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Medical use, non-medical use and use disorders of benzodiazepines and prescription opioids in adults: Differences by insurance status

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ABSTRACT

Objectives: To report and analyze prevalence's of Benzodiazepines (BZDs) and Prescription Opioids (POs) use by insurance status and to investigate associations between insurance status and BZDs, POs and concurrent medical/non-medical use and use disorders.

Methods: This study included 81,133 adults ages 18 and older from 2015 and 2016 National Survey on Drug Use and Health. Participants' self-reported past- year medical use, non-medical use and use disorders of BZDs and POs were assessed, along with their insurance status (Private/Military, Medicare, Medicaid, and Uninsured) and demographic characteristics.

Results: In 2015–2016, 12.6% of adults reported using BZDs and 36.9% reported using POs in the past year. Among adults, 8.3% reported past-year use of both BZDs and POs; also, 1.9% and 3.8% reported non-medical use of BZDs and POs, respectively, and 0.9% reported non-medical use of both BZDs and POs. Medicaid-covered respondents had higher risk of BZDs (aRRR = 1.59, 95%CI = [1.45, 1.74]), POs (aRRR = 1.66, 95%CI = [1.54, 1.79]) and concurrent past-year medical use (aRRR = 2.11, 95%CI = [1.87, 2.38]), higher risk of BZDs non-medical use (aRRR = 1.40, 95%CI = [1.17, 1.68]) and BZD Use Disorders (aRRR = 2.60, 95%CI = [1.82, 3.72]), POs non-medical use (aRRR = 1.67, 95%CI = [1.45, 1.92]), PO use Disorders (aRRR = 4.12, 95%CI = [3.33, 5.11]) and concurrent non-medical use (aRRR = 1.52, 95%CI = [1.20, 1.92]) and Use Disorders (aRRR = 3.68, 95%CI = [1.93, 6.78]), compared to those with private insurance.

Conclusions: Future health policies should focus on reducing individual and co-prescription of BZDs and POs and providing different strategies of pain management.

1. Background

Benzodiazepines (BZDs) and Prescription Opioids (POs) are among the most commonly used medications that are also used non-medically by adolescents (Collins et al., 2011; Drazdowski et al., 2015; Perlmutter et al., 2018) and adults (Blanco et al., 2007) in the United States and worldwide (Abrahamsson et al., 2015; Perlmutter et al., 2018). BZDs (28.7%). POs (39.2%) are responsible for a considerable share of pharmaceutical-related Emergency Department visits in the United States (U.S. Department of Health and Human Services - Substance Abuse and Mental Health Services Administration, 2011). The concurrent use of BZDs and POs is particularly worrisome due to the increased risk of overdose since both drugs might promote respiratory depression (Jones et al., 2012). Prescriptions of both BZDs and POs have risen through the past decades (Mojtabai, 2018; Olfson et al., 2015), and so have Emergency Department Visits and Overdose Deaths from their combined use (Jones and McAninch, 2015). The United States is currently going through an opioid crisis (Food and Drug Administration, 2018) with very severe consequences (Kolodny et al., 2015). Even though many medical providers have stopped initiating therapy with POs, high-risk initial prescribing of opioids is still a matter for concern (Zhu et al., 2019).

BZDs promote sedation by enhancing γ-aminobutyric acid (GABA), the most important inhibitory neurotransmitter in the human central nervous system (Hood et al., 2014). They are used in the treatment of several psychiatric disorders, such as anxiety and insomnia (Dell'osso and Lader, 2013). BZDs are also known for their side effects and risks, that include dependence, withdrawal symptoms and overdose (Lader,

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2011), as well as increased risk of bone fracture (Xing et al., 2014) and dementia (Billioti de Gage et al., 2012; Zhong et al., 2015). POs act on *mu*, *kappa* and *delta* opioid receptors in brain areas such as the cerebral cortex, hypothalamus, and raphe nuclei (Pasternak, 2005). They are widely used as treatment for acute and chronic pain, even though the most recent Center for Disease Control and Prevention guideline (Center for Disease Control and Prevention, 2016) states that POs are not first-line therapy for the management of non-cancer chronic pain. This is in line with guidelines from Canada (Busse et al., 2017), Hong Kong (Cheung et al., 2016) and Latin America (Lara-Solares et al., 2017) that also do not recommend POs as first-line therapy for chronic pain.

