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Original Research Article

Prevalence and Factors Associated with Multiple Provider Episodes in Texas: An Epidemiological Analysis of Prescription Drug Monitoring Program Data

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Abstract

Objective. Prescription drug abuse has reached epidemic levels, leading to overdose-related morbidity and mortality. Patient and regional-level factors are believed to contribute to higher rates of prescription drug abuse. The objective of this study was to determine the prevalence and factors associated with multiple provider episodes (MPEs) in Texas.

Methods. This was a retrospective cohort analysis of data from the Texas Prescription Drug Monitoring Program (PDMP) database, linked with Texas county census data. Descriptive statistics and a multilevel model regression analysis were employed to estimate the prevalence of MPEs and examine the association between individual controlled substance prescription (CSP) utilization and county factors associated with MPEs.

Results. Among the 10,381,532 Texas residents utilizing CSPs in 2013, prescription opioids were the most frequently dispensed CSP (38.64%). The prevalence of MPEs was 71.30 per population of 100,000. Of those with MPEs, 76.98% received CSPs for more than 150 days and 11.48% had an average daily morphine equivalent dose (MED) 100 mg/day or higher. Residing in metropolitan areas, traveling more than 100 miles to obtain and fill prescriptions, chronic use of CSPs, younger age, and high MED were all significantly associated with increased risk of MPEs.

Conclusions. This study revealed that previous estimates of prescription drug abuse may be drastically underestimated. Prescription drug abuse is a major public health problem in Texas, especially in metropolitan areas. Therefore, prevention efforts need to be addressed at the individual level and through public health and policy legislation.

Key Words. Prescription Drug Abuse; Prescription Drug Monitoring Program (PDMP); Controlled Substance Prescriptions (CSPs); Multiple Provider Episodes (MPE); Prescription Opioids

Introduction

Prescription drug abuse in the United States has reached epidemic levels, resulting in unprecedented morbidity and mortality rates [1,2]. The Substance Abuse and Mental Health Services Administration (SAMHSA) 2013 National Survey on Drug Use and Health (NSDUH) indicated that 15.7 million persons aged 12 years or older reported using pharmaceuticals nonmedically within the past year. Nonmedical use can be defined as the use of prescription-type drugs that were not prescribed for the respondent, for purposes other than prescribed, or for the experience or feeling the medication can produce [3–6]. The National Institute on Drug Abuse (NIDA) reported that prescription opioids were present in 50% of emergency department visits related to the nonmedical use of pharmaceuticals [7]. The mortality associated with drug overdoses is estimated at one death every 19 minutes, with the majority of cases involving opioid use, a form of controlled substance prescription (CSP) drug abuse [8–11]. Moreover, opioid abuse results in approximately $53–$72 billion in societal and medical costs each year alone [12–14].

Previous literature has shown that both individual-level factors and environmental factors contribute to an increased likelihood of developing CSP abuse [15–19]. Individual-level factors include younger age (e.g., 18–25 years) [16–20], being male [8,21], and a greater number and type of CSPs dispensed [17–19,22–26]. Environmental factors, such as an individual's region or county, are also believed to play a role in the likelihood of abuse, given that individuals in the same geographic region often have comparable access to health care resources and share similar sociodemographic characteristics [17,19,25,27–29].

The Centers for Disease Control and Prevention (CDC) has recommended that abuse prevention efforts target individuals at highest risk in terms of prescription opioid dosage and the number of CSPs dispensed and prescribers utilized [2]. This includes individuals who obtain CSPs from multiple prescribers without the prescribers' knowledge of the other prescriptions [30–32]. This behavior, classified by the CDC as *doctor shopping*, is defined as a patient obtaining controlled substances from multiple health care practitioners without the prescribers' knowledge of the other prescriptions [33]. This behavior also includes *pharmacy shopping*, which refers to individuals who visit multiple pharmacies to fill their prescriptions [20,31]. For the purpose of this article, the term *multiple provider episodes* (MPEs) is meant to comprise both definitions and represent high-risk acquisition of CSPs. MPEs may characterize aberrant utilization behavior (e.g., using CSPs in a way other than intended by the prescriber) that contributes significantly to CSP diversion rates [34,35].

