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BEHAVIORAL, MENTAL, AND PHYSICAL HEALTH CHARACTERISTICS AND OPIOID MEDICATION MISUSE AMONG COMMUNITY PHARMACY PATIENTS: A LATENT CLASS ANALYSIS

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Abstract

Background—Community pharmacists are well-positioned to address the US opioid medication crisis, which has created a need to detect misuse risk in order to provide optimal patient care.

Objectives—This study sought to identify community pharmacy patient subgroups at risk for opioid medication misuse.

Methods—This study was a cross-sectional survey that examined behavioral, mental, and physical health characteristics among patients filling opioid pain medications. A convenience sample of adult patients filling opioid pain medications who were not receiving cancer treatment were screened in 2 urban and 2 rural community pharmacies in southwestern Pennsylvania. Patient subgroups were identified using latent class analysis. Latent class regression analysis was used to examine the association between subgroup membership and misuse.

Results—A total of 333 patients completed the survey (response rate 71.4%). Latent class analysis results showed that a 3-class solution best fit the data, which were labeled: *mental health* (8.4%, n=28), *poor health* (79.6%, n=265), and *hazardous alcohol use* (12%, n=40). Individuals within the *mental health* subgroup had an increased risk for opioid medication misuse (Odds Ratio=6.23, 95% CI=5.13–7.33).

Conclusion—These findings demonstrate heterogeneity of this population receiving prescribed opioids and the potential to identify subgroups with high misuse risk. These findings also support

routine screening of patients filling opioid medications and suggest the need for evidence-based patient-centered intervention development.

Keywords

Opioid medication misuse; screening; community pharmacy; latent class analysis

Introduction

Community pharmacists are continuing to position themselves as major contributors to addressing the opioid medication epidemic in the US. Advancements in the proliferation of pharmacist training to identify and provide interventions to patients who misuse opioid medications are rapidly moving forward.^{1–8} This response is crucial given the serious threat posed to public health by continued misuse and overdose.⁹ Previous research demonstrated that in 2014 approximately 4.3 million individuals were engaged in the non-medical use of pain medications in the US.¹⁰ Furthermore, between 2001–2013, there was a >300% growth in opioid medication overdose deaths,¹¹ with 44 individuals currently experiencing fatal overdose daily.¹² Analyses of Medicaid data show, for instance, a marked increase for opioid medication overdose among those who misuse compared to those who do not.¹³ Individuals involved in opioid medication misuse have a number of behavioral, mental, and physical health issues that increase risk for misuse, including co-occurring substance use disorders,^{14–19} mental health/psychiatric conditions,^{17, 18, 20–22} severe and chronic pain,^{16, 19, 22–24} and poor general health/quality of life.^{17, 24}

Typical approaches for identifying patient risk characteristics for misuse employ null hypothesis testing statistical methods. Limitations associated with these approaches include sensitivity to sample size, lack of clinical significance despite achieving “statistical significance,”²⁵ and narrow ability to accurately represent multifactorial individual risk. Latent variable modeling can, in contrast, identify nuanced patient characteristics, develop theoretical and practical knowledge,^{25–28} and elucidate complex health problems.²⁹ In latent class analyses (LCA), the variable of interest is unobserved but characterized by multiple observed indicators.^{27, 30} An important property of LCA is that it is a model-based approach for identifying homogeneous classes or “subgroups” according to a shared pattern of responses.^{27, 29, 31, 32} A main advantage of LCA is that it enables modeling of multiple variables with precision to characterize a subgroup of individuals’ unique current or potential risk. Given the present national opioid crisis and the urgency to identify and provide care for patients engaged in or at risk for misuse, the application of LCA, therefore, is highly appropriate.

LCA may be especially useful for understanding misuse risk considering that individuals engaging in opioid misuse possess a variety of characteristics that have differential etiological salience. Aggregating individuals into distinct subgroups based on their particular configuration of risk characteristics enables accurate matching of interventions to the particular factors promoting and maintaining opioid misuse. Accordingly, the pharmacist has a unique opportunity to both accurately specify the pattern and severity of risk as well as inform intervention.