From 2001 to 2013, the proportion of BZD users among patients who filled at least one prescription of POs users rose from 9% to 17% in adults (Sun et al., 2017). A more recent study from a university outpatient service sample in Philadelphia reported that as much as 49.4% of PO users were also receiving BZDs (Simon et al., 2018). Another recent study reported a 5-fold increase in the risk of overdose when comparing concurrent BZDs and POs users with PO use alone (Hernandez et al., 2018).

In the United States, health insurance refers to any program that pay for healthcare expenses (United States Census Bureau, 2016). The majority of the American population (67.2%) is covered by a private insurance plan, most of which are sponsored through an employer. Public programs come right afterwards, with 37.7% reporting enrollment to Medicaid (program that provides health coverage to the needy), Medicare (program that covers healthcare for those aged 65 or older or with certain disabilities), and the Children's Health Insurance Program (healthcare for low income children who do not qualify for Medicaid). Also, Military healthcare plans account for health insurance coverage for 4.8% of the American population. On the other hand, 8.8% of the Americans did not have any health insurance plan in 2017, and this proportion is higher among ethnic minorities such as Blacks and Hispanics (Berchick et al., 2018). Public health programs are available for specific populations: Medicare provides health insurance for persons aged 65 or older, permanently disabled, or with chronic specific diseases. In turn, Medicaid is a social insurance program designed for those whose resources are insufficient to afford paid healthcare (Berchick et al., 2018).

Insurance status has been associated with access to treatment for Substance Use Disorders (SUD) (Ali et al., 2017), and could be an important predictor of concurrent use of PO BZD, as well as of risk of drug overdose. Non-medical PO use and PO users with a substance use disorder are most commonly uninsured (Han et al., 2015), and it is known that a significant number of uninsured patients live with SUD (Ali et al., 2016). Also, having insurance can increase the probability of receiving PO or BZD prescriptions. For example, the number of Medicare patients receiving BZDs more than doubled from 1991 to 2009 (Gorevski et al., 2012), and POs had their steepest rise among Medicaid patients (Zerzan et al., 2006) and overall (Garland et al., 2015; Olsen et al., 2006) in the late 90 s compare to those with other types of insurance. Also, Medicare/Medicaid patients reported greater odds of receiving POs by Primary Care doctors, compared to the general population (Olsen et al., 2006). Startling rates of concurrent use of BZDs and POs have been reported in Medicaid (Jayawardhana et al., 2018; Mack et al., 2015) and Medicare (Hernandez et al., 2018) covered individuals, but that was also found in a study with private insurance (Sun et al., 2017) settings. A previous cross-sectional analysis has studied in 2008 the relationship between insurance status and opioid use disorders in 2002–2004 and found that uninsured and Medicaid-insured individuals were at higher risk of POs use disorder, compared to those with private insurance. (Becker et al., 2008).

To date, the relationship between insurance status and BZDs/POs non-medical/medical use, as well as with related abuse/dependence has not been studied in detail. Examining differences among insurance categories could provide policymakers a clearer picture of the current caveats concerning access to treatment and quality of healthcare in receivers of Medicare, Medicare, and uninsured individuals. Thus, our findings could provide directions for future guidelines aiming at lowering the probability of non-medical use, use disorders and co-prescription of BZDs and POs. The aims of this study are to i) estimate the past-year prevalence of BZD and PO medical use, non-medical use and DSM-IV abuse/dependence in 2015–2016, by insurance status; and ii) analyze differences between these prevalences across insurance strata in the United States. We hypothesize that privately insured patients will present a higher prevalence of past-year medical use, non-medical use and use disorders of BZDs and POs compared to Medicare/Medicaid and uninsured patients since this population has more access to medical services and prescriptions.