Contemporary prescription drug monitoring programs (PDMPs) are designed to address issues of CSP abuse and diversion [36]. PDMPs are statewide electronic databases that collect designated data on CSPs dispensed within the respective state. In the state of Texas, when a CSP is dispensed, the pharmacist must report the prescription data to the PDMP within seven days of the prescription being filled [37]. This may hinder a physician or pharmacist's ability to view the patient's CSP filling history in real time, as well as link the PDMP data to patient medical records. However, one benefit of PDMPs is their capability to track an individuals' CSP history longitudinally and use the program as a clinical surveillance tool [38]. Ideally, practitioners would utilize PDMPs as a public health tool to reduce morbidity and mortality and to improve health outcomes regarding pain management [39]. While the potential of PDMPs to identify and reduce abuse and diversion is evident, there is limited research in the literature assessing PDMP data for epidemiological studies. In California, Wilsey et al. were able to identify the CSPs most frequently associated with MPEs using PDMP data [18]. Also in California, Gilson et al. examined the effect of policy changes to the state PDMP, representing a transition from a triplicate form for Schedule II medications to a tamper-resistant security form covering medications in multiple schedules [40]. In the 2016 CDC Guidelines for Prescribing Opioids, the CDC highlighted the lack of available studies examining utilizing PDMP data to identify risk mitigation strategies, studies utilizing PDMP data at the state level, and studies evaluating the effectiveness of PDMPs related to overdose, addiction, and abuse outcomes [41].

The current extent of CSP abuse and overdose deaths in Texas is not well known and is believed to be drastically underestimated [42]. As detailed extensively by local media, Harris County, home to Houston, the fourth largest city in the United States, has experienced a years-long battle with CSP drug abuse [43,44].

The objective of this study was to estimate the prevalence of MPEs in Texas and to identify the associated predictive individual-level and county-level factors while utilizing PDMP data.

Methods

Study Design and Data Source

This was an epidemiological retrospective cohort analysis of data from the Texas PDMP (PAT) database. The Texas PDMP database is operated under the authority of the Texas Department of Public Safety (DPS) and contains information on all CSPs dispensed from outpatient and community pharmacies in the state. This study included all prescriptions dispensed from June 1, 2013, to June 1, 2014 [45]. Individuals in this database filled at least one CSP during the data analysis period. The database consisted of 39,904,964 CSPs, obtained by 10,688,720 individuals, written by 113,143 prescribers, and dispensed from 5,155 pharmacies. The data were deidentified by the PDMP vendor prior to acquisition. After removing missing and implausible observations and restricting the analysis to only Texas residents, a total of 38,350,287 CSPs obtained by 10,381,532 individuals were included in the descriptive statistics and final analysis. Texas Census Data also were used to provide information about each of the 254 counties in Texas [46–50] and were linked to Texas PDMP data.

Primary Outcome

The main outcome of interest in this study was to identify individuals with an MPE, which was defined as utilizing five or more prescribers and five or more pharmacies within a 12-month period. Prior research has employed similar operational definitions of MPEs (i.e., five or more prescribers and five or more pharmacies) [25,51]. Sensitivity analysis was conducted employing different definitions of MPE (e.g., three or more prescribers and three or more pharmacies; four or more prescribers and four or more pharmacies). However, the results did not differ significantly based on operational definition. Each provider and pharmacy in the Texas PDMP database is assigned a unique prescriber or unique pharmacy identification number.

