicing in different geographic regions may exist, a random effect was incorporated to account for the variability in the outcome related to provider location. The fixed and random effects portions of the models were specified to increase precision and reduce bias in the estimated effects on the outcome.

Change in high-dose opioid prescribing

The MEDD values for opioid medication orders are calculated within Epic and stored in the data warehouse like all other clinical data. The percentages of patients with average MEDD categories of <50, 50 to 89, and ≥90 were calculated during the pre- and postindex period. The index date was defined as the date on which the opioid EMR CDS was launched (October 17, 2017). A chi-square test was used to assess the association between study period and the proportion of patients in the 3 MEDD categories. A paired analysis was used to compare changes in average MEDD at the individual patient level before and after the launch of the EMR CDS. Baseline characteristics that stay fixed over time are irrelevant in paired analyses because they cancel out when calculating differences between study periods. Thus, no baseline covariates were included in the analysis. Instead, an unadjusted paired *t* test comparing patient-level change in average MEDD from the pre- to postindex period was used, implicitly accounting for within-patient correlation across the study period. The average MEDD values within each period and the *P* value from the paired *t* test are presented.

Change in inpatient and ED utilization rates

A multivariable mixed-effects Poisson regression model was used to assess differences in service utilization rates during the pre- and postindex period. It was assumed that patients remained in the system from their first observed encounter through the end of the study period (October 31, 2018). The model included an indicator of period, ORT status, average MEDD ≥50 mg, as well as the covariates of interest. Each model included an offset term for length of follow-up in years within each period (pre–/post–EMR

Table 2. Completion of risk mitigation strategies by intervention period.

	Preintervention (n = 14 221)	Postintervention (n = 14 221)
Completed ORT, n (%)*	926 (6.5)	1452 (10.2)
Location of administration, n (%)*		
Primary care clinic	814 (87.9)	754 (51.9)
Specialty clinic	112 (12.1)	698 (48.1)
ORT score, n (%)		
Low (0-3)	733 (79.2)	1113 (76.7)
Medium (4-7)	139 (15.0)	224 (15.4)
High (>7)	54 (5.8)	115 (7.9)
Pain contract, n (%)	1783 (12.5)	1819 (12.8)
Urine drug screen ordered, n (%)*	1053 (7.4)	2346 (16.5)
Urine drug screen completed, n (%)*	922 (6.5)	1965 (13.8)
Prescribed naloxone, n (%)*	78 (0.6)	348 (2.5)
Specialty referral, n (%)		
Physical therapy/ occupational therapy*	2970 (20.9)	3706 (26.1)
Orthopedics*	1454 (10.2)	1699 (12.0)
Neurology*	849 (6.0)	1001 (7.0)
Psychiatry/psychology*	625 (4.4)	809 (5.7)
Pain clinic	449 (3.2)	448 (3.2)
PEG-3 pain scale*	0 (0.0)	51 (0.4)
Depression/anxiety screening, n (%)		
PHQ-4*	0 (0.0)	25 (0.2)
PHQ-9*	387 (2.7)	1118 (7.9)
GAD-7*	10 (0.1)	54 (0.4)

GAD-7 indicates Generalized Anxiety Disorder–7; ORT, Opioid Risk Tool; PHQ, Patient Health Questionnaire.
*$P < .001$.

CDS). Follow-up time was calculated in the preintervention period as the number of days from the first observed encounter to October 16, 2017, for each patient and in the postintervention period as the number of days from October 17, 2017, to October 31, 2018, for all patients. Follow-up time in days was then compartmentalized into 30-day bins (eg, follow-up of 31-60 labeled 60 days) to avoid inflated utilization rates. Similar to the mixed-effects model used for assessing changes in high-dose opioid prescribing, a random region effect and random patient effect were incorporated into this model. In this instance, the region effect accounts for variability in utilization rates across regions, and the patient effect accounts for within-patient correlations in utilization rates across periods. The random effects help ensure unbiased and precise estimates of the fixed effects included in the model. Adjusted period-specific rates are presented along with rates and rate ratios.

