

Brief Research Report

Opioid Prescribing Patterns and Patient Outcomes by Prescriber Type in the Oregon Prescription Drug Monitoring Program

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Abstract

Objective. Prescription drug monitoring programs (PDMPs) were created to facilitate responsible use of controlled substances. In Oregon, physicians,

physician's assistants (MDs/DOs/PAs), dentists, nurse practitioners (NPs), and naturopathic physicians (NDs) may prescribe opioids, but differences in prescribing practices, patient mix, and patient outcomes among prescriber types have not been characterized.

Methods. De-identified Oregon PDMP data from October 2011 through October 2014 were linked with vital records and a statewide hospital discharge registry. The disciplines of registered prescribers were identified by board affiliations. Prescription profiles associated with opioid overdose risk were tabulated for patients with at least one registered prescriber. Opioid-related hospitalizations and deaths were identified using ICD-9 and ICD-10 codes.

Results. There were 5,935 prescribers registered during the study period. Patients of NPs or NDs received more high-risk opioid prescriptions than patients of MDs/DOs/PAs. For example, they received greater proportions of high-dose prescriptions (NP 12.9%, ND 15%, MD/DO/PA 11.1%), and had greater opioid-related hospitalization (NP 1.7%, ND 3.1%, MD/DO/PA 1.2%; $P < 0.005$ for all). However, patients of NPs or NDs were also more likely to have four or more prescribers (NP 45.3%, ND 58.5%, MD/DO/PA 27.1%), and most of their patients' high-risk opioid prescriptions came from prescribers in other disciplines.

Conclusions. Our analysis suggests significant differences in opioid prescription profiles and opioid-related hospitalization and mortality among patients receiving opioid prescriptions from nurse practitioners, naturopathic physicians, or medical clinicians in Oregon. However, these differences appear largely due to differences in patient mix between provider types rather than discipline-specific prescribing practices.

Key Words. Opioids; Opioid Overdose; Prescription Drug Monitoring Programs; Clinical Practice Patterns

Introduction

Opioid medications are a growing source of morbidity and mortality in the United States [1–3]. Prescription drug monitoring programs (PDMPs) have been created by most states to facilitate responsible use of controlled substances and to better understand the activities of prescribers, pharmacies, and patients.

In Oregon, physicians, physician's assistants, dentists, nurse practitioners, and naturopathic physicians may prescribe controlled substances. Though practice setting, prescriber training, and patient population vary among these groups, differences between them in patient opioid risk profiles and opioid-related morbidity and mortality have yet to be studied. Any differences in these factors may have implications for prescriber training, as well as for outreach regarding use of the PDMP.

Methods

Activities were approved by the Institutional Review Boards of Oregon Health and Science University and the Public Health Division of the Oregon Health Authority, which houses the PDMP.

Data Preparation

Deidentified Oregon PDMP prescriber and patient data from October 2011 through October 2014 were linked with Oregon vital records and a statewide hospital discharge registry, as previously described [4]. To assure anonymity in the research database, all identifying information for patients, prescribers, and pharmacies was removed from the relevant databases by an analyst in the state Public Health Division. Before removing identifying information, the analyst linked prescriptions for a given patient using probabilistic methods. Linking is performed by the PDMP vendor using a proprietary, largely deterministic algorithm, using patient name, birthdate, and address. However, a unique individual may not always be identified due to misspellings, transposed digits or characters, nicknames, surname changes, or residence changes.

Therefore, the analyst used linkage software (The Link King v7.1.21) to match individuals within and between data sets using name, birthdate, and zip code. This program creates six ordinal "linkage certainty levels," each less certain of a true match. It facilitates reviewing a sample of potentially linked pairs within each level. For certainty levels with <95% positive predictive value, potential record matches were manually reviewed. Data preparation also removed prescriptions from non-Oregon prescribers and erroneous entries such as medication transfers between pharmacies. During these

study years, the PDMP did not collect data on patient gender, race, or ethnicity.