Predictor Variables

The predictor variables in the analysis included individual-level variables (e.g., age category, drug utilization variables) and residential county–level variables, as detailed below. The variable capturing an individual's age was collapsed into to six categories based on previous literature and specifically to identify which age categories were associated with an increased risk of MPEs [16,19]. Identifying the age categories that are at an increased risk of an MPE can help to target drug abuse prevention efforts to a specific demographic group. The number of CSPs dispensed to individuals during the study period was captured as a count variable to capture effects associated with patients utilizing multiple CSPs. The total number of days that an individual was in receipt of a CSP during the study time period was captured in five categories to examine the effect of different categories of short-term and chronic, long-term utilization of CSPs. Filling CSPs for more than three months (90 days) is generally considered long-term utilization [52]. Additionally, findings from the 2016 CDC Guidelines for Prescribing Opioids found that continuing opioid therapy for more than three months increased the risk for an opioid use disorder [41]. Several clinical studies, and as highlighted by the 2016 CDC report, have reported a dose-dependent relationship between opioids and an increased risk for adverse event or overdose [41,53–55]. To examine if a dose-dependent relationship exists between opioid utilization and having an MPE, an average daily morphine equivalent dose (MED) was captured for all opioid prescriptions in five categories ranging from 0 MED to >100 MED [56–59]. The average MED morphine equivalent can be calculated using the following formula [60]:

$$\text{MED Conversion Formula: } \frac{(\text{Drug Strength})(\text{Drug Quantity})\leftarrow(\text{MED Conversion Factor})\leftarrow}{\text{Days Supply}}$$

Current opioid dosing guidelines recommend that the daily dose of opioids for patients with chronic noncancer pain should not exceed 120 mg of oral morphine [61]. However, Dunn et al. reported that, as compared to patients receiving 1–20 mg of opioids per day, those receiving 100 mg or more per day had an 8.9-fold increase in overdose risk and a 1.8% annual overdose rate [55]. The distance the patient traveled to obtain their CSPs was captured in three variables: the distance between the individual's ZIP code and CSP prescriber's ZIP code; the distance between the individual's and the prescriber's ZIP code; and the distance between the prescriber's ZIP code and the dispensing pharmacy's ZIP code. The distances were calculated for each unique CSP fill. The distance-traveled variables were categorized into three categories: 1–25 miles, 26–99, and ≤100 miles [62].

County-Level Variables

Regional-level characteristics and population-specific demographics that vary by communities, counties, and states are believed to influence individual behavior and potential for an increased risk of abuse [17,19,27,28]. Previous research has indicated that variances in regulations, policies, health care resource availability, and demographic characteristics that vary by geographic location affect not only opioid and CSP use, but also abuse [29]. The county-level variables included in the analysis were county population, race (percent nonwhite population), percent uninsured, percent unemployed, high school graduation rate, ratio of direct patient care clinicians per 100,000 population, and ratio of pharmacists per 100,000 population [17–19,29].

Statistical Analysis

Descriptive statistics were conducted on all Texas residents receiving CSPs during the 12-month study period (n = 10,381,532) and among those with an MPE. The association between individual-level prescription utilization and county-level variables and having an MPE was examined using multilevel modeling (MLM) and proc glimmix in SAS. MLM takes into account the similarities and correlations of individuals clustered within counties; therefore individuals were clustered by county level in the MLM model [63]. A McFadden R^2 analysis was conducted to assess goodness-of-fit for the MLM. The PDMP data was also mapped spatially by Texas county. Patients with MPEs were attributed to a Texas county based on the ZIP code in which they resided. This technique allows for the visual identification of MPEs and discerns the areas in the state with the highest prevalence of MPEs. All statistical analyses were conducted using SAS, version 9.3 (SAS Institute Inc., Cary, NC, USA). This study and its research activities were approved by the institutional review board at the University of Houston.

Results

Descriptive statistics of the main cohort (all Texas residents utilizing CSPs) and among the MPE cohort are provided in Table 1. During the study period, individuals filled a mean (mean ± SD) of 3.62 ± 5.42 CSPs and utilized 1.39 ± 0.88 prescribers and 1.19 ± 0.58 pharmacies to obtain their CSPs. However, individuals with

Table 1 Descriptive Statistics of Controlled Substance Prescription Utilization in Texas and Among a Multiple Provider Episode (MPE) Cohort