Results

A total of 14 221 patients met the eligibility criteria for inclusion in the data analysis. Table 1 displays the characteristics of patients prescribed chronic opioid therapy for noncancer pain. Most patients were female, white non-Hispanic, and Medicare insured, and they had an average age of 57 years. The most common pain syndromes included neck/back/knee pain, arthritis, and fibromyalgia. Comorbid mental health conditions (depression/anxiety/substance abuse) were documented among up to 27% of patients. Hydrocodone was the most frequently prescribed opioid. Approximately 21% of the population were prescribed opioids, with an average MEDD ≥50 mg and 9% ≥90 mg. Although some patients received opioid prescriptions from either a primary care provider or a specialist, others received prescriptions from both provider types. The most commonly prescribed nonopioid pain medications included nonsteroidal anti-inflammatories and gabapentin/pregabalins. Approximately 13% of patients had a co-prescription for the benzodiazepine alprazolam.

Completion of Risk Mitigation Strategies and Functional Assessment

Only 7% (n = 926) of patients had a complete ORT with validated scoring in the preindex period and only 10% (n = 1452) in the postindex period (Table 2). The ORT was most frequently completed by primary care providers, with approximately 21% of these patients being classified as medium or high risk for drug aberrant behavior in the preindex period and 23% in the postindex period. After the EMR CDS implementation, patients had a higher rate of urine drug screening, naloxone prescriptions, and referrals to specialty care. Few patients were screened for symptoms of depression or anxiety using the PHQ-4 or Generalized Anxiety Disorder–7. Nevertheless, patients with a documented PHQ-9 increased from 3% to 8% after the EMR CDS index date. Less than 1% had the PEG-3 pain scale documented.

Factors Associated With Prescribing High-Dose Opioids

The odds of high-dose opioid prescriptions (average MEDD ≥90) were lower with increasing age, female sex, black non-Hispanic race, increasing Charlson Comorbidity Index, having been prescribed nonopioid pain medications, and referral to specialty care (Table 3). Diagnosis of a substance abuse disorder was associated with a substantially increased odds of high-dose opioid prescribing by a provider (odds ratio 4.75; 95% confidence interval [CI] 4.07-5.52). In addition, Medicare or self-pay, pain management agreements, and diagnoses of depression or anxiety were associated with increased odds of prescribing above this high-dose threshold. Co-prescription of benzodiazepines revealed a trend toward increased odds of high-dose opioid prescribing; however, this observed association was not statistically significant in this study. Completion of the ORT was also not associated with the odds of prescribing high-dose opioids. Similar trends in the direction and strength of the association between these factors and prescribing opioids with MEDD ≥50 mg were observed. Of note, this study did not find any significant changes in the proportion of patients diagnosed with chronic pain syndromes or mental health conditions among patients prescribed high-dose opioids before and after EMR CDS implementation (Table 4).

Change in High-Dose Opioid Prescribing

There were no significant differences in the proportion of patients prescribed <50 mg, 50 to 89 mg, or ≥90 mg MEDD or in the average patient-level MEDD before and after launching the opioid EMR CDS (Table 5).

Change in Inpatient and ED Utilization Rates

During the study period, the adjusted inpatient visit rates increased from 202 per 1000 patients to 211 per 1000 patients, although the change was not statistically significant (rate ratio 1.04; 95% CI 0.98-1.10). In contrast, the adjusted ED visit rates

Table 3. Factors associated with average morphine equivalent daily dose above threshold values during the study period (N = 14 221)

