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Factors Associated with Prescription Pain Reliever Misuse: An Analysis of Statewide Data

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Abstract

Objective: Characterize the individual-level risk factors associated with recent prescription pain reliever misuse (PPRM).

Design: A multivariable logistic regression was developed with 21 covariates.

Setting and Participants: The 2015 Ohio Medicaid Assessment Survey (OMAS) was analyzed. The 2015 OMAS was a complex-designed representative survey of all adult Ohioans, regardless of Medicaid status (n = 42,876).

Outcome measures: The main outcome was PPRM within the past year (“Yes” versus “No”).

Results: An estimated 2.75% of adults in Ohio reported PPRM in the past year (approximately 242,232 individuals). The regression model identified 11 covariates with significantly higher odds of PPRM within the past year. The five covariates with the largest, significant effect sizes were: binge drinking habits (AOR for binge drinking in the past month: 2.35, 95% CI: 1.97 – 2.81; AOR for drinking in the past month but no bingeing: 1.43, 95% CI: 1.22 – 1.67), did not get medical exam / medical supplies / mental health care / eyeglasses in the past year due to cost (AOR: 1.74, 95% CI: 1.44 – 2.11), no insurance (AOR: 1.67, 95% CI: 1.15 – 2.45), emergency room visits in the past year (AOR: 1.66, 95% CI: 1.42 – 1.93), and had problems paying medical bills in the past year (AOR: 1.52, 95% CI: 1.29 – 1.80).

Conclusion: In this cross-sectional study of 42,847 adult Ohioans, the covariates associated with PPRM in the past year were identified and quantified. The significant covariates can be broadly grouped into substance use history, poor health care access, demographic characteristics,

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Both authors contributed to the conceptualization and writing, review, and editing of the manuscript. Uriel Kim conducted the formal analysis.

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and chronic health conditions. The single covariate with the largest effect size was binge drinking in the past month; those individuals were more than twice as likely to have endorsed PPRM in the past year compared to those who did not drink at all in the past month.

Background

Prescription drug misuse (PDM) refers to the non-medical use of prescription drugs.^{1,2} A key concern about PDM is the potential for misusers to transition to abuse and addiction. The differentiating factor between prescription drug misuse and prescription drug abuse is the presence of consequences in the latter (for example, drug use that causes legal problems, accidents, or injuries).^{2,3} Prescription drug addiction, on the other hand, describes a chronic, neurobiological disease characterized by drug dependency.^{2,4} The three most common prescription drugs classes that are abused are opioids, central nervous depressants, and stimulants.⁵

The abuse potential of prescription opioids is particularly worrisome because of its associated morbidity and mortality. Prescription opioid abuse has currently reached epidemic levels⁶ with overdose deaths from prescription opioids claiming 17,029 lives nationally in 2017.⁷ These statistics are compounded by the possibility that prescription opioid abusing individuals might transition to abusing illicit, and potentially more lethal, opioids.⁸ Indeed the association between prescription opioid abuse and heroin use is strong: during the period 2011–2013, 42.4% of individuals who used prescription opioids non-medically in the past year reported also using heroin.⁸ In 2017, heroin and synthetic opioids (predominately fentanyl) claimed over 30,000 lives nationally.⁷ The overall economic burden resulting from prescription opioid abuse is estimated to be over 70 billion dollars when accounting for the overdose fatalities, and the costs associated with medical care, substance abuse treatment, criminal justice proceedings, and lost productivity attributable to prescription opioid abusers.^{9,10}