2. Methods

2.1. Study population

The National Survey on Drug Use and Health (NSDUH) is an yearly nationally-representative survey of the civilian, non-institutionalized population aged 12 years and older designed to gather information on the prevalence of substance use and related variables, including insurance, treatment status and legal problems (Substance Abuse and Mental Health Services Administration, 2015). The survey covers residents of households and excludes homeless or transient unsheltered people. NSDUH uses a probability sample for each of the 50 states and the District of Columbia (DC) and oversamples younger age groups (12–25 years old), using an independent multistage area probability sample within each state and the DC. Trained interviewers conducted in-person interviews using computer-assisted interviewing (CAT). Questions about sensitive behaviors such as drug use were performed using audio computer-assisted self-interviewing (ACASI), so to increase the accuracy of answers related to such behaviors. Weighted interview response rates were of 69.25% in 2015 and 68.44% in 2016. More information on the data collection is available elsewhere (Substance Abuse and Mental Health Services Administration, 2017).

In the present study, we performed a cross-sectional analysis of aggregated data from 2015 and 2016, which provided us with a sample size of 83,311 individuals. We restricted analyses to the population aged 18 or older.

2.2. Measures

2.2.1. Outcome Variables

Participants were asked if they had used any BZD medications (e.g. Alprazolam, Diazepam, Clonazepam, Triazolam) and pain relievers (e.g. Oxycodone, Hydrocodone, Morphine) during the past 12 months. We created four-level categories separately for BZDs (BZDs: 0 – no use of any BZDs, 1 – Medical use only, 2 – Non-medical use, either concurrent with medical use or not, and 3 – Abuse/Dependence, either concurrent or not with medical or non-medical use) and POs (0 – no use of any POs, 1 – Medical use only, 2 – Non-medical use, either concurrent with medical use or not, and 3 – Abuse/Dependence, either concurrent or not with medical or non-medical use).

Definitions were as follows: medical use: any past-year use that does not fulfill criteria for either non-medical use nor use disorders; non-medical use: any past-year use without a prescription; and use disorders: abuse and dependence, as determined by DSM-IV (American Psychiatric Association, 1994) criteria, were merged into one category since both are indications for treatment.

We also created another four-level category for co-use. Individuals were included in one of these four categories: 0 – no co-use (includes non-users of BZDs and POs, medical use/non-medical use/use disorders of BZDs with no past-year POs use, and medical use/non-medical use/use disorders of POs with no past-year BZDs use), 1 – concurrent medical use (includes medical use of BZDs and POs, medical use of

Table 1
Demographics characteristics of participants aged 18 or older (n = 83,311) reporting prevalence of BZDs and POs medical use, non-medical use or use disorders., NSDUH.2015–2016.

	Total n = 83,311 (100%)	No Use of either n = 49,907	BZD[a]				PO[b]			
			No Use n = 73,269	Medical Usersn = 7,562	Non-Medical Users n = 2,175	Use disordersn = 305	No Use n = 53,235	Medical Users n = 25,289	Non-Medical Users n = 4,010	Use disorder n = 777
Total	83,311 (100%)	49,907 (58.8%)	73,269 (87.4%)	7,562 (10.4%)	2,175 (1.9%)	305 (0.3%)	53,235 (63.1%)	25,289 (32.4%)	4,010 (3.8%)	777 (0.8%)
Sex										
Male	0.48	0.51	0.50	0.34	0.50	0.45	0.50	0.43	0.55	0.60
Female	0.52	0.49	0.50	0.66	0.50	0.55	0.50	0.57	0.45	0.40
Age (years old)										
18–25	0.14	0.15	0.14	0.07	0.34	0.34	0.15	0.11	0.25	0.18
26–34	0.16	0.16	0.16	0.12	0.25	0.19	0.16	0.14	0.25	0.27
35–49	0.25	0.25	0.25	0.25	0.19	0.26	0.25	0.25	0.24	0.31
50–64	0.26	0.24	0.25	0.32	0.16	0.17	0.25	0.29	0.20	0.20
65 or older	0.20	0.20	0.20	0.24	0.06	0.04	0.20	0.22	0.06	0.03
Ethnicity										
Non-Hispanic White	0.65	0.61	0.63	0.80	0.76	0.73	0.63	0.69	0.67	0.73
Non-Hispanic Black	0.12	0.12	0.12	0.07	0.07	0.11	0.11	0.12	0.10	0.11
Hispanic	0.16	0.18	0.16	0.09	0.12	0.11	0.17	0.12	0.17	0.11
Other	0.08	0.09	0.08	0.04	0.04	0.06	0.09	0.06	0.06	0.05
Total Family Income										
Less than $20,000	0.17	0.16	0.17	0.18	0.23	0.30	0.16	0.18	0.22	0.29
$20,000–$49,999	0.30	0.29	0.30	0.30	0.32	0.32	0.29	0.31	0.32	0.33
$50,000–$74,999	0.16	0.16	0.16	0.16	0.13	0.16	0.17	0.16	0.15	0.15
$75,000 or more	0.37	0.38	0.37	0.36	0.31	0.21	0.38	0.35	0.31	0.24
Insurance Type										
Private & Military	0.56	0.58	0.56	0.50	0.58	0.46	0.58	0.52	0.56	0.42
Medicare	0.19	0.18	0.19	0.26	0.06	0.08	0.18	0.23	0.07	0.07
Medicaid	0.15	0.13	0.14	0.17	0.19	0.31	0.12	0.17	0.20	0.33
Uninsured	0.10	0.11	0.11	0.06	0.17	0.15	0.11	0.08	0.17	0.18