The purpose of the current project was to identify risk subgroups based on mental, behavioral, and physical health characteristics of patients filling opioid medications in community pharmacies. This study further sought to identify which subgroups of patients possessed the highest risk for reporting misuse of their opioid pain medications. The knowledge produced herein provides clinical pharmacists with valuable insight into characteristics of patients with the highest risk for misuse. The results of this study also have the capacity to provide clinical researchers with a foundation for further exploration of methods to identify individual and distinct health needs.

Materials and Methods

Sample, Recruitment, and Survey

This study was a cross-sectional survey in 4 community pharmacies in southwestern Pennsylvania between September, 2015 and June, 2016, which methods have been described in detail elsewhere.³³ Patients dropping off new and/or refill prescriptions for any opioid pain medication were identified by pharmacists or pharmacy staff and asked if they were interested in completing a health screening questionnaire. Interested patients were handed a computer tablet wherein they were asked to confirm they were 18 years of age, not receiving treatment for cancer, and had not previously completed the survey. Qualified and interested individuals were prompted to continue to the next page where they were: informed about the purpose of the survey, given assurances of anonymity, and provided with contact information for the study Principal Investigator. Patients were also informed that they were not required to complete any of the questions, and if they chose to not participate in the study, their services at the pharmacy location would not be effected. Patients were also provided health and social services information if they wished to receive additional assistance. In order to enhance acceptability in the community pharmacy settings, the survey was brief, consisting of 45 multiple-choice or yes/no demographic, behavioral, mental, and physical health questions. Upon completing the survey, participants were given a \$20 gift card. This study was designated exempt by the University of Pittsburgh Institutional Review Board.

Measurement Model Indicators

Five self-report measures of behavioral, mental, and physical health characteristics commonly associated with opioid medication misuse were administered: 1) the Alcohol Use Disorders Identification Test-C (AUDIT-C)³⁴ assesses hazardous alcohol consumption. This 3-item screener for hazardous drinking has a cut-off score of 3 for women and 4 for men.^{34–36} 2) Drug use was screened using the Drug Abuse Screening Test-10 (DAST-10). The DAST is comprised of 10 items and assesses substance use severity.³⁷ A cut-off score of 1 indicates a need for intervention.³⁷ 3) Depression was screened using the 2-item Patient Health Questionnaire-2 (PHQ-2). A score of 3 indicates a positive screen.^{38, 39} 4) Posttraumatic stress disorder (PTSD) was assessed using the 4-item Primary Care-Posttraumatic Stress Disorder (PC-PTSD) screen, with a score of 3 indicating PTSD.^{40–42} 5) Health was assessed using the Short-Form-12 Health Survey (SF-12).⁴³ The SF-12 contains valid single-item general health and pain subscales.⁴⁴ Variables were included in

the measurement model as binary indicators (i.e., a positive/negative screen) to identify subgroups.

Opioid Misuse and Use Indicators

Opioid medication misuse was assessed using the 6-item Prescription Opioid Misuse Index (POMI).⁴⁵ This measure asks about behaviors pertaining to medication misuse, such as doctor shopping, taking medication at higher doses or more frequently than prescribed, and consumption to obtain psychological relief from stress/anxiety or to experience euphoria. A score of 2 affirmative responses indicates opioid medication misuse.⁴⁵ Patients were also asked to list their prescription opioid medication(s) they were obtaining in their visit to the pharmacy.