Variable		All CSP utilization in Texas (10,381,532)		MPE* cohort (19,223)	
		Frequency	%	Frequency	%
Number of prescriptions accounted for		38,350,287	100	492,931	1.28
Age distribution	1–18	927,144	8.93	89.0	0.46
	18–34	2,248,759	21.66	4,655	24.22
	35–44	1,619,562	15.60	5,041	26.22
	45–64	3,528,745	33.99	8,319	43.28
	65–74	1,139,414	10.98	893	4.65
	≥75	917,908	8.84	226	1.18
Frequency by class of medication	Opioids	14,510,859	38.64	319,854	64.93
	Benzodiazepines	8,229,548	21.92	56,536	11.49
	Sedatives	3,421,778	9.11	25,419	5.16
	Stimulants	4,367,227	11.63	20,871	4.24
	Muscle relaxants	870,440	2.32	18,009	3.66
	Steroids/hormones	788,834	2.10	1,821	0.37
	Barbiturates	229,949	0.61	1,425	0.29
	Others	5,931,652	13.67	48,996	9.86

Variable	Drug (all CSP)	Frequency	%	Drug (MPE* cohort)	Frequency	%
Top CSPs dispensed (by drug name, any strength)	Hydrocodone-APAP	13,246,938	34.54	Hydrocodone-APAP	193,888	39.33
	Xanax (alprazolam)	3,411,191	9.01	Alprazolam	36,554	8.62
	Ambien (zolpidem tartrate)	3,058,117	8.08	Zolpidem tartrate	32,646	6.62
	Klonopin (clonazepam)	1,889,166	5.00	Carisoprodol	31,788	6.45
	Ativan (lorazepam)	1,385,439	3.67	Clonazepam	22,833	4.63
	Mixed amphetamine salts (Adderall)	1,199,943	3.12	Mixed amphetamine salts	14,606	2.96

Variable		All CSP Frequency	%	MPE* Frequency	%
Average daily morphine equivalent dose (mg)	0	5,163,761	49.74	818	4.26
	1–19	1,519,756	14.64	2,092	10.88
	20–49	2,621,524	25.25	10,788	56.13
	50–99	833,655	8.03	3,317	17.26
	≥100	242,484	2.34	2,206	11.48
Total days with CSP (during 365 days of analysis)	1–30	4,849,813	46.72	252	1.31
	31–60	2,904,381	27.98	747	3.89
	61–90	627,818	6.05	911	4.74
	91–149	703,287	6.77	2,516	13.09
	>150	1,296,233	12.49	14,797	76.98

APAP = acetaminophen; CSP = Controlled Substance Prescriptions; MPE = Multiple Provider Episode.
*Utilizing five or more prescribers and five or more pharmacies in 12 months.

indicators of doctor shopping contributed significantly to the number of CSPs filled and the numbers of pharmacies and prescribers utilized. At least one individual was identified with 473 CSPs during the study period; two other individuals utilized up to 43 different prescribers and filled prescriptions at 39 different pharmacies; however, these patients represent extreme outliers.

This study identified 19,223 individuals with MPEs, equivalent to 71.30 MPEs per 100,000 population. Almost 24% of all MPEs occurred in Harris County (home to Houston), producing a rate of 103.87 per 100,000 population within the county. The most frequently dispensed CSPs were opioids (e.g., oxycodone) in both the main cohort (38.64%) and the MPE cohort

Table 2 Patient- and county-level variables associated with multiple provider episodes