Opioids are prescribed as an analgesic, constituting one of the most common classes of prescription pain relievers along with nonsteroidal anti-inflammatory drugs (NSAIDs). More than 110 million prescriptions are written for NSAIDs¹¹ annually, and more than 190 million prescriptions are written for prescription opioids.¹² While the emerging evidence suggests that the opioid prescribing rate has leveled off,^{12,13} prescription opioid abuse remains as a major public health concern. Recent studies estimate the number of prescription pain reliever misusing adults at 10.5 million annually,¹⁴ and overdose deaths from prescription and non-prescription opioids are currently near or at their all-time highs.⁷ Halting the progression from prescription pain reliever misuse (PPRM) to prescription pain reliever abuse can be a point of leverage in the opioid epidemic: by intervening at the PPRM stage, individuals can be diverted away from abuse and addiction altogether. However, interventions that focus on this earlier stage are frustrated by the paucity of information surrounding risk factors associated with PPRM. Rather, most studies focus on the risk factors associated with prescription pain reliever abuse.⁶ As such, studies that characterize risk factors associated with PPRM fill an important gap in the literature, and data from these studies can guide future interventions that halt the transition from prescription pain reliever misuse to abuse.

Objectives

The key objective of this study was to characterize the individual-level risk factors associated with PPRM.

Methods

Data Sources and Study Population

We analyzed the de-identified public use data from the 2015 Ohio Medicaid Assessment Survey (OMAS). Sponsored by the Ohio Department of Medicaid, Ohio Department of Health, and the Ohio State University, the OMAS was a representative cross-sectional survey of non-institutionalized Ohio residents, regardless of their Medicaid status. The OMAS was a complex-designed (multiple strata), dual-frame (cell and landline phone numbers), random digit dial telephone survey, reporting on a broad range of measures including health status (physical, mental, dental), insurance status, chronic conditions, perceptions of health care quality, and use of preventative and other health services. In total, the 2015 OMAS included 42,876 completed household interviews.¹⁵ The 2015 OMAS generalized to the Ohio Adult population of 8,806,655 individuals (calculated by summing the survey weights of the adult respondents).

Variables of Interest

In order to acknowledge the complex relationships that likely exist between individual-level risk factors and PPRM, we developed a conceptual model based on the Andersen Health Services Utilization Model.^{16,17} Our conceptual model suggests that PPRM arises from a combination of (and interaction between) “predisposing,” “enabling,” and “need” factors; furthermore, we posited that prescription pain reliever misuse is the first in a cascade of events that lead to abuse and then addiction (see figure 1).

The main outcome measure was PPRM in the past year (“yes” versus “no”). PPRM in this study was defined as: using, even once, any prescription pain relievers in any way a doctor did not direct them to be used in the past year (this includes using prescription pain relievers without a person’s own prescription; using prescription pain relievers in greater amounts, more often, or longer than the person was told to take them; or using prescription pain relievers in any other way a doctor did not direct the person to use it).

The covariates of interest included 4 predisposing factors (age, gender, race, family composition), 7 enabling factors (SES score, insurance type, region of residence, delayed / avoided getting needed medical care in the past year due to cost, did not fill prescription in the past year due to cost, did not get medical exam / medical supplies / mental health care / eyeglasses in the past year due to cost, had problems paying medical bills in the past year); and 10 need factors (self-rated health, smoking status, binge drinking in past month, emergency room visits in the past year, overnight hospitalizations in the past year, has a history of cancer, diagnosed with hypertension, diagnosed with heart disease, diagnosed with diabetes, and body mass index). “Heart disease” was a binary, composite covariate, indicating those with any diagnosis of myocardial infarction, coronary heart disease, or congestive heart failure. The “SES score” covariate was a continuous measure

of socioeconomic status ranging from 0 – 7 points, adapted from Berzofsky, et al.¹⁸ SES score is derived by compositing the three categorical variables of education, income, and employment. Each category of the education, income, and employment variables are assigned point values, and the SES score is the sum of these point values. Education was assigned the following points: Less than High school (0 points); High school, some college, associate's degree (1 point); Bachelor's degree (2 points); Master's, professional, doctorate degree (3 points). Income, as a percentage of the federal poverty level, was assigned the following points: 100% or less (0 points); 101%–200% (1 point); 201%–400% (2 points); 401% or greater (3 points). Finally, employment was assigned the following points: Unemployed in the past 6 months (0 points); Employed past in the 6 months (1 point). The study covariates are further specified in table 1.

