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Controlled Substance Prescribing Patterns — Prescription Behavior Surveillance System, Eight States, 2013



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Controlled Substance Prescribing Patterns — Prescription Behavior Surveillance System, Eight States, 2013

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Abstract

Problem/Condition: Drug overdose is the leading cause of injury death in the United States. The death rate from drug overdose in the United States more than doubled during 1999–2013, from 6.0 per 100,000 population in 1999 to 13.8 in 2013. The increase in drug overdoses is attributable primarily to the misuse and abuse of prescription drugs, especially opioid analgesics, sedatives/tranquilizers, and stimulants. Such drugs are prescribed widely in the United States, with substantial variation by state. Certain patients obtain drugs for nonmedical use or resale by obtaining overlapping prescriptions from multiple prescribers. The risk for overdose is directly associated with the use of multiple prescribers and daily dosages of >100 morphine milligram equivalents (MMEs) per day.

Period Covered: 2013.

Description of System: The Prescription Behavior Surveillance System (PBSS) is a public health surveillance system that allows public health authorities to characterize and quantify the use and misuse of prescribed controlled substances. PBSS began collecting data in 2012 and is funded by CDC and the Food and Drug Administration. PBSS uses standard metrics to measure prescribing rates per 1,000 state residents by demographic variables, drug type, daily dose, and source of payment. Data from the system can be used to calculate rates of misuse by certain behavioral measures such as use of multiple prescribers and pharmacies within specified time periods. This report is based on 2013 de-identified data (most recent available) that represent approximately one fourth of the U.S. population. Data were submitted quarterly by prescription drug monitoring programs (PDMPs) in eight states (California, Delaware, Florida, Idaho, Louisiana, Maine, Ohio, and West Virginia) that routinely collect data on every prescription for a controlled substance to help law enforcement and health care providers identify misuse or abuse of such drugs.

Results: In all eight states, opioid analgesics were prescribed approximately twice as often as stimulants or benzodiazepines. Prescribing rates by drug class varied widely by state: twofold for opioids, fourfold for stimulants, almost twofold for benzodiazepines, and eightfold for carisoprodol, a muscle relaxant. Rates for opioids and benzodiazepines were substantially higher for females than for males in all states. In most states, opioid prescribing rates peaked in either the 45–54 years or the 55–64 years age group. Benzodiazepine prescribing rates increased with age. Louisiana ranked first in opioid prescribing, and Delaware and Maine had relatively high rates of use of long-acting (LA) or extended-release (ER) opioids. Delaware and Maine ranked highest in both mean daily opioid dosage and in the percentage of opioid prescriptions written for >100 MMEs per day. The top 1% of prescribers wrote one in four opioid prescriptions in Delaware, compared with one in eight in Maine. For the five states whose PDMPs collected the method of payment, the percentage of controlled substance prescriptions paid for in cash varied almost threefold, and the percentage paid by Medicaid varied sixfold. In West Virginia, for 1 of every 5 days of treatment with an opioid, the patient also was taking a benzodiazepine. Multiple-provider episode rates were highest in Ohio and lowest in Louisiana.

Interpretation: This report presents rates of population-based prescribing and behavioral measures of drug misuse in the general population that have not been available previously for comparison among demographic groups and states. The higher prescribing rates for opioids among women compared with men are consistent with a higher self-reported prevalence of certain common types of pain, such as lower back pain among women. The trend in opioid prescribing rates with age is consistent with an increase in the prevalence of chronic pain with age, but the increasing prescribing rates of benzodiazepines with age is not consistent with the fact that anxiety is most common among persons aged 30–44 years. The variation among states in the type of opioid or benzodiazepine

of choice is unexplained. Most opioid prescribing occurs among a small minority of prescribers. Most of the prescriptions by top-decile prescribers probably are written by general, family medicine, internal medicine, and midlevel practitioners. The

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source of payment varied by state, for reasons that are unclear. Persons who are prescribed opioids also are commonly prescribed benzodiazepine sedatives despite the risk for additive depressant effects.

Public Health Actions: States can use their prescription drug monitoring programs to generate population-based measures for the prescribing of controlled substances and for behaviors that suggest their misuse. Comparing data with other states and tracking changes in these measures over time can be useful in measuring the effect of policies designed to reduce prescription drug misuse.

Introduction

The death rate from drug overdose in the United States more than doubled during 1999–2013, from 6.0 per 100,000 population in 1999 to 13.8 in 2013 (1), attributable largely to an increase in overdoses involving prescribed controlled substances, especially opioid analgesics and antianxiety/insomnia medications (2,3). Morbidity also has increased; during 2004–2011, the number of persons seen in emergency departments because of the misuse/abuse of prescription drugs increased 153% for opioid analgesics and 124% for antianxiety/insomnia medications (4,5).

To characterize and describe trends in controlled substance prescribing and prescription drug misuse, CDC and the Food and Drug Administration (FDA) funded the Prescription Behavior Surveillance System (PBSS) through an interagency agreement with the Bureau of Justice Assistance (BJA). BJA in turn contracted with the Prescription Drug Monitoring Program Center of Excellence at Brandeis University (<http://www.pdmpexcellence.org>) to develop, manage, and host PBSS.

PBSS collects data from participating state Prescription Drug Monitoring Programs (PDMPs), which are systems that are mandated to collect information from prescriptions for controlled drugs dispensed within a state (6). As of August 2015, PDMPs operated in all 50 states except Missouri. PDMPs were originally created primarily as a tool for law enforcement to identify patients, prescribers, or dispensers engaged in illegal activities such as drug diversion. Later, they became sources of information for prescribers on the prescription histories of their patients, which helps prescribers identify signs of prescription drug misuse or abuse, such as the use of multiple prescribers for the same drugs (7). Most PDMPs are managed by state health departments or boards of pharmacy.

PBSS represents an additional use of PDMP data for public health surveillance (8). PBSS allows comparisons to be made among states in the use and abuse of prescription drugs and will provide early warning of changes in such use. As with many surveillance systems, such as the Behavioral Risk Factor Surveillance System (<http://www.cdc.gov/brfss>), trends in PBSS data can be used to evaluate initiatives designed to change patient and provider behaviors to reduce prescription drug abuse and the resulting fatal overdoses. This is the first report to provide comparable, current data on controlled substance use from multiple state PDMPs for public health purposes. State agencies can use the information in this report to implement and evaluate interventions to address prescription drug abuse.

Methods

General Characteristics of PBSS

PBSS is an ongoing, population-based surveillance system that compiles data on all prescriptions for controlled drugs dispensed at pharmacies located within participating states. Regulations for the majority of states require that all pharmacies submit prescription information electronically to the system within 1 week of a prescription being filled (9), including prescriptions that were written out of state but dispensed in state. As of November 2014, a total of 44 of the 49 states with PDMPs also required mail-order, Internet, and out-of-state pharmacies to submit information on prescriptions written for their residents but dispensed out of state (10). Substance abuse treatment programs do not submit information to PDMPs on drugs they administer to patients. Veterans Administration facilities are authorized to submit data to state PDMPs and began doing so in 2014. As of September 2014, Indian Health Service facilities were preparing to participate in state PDMPs (11).

Selected states submit record-level PDMP data electronically to PBSS. States submit “legacy” data (i.e., data from previous years) upon joining the system and submit quarterly incident data thereafter. Quarterly data are available for use in PBSS within 3 months of the close of each calendar quarter. Data are available from most PBSS states for 2010 and following years, but only data from 2013, the most recent year for which data are available, are included in this report.