Patient-level variables	Variable	Odds ratio	95% CI
Age category (<18 reference)	18–34	6.35	6.01–6.70
	35–44	5.12	4.90–5.47
	45–64	2.61	2.47–2.75
	65–74	0.91	0.86–0.96
	>75	0.31	0.29–0.33
Distance between patient ZIP and prescriber ZIP (miles)	26–99	1.64	1.61–1.66
(1–25 miles, reference)	≥100	2.02	1.97–2.06
Distance between patient ZIP and pharmacy ZIP (miles)	26–99	1.45	1.43–1.7
(1–25 miles, reference)	≥100	1.48	1.46–1.51
Distance between prescriber and pharmacy (miles)	26–99	0.70	0.69–0.71
(1–25 miles reference)	≥100	0.75	0.74–0.76
Number of controlled substance prescriptions (continuous)		1.024	1.023–1.025
Daily morphine equivalent (mg) (0 mg, reference)	1–19	8.40	8.24–8.54
	20–49	16.74	16.48–17.01
	50–99	14.72	14.48–14.98
	>100	10.14	9.96–10.32
Total study days with CSPs (<30 reference)	31–60	7.29	6.92–7.68
	61–90	22.21	21.13–23.35
	91–149	39.01	37.20–40.91
	>150	76.34	72.86–80.00
County-level variables			
Population (<15,000, reference)	15,000–99,999	1.68	1.63–1.73
	100,000–1,000,00	3.21	3.11–3.31
	>1,000,000	7.30	7.06–7.55
Race (% nonwhite) (<10, reference)	11–19	0.97	0.96–0.98
	>20	0.96	0.94–0.97
% uninsured (<20%, reference)	21–29	0.59	0.58–0.59
	>30	0.67	0.66–0.69
Ratio of direct patient care clinicians (per 100,000) (<20, reference)	21–99	0.89	0.86–0.91
	>100	0.98	0.95–1.01
% unemployed (<10%, reference)	>10	1.00	0.98–1.02
% graduated high school (≤75, reference)	76–90	1.34	1.31–1.43
	>90	1.60	1.53–1.67
Pharmacist ratio per 100,000 population (<25, reference)	26–99	0.76	0.74–0.78
	>100	0.74	0.72–0.77

CI = confidence interval; CSP = Controlled Substance Prescriptions.

(64.93%). Utilization of a high daily dosage (MED ≥ 100 mg) was relatively low, occurring in only 2.34% of the main cohort; however, 11.48% of individuals in the MPE cohort obtained more than 100 MED daily. Additionally, 76.98% of individuals with MPEs obtained CSPs for more than 150 days. The largest percentage (43.28%) of MPEs occurred among the 45–64 age category.

Individual-Level Factors Associated with MPE

The MLM produced a McFadden pseudo-R^2 of 0.24, which indicates a good model fit based on the model assumptions [64]. Individuals in the age category 18–34 years had a 6.35 times (adjusted odds ratio [OR] = 6.35, 95% confidence interval [CI] = 6.01–6.70) increased odds of having an MPE, and individuals in the 35–44 years age category had a 5.12 times (95% CI = 4.90–5.47) increased odds (Table 2). A linear relationship was also found between MPEs and increasing number of days with CSPs, with individuals being prescribed CSPs for more than five months having a 76.34 times (95% CI = 72.86–80.00) increased odds of having an MPE.

As compared to individuals not utilizing prescription opioids, the odds of having an MPE were increased across all categories of daily MED. However, having a daily MED between 20 to 99 mg produced the greatest odds