	Odds ratio (95% confidence interval)	
Covariates	MEDD ≥50 mg	MEDD ≥90 mg
Age	0.97 (0.97-0.98)*	0.96 (0.96-0.97)*
Sex: female vs male	0.65 (0.60-0.71)*	0.67 (0.59-0.76)*
Race: black, non-Hispanic vs white, non-Hispanic	0.71 (0.63-0.79)*	0.41 (0.34-0.49)*
Insurance (vs commercial)		
Medicare	1.21 (1.06-1.39)†	1.30 (1.06-1.58)†
Medicaid	1.09 (0.91-1.29)	1.13 (0.89-1.43)
Other/uninsured/self-pay	1.04 (0.86-1.26)	1.48 (1.15-1.90)*
Charlson Comorbidity Index score	0.97 (0.95-0.99)†	0.92 (0.89-0.96)*
Diagnosis: depression/anxiety (yes vs no)	1.08 (0.98-1.20)	1.16 (1.00-1.35)†
Diagnosis: substance abuse (yes vs no)	2.63 (2.36-2.93)*	4.74 (4.07-5.52)*
Prescribed benzodiazepines	1.06 (0.95-1.18)	1.02 (0.87-1.21)
Opioid Risk Tool completed (yes vs no)	1.00 (0.88-1.13)	0.91 (0.76-1.10)
Non-opioid pain medication (yes vs no)	0.85 (0.78-0.94)†	0.72 (0.63-0.82)*
Specialty referral (yes vs no)	0.93 (0.85-1.02)	0.68 (0.60-0.77)*
Pain contract	1.15 (1.01-1.32)†	1.55 (1.29-1.85)*

MEDD indicates morphine equivalent daily dose.
*$P < .001$.
†$P < .05$.

decreased significantly from 685 per 1000 patients to 622 per 1000 patients (0.91; 0.88-0.94).

Discussion

The EMR CDS directly targeted providers to increase awareness of best practices within their usual workflow. This study demonstrates that implementation of EMR CDS did not change the rates of prescribing high-dose opioids. Nevertheless, it increased rates of opioid risk mitigation within 12 months of implementation. The effect appears to be greater with respect to increasing urine drug screening and naloxone prescribing. Finally, reductions in the rates of ED use were observed, whereas the rates of hospitalization did not change.

Between 2006 and 2017, the United States had a 19% reduction in the annual opioid-prescribing rate and a concurrent decline in the rate of prescribing high-dose opioids.[18] Although the overall US prescribing rate in 2017 was 58.7 prescriptions per 100 persons, Louisiana had the fifth highest of 89.5 per 100.[19] In a recent study of US retail pharmacies, the nationwide rate of high-dose prescribing declined from 11.5 per 100 persons to 5.0 per 100, whereas Louisiana's rate declined from 14.5 per 100 to 5.0 per 100.[20] Most of the decline in Louisiana's high-dose prescribing occurred between 2009 and 2012. It is within this context that Louisiana passed state legislation in 2017.

Ochsner Health System implemented the EMR CDS for safe opioid prescribing. Nevertheless, embedding alerts of high MEDD within the medication order did not alter the rates of prescribing high-dose opioids. "Hard stops" were not programmed into the prescription writer to preserve provider clinical decision making. This study was not designed to determine whether patients had failed nonopioid medication therapies or had contraindications to alternative therapies. Nonetheless, prescribing nonopioid pain medications and referring to specialty care were associated with lower odds of high-dose prescribing. Whether or not inclusion of these latter best practices into the EMR CDS would drive changes in opioid-prescribing behaviors deserves further examination.

The EMR CDS was purposely incorporated into the primary care provider health maintenance workflow for preventive health and chronic disease management. Although prompts for the ORT and risk mitigation tasks were included as health maintenance reminders, screening for depression and anxiety or functional pain assessment were not set as reminders. Accordingly, the study

Table 4. Diagnoses of pain syndromes and mental health conditions among patients with average MEDD ≥90 across the preindex period, across the postindex period, and across the entire study period.

	Preindex (n = 1451)	Postindex (n = 1360)
Pain syndromes, n (%)		
Back/neck/knee pain	588 (40.5)	528 (38.8)
Rheumatoid arthritis/osteoarthritis	517 (35.6)	490 (36.0)
Fibromyalgia/chronic pain and fatigue	699 (48.2)	638 (46.9)
Mental health conditions, n (%)		
Depression	357 (24.6)	340 (25.0)
Anxiety	371 (25.6)	375 (27.6)
Substance abuse	492 (33.9)	497 (36.5)

Table 5. Changes in average morphine equivalent daily dose (MEDD) among patients on chronic opioid therapy during both the preindex and postindex period (N = 14 221).