Prescriber Disciplines

Due to the structure of the PDMP, prescriber type was only known for prescribers who registered to access the database, a voluntary process. Prescribers were grouped according to their professional board registration in dentistry (DDS/DMD), nursing (NP), medical (MD/DO/PA), or naturopathy (ND) boards. The number of patients who filled opioid prescriptions, the number of opioid prescriptions filled, and additional patient population characteristics were tabulated for all opioid prescribers who registered to access the PDMP during the study period.

High-risk Prescriptions

Prescription patterns associated with increased opioid overdose risk or discouraged in current guidelines were tabulated for patients with at least one prescriber registered with one of the above boards [5–8]. In an adaptation from earlier work, "inappropriate prescriptions" were defined as a second of the same opioid prescription written within seven days of an earlier prescription for ≥ 30 tablets from another clinician [7]. "High-dose" prescriptions were defined as $\geq 2,700$ cumulative morphine milligram equivalents (MMEs) in 30 days, as this is an average daily dose of ≥ 90 MMEs, a level discouraged by recent Centers for Disease Control (CDC) guidelines [5].

Hospitalizations and Mortality

Oregon hospitalizations for potentially opioid-related causes were identified using ICD-9 codes. Definite opioid overdoses were identified with ICD-9 codes that directly labeled them as such, e.g., "965.0 Poisoning by opiates and related narcotics." Probable opioid overdoses were identified by a code for an adverse effect of an opioid on the same day as a diagnosis suggestive of overdose, e.g., "E935.2 Adverse effects of other opioids and related narcotics" and "518.81 Acute respiratory failure." Opioid-related nonoverdose hospitalizations were identified by codes for explicitly labeled opioid-related adverse effects other than definite or probable overdose, e.g., "304.01 Opioid type dependence continuous use" without a code to suggest overdose as above [4].

Because most patients had multiple prescribers for opioids and other controlled medications (e.g., benzodiazepines), some of whom were not registered with the PDMP, we did not attempt to attribute hospitalization or death to a particular prescriber or discipline. Instead, we tabulated each hospitalization or death for every discipline that had prescribed opioids for that patient. As a result, a single death or hospitalization could be counted multiple times, once for each discipline that prescribed an opioid.

Analysis

By almost all measures of opioid prescribing, PDMP registrants in dentistry had substantially lower rates of high-risk opioid prescribing than registrants with other professional boards. We therefore focused on comparisons between nursing registrants, naturopathic registrants, and those registered with the medical board.

Patient characteristics and prescribing practices of different provider types were compared using chi-square statistics. *P* values given are for simple pairwise comparisons between dental, nursing, or naturopathic board registrants and medical board registrants.

Results

Prescriber Types

There were 633 dentists, 1,059 nurse practitioners, 139 naturopathic doctors, and 4,104 medical prescribers (MDs/DOs/PAs, “medical clinicians” hereafter) who registered with the PDMP during the study period. These figures represent 32% of NPs, 21% of medical clinicians, and 13% of NDs licensed in the state. Although these registrants were a minority of licensed clinicians, they prescribed 64.8% of all opioid prescriptions filled in Oregon during the study period.

Patient Demographics

In a comparison of patient demographics by prescriber type, NPs prescribed for a larger proportion of rural patients than did other prescriber types (40.2%). NDs had the smallest proportion of rural patients (23.5%). Age distributions of patients receiving opioids for each prescriber type were qualitatively similar, with the exception of NDs, who cared for more middle-aged patients (25–54) and fewer patients at the extremes of age (≤ 17 or ≥ 65 years).