Drug Classes Included in PBSS

Prescription drugs regulated by the Controlled Substances Act (21 U.S.C. §§801–904) are termed “controlled substances” and are classified by the Drug Enforcement Administration (DEA) into five schedules (6). Prescription drugs prone to abuse usually are included in Schedules II–V (Schedule I includes illicit drugs). Schedule V is limited to drugs with the lowest potential for abuse (e.g., cough and cold formulations and antidiarrheal agents). As of 2014, all states in PBSS tracked at least drugs in Schedules II–IV. States can, at their discretion, add other drugs not scheduled by DEA to the list of drugs that must be reported to PDMPs. For example, some states added carisoprodol and/or the opioid analgesic tramadol before those drugs were scheduled by DEA in 2012 and 2014, respectively (12,13).

PBSS categorizes controlled prescription drugs primarily into three pharmacologic categories (opioid analgesics, benzodiazepines, and stimulants) rather than into schedules. PBSS also tracks selected other controlled drugs such as carisoprodol and the sleep aid zolpidem. Other controlled prescription drugs (e.g., barbiturates) are captured by PDMPs but are not tabulated separately by PBSS because those drugs were not considered important contributors to the drug overdose problem as of 2010 (3). Although the primary use of buprenorphine is for substance abuse treatment, PBSS categorizes it as an opioid analgesic. Cough and cold formulations containing opioids are not included in the opioid analgesic category in PBSS. Tramadol was not included in PBSS until 2014 and is not included in this report.

Data Source and Elements

The original source of information is a paper or electronic prescription form from a provider that is submitted to a pharmacy. Pharmacy software systems add the National Drug Classification (NDC) codes to the electronic prescription record based on the drug description. On receipt of data from pharmacies, PDMPs or their data management vendors use personal identifiers to link all the prescriptions for each patient, using a variety of deterministic or probabilistic methods. They also link all the prescriptions written by individual prescribers and dispensed by individual pharmacies based on their unique DEA numbers. Once linkage is completed, PDMPs anonymize the information by replacing patient, prescriber, and pharmacy identifying information with unique identifying numbers before submitting data to PBSS. These project-specific identifying numbers are maintained as PDMPs update their data to PBSS. PDMPs submit a standard set of 25 data elements (Box 1).

Data Processing at Prescription Drug Monitoring Program Center of Excellence

The Prescription Drug Monitoring Program Center of Excellence (COE) at Brandeis University processes data submitted by PBSS states. COE computes new variables using the submitted data, including patient age in years, the distance from patient to prescriber and from patient to dispenser, and the strength of an opioid prescription in standard units of morphine milligram equivalents (MMEs). The conversion factors for each opioid to MMEs were developed by CDC and are available on request from the Division of Unintentional Injury Prevention, National Center for Injury Prevention and Control, CDC. COE groups opioid analgesics into long-acting/extended-release

BOX 1. Data elements submitted to the Prescription Behavior Surveillance System by state prescription drug monitoring programs

- Patient de-identified number
- Patient year of birth
- Patient state
- Patient zip code
- Patient city
- Patient sex
- Prescriber de-identified number
- Prescriber state
- Prescriber zip code
- Prescriber city
- Dispenser de-identified number
- Dispenser state
- Dispenser zip code
- Dispenser city
- Date dispensed
- Date prescription was written
- National Drug Code for the drug
- Drug name
- Prescription number (when applicable)
- Strength
- Days of supply
- Quantity dispensed, e.g., number of pills
- Method of payment (some states only)
- Refills authorized in original prescription (yes/no)
- Refill number

forms or short-acting forms on the basis of their NDC codes. COE also assigns ranks to prescribers and dispensers by daily prescribing or dispensing volume and median distance from patient to prescriber or from patient to dispenser so they can be categorized into state-specific percentiles. COE further determines whether patients are prescribed different classes of drugs (e.g., opioids and benzodiazepines) simultaneously or are seeing multiple prescribers and dispensers for the same class or schedule of drugs.

The COE project team, in collaboration with CDC and FDA, has developed 43 prescription behavior measures (<http://www.pdmpexcellence.org/content/prescription-behavior-surveillance-system-0>). Measures of misuse/abuse are based on their association with overdose or clinical diagnosis of drug abuse (14,15). All measures are restricted to state residents. Prescriber and dispenser measures are restricted to in-state providers. Most measures are expressed as crude, population-based rates calculated from the most current state census information available from the U.S. Census Bureau.

Quality Control

Each quarterly update from a state consists of the latest data and the three preceding quarters of data, so any corrections to the data submitted by reporting pharmacies will be captured eventually in the PBSS database. PBSS staff inspect reports of the prescription behavior measures for values that appear to be out of range and assess types of errors and error rates in PBSS data by examining the percentage of records for each field that are corrected in successive quarterly updates for each state. Quarterly reports include the percentage of missing values for key variables such as patient sex, age, zip code, and method of payment. Demographic variables are rarely missing (<1%), but method of payment is missing for 5%–25% of prescriptions.

Surveillance Sites

Eight states submitted complete 2013 data to PBSS in time to be included in this first report: California, Delaware, Florida, Idaho, Louisiana, Maine, Ohio, and West Virginia. These eight states represent all four U.S. Census Bureau regions and comprise one fourth of the U.S. population.

Analysis

A subset of 12 of the most frequently employed behavior measures is included in this report (Box 2). Rates for drug classes and individual drugs are calculated per 1,000 state residents. Multiple-provider episode (MPE) rates are calculated per 100,000 state residents. An MPE is defined as an instance in which a patient fills prescriptions from five or more prescribers at five or more pharmacies for drugs of a particular class within a 6-month period. Annual MPE rates were calculated as the mean of the two 6-month rates during the calendar year. Overlapping prescribing is calculated as the percentage of prescribed days for a particular class of drugs that overlap with a prescription for another class of drugs. For the percentage of long-acting opioid prescriptions dispensed to “opioid-naïve” patients, patients were defined as “opioid-naïve” if they had not had an opioid prescription in the preceding 60 days.

Results

Opioid analgesics were prescribed at higher rates than stimulants or benzodiazepines in all states, with rates approaching one prescription per state resident (Table 1). Prescribing rates by drug class varied widely by state: 1.7-fold for opioids, 4.6-fold for stimulants, and 1.9-fold for benzodiazepines. Louisiana had the highest rate and California the lowest rate for all drug classes. Females had substantially higher rates for opioids and benzodiazepines than males in all

BOX 2. Behavior measures from the Prescription Behavior Surveillance System included in this summary

- Prescribing rates by drug class and sex
- Prescribing rates by drug class and age group
- Prescribing rates by type of opioid
- Prescribing rates by type of benzodiazepine
- Prescribing rates by type of stimulant
- Prescribing rates for the miscellaneous drugs carisoprodol and zolpidem
- Mean daily dosage in morphine milligram equivalents (MMEs) by type of opioid
- Proportion of opioid prescriptions accounted for and mean MMEs for different prescriber percentiles
- Proportion of prescriptions by payment type for opioids and all controlled substances
- Proportions of opioid-treated days overlapping with benzodiazepines and overlapping types of opioids
- Proportion of long-acting/extended-release opioids prescribed to opioid-naïve patients and their daily dosage
- Multiple-provider episode rates (6-month), by drug schedule and age group

states. For stimulants, male rates were at or above female rates in five states (California, Delaware, Idaho, Maine, and Ohio).