a: BZD: Benzodiazepine Medications; b: PO: Prescription Opioids.

BZDs with non-medical use/use disorders of POs, and medical use of POs with non-medical use/use disorders of BZDs), 2 – concurrent non-medical use (includes non-medical use of BZDs and POs, non-medical use of BZDs with use disorders of POs, and non-medical use of POs with use disorders of BZDs) and 3 – concurrent use disorders (includes individuals with use disorders of both BZDs and POs).

2.2.2. Exposure Variable

Insurance Status was our exposure variable of interest. To assign a single insurance category to each respondent, we used four possible categories. Those who indicated any type of private insurance (e.g., Tricare, Champus, Champva, military or private insurance) were categorized as 1-Private; those who indicated Medicare coverage were coded as 2-Medicare. those who reported Medicaid/S − CHIP were coded as 3-Medicaid; those uninsured for nine months or more of the past year were categorized as 4-Uninsured. We excluded from our analysis respondents who did not fulfill either of these criteria (3.34%, 2,875 out of 86,186).

2.2.3. Covariates

Covariates included age (18–25 years old, 26–34, 35–49, 50–65, and 65 or more), gender, total annual family income in US Dollars (0–19 999, 20 000–39 999, and 40 000–74 000, and 75 000 or more), race [categorized as Non-Hispanic (NH) White, NH Black, Hispanic, and others (others included NH Native American/AK Native, NH Native Hawaiian/Other Pacific Islands, NH Asian, NH more than one race)], past-year DSM-IV (American Psychiatric Association, 1994) alcohol abuse/dependence (yes or no) and survey year (2015 and 2016).

2.3. Statistical analyses

Descriptive and exploratory analyses were conducted to estimate weighted proportions of individuals with past-year medical, non-medical and use disorders of BZD and the same for POs, as well as their socio-demographic characteristics. To take into account the complex sampling design, all analyses were be based on Taylor series (Skinner et al., 1989) approximations, using "svy" commands of Stata SE 15.0 (StataCorp, College Station, Texas) to estimate variances. To obtain unbiased estimates, analyses were weighted using the provided person-level analysis weights that account for the selection probability at specific stages or for adjustment factors. As multiple NSDUH survey years were used (2015 and 2016 combined), we divided the person-level analysis weights by the number of years of NSDUH data used in analyses (2 years). The final weight can be interpreted as the total number of people in the target population represented by each record in the sample.

We described frequencies and prevalence of the outcomes of interest (past-year prevalence of medical and non-medical BZD Use, medical and non-medical PO Use, BZD Use Disorders and PO Use Disorders); then, we examined bivariate associations between insurance status and each of the four outcome variables.

We then ran multinomial logistic regression models (past-year prevalence of BZDs and POs medical co-use, non-medical co-use and co-use disorders) with insurance status, age, sex, yearly income and race predicting each of the two outcome variables (four-level BZDs and POs medical use/non-medical use/use disorders) to obtain adjusted Relative Risk Ratio (aRRR) estimates using Stata's *mlogit* command. Our reference category for both BZDs and POs was 0- No use of any BZDs/POs.