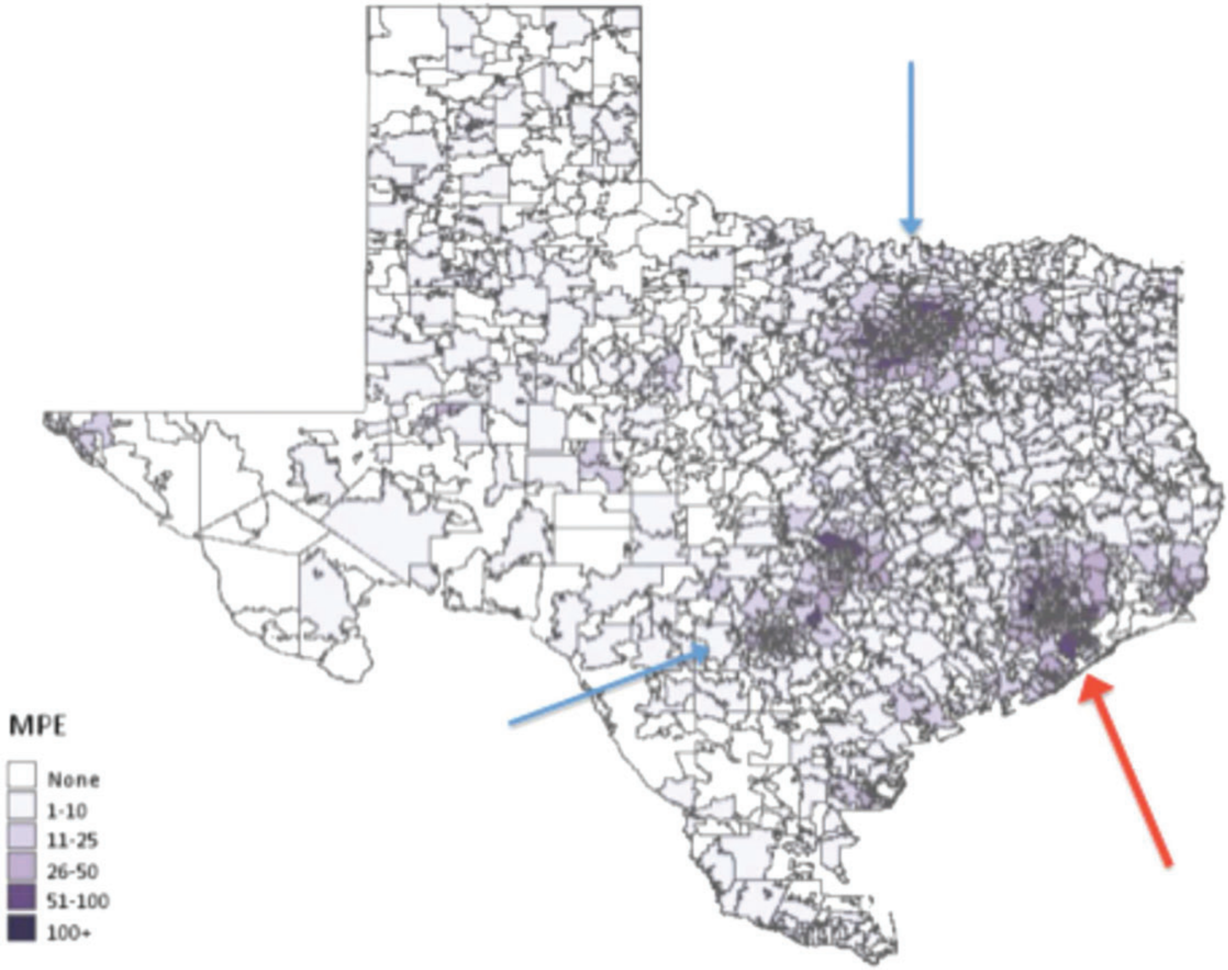

Figure 1 Frequency of Multiple Provider Episodes (MPE) by Texas ZIP code.

(20 to 49 mg: OR = 16.48, 95% CI = 16.48–17.01; 50 to 99 mg: OR = 14.72, 95% CI = 14.48–14.98). Individuals traveling more than 25 miles from their home to visit a prescriber and/or pharmacy were also at an increased risk, with those traveling 100 miles or farther having the highest odds (distance to prescriber: OR = 2.02, 95% CI = 1.97–2.06; distance to pharmacy: OR = 1.48, 95% CI = 1.46–1.51).

County-Level Variables Associated with MPE

Among the county-level variables, the odds of MPE increased among individuals living in a metropolitan area (>1,000,000 population) (OR = 7.30; 95% CI = 7.06–7.55), as compared to those in living in rural counties (<15,000 population). Counties with higher educational attainment also exhibited increased odds of their residents having MPEs (>90% graduation rate: OR = 1.60, 95% CI = 1.53–1.67). Counties with more uninsured residents (>30%) were found to have a reduced odds of having MPEs (OR = 0.67, 95% CI = 0.66–0.69), as well as counties with a higher pharmacist-to-resident ratio (>100 per 100,000 population: OR = 0.74, 95% CI = 0.72–0.77). Individuals residing in counties with percentages of nonwhite populations greater than 10% had a reduced odds of MPE. The results of the spatial mapping indicate a high prevalence of MPEs in the metropolitan areas of Texas, including areas within Houston, Dallas, San Antonio, and Austin (see Figure 1).