Data analyses

We first started with descriptive analyses, applying the appropriate statistical test for continuous (t test) and categorical (χ^2 test) covariates. Then we developed a multivariable logistic regression model to characterize the risk factors associated with PPRM in the past year. Our final model included all covariates outlined in table 1. Since these covariates were selected based on our conceptual model, all covariates were retained in our model whether or not they had significant odds ratios after adjusting for the other covariates. The unweighted data was utilized for the descriptive and regression analyses described above. The survey-weighted data was utilized to estimate population-level parameters, namely the number and proportion of adults in Ohio who report PPRM in the past year.

We addressed the possibility of collinearity in our model using a two-step approach. First, we created two composite variables of covariates that are likely to be highly correlated. These composite variables are heart disease and SES score, as described earlier. Second, we assessed the collinearity of our model using Variance Inflation Factors (VIF), using the method described by Fox and Monet.^{19,20} All data management and data analyses procedures were conducted using the R Statistical Software (The R Foundation).

Results

From the full, unweighted dataset of 42,876 adults in the 2015 OMAS, 29 observations were dropped due to missingness in the PPRM outcome to form our study sample. In our study sample, 2.37% of individuals report PPRM in the past year ($n = 1,015$). When applying the survey weights to the study sample, an estimated 2.75% of adults in Ohio reported PPRM in the past year (approximately 242,232 individuals). Table 1 includes the distribution for the study covariates in the unweighted study sample, comparing the “No PPRM” and “PPRM” groups. There were statistically significant differences between the patients who did and did not misuse prescription pain relievers with respect to age, region of residence, insurance type, emergency room visits in past year, overnight hospitalizations in the past year, self-rated health, delaying / avoiding getting needed care in the past year due to cost, not filling prescription in past year due to cost, not getting medical exam / medical supplies / mental health care / eyeglasses in past year due to cost, and having problems paying medical bills in the past year.

When adjusting for all 21 covariates in our model, 11 covariates emerged as having significantly higher odds of PPRM in the past year. The five covariates with the largest, significant effect sizes were: binge drinking habits (AOR for binge drinking in the past month: 2.35, 95% CI: 1.97 – 2.81; AOR for drinking in the past month but no bingeing: 1.43, 95% CI: 1.22 – 1.67; the reference group is did not drink at all in the past month), did not get medical exam / medical supplies / mental health care / eyeglasses in the past year due to cost (AOR: 1.74, 95% CI: 1.44 – 2.11), no insurance (AOR: 1.67, 95% CI: 1.15 – 2.45; the reference group is Medicaid and Medicare dual-insured individuals), emergency room visits in the past year (AOR: 1.66, 95% CI: 1.42 – 1.93), and had problems paying medical bills in the past year (AOR: 1.52, 95% CI: 1.29 – 1.80). The effect sizes for all 21 covariates in the model are noted in table 1, and the significant covariates in the model are further described in figure 2.

The generalized variance inflation factors (GVIF) for the 21 covariates in the model were all below 10. The covariates with the highest GVIFs were Age (GVIF = 4.4) and insurance status (GVIF = 5.4). The GVIFs for the other factors ranged from 1.1 to 1.6.

Discussion

The 11 covariates with significantly higher odds of PPRM in the past year can be broadly grouped into substance use history (binge drinking in past month, smoking status); poor health care access (did not get medical exam / medical supplies / mental health care / eyeglasses in the past year due to cost, emergency room visits in the past year, insurance type, had problems paying medical bills in the past year, delayed / avoided getting needed medical care in the past year due to cost, did not fill prescription in the past year due to cost); demographic characteristics (age, region of residence); and chronic health conditions (has history of cancer). There are several covariates that could serve as particularly strong predictors: binge drinking in the past month, not getting medical exam / medical supplies / mental health care / eyeglasses in the past year due to cost, being uninsured, visiting the emergency room one or more times in the past year, problems paying medical bills, and being between 18–34 years of age. These covariates confer an approximately 50% or larger risk of PPRM. The covariates that are not significantly associated with PPRM are also informative. There does not appear to be a significant relationship between PPRM and family composition, gender, race, SES score, overnight hospitalizations, self-rated health, and certain chronic health conditions (hypertension, heart disease, diabetes, and obesity).