As an additional set of analyses restricted to medical and non-medical users of BZDs and POs, we ran multinomial logistic regression

models predicting the risk of BZDs, POs and BZD/PO use disorders by insurance categories adjusted for demographic covariates and survey year, We created a four-level categorical use disorder variable (0 – no use disorder; 1 – BZD only Use Disorders; 2 – PO only Use Disorders; 3 – Concurrent BZD and PO Use Disorders). Category 0 (no PO or BZD use disorder) was defined as the reference group. We also reported aRRR estimates obtained from Stata's *mlogit* command, comparing categories 1, 2 and 3 to reference category 0.

3. Results

3.1. Descriptives

12.6% of the study population made any use of BZDs over the past year. This encompasses medical-only use (10.4%), non-medical use (1.9%) and use disorders, including DSM-IV abuse or dependence (0.3%). As for POs, 36.9% of the study sample presented any past-year POs use, 32.4% from medical-only use, 3.8% from non-medical use and 0.8% from PO use disorders. In our sample, 8.3% of the respondents reported medical use, non-medical use or use disorders of both BZDs and POs. Within those, 7.3% reported concurrent medical use of BZDs and POs, while 0.9% reported concurrent non-medical use of BZDs and POs and 0.1% reported use disorders of both BZD and POs (Tables 1 and 2).

Among those with Private insurance, past-year prevalences were as follows: for BZD, 11.6% of the population made any use, 2.2% non-medical use and 0.2% had BZDs use disorders; for POs, 34.6% of the population made any use, 4.4% non-medical use and 0.6% had POs use disorders; for concurrent use, 7.1% made any use of BZDs and POs, 1.0% non-medical use of BZDs and POs and 0.001% had concurrent BZDs and POs use disorders. Among those with Medicare, past-year prevalences were as follows: for BZD, 15.0% of the population made any use, 0.7% non-medical use and 0.1% had BZDs use disorders; for POs, 39.8% of the population made any use, 1.7% non-medical use and 0.3% had POs use disorders; for concurrent use, 9.6% made any use of BZDs and POs, 0.2% non-medical use of BZDs and POs and 0.0005% had concurrent BZDs and POs use disorders. Among those with Medicaid, past-year prevalences were as follows: for BZD, 15.1% of the population made any use, 3.0% non-medical use and 0.6% had BZDs use disorders; for POs, 45.8% of the population made any use, 6.8% non-medical use and 1.7% had POs use disorders; for concurrent use, 12.1% made any use of BZDs and POs, 1.5% non-medical use of BZDs and POs and 0.3% had concurrent BZDs and POs use disorders. As for the uninsured population, past-year prevalences were as follows: for BZD, 10.1% of the population made any use, 3.6% non-medical use and 0.4% had BZDs use disorders; for POs, 31.5% of the population made any use, 7.4% non-medical use and 1.3% had POs use disorders; for concurrent use, 6.9% made any use of BZDs and POs, 2.1% non-medical use of BZDs and POs and 0.2% had concurrent BZDs and POs use disorders.

Table 2
Past-Year Prevalence of BZDs and POs medical use, non-medical use and use disorders and concurrent medical/non-medical use and use disorder, NSDUH 2015–2016 (n = 83,311).

Total past-year Prevalence	Number of Individuals (%)
BZDs (12.6%)	
No BZD Use	73,269 (87.4%)
Total BZD Medical Use	7,562 (10.4%)
Total BZD Non-Medical Use	2,175 (1.9%)
Total BZD Use Disorders	305 (0.3%)
POs (36.9%)	
No PO Use	53,235 (63.1%)
Total PO Medical Use	25,289 (32.4%)
Total PO Non-Medical Use	4,010 (3.8%)
Total PO Use Disorders	777 (0.8%)
Co-Use (8.3%)	
No Concurrent Use	76,597 (91.7%)
Concurrent Medical Use	5,462 (7.3%)
Concurrent Non-Medical Use	1,122 (0.9%)
Concurrent Use Disorders	130 (0.1%)

a: BZD: Benzodiazepine Medications; b: PO: Prescription Opioids.