Opioid prescribing rates increased steadily with age in two states (California and Idaho) (Table 2) (Figure 1). In the other six states, prescribing rates peaked in either the 45–54 years or the 55–64 years age group. Louisiana had the highest prescribing rate for all age groups other than the 25–34 years age group. The peak prescribing rate for benzodiazepines was in the oldest age group (age ≥65 years) in all states but Delaware, where rates peaked among persons aged 55–64 years. For stimulants, prescription rates were highest among children aged <18 years in all states but Idaho. The age groups with the next highest rates were 18–24, 25–34, or 35–44 years. Children aged <18 years were prescribed stimulants 5.8 times more often in Louisiana than in California.

The variation from highest to lowest states was greater for individual types of opioids than for the category of opioids in general (Table 3). Louisiana ranked first for opioids largely because of its high rates for short-acting (SA) hydrocodone, 3.8 times the rate in Delaware, the state with the lowest rate. Hydrocodone SA accounted for 65% of Louisiana’s opioid prescriptions and 21% of Delaware’s opioid prescriptions (Figure 2). In contrast, oxycodone SA accounted for 43% of opioid prescriptions in Delaware and 15% of opioid prescriptions in Louisiana. California had the highest ratio of

TABLE 1. Prescribing rates,* by drug class and sex — Prescription Behavior Surveillance System, seven states,† 2013

Drug class/Sex	State						
	California	Delaware	Florida	Idaho	Louisiana	Maine	Ohio
Opioids							
Male	504.9	750.2	634.2	600.9	923.5	789.0	770.0
Female	685.9	902.8	769.1	811.7	1,112.4	918.1	1,001.9
Total	596.3	829.4	703.4	777.1	1,021.7	855.1	888.7
Stimulants							
Male	90.0	306.1	175.3	175.2	400.7	307.5	260.0
Female	85.4	270.4	224.2	171.3	406.1	280.9	193.7
Total	87.7	287.7	200.4	190.9	403.9	293.9	226.2
Benzodiazepines							
Male	223.0	291.0	391.0	194.4	404.9	339.8	304.5
Female	396.8	555.8	698.6	388.7	746.8	630.1	590.0
Total	310.8	428.2	548.8	324.3	580.6	488.3	450.7

* Per 1,000 state residents.

† West Virginia was not included because it did not collect data on patient sex for most of 2013.

TABLE 2. Prescribing rates,* by drug class and age group — Prescription Behavior Surveillance System, eight states, 2013

Drug class/ Age group (yrs)	State							
	California	Delaware	Florida	Idaho	Louisiana	Maine	Ohio	West Virginia
Opioid								
<18	32.3	48.6	32.5	71.8	141.9	46.9	68.6	58.6
18–24	223.8	336.1	250.2	414.2	437.7	378.1	419.9	356.1
25–34	435.6	861.8	612.0	755.9	978.7	1,048.6	896.5	1,010.2
35–44	596.8	1,138.9	798.5	959.1	1,309.5	1,089.3	1,115.7	1,201.3
45–54	922.3	1,488.5	1,070.2	1,223.8	1,618.6	1,239.1	1,380.7	1,387.2
55–64	1,210.7	1,344.1	1,220.1	1,339.9	1,715.7	1,157.5	1,412.2	1,407.1
≥65	1,249.0	948.2	1,031.6	1,344.7	1,588.3	1,105.2	1,312.0	1,249.4
Total	596.3	829.4	703.4	777.1	1,021.7	855.1	888.7	929.3
Stimulant								
<18	118.4	562.8	280.8	246.5	689.8	557.8	496.7	448.8
18–24	99.6	369.8	188.9	189.2	418.1	399.6	279.5	167.7
25–34	97.7	332.0	244.5	214.9	504.6	444.2	219.3	192.3
35–44	83.0	269.8	277.4	250.4	470.7	350.1	183.5	210.1
45–54	80.4	208.8	224.7	196.8	288.0	205.7	136.7	145.2
55–64	74.3	132.3	160.1	140.9	165.8	126.3	89.5	88.3
≥65	33.2	32.1	46.9	49.0	47.7	38.5	28.2	24.4
Total	87.7	287.7	200.4	190.9	403.9	293.9	226.2	194.3
Benzodiazepine								
<18	12.5	25.1	20.4	16.2	23.5	26.9	25.6	23.1
18–24	81.3	118.0	95.7	109.4	128.0	133.4	115.3	97.0
25–34	187.1	343.8	294.8	268.8	414.9	440.5	342.1	368.4
35–44	293.6	514.2	494.5	420.7	678.5	605.1	523.6	639.9
45–54	465.3	696.2	739.4	536.9	900.8	690.8	690.3	873.5
55–64	636.3	728.5	930.2	587.0	1,022.8	687.8	744.4	942.0
≥65	764.4	695.4	1,150.3	609.6	1,282.3	774.2	852.7	1,015.5
Total	310.8	428.2	548.8	324.3	580.6	488.3	450.7	572.1

* Per 1,000 state residents.

hydrocodone SA to oxycodone SA, 5.7. Delaware and Maine had high rates of prescribing of long-acting (LA) or extended-release (ER) opioids such as fentanyl LA, methadone, and oxycodone LA. Buprenorphine, a drug used primarily for outpatient substance abuse treatment rather than for pain, was prescribed nine times more often in Maine and West Virginia than in California. Maine moves from fourth to sixth in the state ranking if buprenorphine is not included in its total.

Overall, alprazolam, lorazepam, and clonazepam were the three most prescribed benzodiazepines (Table 4). Alprazolam accounted for almost half of all benzodiazepine prescriptions in Delaware (48.5%) (Figure 3). In contrast, it represented only 21.3% of such prescriptions in Maine, where lorazepam was the most prescribed product.

Amphetamine, methylphenidate, and lisdexamfetamine ranked first, second, and third, respectively, among stimulants

FIGURE 1. Opioid prescribing rates per 1,000 state residents, by age group — Prescription Behavior Surveillance System, eight states, 2013

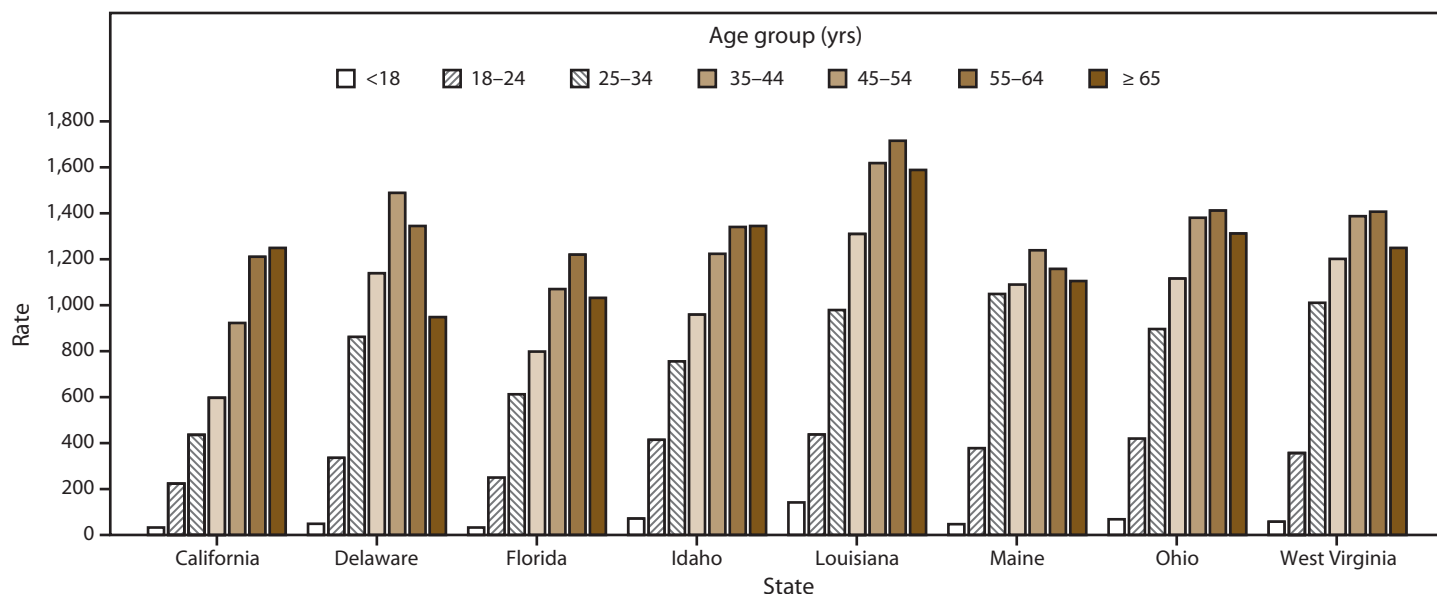


TABLE 3. Prescribing rates,* by type of opioid drug — Prescription Behavior Surveillance System, eight states, 2013