Our study suggests that there are some key differences and similarities between the prescription pain reliever misuse and the abuse populations. Multiple studies have suggested that young, white males constitute an archetype of prescription pain reliever abusers.^{2,21–24} While our study shows a strong linear relationship between younger age and risk of PPRM, there is only a modest, insignificant association between gender and race with PPRM. Additionally, other studies have demonstrated the relationship between substance use patterns (including cigarette smoking^{2,23} and alcohol use^{2,25}) and prescription pain reliever abuse. Similarly, in this study, binge drinking behavior is the single strongest predictor of PPRM (with recent binge drinking more than doubling the likelihood of PPRM). Finally, previous studies have identified poor self-rated health^{2,26,27} as a risk factor

for prescription pain reliever abuse. We could not identify this relationship in our study of PPRM; rather poor health care access seems to be more strongly associated with PPRM. However, the differences and similarities between this study and others should be interpreted cautiously because there is substantial controversy and lack of consensus between the various definitions of prescription drug misuse, abuse, and addiction.^{2,6,28}

This study focuses on PPRM, so direct inferences to prescription opioid misuse based on the study results should be made carefully. Prescription pain relievers include several drug classes including NSAIDs, Calcitonin gene-related peptide inhibitors, and narcotic (opioid) analgesics. While opioids constitute one of the most common classes of prescription relievers and have the highest abuse potential,^{5,12} PPRM should be treated as a proxy measure, rather than a direct measure, of prescription opioid misuse. This subtle, yet important, distinction is often overlooked since the terms “prescription pain relievers” and “prescription opioids” are often used interchangeably in both the popular press^{29–31} and in the literature.^{14,32,33}

A limitation of our study was the structure of the outcome variable. The “PPRM” group included individuals who were prescribed prescription pain relievers and misused those pain relievers at least once in the past year. The “No PPRM” group included individuals who were either never prescribed pain relievers or individuals who were prescribed pain relievers but did not misuse them. Thus, our study cannot address the risk factors associated with “high-intensity” PPRM (many instances of PPRM in the past year), which we presume is the most likely precursor to prescription pain reliever abuse. Additionally, our identified risk factors apply to those who report PPRM in the past year and those that do not (including those who were never prescribed prescription pain medications). Future studies that examine only those who were prescribed prescription pain relievers and identify the risk factors associated with those who misuse prescription pain medications within this subpopulation can provide additional valuable information for interventions that aim to reduce prescription pain reliever misuse.

These limitations are tempered by several factors that give confidence in the validity of our findings. First, we analyzed a large, representative sample with a relatively high number of PPRM cases. Our final analytic sample included 42,847 individuals representing adult Ohioans, comparing favorably in sample size to other large, nationally-representative, cross-sectional studies that examine prescription drug use.^{34–36} Therefore, we believe that the risk that our model is overfitted is low. Additionally, all of the variance inflation factors for our model were below 10, which gives us reasonable confidence in our estimates of the regression coefficients.³⁷ Finally, because of the richness of our dataset, we believe that we were able to create a regression model that corresponds to our conceptual model (outlined in figure 1), capturing the multiplicity of factors that contribute to PPRM.

There are several promising public health interventions that could reduce prescription pain reliever and opioid misuse. One such approach is adapting the SBIRT (screening, brief intervention, and referral to treatment) approach to prescription pain relievers and opioids. SBIRT has been implemented in a variety of clinical settings, traditionally for alcohol and tobacco substance use disorders.³⁸ As with any SBIRT program, successful prescription pain

reliever and opioid-targeted SBIRT efforts will need reliable screening tools to identify the highest-risk individuals.³⁸ The screening tools developed for future Pharmacist-led SBIRT efforts for prescription pain reliever and opioid misuse will additionally need to be implementable within the context of the pharmacy workflow.³⁹ Of the covariates with significantly higher odds of PPRM identified in our study, recent binge drinking and age show promise for inclusion into the screening tools of Pharmacist-led SBIRT efforts for prescription pain reliever and opioid misuse.