3.2. Associations between insurance status with Medical/Non-Medical use and use disorders of BZDs only, POs only and Co-use of BZDs and POs

3.2.1. Medical use

Individuals with Private insurance (aRRR = 1.14, 95%CI = [1.03, 1.26]), Medicare (aRRR = 2.60, 95%CI = [2.13, 3.18]), and Medicaid (aRRR = 1.82, 95%CI = [1.57, 2.12]) had a significantly higher risk of having used BZDs medically in the past year as compared to those Uninsured. Also, those with Medicare (aRRR = 2.27, 95%CI = [1.86, 2.77]) and Medicaid (aRRR = 1.59, 95%CI = [1.45, 1.74]) had higher risk of medical BZDs use compared to those with Private insurance. Regarding POs, individuals with Private insurance (aRRR = 1.21, 95%CI = [1.13, 1.30]), Medicare (aRRR = 2.16, 95%CI = [1.87, 2.51]), and Medicaid (aRRR = 2.01, 95%CI = [1.85, 2.19]) had significantly higher risk of having used POs medically than the Uninsured. Also, those with Medicare (aRRR = 1.79, 95%CI = [1.58, 2.02]) and Medicaid (aRRR = 1.66, 95%CI = [1.54, 1.79]) had higher risk of POs medical use compared to those with Private insurance.

Regarding concurrent medical use, individuals with Medicare (aRRR = 2.89, 95%CI = [2.30, 3.63]) and Medicaid (aRRR = 2.18, 95%CI = [1.83, 2.59]) presented significantly higher risk of concurrent medical use of BZDs and POs, as compared to Uninsured respondents. When the Private category was set as the reference, those with Medicare (aRRR = 2.81, 95%CI = [2.29, 3.45]) and Medicaid (aRRR = 2.11, 95%CI = [1.88, 2.38]) presented higher risk of concurrent medical use of BZDs and POs. No significant differences were found between Uninsured and those with Private insurance. Male respondents were at significantly lower risk of medical use of BZDs (aRRR = 0.50, 95%CI = [0.47, 0.53]), POs (aRRR = 0.79, 95%CI = [0.75, 0.82]), and concurrent medical use (aRRR = 0.53, 95%CI = [0.49, 0.57]) compared to women. Higher income was related to lower risk of BZDs, POs, and concurrent medical use. NH whites were at higher risk of BZDs, POs, and concurrent medical use compared to all other ethnicity categories. See Table 3 for detailed results on covariates gender, income, race/ethnicity, age, alcohol use disorders and study year.

3.2.2. Non-medical use

Those with private insurance had a lower risk of past-year non-medical use of BZD compared to uninsured individuals (aRRR = 0.67, 95%CI = [0.56, 0.79]). Those in the Medicare and Medicaid categories did not significantly differ from those in the Uninsured category regarding non-medical use of BZDs. When the Private insurance category was set as the reference, respondents with Medicaid (aRRR = 1.40, 95%CI = [1.17, 1.68]) insurance had a higher risk of non-medical use of BZDs. Regarding POs, those with private insurance had a significantly lower risk of non-medical use of POs compared to Uninsured (aRRR = 0.74, 95%CI = [0.66, 0.85]), whereas among Medicaid insured individuals this risk was significantly higher compared to Uninsured (aRRR = 1.24, 95%CI = [1.06, 1.46]). When the Private insurance category was set as the reference, respondents with Medicare (aRRR = 1.65, 95%CI = [1.16, 2.34]) and Medicaid (aRRR = 1.67, 95%CI = [1.45, 1.92]) insurance o reported higher risk of POs non-medical use. With regards to concurrent non-medical use, those with private insurance had a significantly lower risk of concurrent BZDs and POs non-medical use, as compared to Uninsured (aRRR = 0.56, 95%CI = [0.45, 0.70]). Respondents with Medicaid presented a higher risk of concurrent BZDs and POs non-medical use when compared to privately insured respondents (aRRR = 1.52, 95%CI = [1.20, 1.92]). Males presented lower risk of non-medical use of BZDs (aRRR = 0.88, 95%CI = [0.78, 0.98]), but higher risk POs non-medical use (aRRR = 1.11, 95%CI = [1.01, 1.22]) compared to women. Higher income (over

Table 3
Adjusted Relative Risk Ratios and 95% Confidence Intervals for past-year BZD and PO medical use, non-medical use and abuse/dependence (use disorders) by insurance status, gender, yearly income, race/ethnicity and age group among NSDUH sample (2015–2016) 18 years or older (n = 83,311).