Opioid drug	State							
	California	Delaware	Florida	Idaho	Louisiana	Maine	Ohio	West Virginia
Buprenorphine	11.4	51.6	36.5	15.2	59.8	102.9	47.2	103.8
Butorphanol	0.4	0.9	0.8	1.0	1.6	0.5	0.9	1.1
Codeine	39.3	50.6	27.5	26.0	45.1	29.8	38.3	25.6
Dihydrocodeine	0	0	0.1	0	2.3	0	0	0.1
Fentanyl LA	13.9	31.3	19.3	23.8	17.7	33.4	21.6	19.6
Fentanyl SA	0.5	0.4	0.5	0.2	0.1	0.2	0.4	0.1
Hydrocodone SA	392.4	175.6	314.3	513.9	659.6	333.1	421.0	526.8
Hydromorphone	11.9	31.8	23.8	10.2	9.2	17.5	8.7	6.5
Meperidine	0.3	0.5	1.4	1.0	5.9	0.6	0.7	0.5
Methadone	13.3	24.0	18.0	22.0	10.9	25.0	14.1	10.4
Morphine LA	20.5	41.7	31.5	28.1	21.6	29.0	22.3	20.4
Morphine SA	8.9	19.0	15.9	8.6	10.4	16.2	10.3	7.3
Oxycodone LA	11.3	34.1	15.7	15.6	11.7	28.8	20.1	11.5
Oxycodone SA	68.4	355.9	189.7	107.1	156.0	233.3	273.6	186.8
Oxymorphone LA	1.4	5.9	3.1	2.2	4.3	2.6	3.8	4.5
Oxymorphone SA	0.3	0.6	0.9	0.5	0.6	0.7	0.8	0.5
Pentazocine	0.2	0.2	0.5	0.3	2.5	0.1	0.7	2.4
Tapentadol	1.8	4.3	4.0	1.4	2.5	1.0	4.1	1.5
Other†	0.2	1.0	0.1	0.2	0.1	0.4	0.2	0.1
Total	596.4	829.4	703.4	777.1	1,021.7	855.1	888.7	929.3
Total excluding buprenorphine	585.0	777.8	666.9	761.9	961.9	752.2	841.5	825.5

Abbreviations: LA = long-acting opioid formulation; SA = short-acting opioid formulation.

* Per 1,000 state residents.

in most states (Table 5). The proportion of stimulant prescriptions accounted for by amphetamines ranged from 38.4% in Delaware to 27.5% in West Virginia.

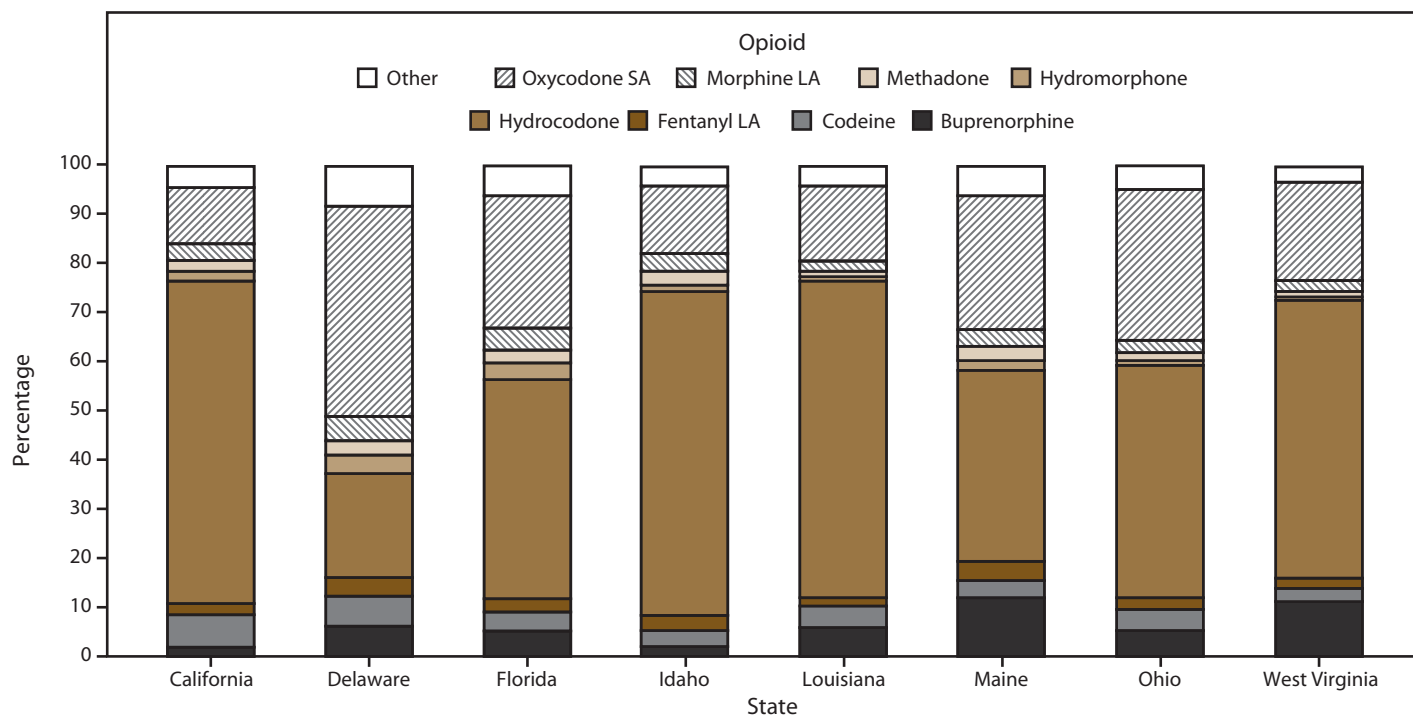
Carisoprodol had a 7.9-fold variation in prescribing rates, from a high of 69.1 in Louisiana to a low of 8.7 in Maine. This contrasts with 1.7-fold variation in rates between Louisiana and California for zolpidem (Table 6).

Delaware and Maine ranked highest in both mean daily opioid dosage and percentage of opioid prescriptions written

for >100 MMEs per day (Table 7). Approximately one in every six opioid prescriptions in Delaware was for >100 MMEs per day. Ohio and West Virginia had the lowest overall daily dosage. California had the fifth highest overall daily dosage at 65.0 MMEs and the highest dosage among all states for fentanyl LA, morphine LA and SA, oxycodone LA and SA, and oxymorphone LA and SA.