Conclusion

In this cross-sectional study of 42,847 adult Ohioans, the covariates associated with PPRM in the past year were identified and quantified. The factors that were significantly associated with PPRM in the past year can be broadly grouped into substance use history, poor health care access, demographic characteristics, and chronic health conditions. The single covariate with the largest effect size was binge drinking in the past month; those individuals were more than twice as likely to have endorsed PPRM in the past year compared to those who did not drink at all in the past month.

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Key Points:**Background**

- Prescription pain reliever misuse (PPRM) can contribute to increasing healthcare costs and drug abuse.
- The risk factors associated with PPRM are poorly understood.

Results

- 11 statistically significant covariates associated with PPRM were identified.
- Understanding the individual-level risk factors associated with PPRM can provide valuable information for future interventions that aim to reduce PPRM.

Figure 1.
Conceptual model

Figure 2.
 Covariates significantly associated with PPRM, arranged by effect size

Table 1.

Characteristics of the study population and results from regression analysis for PPRM in the past year

Study Covariates	NoPPRM (n = 41,832)	PPRM (n = 1,015)	p [†]	Adjusted Odds ratio & 95% CI [§]		p [‡]
<i>Predisposing factors</i>						
Age			<0.01			
65+ years	12,004 (28.7)	201 (19.8)		1.00 (reference)		
55 – 64 years	9,414 (22.5)	203 (20.0)		1.08	0.81 – 1.44	0.59
45 – 54 years	7,483 (17.9)	192 (18.9)		1.16	0.85 – 1.58	0.34
35 – 44 years	5,082 (12.1)	159 (15.7)		1.42	1.01 – 1.98	0.04
18 – 34 years	7,849 (18.8)	260 (25.6)		1.48	1.08 – 2.04	0.02
Gender			0.16			
Female	23,238 (55.6)	541 (53.3)		1.00 (reference)		
Male	18,594 (44.4)	474 (46.7)		1.08	0.95 – 1.24	0.25
Race			0.96			
All Others	11,016 (26.3)	266 (26.2)		1.00	(reference)	
White	30,816 (73.7)	749 (73.8)		1.12	0.95 – 1.31	0.18
Family Composition			0.08			
1 Adult, no children	12,856 (30.7)	301 (29.7)		1.00 (reference)		
1 Adult, 1+children	2,470 (5.9)	72 (7.1)		1.01	0.76 – 1.33	0.96
2 + Adults, no children	17,195 (41.1)	392 (38.6)		1.03	0.88 – 1.21	0.68
2 + Adults, 1+children	9,311 (22.3)	250 (24.6)		1.03	0.85 – 1.24	0.79
<i>Enabling factors</i>						
SES score, mean (± SD)	3.52 (1.79)	3.43 (1.80)	0.10	1.03	0.98 – 1.08	0.22
Insurance Type			<0.01			
Medicaid and Medicare	2,758 (6.6)	49 (4.8)		1.00 (reference)		
Medicaid only	6,133 (14.7)	179 (17.6)		1.19	0.85 – 1.71	0.32
Medicare only	10,757 (25.7)	212 (20.9)		1.38	0.99 – 1.95	0.06
Job-based coverage	16,173 (38.7)	364 (35.9)		1.18	0.83 – 1.71	0.37
Exchange Coverage	725 (1.7)	15 (1.5)		1.09	0.50 – 2.15	0.81
Uninsured	2,368 (5.7)	129 (12.7)		1.67	1.15 – 2.45	<0.01
Other	2,918 (7.0)	67 (6.6)		1.24	0.82 – 1.88	0.31
Region of residence (county type)			0.01			
Rural Non-Appalachian	6,167 (14.7)	116 (11.4)		1.00 (reference)		
Rural Appalachian	6,850 (16.4)	151 (14.9)		1.10	0.86 – 1.42	0.45
Suburban	6,701 (16.0)	167 (16.5)		1.35	1.05 – 1.72	0.02
Metro	22,114 (52.9)	581 (57.2)		1.33	1.08 – 1.64	<0.01
Delayed/avoided getting care in the past year due to cost			<0.01			
False	35,745 (84.8)	698 (68.1)		1.00 (reference)		
True	6,087 (15.2)	317 (31.9)		1.39	1.17 – 1.65	<0.01
Did not fill prescription in past year due to cost			<0.01			