	BZD[a]s (n=10,042)						PO[b]s (n=30,076)		
	Medical Use aRRR[c] (95% CI[d])	*p*- value	Non-Medical Use aRRR (95% CI)	*p*- value	Use Disorders aRRR (95% CI)	*p*- value	Medical Use aRRR (95% CI)	*p*- value	Non-Medical Use aRRR (95% CI)
Insurance (ref = uninsured)									
Private	1.14* (1.03, 1.26)	0.01	0.67* (0.56, 0.79)	< 0.01	0.65 (0.39, 1.08)	0.10	1.21* (1.13, 1.30)	< 0.01	0.74* (0.66, 0.85)
Medicare	2.60* (2.13, 3.18)	< 0.01	0.64 (0.28, 1.50)	0.31	2.47 (0.76, 8.08)	0.13	2.16* (1.87, 2.51)	< 0.01	1.23 (0.86, 1.75)
Medicaid	1.82* (1.57, 2.12)	< 0.01	0.93 (0.76, 1.15)	0.53	1.69* (1.08, 2.63)	0.02	2.01* (1.85, 2.19)	< 0.01	1.24* (1.06, 1.46)
Insurance (ref = private)									
Medicare	2.27* (1.86, 2.77)	< 0.01	0.97 (0.43, 2.18)	0.93	3.81* (1.13, 12.87)	0.03	1.79* (1.58, 2.02)	< 0.01	1.65* (1.16, 2.34)
Medicaid	1.59* (1.45, 1.74)	< 0.01	1.40* (1.17, 1.68)	< 0.01	2.60* (1.82, 3.72)	< 0.01	1.66* (1.54, 1.79)	< 0.01	1.67* (1.45, 1.92)
Uninsured	0.87* (0.79, 0.97)	< 0.01	1.50* (1.26, 1.78)	< 0.01	1.55 (0.93, 2.57)	0.1	0.83* (0.77, 0.89)	< 0.01	1.34* (1.18, 1.52)
Gender (ref = female)									
Male	0.50* (0.47, 0.53)	< 0.01	0.88* (0.78, 0.98)	0.02	0.71* (0.55, 0.93)	0.01	0.79* (0.75, 0.82)	< 0.01	1.11* (1.01, 1.22)
Yearly Income (ref = 0-$20,000)									
$20,000-49,999	0.93 (0.84, 1.02)	0.11	0.92 (0.77, 1.10)	0.36	0.82 (0.53, 1.27)	0.37	1.02 (0.95, 1.08)	0.62	0.91 (0.80, 1.04)
$50,000-74,999	0.88* (0.78, 1.00)	0.04	0.72* (0.58, 0.90)	< 0.01	0.81 (0.47, 1.40)	0.45	0.95 (0.88, 1.03)	0.20	0.82* (0.70, 0.96)
$75,000 +	0.86* (0.77, 0.96)	< 0.01	0.76* (0.62, 0.94)	0.01	0.51* (0.31, 0.84)	< 0.01	0.90* (0.84, 0.96)	< 0.01	0.72* (0.60, 0.86)
Race (reference = NH White)									
NH[e] Black	0.38* (0.33, 0.43)	< 0.01	0.37* (0.31, 0.46)	< 0.01	0.49* (0.29, 0.81)	< 0.01	0.93 (0.86, 1.01)	0.07	0.66* (0.56, 0.78)
Hispanic	0.45* (0.41, 0.50)	< 0.01	0.42* (0.34, 0.51)	< 0.01	0.36* (0.22, 0.56)	< 0.01	0.66* (0.62, 0.71)	< 0.01	0.66* (0.58, 0.75)
Other	0.40* (0.33, 0.47)	< 0.01	0.33* (0.25, 0.43)	< 0.01	0.48* (0.27, 0.84)	0.01	0.65* (0.58, 0.72)	< 0.01	0.54* (0.44, 0.67)
Age (reference = 18-25 years old)									
26-34 yo[f]	1.72* (1.59, 1.87)	< 0.01	0.71* (0.63, 0.79)	< 0.01	0.54* (0.36, 0.80)	< 0.01	1.30* (1.23, 1.39)	< 0.01	0.99 (0.90, 1.10)
35-49 yo	2.28* (2.06, 2.51)	< 0.01	0.37* (0.32, 0.42)	< 0.01	0.58* (0.39, 0.86)	< 0.01	1.46* (1.38, 1.55)	< 0.01	0.68* (0.60, 0.76)
50-64 yo	2.54* (2.28, 2.82)	< 0.01	0.32* (0.25, 0.41)	< 0.01	0.35* (0.20, 0.63)	< 0.01	1.63* (1.53, 1.74)	< 0.01	0.55* (0.48, 0.63)
65+ yo	1.16 (0.95, 1.42)	0.14	0.15* (0.07, 0.33)	< 0.01	0.04* (0.01, 0.25)	< 0.01	0.95 (0.84, 1.07)	0.38	0.14* (0.09, 0.22)
Past-year Alcohol Use Disorders (ref=no)									
Yes	1.99* (1.78, 2.22)	< 0.01	5.27* (4.57, 6.08)	< 0.01	9.59* (7.09, 12.96)	< 0.01	1.32* (1.21, 1.44)	< 0.01	3.93* (3.47, 4.45)
Survey Year (ref = 2015)									
2016	1.01 (0.95, 1.07)	0.80	1.03 (0.90, 1.18)	0.64	0.96 (0.72, 1.27)	0.76	0.89* (0.85, 0.94)	< 0.01	0.92 (0.83, 1.00)