The top 1% of prescribers in terms of numbers of their prescriptions wrote one in four opioid prescriptions in

FIGURE 2. Distribution of opioid prescriptions, by type of opioid drug* — Prescription Behavior Surveillance System, eight states, 2013



Abbreviations: LA = long-acting opioid formulation; SA = short-acting opioid formulation.

* Other includes types of opioids with minimal use (defined as <3%). Includes Butorphanol, Dihydrocodeine, Fentanyl SA, Meperidine, Oxymorphone LA, Oxymorphone SA, Oxycodone LA, Morphine SA, Pentazocine, Tapentadol, and others.

TABLE 4. Prescribing rates,* by type of benzodiazepine drug — Prescription Behavior Surveillance System, eight states, 2013

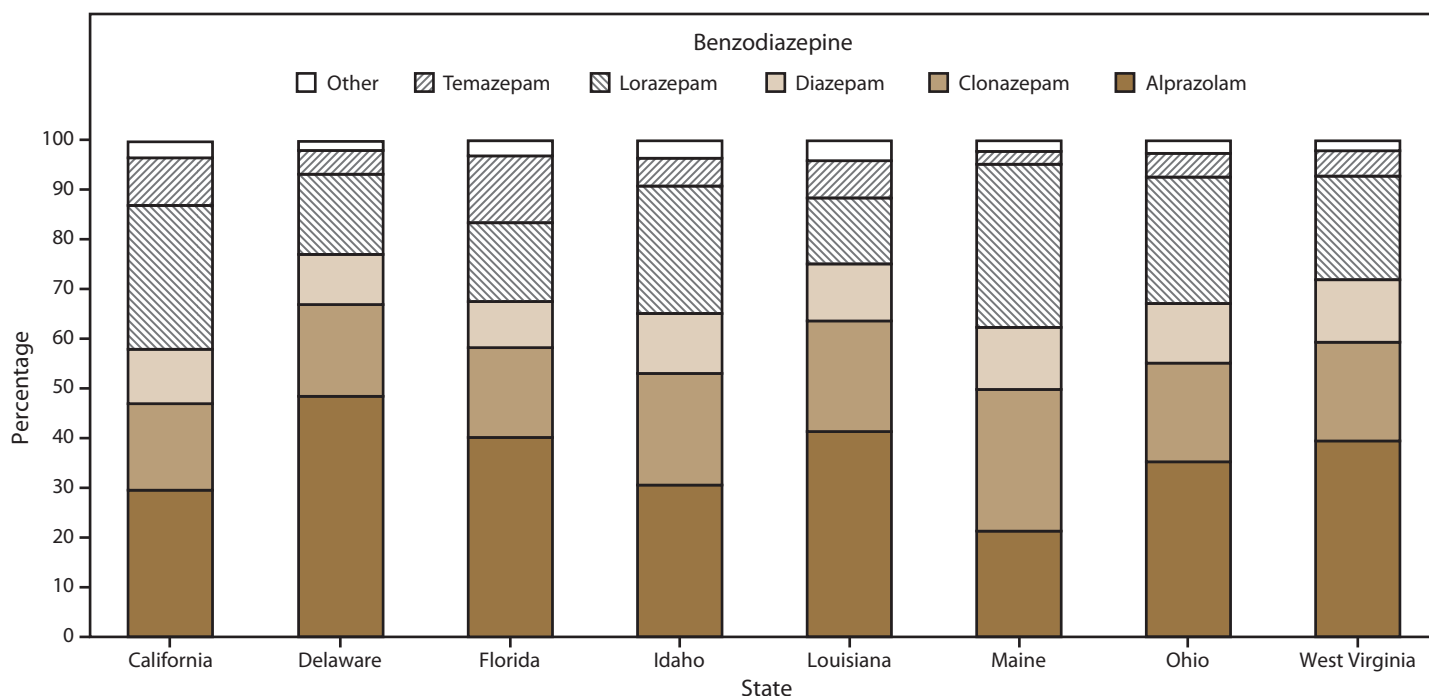
Benzodiazepine	State							
	California	Delaware	Florida	Idaho	Louisiana	Maine	Ohio	West Virginia
Alprazolam	92.1	207.9	220.9	99.2	240.2	103.8	159.2	226.0
Chlordiazepoxide	1.5	1.5	3.7	1.4	3.0	2.4	1.9	2.5
Clonazepam	54.1	79.4	99.2	73.0	129.4	139.6	89.6	114.1
Clorazepate	0.7	1.2	4.4	1.6	8.7	1.7	2.9	2.6
Diazepam	34.3	43.2	50.9	39.3	67.0	61.2	53.9	72.0
Estazolam	0.4	0.3	1.0	0.4	0.6	0.3	0.4	0.4
Flurazepam	1.7	0.6	1.2	0.6	1.6	0.6	0.7	0.5
Lorazepam	90.1	69.5	87.3	83.3	77.2	160.5	115.2	119.5
Oxazepam	1.3	1.2	0.9	0.3	1.1	2.0	1.6	3.0
Temazepam	29.9	20.7	74.1	18.3	43.5	12.6	21.4	29.3
Triazolam	4.1	2.0	4.7	5.8	7.7	2.5	2.9	1.8
Other	0.6	0.9	0.5	1.2	0.7	1.1	1.0	0.5
Total	310.7	428.2	548.8	324.3	580.6	488.3	450.7	572.1

* Per 1,000 state residents.

Delaware, compared with one in eight opioid prescriptions in Maine (Table 8), representing approximately 19 opioid prescriptions per day in the top percentile in Delaware. The top 10% (decile) of prescribers wrote half or more of the opioid prescriptions in all states. The top 10% of prescribers in Delaware wrote two thirds of all opioid prescriptions and wrote for the highest daily dosage among all states (88.6 MMEs/day). In general, the more prescriptions a prescriber wrote, the higher the daily dosage they specified.

For the five states whose PDMPs collected method of payment, the percentage paid for by cash for all controlled substances varied approximately threefold, and the percentage paid for by Medicaid varied approximately sixfold (Table 9). States with higher percentages of cash payment tended to be those with lower percentages of Medicaid payment. The percentages varied little between opioids and all controlled substances.

Overlapping prescriptions were common (Table 10). In West Virginia, for one of every 5 days of treatment with an

FIGURE 3. Distribution of benzodiazepine prescriptions, by type of benzodiazepine drug* — Prescription Behavior Surveillance System, eight states, 2013

* Other includes types of benzodiazepines with minimal use (defined as <3%).

TABLE 5. Prescribing rates,* by type of stimulant drug — Prescription Behavior Surveillance System, eight states, 2013

Stimulant	State							
	California	Delaware	Florida	Idaho	Louisiana	Maine	Ohio	West Virginia
Amphetamine	33.5	110.3	60.5	58.6	141.5	88.6	89.5	53.4
Benzphetamine	0	0	0.1	0.1	2.9	0	0	0.1
Dexmethylphenidate	3.6	30.9	9.1	6.1	30.8	26.0	17.1	21.2
Dextroamphetamine	2.0	2.1	1.7	3.2	3.6	4.2	1.9	2.8
Lisdexamfetamine	9.3	65.3	28.0	19.0	105.8	58.1	36.6	38.6
Methylphenidate	22.9	59.0	31.5	61.3	58.1	107.1	63.7	39.9
Other	16.3	20.1	69.6	42.7	61.2	9.9	17.4	38.3
Total	87.7	287.6	200.5	190.9	403.9	293.9	226.1	194.3

* Per 1,000 state residents.