Analyses

Delineating unique subgroups was undertaken using LCA.²⁷ This statistical method has been frequently employed in substance abuse,^{46–53} health services,^{54–59} and mental health research.^{60–63} Fit criteria and likelihood ratio tests were used to estimate an increasing number of subgroups until the optimum number was determined,^{27, 64} which included the Akaike Information Criterion,⁶⁵ Adjusted Bayesian Information Criterion (ABIC), in which lower values are better; and the Bootstrapped Likelihood Ratio Test (BLRT), in which 1 class minus a non-significant p -value (i.e., $p < 0.05$) indicates the optimal number of classes.^{27, 64} Using the behavioral, mental, and physical health screening instruments described above, the LCA method assigns each patient to a subgroup. A common convention for latent variable modeling suggests roughly 5 to 10 cases per parameter estimated in order to adequately power analyses.⁶⁶

In order to identify the relationships between patients having a positive screen for prescription opioid medication misuse, demographic indicators, and subgroup membership; analyses also included a one-step latent class regression analysis.^{67–69} Medication type was not included in the latent class regression analysis given lack of variability in medication use among some subgroups. The LCA estimation and regression analysis were conducted using Mplus 7.11.⁷⁰ Descriptive demographic and opioid medication filling information by subgroup are also presented.

Results

A total of 333 patients completed the screening survey (response rate 71.4%). A 3-class model best fit the data (Table 1). The 3-class solution estimated a total of 20 parameters, thus having sufficient numbers of cases per parameter ($N=333$ participants/20 parameters). Figure 1 displays the conditional item probabilities for most likely class membership (i.e., the likelihood for respondents endorsing an item). Overall model entropy was high, 0.80⁶⁸ (an entropy of 1.0 represents perfect overall model classification), and the average individual latent class probabilities for subgroup membership were between 0.73–0.95 (i.e., probability of correct individual class assignment). This high level of model entropy provides necessary diagnostic support for the selection of a one-step method for the latent class regression analysis as appropriate.⁶⁹

Discriminating features of subgroups included pain and other key health features, which key features were used to label subgroups (subgroup labels are not intended to be definitive names for each subgroup). The *hazardous alcohol use* subgroup (12% of the sample, n=40) consisted of individuals who endorsed hazardous drinking (58%) and having pain in the last four weeks that interfered with their daily functioning above national norms (81%). The *mental health* subgroup (8.4% of the sample, n=28) consisted of individuals who were 100% likely to screen positive for depression, PTSD, and to have pain in the last four weeks that interfered with their daily functioning above national norms. The *poor health* subgroup (79.6% of the sample, n=265) consisted of individuals who reported generally poor health that interfered with their daily functioning above national norms (98%) and pain in the last 4 weeks that interfered with their daily functioning above national norms (96%). Following detection of these classes or subgroups, this study examined whether any pharmacy site was over represented regarding the subgroups (results not shown). Of the 2 urban and 2 rural pharmacy sites from which the patients were recruited, 1 urban site was overrepresented (24%, n=24, standardized residual=3.5) and 1 rural site was underrepresented (4.1%, n=4, standardized residual=-2.3) in the *hazardous alcohol use* subgroup ($\chi^2=24.9$, df=5, $p<0.001$). All other proportional distributions of the subgroups were not over/underrepresented (standardized residuals<2.0).

Hazardous Alcohol Use Subgroup

Table 2 displays participant demographic and medication data according to each particular subgroup. Individuals in the *hazardous alcohol use* subgroup were the youngest participants (Mean=44 years, Standard Deviation SD=16.4). Just under half of this subgroup were female (47.5%, n=19), were more likely to have education beyond high school (65.5%, n=25), and reported current employment (70%, n=28) relative to the two other subgroups. *Hazardous alcohol use* subgroup members were screened least frequently in the rural pharmacy setting compared to the other subgroups (20.0%, n=8). Members of this subgroup most often reported filling hydrocodone (37.5%, n=15) and oxycodone (37.5%, n=15). Notably, this group had the smallest portion of patients who screened positive for opioid misuse (10.3%, n=4). In terms of individual behaviors of misuse, the largest portion of the total sample who reported feeling high/buzzed from their opioid were members of the *hazardous alcohol use* subgroup (15%, n=6).