Patients with Multiple Opioid Prescribers

Medical board registrants prescribed opioids for the largest number of patients during the study period (926,699) and wrote the largest number of opioid prescriptions (>9 million) (Table 1). However, most patients had multiple opioid prescribers. The mean number of prescribers per patient was greater among those receiving opioids from naturopathic physicians or nurse practitioners than among all patients receiving prescriptions from medical clinicians (mean numbers: ND 6.1, NP 4.3, medical clinicians 3.0). Correspondingly, patients of NDs and NPs were more likely to have four or more prescribers than all patients who received opioids from medical clinicians (58.5% among patients of NDs, 45.3% among patients of NPs, 27.1% among patients of medical clinicians; $P < 0.01$) (Table 2). For patients who received opioids from NDs or NPs, the majority also received an opioid from a medical clinician (64.2% for NDs, 61.4% for NPs) (Table 1).

“Inappropriate” Opioid Prescriptions and Potential Benzodiazepine Overlaps

“Inappropriate prescriptions” written by any provider type were most frequent among patients prescribed opioids by NDs (0.92% among patients of NDs, 0.45% among patients of NPs, 0.42% among all patients of medical clinicians; $P < 0.005$). However, for patients of NDs and NPs, relatively few of the “inappropriate prescriptions” were actually written by prescribers in these disciplines (18.7% NP, 19.1% ND) (Table 2).

Additionally, patients filling opioid prescriptions from NDs and NPs were more likely than patients of medical clinicians to also have a benzodiazepine prescription within the previous six months (27.8% ND, 21.0% NP, 20.3% medical clinicians; $P < 0.005$).

High-Dose Opioid Prescriptions

As with “inappropriate prescriptions,” high-dose prescriptions written by any provider type were most frequent among patients for whom NDs and NPs prescribed opioids (15.0% among patients of NDs, 12.9% among patients of NPs, 11.1% among patients of medical clinicians; $P < 0.005$). However, as with inappropriate prescriptions, for patients of NDs and NPs, only a minority of high-dose prescriptions were actually written by prescribers in these disciplines (33.7% NP, 34.5% ND; both $P < 0.005$ compared with medical clinicians).

Hospitalizations and Deaths

All-cause hospitalization rates were significantly higher among patients of NDs and NPs compared with those of medical clinicians (10.5% among patients of NDs, 9.5% among patients of NPs, 8.1% among patients of medical clinicians; $P < 0.005$). Opioid-related hospitalization rates were also higher among patients of NDs (3.1%) and NPs (1.7%) compared with medical clinicians (1.2%; both $P < 0.005$) (Table 2). Similarly, the proportion of patients prescribed an opioid by NDs and NPs who died of opioid-related causes was significantly larger than among patients of medical clinicians (0.16% among patients of NDs, 0.08% among patients of NPs, 0.05% among patients of medical clinicians; $P < 0.005$).

Sensitivity Analysis

Because no information was available on patient diagnoses, we conducted a sensitivity analysis intended to exclude the vast majority of patients with invasive cancer or those receiving palliative care [9,10], recognizing that opioid prescribing practices for these patients are often liberal. The primary analysis was repeated, while limiting the analysis to patients under age 45 years who did not die during the study period and who never had an address outside Oregon recorded in the PDMP. Though the overall numbers of patients and