TABLE 6. Prescribing rates,* by type of miscellaneous drug — Prescription Behavior Surveillance System, eight states, 2013

Miscellaneous drug	State							
	California	Delaware	Florida	Idaho	Louisiana	Maine	Ohio	West Virginia
Carisoprodol	37.3	35.9	30.2	30.6	69.1	8.7	15.6	16.0
Zolpidem	107.4	138.5	142.6	150.2	179.0	116.3	116.8	126.5

* Per 1,000 state residents.

opioid, the patient was also taking a benzodiazepine. For six of eight states, long-acting (LA) opioid prescriptions were more likely to overlap with other LA prescriptions than they were to overlap with short-acting (SA) opioid prescriptions.

Substantial fractions of LA/ER prescriptions were dispensed to persons who had not had an opioid prescription within

the previous 60 days (i.e., opioid-naïve persons), especially in West Virginia and Idaho (Table 11). Dosages for LA/ER prescriptions for opioid-naïve patients (Table 11) were higher than daily dosages for opioids overall and lower than daily dosages for LA/ER opioids for all patients (Table 7).

TABLE 7. Mean daily dosage* per patient in morphine milligram equivalents, by type of opioid — Prescription Behavior Surveillance System, eight states, 2013

Opioid drug	State							
	California	Delaware	Florida	Idaho	Louisiana	Maine	Ohio	West Virginia
% receiving >100 MMEs daily [†]	10.3	16.0	13.2	12.0	9.2	15.0	8.1	10.3
Buprenorphine	112.0	112.7	129.0	127.3	152.1	113.6	142.0	137.3
Butorphanol	27.8	19.2	20.9	13.7	21.5	23.2	18.9	16.8
Codeine	20.9	21.3	18.9	21.2	16.4	21.5	20.7	18.3
Dihydrocodeine	25.4	13.3	20.8	61.6	14.7	0	22.5	16.2
Fentanyl LA	169.8	151.6	155.4	151.9	151.3	136.0	141.4	151.8
Fentanyl [§] SA	494.9	260.1	406.5	418.9	426.3	503.0	359.1	193.8
Hydrocodone SA	33.8	27.0	29.0	37.1	28.7	29.8	25.4	26.7
Hydromorphone	96.5	80.7	110.7	89.9	81.4	90.2	85.4	89.5
Meperidine	28.1	22.2	24.9	19.8	22.9	22.1	23.0	21.4
Methadone	159.5	118.0	141.2	128.8	166.4	171.9	123.5	139.5
Morphine LA	119.1	96.0	109.2	97.9	101.8	94.8	93.1	97.4
Morphine SA	105.5	80.3	89.4	98.2	89.7	100.1	83.4	90.8
Oxycodone LA	185.0	143.0	154.1	130.2	150.4	131.7	140.3	134.5
Oxycodone SA	95.9	76.5	86.3	88.4	86.0	87.8	59.4	82.9
Oxymorphone LA	194.1	168.9	174.3	155.4	168.1	176.9	164.4	165.9
Oxymorphone SA	128.4	89.7	109.3	124.9	95.0	116.2	84.4	73.2
Pentazocine	83.3	105.2	58.6	69.3	46.7	76.5	70.0	59.7
Tapentadol	113.1	110.0	108.5	113.7	107.3	125.9	106.9	99.8
Other	111.1	68.5	83.8	122.3	80.1	72.2	90.7	111.2
Any opioid	65.0	82.1	73.6	66.6	61.1	79.9	58.6	57.8

Abbreviations: LA = long-acting opioid formulation; MME = morphine milligram equivalent; SA = short-acting opioid formulation.

* MME per day calculated by the total number of MMEs prescribed over the total number of prescription days.

[†] The percentage of patients receiving >100 MMEs per day for all opioids used by the patient calculated as an average of four quarters.

[§] Fentanyl SA products are not necessarily bioequivalent to each other and do not lend themselves readily to calculation of MMEs as a group. The MMEs reported for fentanyl SA are likely an overestimation, and the data should be interpreted with caution.

TABLE 8. Prescriber deciles,* by percentage of opioid prescriptions and mean opioid daily dose in morphine milligram equivalents — Prescription Behavior Surveillance System, eight states, 2013

Prescriber decile		State							
		California	Delaware	Florida	Idaho	Louisiana	Maine	Ohio	West Virginia
Top 1%	Prescriptions (%)	17.3	25.2	23.4	14.3	21.8	13.5	20.8	21.0
	Mean dose (MME)	91.7	97.4	95.7	87.7	76.2	97.8	68.0	60.7
1	Prescriptions (%)	57.5	65.9	62.9	49.6	60.4	50.8	58.8	63.6
	Mean dose (MME)	71.9	88.6	80.3	73.5	62.7	88.0	61.7	54.5
2	Prescriptions (%)	18.1	14.4	15.2	18.4	16.0	18.9	17.4	16.4
	Mean dose (MME)	51.2	65.5	52.5	53.7	44.2	71.5	51.3	54.2
3	Prescriptions (%)	10.1	8.2	8.7	11.8	9.3	11.4	10.0	8.6
	Mean dose (MME)	45.0	58.5	45.0	52.7	40.6	62.6	44.1	50.1
4	Prescriptions (%)	6.0	4.8	5.5	7.9	6.0	7.5	6.0	5.1
	Mean dose (MME)	41.5	54.3	43.2	46.8	38.9	57.3	40.2	40.0
5	Prescriptions (%)	3.7	3.0	3.4	5.2	3.8	4.9	3.6	3.0
	Mean dose (MME)	40.3	48.9	42.0	44.6	38.0	48.9	40.1	39.5
6	Prescriptions (%)	2.2	1.8	2.1	3.4	2.3	3.1	2.1	1.7
	Mean dose (MME)	38.3	48.6	40.1	44.0	36.8	48.4	39.4	37.4
7	Prescriptions (%)	1.3	1.0	1.2	2.0	1.3	1.8	1.2	0.9
	Mean dose (MME)	35.9	46.2	37.9	42.5	36.6	45.0	38.5	35.7
8	Prescriptions (%)	0.7	0.5	0.6	1.1	0.7	1.0	0.6	0.5
	Mean dose (MME)	35.2	44.1	37.6	40.0	35.0	45.3	37.5	35.0
9	Prescriptions (%)	0.4	0.3	0.3	0.5	0.3	0.4	0.3	0.2
	Mean dose (MME)	33.2	40.7	35.2	39.6	33.8	43.5	36.5	35.1
10	Prescriptions (%)	0.2	0.2	0.1	0.2	0.1	0.2	0.1	0.1
	Mean dose (MME)	0.6	45.8	37.9	42.6	34.5	56.2	40.2	35.8

Abbreviation: MME = morphine milligram equivalent.

* Prescribers are ranked by numbers of opioid prescriptions written; prescribers categorized into the first decile write the greatest number of opioid prescriptions, and prescribers categorized into the 10th decile write the fewest.

TABLE 9. Payment for controlled substances and opioids, by source — Prescription Behavior Surveillance System, five states,* 2013

Payment type† (%)	State				
	California	Delaware	Florida	Maine	Ohio
Controlled substance					
Cash	18.0	7.7	20.4	7.6	10.8
Medicaid	4.6	21.6	7.7	27.8	6.7
Medicare	12.2	12.1	10.4	14.5	15.3
Private insurance	63.9	58.1	61.0	49.9	65.7
Opioids					
Cash	17.3	8.0	19.5	9.0	11.1
Medicaid	4.9	21.5	7.4	25.4	6.3
Medicare	13.6	13.9	11.3	15.8	17.0
Private insurance	62.4	55.5	61.0	49.5	63.8

* Includes only states with prescription drug monitoring programs that collect complete method of payment data.

† Totals do not add to 100% because other payment types are not shown.