Mental Health Subgroup

Average age of the *mental health* subgroup was 49.2 years (SD=9), and 60.7% (n=17) were female. The largest portion of members of this group compared to the other two groups were screened in the rural pharmacy settings (64.3%, n=18). This subgroup had the lowest portion of members relative to the other groups who possessed more than a high school education 32.1% (n=9) and were currently employed (25%, n=7). Opioid medication consumption was primarily hydrocodone (42.9%, n=12) and oxycodone use (42.9%, n=12). Members of this subgroup had the highest percentage of positive screens for opioid misuse (44.4%, n=12) compared to the other subgroups. For specific opioid misuse behaviors, this subgroup reported the highest rates compared to the other groups of taking larger dosages than prescribed (40.7%, n=11), shortening time between dosages (57.1%, n=16), obtaining early

refills (32.1%, n=9), taking their opioids when upset or to cope with problems (7.1%, n=2), and doctor shopping (7.1%, n=2).

Poor Health Subgroup

Members of the *poor health* subgroup were, on average, 50.8 years old (SD=11.7), and most often female (57.9%, n=152). The majority of group members were screened in the rural pharmacy settings (55.5%, n=147). Less than half of subgroup members possessed more than a high school education (42.2%, n=111), and approximately one-quarter were employed (25.8%, n=68). This subgroup primarily used hydrocodone (39.3%, n=265) and oxycodone (36.2%, n=96). The percentage of patients positive for misuse was second highest in the *poor health* subgroup (12.7%, n=33), and the most common misuse behavior was shortening the time between dosages (20.9%, n=55).

Multivariable Analysis of Subgroup Membership and Opioid Misuse

Associations between subgroup membership, opioid medication misuse, and demographic characteristics are reported in Table 3. Individuals within the *mental health* subgroup had a 6.23 times higher odds (OR 95% CI=5.13–7.33) for obtaining a positive misuse screen compared to patients the *poor health* subgroup. Patients in the *hazardous alcohol use* subgroup did not have elevated risk for a positive opioid medication misuse screening (OR=0.61, 95% CI=–0.63–1.88). Analyses also involved re-estimating the latent class regression analysis with the *hazardous alcohol use* subgroup as the reference category. In this analysis, the substantive model interpretation was identical, with exception that the odds for the *mental health* subgroup having a positive opioid medication misuse screen increased (Table 3).

Discussion

As community pharmacy continues to advance patient care for addressing the opioid medication misuse and overdose epidemic, it is imperative pharmacists possess knowledge regarding patients who are at the highest risk for and possess the characteristics that increase probability for developing misuse.² Pharmacists have a distinct and comprehensive knowledgebase regarding the safe and effective use of medications, including adverse medication effects and inappropriate use.⁷¹ When dispensing opioid medications, pharmacists have a responsibility to ensure that patients obtain appropriately prescribed medications. This responsibility must be balanced with preventing misuse and/or diversion of controlled substances. One fundamental component of this role is identifying patients who are at high risk for opioid misuse.⁷²

Common null hypothesis statistical methods employed to assess risk among patients can provide a linear understanding of relationships between exposure/risk indicators and dependent variables. LCA, on the other hand, is an analytical advancement that permits identification of homogeneous subgroups within a heterogeneous population.^{27, 29, 31, 32} The current study analyzed data from a community pharmacy-based study that surveyed patients filling opioid medications. LCA was utilized to identify risk-related subgroups based on mental, behavioral, and physical health characteristics of patients filling opioid medications.

Further, this study sought to identify which subgroup of patients had the highest risk for reporting misuse of their opioid medications.