Table 1 Opioid prescribing according to Licensing Board, Oct 2011–Oct 2014*

	Dental Board	Nursing Board	Medical Board	Naturopathy Board
Prescribers registered with the PDMP during the study period, No.	633	1,059	4,104	139
Patients with at least 1 opioid prescription, No.	187,952	194,276	926,699	4,411
Total opioid prescriptions filled, No.	1,441,175	2,962,911	9,194,559	113,373
No. (%) of opioid prescriptions that came from a prescriber in this discipline	310,468 (21.5)	842,544 (28.4)	6,046,624 (65.8)	35,740 (31.5)
Mean (SD) No. of opioid prescribers (PDMP-registered or not) per patient	3.1 (3.6)	4.3 (4.0)	3.0 (2.7)	6.1 (6.9)
Mean (SD) No. of PDMP-registered opioid prescribers in this discipline per patient	1.1 (0.47) [†]	1.2 (0.56) [†]	1.7 (1.42)	1.3 (0.68) [†]
% of patients in this column who also had an opioid prescription from a registered medical board member	38.7	61.4	100	64.2
% of patients with an opioid prescription living in rural areas	35.3 [†]	40.2 [†]	37.4	23.5 [†]
Patient age category at time of first opioid prescription from this clinician type, No. (%)	†	†		†
Under 18 y	11,436 (6.08)	5,534 (2.85)	36,117 (3.90)	23 (0.52)
18–24 y	26,093 (13.9)	16,771 (8.6)	82,529 (8.9)	171 (3.9)
25–34 y	38,652 (20.6)	35,294 (18.2)	146,370 (15.8)	977 (22.2)
35–44 y	30,441 (16.2)	34,764 (17.9)	144,546 (15.6)	1,010 (22.9)
45–54 y	31,836 (16.9)	38,018 (19.6)	160,186 (17.3)	1,102 (25.0)
55–64 y	28,852 (15.4)	33,535 (17.3)	160,665 (17.3)	887 (20.1)
≥65 y	20,642 (11.0)	30,360 (15.6)	196,286 (21.2)	241 (5.5)

Patients are counted if at least one of a patient's prescribers was registered in that professional board. All prescriptions written during the three-year study interval by a PDMP-registered prescriber from at least one of these boards are included.

*Prescribers are counted as "registered" if they were ever registered for the PDMP in the study period. Some prescriptions counted here may have been written prior to registration. Patients are counted once for each provider type, so they may be represented in more than one column if they saw more than one provider type during the study period.

[†] $P < 0.0001$ in comparison with medical board registrants, chi-square.

prescriptions were smaller, the results of this analysis were qualitatively similar.

Discussion

There were significant differences in prescription risk profiles and outcomes among patients who saw different prescriber types in Oregon. The most substantial differences were observed for patients of dentists, where prescribing practices were substantially lower-risk in all categories, and whose opioid-related hospitalization and mortality were lowest. This is likely due to the predominance of short-term and low-dose postprocedure opioid prescribing, rather than long-term prescribing.

The proportion of opioid-related hospitalizations and deaths among patients prescribed an opioid by a nurse

practitioner was significantly greater than that of all patients prescribed an opioid by a medical clinician. Patients who received an opioid from an NP also had, on average, more opioid prescribers than did all patients who received an opioid from a medical clinician. However, only a minority of the high-risk prescriptions came from NPs. This suggests that high-risk patients may be more likely to seek an NP, rather than that an NP is more likely (than medical clinicians) to write high-risk prescriptions. Indeed, the absolute numbers of inappropriate opioid prescriptions, high-dose prescriptions, and potential opioid-benzodiazepine overlaps were greatest from medical clinicians (Table 2).

A similar pattern was observed among patients who received an opioid from a PDMP-registered naturopathic doctor during the study period. NDs were the smallest

Table 2 Prescribing practices, opioid-related hospitalizations, and opioid-related deaths among patients receiving at least one opioid prescription from a PDMP-registered clinician during the study interval*