Discussion

This study is the first known epidemiological analysis of an indicator of CSP abuse (i.e., MPEs) in Texas using PDMP data, which demonstrates new patterns of CSP utilization and abuse. After analyzing the Texas PDMP data in conjunction with county census data, the prevalence of CSP utilization and MPEs was identified, as well as factors that may put individuals at an increased risk for CSP abuse. While this study identified 71.30 MPEs per 100,000 population, these results may also be conservative due to observations that were deleted due to missing values. In comparison, utilizing the same methodology, a study conducted in Washington that analyzed PDMP data and utilized the same definition for MPE (i.e., five or more doctors and five or more prescribers) found that 7.3 patients per 100,000 population were involved in MPEs [65]. Given these findings, it is hypothesized that the current state of CSP abuse in Texas is more extensive than previously reported. One explanation for this discrepancy is that the majority of previous studies estimating the prevalence of abuse indications in Texas were conducted utilizing a smaller sample of Texas prescription claims. However, this analysis utilized PDMP data, which captures all outpatient CSPs dispensed within the state.

Among the main cohort (all CSP utilization individuals) and especially in the MPE cohort, opioids, particularly hydrocodone combination products, were the most frequently dispensed CSP. This finding is consistent with opioid-prescribing trends within Texas and across the United States [66,67]. Also, the study by Han et al., which was an analysis of the California PDMP data, found an association between higher daily MED and MPEs [19]. Han et al. reported a strong association between the utilization of as little as greater than 40 mg of opioids per day and use of additional providers. This study found a strong correlation between increasing MED and odds of an MPE. Another alarming finding from this study was the high prevalence of individuals receiving chronic CSP therapy. With 12.5% of the main cohort and over 75% of the MPE cohort utilizing CSPs for more than five months, this raises concerns about the current culture in which individuals rely heavily on CSP therapy, which can increase their risks for tolerance and dependence. An analysis from Daubresse et al. reported that 19.6% of patients visiting a physician's office with symptoms of pain were prescribed an opioid [68]. While it is difficult to draw conclusions without the availability of clinical data and information on co-occurring treatments, the findings of this study highlight the need for prescribers to continually evaluate their chronic opioid utilization patients for an elevated risk of abuse.

Less than 25% of Texas patients utilizing CSPs were under the age of 35; however, individuals in the 18–34 years age category had the greatest association with having an MPE. This finding is consistent with previous studies, which examined characteristics associated with CSP abuse [16–20]. Similarly, Cepeda et al.'s longitudinal analysis of national IMS data found a positive correlation between individuals traveling farther distances to obtain CSPs from prescribers and pharmacies and an increased odds of MPEs [62]. This trend may be indicative of several phenomena, such as individuals not having a prescriber geographically near to them or that doctor shopping individuals may be trying to avoid detection by traveling to prescribers and pharmacies in different locations. While analyses in this study did not examine out-of-state individuals traveling to Texas to fill their CSPs, these findings further support the need for increased PDMP utilization and also for PDMPs to be interconnected with other state PDMPs, especially among bordering states.

As revealed by the spatial mapping and the MLM, residing in metropolitan areas (>1,000,000 residents) increased the odds of MPEs, consistent with findings from Han et al. [19]. Identifying metropolitan areas that have the greatest proportion of MPEs can assist with the allocation of resources for CSP abuse prevention efforts. Two noteworthy findings from this study were that counties with higher educational attainment have increased odds of MPEs and the variables capturing racial distribution and unemployment rates within counties were found to be insignificant. This highlights the need for prescribers and pharmacists to be aware that no longer are stereotypical drug abuser profiles the norm, but recognize that CSP abuse is more widespread across diverse populations, both racially and socioeconomically.