Screening Patients

Results showed that a 3-class (subgroup) model best fit the data, which subgroups were labeled *mental health*, *poor health*, and *hazardous alcohol use*. These data provide valuable information for community pharmacists to better understand the patients to whom they dispense opioid medications. Results show that patients receiving opioids have diverse needs considering their health profiles. Bivariate analyses demonstrated that nearly 45% of those within the *mental health* subgroup screened positive for misuse. Regression analyses indicated that the members of this subgroup had the highest odds for opioid misuse and were the only subgroup associated with a positive report for misuse. Depression, PTSD, and pain diagnoses have been previously linked to opioid medication misuse,^{17, 18, 20–22} and the current analyses show that positive screens for these conditions were universally present among members of the *mental health* subgroup. Mental health and psychiatric problems often exacerbate physical disorders and may complicate overall patient management, including medication adherence.⁷³ Identification of individuals in this subgroup thus offers a valuable opportunity for early intervention, including referral for dually-diagnosed patients to specialized care.¹ Such at risk patient identification may be guided by surrogate markers for the *mental health* subgroup, such as prior prescription fills for antidepressants utilizing claims data or patient prescription profiles recorded within pharmacy dispensing software. Furthermore, this study indicates that screening in the community pharmacy setting can identify undetected mental health and medical problems that require intervention.

It is important to note that the while misuse was detected in the *poor health* (12.7%) and *hazardous alcohol use* (10.3%) subgroups, a relationship between membership in these subgroups and a positive misuse screening was not observed. Despite previous literature that has reported associations between those with pain,^{16, 19, 22–24} poor general health,^{17, 24} and misuse; it appears the combination of these indicators as primary characteristics of subgroup membership did not elevate risk to the level of patients currently misusing their opioid medication. It may be the case, however, that these conditions are markers for subsequent misuse behaviors and require further prospective monitoring in the population of community pharmacy patients. Notably, previous research has documented a significant increase in misuse among patients who have alcohol use disorder.¹⁶ Whether employing more comprehensive, albeit labor intensive, clinical diagnostic measures of alcohol use disorders rather than screening for hazardous use provides a better understanding of this subgroup must be further investigated.

There are currently limited resources to assist community pharmacists in the identification of patients who are at risk for opioid medication misuse.⁴ Despite guidelines that recommend routine deployment of screening tools, previous reports have indicated that current tools (e.g., Opioid Risk Tool,⁷⁴ Screener and Opioid Assessment for Patients with Pain Version 1,⁷⁵ and Brief Risk Interview⁷⁶) have limitations for identifying opioid misuse.⁷⁷ The results of the current study suggest the importance of potentially developing and implementing algorithm-based risk stratification tools. Such tools would require pharmacists to enter

patient information into secure databases, which would analyze and produce risk subgroups according to patient characteristics. Such algorithms could be housed and operated, for example, within prescription monitoring program databases or Medicare Quality of Patient Care Star Rating analysis programs.

Need for Intervention Research

Community pharmacists working in the frontline of healthcare are in an exceptional position to provide the first response to prevent and intervene with opioid misuse.⁷⁸ The pharmacy profession has quickly expanded into clinical pharmacotherapy, information services, disease management, and other health services.⁷⁹ Combined with specialized knowledge of medications, pharmacists are uniquely positioned for taking an active role in misuse prevention. Toward this goal, it is noteworthy that there are various interactive tools and guidelines available to support the delivery of care to patients who are prescribed opioids. Some of the more recent tools include: a buprenorphine treatment physician locator;^{80, 81} Medicare Part D opioid mapping tool;⁸¹ the CDC's opioid prescribing guidelines;⁷⁷ and the American Pharmacist Association Opioid Use, Abuse, and Misuse Resource Center.⁸² While there are no existing evidence-based intervention protocols for community pharmacy that are specific to opioid medication misuse, it is clear from sources, such as the recently released CDC Guidelines for Opioid Prescribing, that multimodal interventions ought to be considered for patients who do not respond to single-modality therapy, with combinations being tailored to the patient's needs.⁷⁷ Data presented herein support the need for multimodal patient-centered interventions to address multiple needs of patients. In addition, the data presented from this project also suggest that when misuse does occur among community pharmacy patients (regardless of subgroup), behaviors are primarily centered around seeking early refills (11.8%), shortening time between doses (23.6%), and taking higher dosages than prescribed (12.8%). Such behaviors for intervention reside strongly within the pharmacist's skillset and expertise and could be addressed through targeted brief medication management interventions directed at improving opioid regimen adherence.⁸³ Future research must seek to develop, test, and implement such opioid intervention strategies at the point of medication dispensing.