TABLE 10. Percentage of overlapping* days of treatment, by drug class — Prescription Behavior Surveillance System, eight states, 2013

Drug class	State							
	California	Delaware	Florida	Idaho	Louisiana	Maine	Ohio	West Virginia
Opioid and benzodiazepine	12.0	12.4	14.5	12.7	12.2	11.7	14.2	19.3
Opioid class								
LA and SA	8.6	18.0	12.5	11.5	5.7	9.3	8.1	6.0
LA and LA	12.2	10.2	9.5	12.9	7.5	14.7	10.0	11.0
SA and SA	8.5	6.9	8.0	10.9	6.6	8.7	7.8	8.3

Abbreviations: LA = long-acting opioid formulation; SA = short-acting opioid formulation.

* Overlap refers to the percentage of prescribed days on which a patient has prescriptions for both classes of drugs.

MPE rates per 100,000 persons increased when their measure included more drug schedules (Table 12). Highest MPE rates for schedules II, III, and IV were among persons aged 35–54 years. Persons aged 18–34 years were almost universally more likely to see multiple prescribers than persons aged ≥55 years. MPE rates were highest in Ohio and lowest in Louisiana for both Schedules II and III and II–IV.

Discussion

PBSS is a novel surveillance system that allows public health officials to characterize the use and misuse of controlled prescription drugs. PBSS provides timely, population-based measures by both demographic characteristics and state. This report highlights the wide variations among states in multiple measures.

State ranks for prescribing of opioids, benzodiazepines, and stimulants in PBSS are consistent with their ranks in commercial prescription data (16,17). For example, California had the lowest opioid and benzodiazepine rates in this study and in a similar study that used data from IMS Health, a company that estimates state rates from a sample of pharmacies (<http://www.imshealth.com/portal/site/imshealth>). Population characteristics, such as ethnicity and socioeconomic status, and the availability of prescribers can explain only a small fraction

of the variation in prescribing rates for opioid analgesics. Nor does the variation reflect variation in the prevalence of conditions for which analgesics are commonly prescribed (18). Similarly, the state variation in prescribing of stimulants is not likely attributable to variation in the prevalence of diagnoses of attention deficit/hyperactivity disorder (ADHD) and other conditions for which stimulants are prescribed (17). The contribution of other factors (e.g., physician norms, state policies, and drug marketing to prescribers and consumers) has not been well quantified.

The greater prescribing rate for opioids among women compared with men is consistent with a higher self-reported prevalence of certain common types of pain (e.g., chronic joint symptoms, lower back pain, and severe headaches) among women (19). The higher prescribing rates of benzodiazepines are consistent with higher female prevalence of receiving a diagnosis of anxiety disorder, the condition for which benzodiazepines are most commonly prescribed (20). Boys aged <17 years are more likely to be treated with stimulants than girls the same age, whereas females aged ≥17 years are slightly more likely than males in that age group to be so treated (17). The excess prescribing among adult women might reflect the fact that stimulants also are prescribed for weight control (21).

The age trend in opioid prescribing rates in California and Idaho is consistent with a general increase in the prevalence of chronic pain with age (22), but in most states, rates were

TABLE 11. Percentage of long-acting/extended-release opioid prescriptions and daily dosage written for opioid-naïve* patients — Prescription Behavior Surveillance System, eight states, 2013

Opioid-naïve	State							
	California	Delaware	Florida	Idaho	Louisiana	Maine	Ohio	West Virginia
% prescriptions	11.6	9.2	9.8	25.1	14.3	12.5	7.6	43.4
Daily dosage per prescription (MME) [†]	123.1	108.4	112.6	105.4	134.3	106.7	109.4	131.0

Abbreviation: MME = morphine milligram equivalent.

* Refers to patients with no opioid prescription in the last 60 days.

[†] Average daily dose is calculated in MME per long acting/ extended release opioid prescriptions.

TABLE 12. Six-month multiple-provider episode* rates[†] for state residents, by drug schedule and age group — Prescription Behavior Surveillance System, eight states, 2013

Drug schedule/ Age group (yrs)	State							
	California	Delaware	Florida	Idaho	Louisiana	Maine	Ohio	West Virginia
Schedule II								
<18	0	0.5	0.5	0.4	0.1	0.6	0.8	0
18–34	1.0	13.9	8.8	2.7	0.6	5.3	17.8	0.4
35–54	1.2	34.7	16.6	3.8	0.4	11.0	27.0	2.7
≥55	0.8	11.6	9.4	1.7	0.1	4.6	11.4	0.8
Total	0.8	15.7	9.3	2.1	0.3	5.7	14.5	1.0
Schedule II and III								
<18	0	0.7	0.8	0.4	0.1	0.6	1.3	0.7
18–34	6.8	26.1	32.3	25.7	4.9	25.4	75.8	13.1
35–54	10.0	53.8	54.7	25.2	5.4	25.1	82.1	16.3
≥55	5.1	16.2	23.3	7.2	0.8	7.2	25.4	4.8
Total	5.6	24.8	28.8	14.0	2.8	14.4	46.0	8.7
Schedule II, III, IV								
<18	0	1.0	0.8	0.5	0.1	0.6	1.7	1.6
18–34	9.9	44.9	50.4	36.7	6.7	34.9	101.1	26.1
35–54	15.7	95.7	99.6	39.3	9.2	36.9	122.2	34.1
≥55	8.9	32.8	49.9	10.6	1.6	10.7	41.2	11.1
Total	8.9	45.0	52.9	20.9	4.4	20.7	66.8	18.4

* Multiple-provider episode is defined as a resident filling a controlled substance prescription from five or more prescribers at five or more pharmacies within 6 months.

[†] Per 100,000 state residents; annual rate is based on the average of the two half-year rates.

higher in at least one age group among persons aged <65 years, suggesting that middle-aged persons in those states might be more likely to use opioids for reasons other than pain control (i.e., nonmedical use). The increasing prescribing rates of benzodiazepines with age also are not consistent with the age-specific prevalence of anxiety disorders, which occur most commonly among persons aged 30–44 years (23), or the age-specific prevalence of insomnia as reflected in the rate of use of medications for insomnia, which is greater among persons aged 50–59 years than among those aged ≥60 years (24). Benzodiazepines are prescribed most often to persons aged ≥65 years in most states in spite of the fact that their use is a known risk factor for falls in the elderly (25). Stimulants are prescribed to treat ADHD in children, which probably explains the highest prescribing rates in persons aged <18 years. In 2008, an estimated 4.5% of children and 1.2% of adults were dispensed a stimulant prescription in the United States (17). California had the lowest and Louisiana had the third highest rate of pharmacologically treated ADHD among U.S. children in 2003 (26). The markedly different stimulant prescribing

rates among states identified in this report suggest that these rankings might not have changed. The likelihood that a patient will see multiple providers for stimulants, an indication of drug misuse, is greatest among those aged 20–39 years (27), which is consistent with the secondary peaks in prescribing rates in this age range in most of the states in this study.

The variation among states in the opioids of choice is largely unexplained. The high rates of use of LA opioids in Delaware and Maine were also noted in commercial data for 2012 (16). The preference for Schedule III (in 2013) hydrocodone SA over Schedule II oxycodone SA in California has been attributed to the fact that, until recently, California's PDMP monitored only Schedule II drugs (28). However, by 2013, all eight states had PDMPs that tracked at least Schedules II, III, and IV, although the Delaware PDMP only became active in 2012. Buprenorphine can be prescribed for substance abuse treatment only by office-based physicians who have completed special training and obtained a special waiver from DEA (29). The rate of such physicians (per 100,000 residents) varies widely by state and correlates roughly with state differences in

buprenorphine rates noted in PBSS data (29). Better Medicaid funding, a higher rate of opioid overdose deaths, and specific state guidance for office-based buprenorphine use are associated with more waived physicians (30).