Measure	Dental Board	Nursing Board	Medical Board	Naturopathy Board
No. (%) of patients with 4 or more opioid prescribers in database	50,599 (26.9)	87,985 (45.3) [†]	250,654 (27.1)	2,579 (58.5) [†]
No. (%) of inappropriate opioid prescriptions received from any prescriber type	986 (0.07) [†]	13,438 (0.45) [†]	38,270 (0.42)	1,041 (0.92) [†]
Among all inappropriate prescriptions, No. (%) that were written by this prescriber type	127 (12.9) [†]	2,518 (18.7) [†]	19,413 (50.7)	199 (19.1) [†]
Among all opioid prescriptions in this column, No. (%) of high-dose opioid prescriptions ($\geq 2,700$ MMEs/30 d)	103,159 (7.2) [†]	383,257 (12.9) [†]	1,023,615 (11.1)	17,045 (15.0) [†]
Among all high-dose ($\geq 2,700$ MMEs/30 d) opioid prescriptions, No. (%) written by this prescriber type	39 (0.04) [†]	129,242 (33.7) [†]	740,860 (72.4)	5,884 (34.5) [†]
Among all opioid prescriptions, No. (%) to a patient with a benzodiazepine prescription in the previous 6 mo	37,528 (12.1) [†]	176,848 (21.0) [†]	1,224,799 (20.3)	9,931 (27.8) [†]
Among patients with an opioid prescription, No. (%) who were hospitalized for any cause	8,746 (4.6) [†]	18,351 (9.5) [†]	75,345 (8.1) [†]	464 (10.5) [†]
Among patients with an opioid prescription, No. (%) who were hospitalized for opioid-related cause	1,293 (0.7) [†]	3,364 (1.7) [†]	11,023 (1.2)	137 (3.1) [†]
Among patients with an opioid Rx, No. (%) who died of an opioid-related cause	81 (0.04)	149 (0.08) [†]	489 (0.05)	7 (0.16) [†]

*Patients are counted once for each provider type, so they may be represented in more than one column if they saw more than one provider type.

[†] $P \leq 0.005$ in comparison with medical board registrants, chi-square.

group of registered prescribers and prescribed the fewest opioid prescriptions overall. More than half of patients prescribed opioids by NDs received opioid prescriptions from four or more prescribers during the study period, and typically only one was an ND. Though NDs prescribed opioids for a smaller number of patients in total, these patients had higher rates of high-dose opioid prescriptions, inappropriate opioid prescriptions, and potential opioid-benzodiazepine overlaps. However, only a minority of the high-risk prescriptions were written by NDs. As with NPs, this suggests that high-risk patients may be more likely to seek a PDMP-registered ND, rather than that an ND is more likely (than medical clinicians) to write high-risk prescriptions. Though the number of recorded events was small, a larger percentage of patients prescribed an opioid by NDs anytime during the study period had an opioid-related hospitalization or death compared with patients prescribed an opioid by other provider types (Table 2).

Our data have some notable limitations. Though PDMP-registered clinicians wrote almost two-thirds of opioid

prescriptions filled during the study interval, the remaining prescribers did not register during the study period, and thus their professional disciplines are unknown. We cannot ascribe hospitalization or mortality events to individual prescribers, as most patients had multiple prescribers in the study period. Even attributing a high-risk prescription to a given board of clinicians must be done cautiously, because in most cases a single clinician representing a single board was one of many opioid prescribers per patient, and because some metrics require multiple prescribers by definition (e.g., receiving prescriptions from four or more prescribers during the study period). In our data, PDMP registrants were much more frequent opioid prescribers than nonregistrants, so our findings may generalize only to relatively high-volume opioid prescribers.

Our data also do not provide explanations for the differences among provider types that we observed. There are likely differences in patient mix that are not apparent from the limited demographic and clinical information available in the PDMP. For example, it may be that

“doctor shoppers” or those who have failed other therapies seek out NPs or NDs to obtain additional opioid prescriptions, that patients with certain medical or psychiatric conditions are more likely to seek multiple provider types, or that other patient characteristics that lead a patient to seek a particular provider type may also contribute to hospitalization or mortality risk. In some practice situations, physicians may provide initial patient care, but ask NPs to assume long-term follow-up of patients with more recalcitrant chronic pain symptoms. This could result in NPs having more patients with multiple prescribers and higher-risk prescriptions. A similar pattern may occur less formally with NDs.

Overall, our data suggest that nurse practitioners and naturopathic doctors are as likely, if not more likely, than medical clinicians to be sought out by high-risk patients. Consequently, efforts to train clinicians in opioid prescribing and use of the PDMP are at least as important for nurse practitioners and naturopathic physicians as for medical physicians and physician assistants. Future research is needed to confirm our findings, to seek explanations for the differences between provider types, and to address the need for training in opioid stewardship and continuing clinician education to address our changing health care provider landscape.

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