Approaches to establish evidence-based protocols include the example of naloxone distribution by pharmacists to individuals misusing opioid medications and bystanders who are at an increased probability to witness an overdose.⁸⁴ The content of this approach has predominantly focused on how to respond to overdose including the emergency administration of naloxone.⁸⁴ There have been strong trends for leveraging pharmacists to address opioid overdose through naloxone distribution and patient education. This is aptly demonstrated by the number of states that have adopted collaborative practice agreements enabling naloxone distribution.⁸⁴ The capability of pharmacists to identify patients filling opioid medications who are at risk for misuse offers a more robust and concerted effort to explicitly target these populations. Future research should seek to incorporate overdose risk into patient subgroup identification in order to assist pharmacists to ensure that naloxone kits and training are delivered to those patients within the highest risk subgroups.

Limitations

This study possesses limitations that should be taken into account when considering its findings. While the geographic locations of the pharmacies sites where the screening took place represented both urban and rural settings, they were nonetheless located within southwestern Pennsylvania and thus may not represent other US states and regions. However, as noted in the discussion, the health characteristics of the patients in this sample closely align with previously published studies, thereby providing increased confidence in the external validity of the findings reported. In addition, it should be noted that the patients in the current project were not directly asked about treatment they were currently receiving for opioid misuse or misuse risk factors. Whether these conditions were being treated or not, it is crucial that the health status of patients be known at the point of opioid dispensing to allow for assessment of possible issues of patient safety—consequently providing an important justification for collecting these data at point-of-service. Lastly, the behavioral, mental, and physical health screening tools employed in this study were selected because of their brevity so as to reduce burden on the pharmacist and the patient. Future research should employ more comprehensive measures in order to identify greater detail in subgroup characterization.

Conclusion

Employing latent class analysis, 3 distinct subgroups were identified: *mental health*, *poor health*, and *hazardous alcohol use*. These data offer the field valuable information to better understand specific patient subgroups that constitute the bases of a patient-centered individualized approach to intervention. The observation that patients in the *mental health* subgroup have highest probability of reporting misuse of opioid medications underscores the need to assess psychiatric needs at the point of dispensing. Using the findings obtained herein as the platform, future research should enhance the characterization of each subgroup with more comprehensive measurement for development of an opioid misuse algorithm enabling rapid, accurate, and routine screening in the community pharmacy setting.

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Figure 1.
Patient Mental, Behavioral, and Physical Health Subgroups

Table 1

Latent Class Analysis Model Fit Statistics

Classes	AIC ^a	ABIC ^b	BLRT ^c	Entropy
2	1567.17	1575.44	0.00	0.77
3	1551.56	1564.28	0.00	0.80
4	1555.99	1573.17	0.33	0.83

^a AIC=Akaike Information Criterion,

^b ABIC=Adjusted Bayesian Information Criterion,

^c BLRT=Bootstrapped Likelihood Ratio Test

Table 2
Bivariate Analyses of Demographics, Opioid Medication, and Misuse by Subgroup (N=333)