Author Manuscript	False	36,056 (85.3)	715 (70.4)		1.00 (reference)	
	True	5,776 (14.7)	300 (29.6)		1.30	1.09 – 1.54
	Did not get medical exam / medical supplies / mental health care /eyeglasses in past year due to cost			<0.01		<0.01
Author Manuscript	False	38,930 (92.6)	797 (78.4)		1.00 (reference)	
	True	2,902 (7.4)	218 (21.6)		1.74	1.44 – 2.11
	Problems paying medical bills in the past year			<0.01		<0.01
Author Manuscript	False	32,674 (76.6)			1.00 (reference)	
	True	9,158 (23.4)	447 (44.3)		1.52	1.29 – 1.80
	Needfactors					<0.01
Author Manuscript	Self-rated health			<0.01		
	Good/Excellent	33,121 (79.2)	752 (74.1)		1.00 (reference)	
	Fair/Poor	8,711 (20.8)	263 (25.9)		0.93	0.78 – 1.10
Author Manuscript	Smoking status			<0.01		
	Never smoked	22,412 (53.6)	464 (45.7)		1.00 (reference)	
	Former Smoker	10,711 (25.6)	242 (23.8)		1.02	0.88 – 1.22
Author Manuscript	Currently Smokes	8,709 (20.8)	309 (30.4)		1.20	1.02 – 1.42
	Binge Drinking in past month			<0.01		
	Did not drink at all	14,135 (33.8)	348 (34.3)		1.00 (reference)	
Author Manuscript	Drank but no bingeing	22,163 (53.0)	390 (38.4)		1.43	1.22 – 1.67
	Yes, binge drinking	5,534 (13.2)	277 (27.3)		2.35	1.97 – 2.81
	ER visits in past year			<0.01		<0.01
Author Manuscript	None	30,831 (73.7)	593 (58.4)		1.00 (reference)	
	1 or more	11,001 (26.3)	422 (41.6)		1.66	1.42 – 1.93
	Overnight hospitalizations in past year			<0.01		<0.01
Author Manuscript	None	35,568 (85.0)	812 (80.0)		1.00 (reference)	
	1 or more	6,264 (15.0)	203 (20.0)		1.07	0.89 – 1.29
	Has cancer history			0.42		0.44
Author Manuscript	False	36,441 (87.1)	875 (86.2)		1.00 (reference)	
	True	5,391 (12.9)	140 (13.8)		1.25	1.03 – 1.52
	Diagnosed with Hypertension			0.99		0.02
Author Manuscript	False	24,342 (58.2)	590 (58.1)		1.00 (reference)	
	True	17,490 (41.8)	425 (41.9)		1.07	0.92 – 1.25
	Has heart disease			0.45		0.37
Author Manuscript	False	37,344 (89.3)	898 (88.5)		1.00 (reference)	
	True	4,488 (10.7)	117 (11.5)		1.03	0.82 – 1.28
	Diagnosed with Diabetes			0.39		0.82
Author Manuscript	False	34,380 (82.2)	823 (81.1)		1.00 (reference)	
	True	7,452 (17.8)	192 (18.9)		1.14	0.94 – 1.36
	Body Mass Index			.23		0.17
Author Manuscript	Obese	14,756 (35.3)	369 (36.4)		1.00 (reference)	
	Overweight	14,557 (34.8)	327 (32.2)		0.97	0.83 – 1.14

Underweight or Normal	12,519 (29.9)	319 (31.4)		1.05	0.89 – 1.24	0.55
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[†]The reported p-values are for the significance levels for the t-test applied to continuous covariates and the χ^2 test applied categorical variables

[§]The reported odds ratios are adjusted for all of the covariates, using a multivariable logistic regression model

[‡]The reported p-values are for the significance levels of the beta coefficients of the multivariable logistic regression model

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