Similar to nationwide findings, individuals with MPEs represented a small percentage of CSP users; however, they accounted for a disproportionate amount of CSPs dispensed, physician visits, and pharmacies utilized [30]. MPEs and other indicators of CSP abuse (e.g., high daily MED) have serious public health implications. Properly addressing indicators of abuse is heightened to an even greater extent given that abuse of opioids, the most frequently prescribed CSP, has been shown to be a significant predictor of future heroin use [69–71]. Given the magnitude of heroin overdoses, prescriber, pharmacist, and individual education regarding opioid use and pain management is necessary in order to mitigate the CSP abuse epidemic.

Furthermore, to address some of the aforementioned issues, there is currently legislation underway and recommendations put forth by Texas legislation to improve the operation and functionality of the Texas PDMP. These improvements include shifting the administration of the Texas PDMP from the Department of Public Safety to the Texas State Board of Pharmacy in 2016, creating interoperability of the PDMP system with other states, making prescribing information available in real time, and creating continuing education for practitioners utilizing the PDMP [72]. While the aforementioned recommendations will help to create a user friendly PDMP with up-to-date information, there are several other essential best practices that should be employed to combat CSP drug abuse and identify individuals obtaining CSPs from multiple prescribers. These recommendations from the PDMP Center of Excellence include collecting the method of payment used to purchase the CSP, integrating PDMP data with electronic prescribing and medical records, standardizing data collection across of CSP types, and adopting of a standardized reporting system across all state PDMPs (Clark, 2012 #334).

Finally, more epidemiological studies addressing issues related to CSP use is warranted in Texas, particularly the identification of specific communities (by ZIP code) most afflicted with CSP abuse. Local public health authorities can more readily and efficiently serve populations through resource allocation, prevention, and treatment efforts if they understand the underlying etiology, prevalence, and distribution of MPEs. Without further investigation, it is unclear if MPEs are the result of CSP abuse, a sign of inefficient pain management, the result of a fragmented health care system, or a combination of multiple factors. Based on the results of this study, both state and local agencies need to coordinate their efforts and work together to address CSP abuse and provide substance abuse treatments.

Limitations

The results of this study should be interpreted in the context of several limitations. The lack of clinical and diagnostic information is a primary limitation with respect to analysis of PDMP data. Therefore, the appropriateness of all CSP use cannot be readily determined. Clinical data may verify that a patient has a diagnosis (e.g., cancer) warranting elevated CSP use. Sociodemographic variables contained in the original PDMP database, such as individual age, sex, and race, were also not provided to the researchers for this analysis. Additionally, there was limited individual prescriber information provided to the researcher. Prescriber information, such a specialty type, may help identify whether prescribing patterns are expected for a certain practice specialty. For example, a pain management physician may have more clinical justification for opioid prescribing, as compared to a primary care physician.

The PDMP database also cannot verify whether individuals obtaining CSPs consumed these medications or whether they were diverted for sale on the black market. While future research utilizing PMDP data containing more extensive patient-level data is warranted (e.g., clinical data), this study highlights how potentially aberrant CSP utilization behaviors, such as MPEs, can be identified through individual prescription utilization, particularly within PDMP data. Currently, there are no validated standards to identifying indicators of abuse. However, analysis of PDMP data may provide better estimates of CSP abuse when compared to studies analyzing third-party data since many doctor shoppers pay out of pocket when obtaining their CSPs. Finally, this study may also lack generalizability to other states. PDMPs operate under different conditions within each specific state and may collect different data. Furthermore, state policies influencing the prescribing and availability of CSPs may vary across states. This analysis only included individuals residing in Texas; therefore individuals traveling to Texas from outside the state to obtain prescriptions from multiple providers were not examined.

Conclusion

While there are no set standards for identifying CSP abuse, PMDP data can be utilized to help identify well-known indicators of abuse. Similar to other states, the findings of this analysis identified that the issue of patients utilizing multiple providers to obtain their CSPs is also very present in Texas. Prescription drug abuse prevention efforts need to be focused at the individual level, as well as through public policy, due to the far-reaching extent of the problem. Recognizing the often dire consequences associated with CSP abuse, this study calls for policy changes that promote the implementation of PDMP best practice and the safe and responsible prescribing of CSPs both in Texas and nationwide.

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