	Preindex	Postindex	*P* value
MEDD, n (%)			.116
<50	11 073 (77.9)	11 207 (78.8)	
50-89	1697 (11.9)	1654 (11.6)	
≥90	1451 (10.2)	1360 (9.6)	
MEDD, mean (SE)	79.8 (2.0)	80.1 (2.0)	.653

observed some improvements in those measures embedded as health maintenance reminders. Even so, study findings suggest that most patients did not have validated ORT scores, indicating that providers ignored the health maintenance prompt. Consequently, most patients' risk status defaulted to "unknown," and their health maintenance only displayed prompts to complete the ORT and pain agreement. The opioid management tool contained quick links to the health maintenance tool, PHQ-4, and PEG-3. Nevertheless, providers could directly access health maintenance without using the opioid management tool and therefore not see the questionnaires for depression, anxiety, or functional pain assessment. Notwithstanding these postulations, provider behaviors most likely reflect differences in knowledge, attitude, and skills for treating chronic pain.[21,22] Accordingly, a key component of the US Department of Health and Human Services National Pain Strategy includes health professional training and education to improve discipline-specific core competencies in pain management.[23]

The study findings are consistent with previous research that demonstrated that psychiatric comorbidities may diminish opioid analgesia and increase the risk for opioid misuse.[24–26] Almost 30% of study patients had a known history of mental health conditions. Even more alarming was the magnitude of the association between a history of substance of abuse and receipt of high-dose opioid prescriptions. Co-prescription of benzodiazepines also appeared to trend toward higher rates of high-dose opioid-prescribing patterns. The degree to which the use and dosage of chronic opioids for noncancer pain and co-prescribed benzodiazepines reflect untreated active mental health conditions remains unclear.

This study further demonstrated relatively low (albeit improved) rates of prescribing naloxone. Although pharmacy-dispensing rates of naloxone have increased across the United States, the rate of dispensing naloxone per high-dose opioid prescription remains low.[27] The EMR CDS prompt for naloxone prescription is consistent with the National Academy of Medicine's recommendation to encourage providers to offer the medication to patients at risk for opioid misuse or overdose.[28] In addition, Louisiana has had since 2016 a standing order for the distribution or dispensing of naloxone to first responders, caregivers, and family/friends of patients on an emergent basis.[29] Pharmacy dispensing was not formally assessed in this study.

The study authors cannot solely attribute reductions in ED utilization to the EMR CDS. ED providers could see the ORT score and MEDD in the prescription writer as well as the banner alert for patients with pain agreements. Additional interventions targeting ED providers included adoption of nonopioid pain management practice guidelines, prescribing only low-dose immediate-release formulations of opioids for short courses (3-5 days), and EMR prescription order defaults that lowered dispense quantities.[30] Perhaps a combination of these practice changes deterred ED use.

This study has several limitations. First, it occurred within 1 organization and may have limited external generalizability. Nevertheless, given that the opioid EMR CDS optimizes tools available in the Epic electronic medical record system, the design of the CDS is potentially scalable to other health systems using the same EMR vendor. This scalability will in turn permit testing the efficacy and effectiveness of the CDS across multiple institutions in future studies. As with all observational studies, residual confounding cannot be entirely excluded. The authors employed analytic methods to minimize threats to internal validity that may occur with data quality, selection bias, and unmeasured confounding. All measured variables representing patient characteristics, patient prescription profiles, and prescribing provider characteristics that are potentially related to study outcomes and receipt of opioid risk assessment were incorporated into the model-based analyses used. Specification of these measured variables as fixed or random effects in the models helps ensure unbiased estimates of the effects of interest.

Conclusion

Implementation of the EMR CDS did not change rates of prescribing high-dose opioids. Given the nationwide opioid crisis, health systems and providers must urgently find ways to extend opioid management beyond standardized monitoring of risk factors for misuse or abuse and set clear protocols for next steps in chronic care management. Technology optimization that targets providers may improve some aspects of opioid risk mitigation but may not as a single intervention change opioid-prescribing behaviors. Multilevel interventions that concurrently target patients, providers, health systems, and health policy are likely to be more effective.

Acknowledgments

This study was supported by 1R01DA045029-01 from the National Institute on Drug Abuse of the National Institutes of Health (NIH). The ideas expressed in this article are the sole responsibility of the authors and do not necessarily represent the official views of NIH.

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