The prescribing rate for benzodiazepines is influenced by level of use of alprazolam, lorazepam, and clonazepam, all of which are short-acting benzodiazepine sedatives that are often used for both anxiety and insomnia. These three drugs were the benzodiazepines most commonly involved in drug-related emergency department visits nationally in 2011, although lorazepam had lower emergency department visit rates than either alprazolam or clonazepam (5).

The proportion of prescribed stimulants accounted for by any one stimulant (e.g., amphetamine) varied less than the rate of prescribing of stimulants among states, suggesting that individual stimulants are not driving the interstate variation in the rate for the entire category. Amphetamine, methylphenidate, and lisdexamfetamine are used to treat ADHD in children and adults. Amphetamines and methylphenidate were the stimulants most commonly used nonmedically by college students in 2005 (31). In addition to using stimulants to improve concentration, adults also misuse them for weight loss (32).

Carisoprodol, a sedative prescribed as a muscle relaxant, has been subject to abuse (33). DEA placed it in Schedule IV in 2012 (13), although four states (Florida, Louisiana, Ohio, and West Virginia) had either scheduled it or monitored it via their state PDMPs previously (33). The insomnia drug zolpidem is also a federally scheduled drug because of its abuse potential (34). Overdose deaths involving zolpidem have increased in Florida in recent years (35).

California's low overall opioid dosage in spite of high dosage for commonly prescribed opioids is apparently because of its relatively low prescribing rates for higher-dosage Schedule II drugs such as morphine and oxycodone (Table 3). Hydrocodone typically is prescribed for acute pain and at much lower dosages than these other opioids. Daily dosage for LA/ER opioids is probably higher than that for SA opioids across all states because patients prescribed LA/ER opioids might have more serious pain requiring around-the-clock treatment and would be expected to have been on opioids for a longer period. The percentage of prescriptions >100 MMEs is consistent with the percentage reported in commercially insured populations in 2009 (15).

Ten percent of prescribers account for 50%–66% of opioid prescribing. However, this subset of prescribers does not account for all the differences in opioid prescribing rates among the states. For example, subtracting the prescriptions written by the top 10% in California and Louisiana would still leave much higher prescribing rates in Louisiana. Prescribers writing

the most opioid prescriptions per day are more likely to be specialists in pain medicine, surgery, and physical medicine; however, these specialties account for <20% of opioid prescriptions nationwide (36). Such specialists cannot account for all the prescriptions written by top-decile prescribers, so that most such prescriptions probably are written by general practitioners, family medicine, internal medicine, and midlevel practitioners, who together prescribe approximately half of all opioid prescriptions (36). Nonetheless, the behavior of practitioners who work in self-identified pain clinics can influence a state's overall rates. Legislation regulating pain clinics has been associated with declines in opioid analgesic prescribing rates (37). Among states in this report, four states (Florida, Louisiana, Ohio, and West Virginia) had pain clinic laws in effect in 2013 (38).

Reasons for the variation in source of payment by state are unclear. Medicaid coverage varies by state, but the percentage paid for by Medicaid does not correlate with the extent of Medicaid coverage. For example, 16% of Delaware residents and 14% of Florida residents were covered by Medicaid in 2012 (39), yet the proportion of prescriptions covered by Medicaid was three times greater in Delaware than in Florida. High percentages of prescriptions paid for by cash generally are regarded as suspicious. For example, persons who seek prescriptions of the same controlled substances from multiple prescribers are more likely to pay for their prescriptions with cash (40).

PDMP results confirm that persons who are prescribed opioids are also commonly prescribed benzodiazepine sedatives despite the risk of their additive depressant effects (41). Short-acting opioids might be prescribed to handle "breakthrough" pain for patients already taking long-acting/extended-release opioids (42), but there is no clinical rationale for prescribing overlapping LA or overlapping SA opioid prescriptions. One previous study reported that 24% of LA/ER prescriptions overlapped another LA/ER prescription by ≥ 7 days (15). Some overlap might occur because persons fill prescriptions early. However, every 30-day LA/ER prescription would have to be refilled 3 days early to produce the 10% overlap typical in this report.

Short-acting opioids are probably safer for opioid-naïve patients because they have a shorter half-life and might have a lower risk for inadvertent overdose (42). Therefore, lower proportions of LA/ER opioids being prescribed to opioid-naïve persons are desirable. States that have difficulty linking all the prescriptions dispensed to individual patients might report inaccurately high rates of use of LA opioids by naïve patients because they fail to link the SA prescriptions that preceded the LA prescriptions in some cases.

Rates of patients involved in MPEs are all less than 1 per 1,000 state residents. However, the definition of MPE episodes used in this report (five or more prescribers and five or more pharmacies within 6 months) is more restrictive than other definitions (43). In addition, problems with linking prescriptions to patients in individual states might have artificially lowered their reported rates. By 2013, all eight states had laws that prohibited a patient from withholding information about prescriptions for controlled substances they have received from other health care practitioners (44). How such laws affect the rate of MPEs has not been evaluated. Various state and national clinical guidelines (42) recommend that prescribers use PDMPs to identify and prevent MPEs, but the impact of such guidelines on this behavior also has not been evaluated.

Limitations

The findings in this report are subject to at least four limitations. First, data submitted from pharmacies to PDMPs might not be accurate or complete. However, internal data quality checks in pharmacy computer systems identify inconsistencies and improbable values. Missing values were uncommon in 2013 with the exception of missing data on source of payment and missing data on patient sex in West Virginia, which did not require pharmacies to submit patient sex until October of 2013. Second, states have different methods of identifying unique patients, so the completeness and accuracy of linkages might vary by state. All states except California use probabilistic linkage methods, but their methods are not identical. For example, Ohio used a particularly sophisticated in-house probabilistic linkage method to maximize linkages of prescriptions to individual patients, so their rates of use of multiple providers might be least likely to be underestimates. California used a deterministic or “exact match” linkage method that might have missed some prescriptions recorded under slightly different names for the same patient. States that contracted with the same data vendors for PDMP operation can be assumed to have the same linkage procedures. Delaware, Florida, and Maine used the same data vendor in 2013, so their rates of multiple-provider episodes can be compared with greater accuracy. Third, pharmacies calculate the “days’ supply” field based on quantity prescribed and daily dosage. PBSS measures of average daily dosage of opioids and of overlapping prescriptions depend on the days’ supply field. But because some prescriptions specify that a drug should be taken as needed, the number of days’ supply is necessarily an estimate. Finally, PDMPs do not routinely capture additional information that might be helpful such as patient diagnosis or prescriber specialty.

Conclusion

States can use their PDMPs as public health surveillance systems to generate timely population-based metrics for the prescribing of controlled substances and for behaviors that suggest their misuse. A report published by the Massachusetts Department of Public Health and its partners demonstrated how this might be done (8), and now other states can follow suit, using PBSS analyses conducted by PBSS or duplicating the PBSS measures internally. Tracking changes in these metrics over time can be useful in measuring the effect of policy changes designed to reduce prescription drug misuse. For example, the New York City Department of Health and Mental Hygiene has used New York State PDMP data to demonstrate the impact of a multipronged intervention on opioid prescribing and opioid-related deaths in one of its boroughs (45). The calculation of similar measures in multiple jurisdictions can now be conducted, and such comparisons can help identify norms and determine whether patterns or trends in one state are attributable to state policies or the result of larger, national influences. Explaining the variation in prescribing from state to state is an important topic for future research.

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