Indicators	Total %	(n)	% Hazardous alcohol use	(n)	% Mental health	(n)	% Poor health	(n)	χ^2	df	p
Demographics											
Age ^{a,b}	49.8	(12.4)	44.0	(16.4)	49.2	(9.0)	50.8	(11.7)	5.5	2	0.01
Female	56.6	(188)	47.5	(19)	60.7	(17)	57.9	(152)	1.6	2	0.44
Rural pharmacy	52.0	(173)	20.0	(8)	64.3	(18)	55.5	(147)	19.4	2	<0.000
>High school education	43.8	(145)	62.5	(25)	32.1	(9)	42.2	(111)	7.5	2	0.02
Employed	31.0	(103)	70.0	(28)	25.0	(7)	25.8	(68)	32.3	2	<0.000
Pain Medication											
Hydrocodone	39.3	(131)	37.5	(15)	42.9	(12)	39.3	(265)	0.2	2	0.90
Hydromorphone ^c	3.6	(12)	0.0	(0)	0.0	(0)	4.5	(12)	3.2	2	0.39
Oxycodone	36.9	(123)	37.5	(15)	42.9	(12)	36.2	(96)	0.5	2	0.79
Morphine ^c	7.5	(25)	0.0	(0)	7.1	(2)	8.7	(23)	3.8	2	0.12
Methadone ^c	3.3	(11)	0.0	(0)	3.6	(1)	3.8	(10)	1.6	2	0.52
Fentanyl ^c	3.9	(13)	2.5	(1)	3.6	(1)	4.2	(11)	0.2	2	1.00
Oxymorphone ^c	4.8	(16)	0.0	(0)	7.1	(2)	5.3	(14)	2.5	2	0.30
Misuse and class assignment											
Prescription opioid misuse ^c	15.1	(49)	10.3	(4)	44.4	(12)	12.7	(33)	20.0	2	<0.001
Misuse behavior and class assignment											
Taking higher dosages	12.8	(42)	7.5	(3)	40.7	(11)	10.7	(28)	21.0	2	<0.001
Shorten time between dosages	23.6	(78)	17.5	(7)	57.1	(16)	20.9	(55)	19.4	2	<0.001
Early refills ^c	11.8	(39)	5.0	(2)	32.1	(9)	10.7	(28)	13.2	2	0.003
Feel high or get a buzz ^c	9.4	(31)	15.0	(6)	10.7	(3)	8.4	(22)	1.8	2	0.34
Taking medication when upset or to cope/relieve problems other than pain ^c	3.3	(11)	0.0	(0)	7.1	(2)	3.5	(9)	2.6	2	0.28

Indicators	Total %	(n)	% Hazardous alcohol use	(n)	% Mental health	(n)	% Poor health	(n)	χ^2	df	p
Going to multiple physicians seeking medication ^c	1.8	(6)	0.0	(0)	7.1	(2)	1.5	(4)	5.3	2	0.14

^aMean (SD), t statistic.

^bBonferroni correction showed poor health subgroup was significantly different than hazardous alcohol subgroup.

^cp value based on Fisher exact.

Table 3

Observed Indicators Predicting Subgroup Membership ^a

Mental health Subgroup	Estimate	SE	OR	(95% CI)	p
Prescription opioid misuse	1.83	0.56	6.23	(5.13–7.33)	<0.001
Age	–0.01	0.02	1.00	(0.95–1.04)	0.82
Female	0.39	0.59	1.48	(0.32–2.63)	0.51
>High school education	–0.10	0.60	0.91	(–0.26–2.08)	0.87
Employed	0.05	0.62	1.05	(–0.15–2.26)	0.93
Rural Pharmacy	0.46	0.61	1.58	(0.38–2.78)	0.45
Hazardous alcohol use subgroup					
Prescription opioid misuse	–0.49	0.65	0.61	(–0.66–1.88)	0.45
Age	–0.02	0.02	0.98	(0.95–1.02)	0.33
Female	–0.34	0.43	0.71	(–0.14–1.56)	0.43
>High school education	0.32	0.45	1.38	(0.49–2.26)	0.48
Employed	1.06	0.45	2.89	(2.02–3.77)	0.02
Rural Pharmacy	–1.15	0.48	0.32	(–0.62–1.25)	0.02

^aReference group=Poor health subgroup. Note, as mentioned in the text, changing the reference group to the *Hazardous alcohol use subgroup* did not change the model interpretation, with the exception of an increase in the magnitude of relationship between misuse and the *mental health* subgroup membership: OR=10.17, 95%CI=8.57–11.78.