(*continued on next page*)

Table 3 (*continued*)

		Use Disorders		Co-use (n = 6,714) Medical Use of BZDs and POs		Non-Medical Use of BZDs and POs		Use Disorders of BZDs and POs	
	p- value	aRRR (95% CI)	*p*- value	aRRR (95% CI)	*p*-value	aRRR (95% CI)	*p*-value	aRRR (95% CI)	*p*-value
Insurance (ref = uninsured)									
Private	< 0.01	0.50* (0.37, 0.67)	< 0.01	1.03 (0.90, 1.18)	0.68	0.56* (0.45, 0.70)	< 0.01	0.58 (0.26, 1.29)	0.18
Medicare	0.25	1.75 (0.89, 3.44)	0.11	2.89* (2.30, 3.63)	< 0.01	0.52 (0.21, 1.28)	0.15	1.81 (0.20, 16.70)	0.60
Medicaid	< 0.01	2.05* (1.54, 2.74)	< 0.01	2.18* (1.83, 2.59)	< 0.01	0.85 (0.66, 1.10)	0.23	2.14* (1.11, 4.13)	0.02
Insurance (ref = private)									
Medicare	< 0.01	3.51* (1.69, 7.26)	< 0.01	2.81* (2.29, 3.45)	< 0.01	0.92 (0.36, 2.33)	0.86	3.13 (0.34, 28.56)	0.31
Medicaid	< 0.01	4.12* (3.33, 5.11)	< 0.01	2.11* (1.88, 2.38)	< 0.01	1.52* (1.20, 1.92)	< 0.01	3.68* (1.93, 6.78)	< 0.01
Uninsured	< 0.01	2.01* (1.49, 2.70)	< 0.01	0.97 (0.85, 1.11)	0.68	1.78* (1.42, 2.23)	< 0.01	1.72 (0.78, 3.81)	0.18
Gender (ref = female)									
Male	0.03	1.40* (1.20, 1.64)	< 0.01	0.53* (0.49, 0.57)	< 0.01	1.00(0.83, 1.20)	0.99	0.84(0.57, 1.25)	0.39
Yearly Income (ref = 0-$20,000)									
$20,000-49,999	0.16	0.82 (0.64, 1.05)	0.11	0.91 (0.81, 1.02)	0.10	0.94 (0.76, 1.16)	0.55	0.89 (0.50, 1.57)	0.68
$50,000-74,999	0.01	0.79 (0.61, 1.03)	0.08	0.81* (0.70, 0.93)	< 0.01	0.64* (0.49, 0.83)	< 0.01	1.35 (0.64, 2.85)	0.43
$75,000 +	< 0.01	0.57* (0.42, 0.77)	< 0.01	0.79* (0.71, 0.88)	< 0.01	0.60* (0.48, 0.75)	< 0.01	0.46 (0.19, 1.12)	0.09
Race (reference = NH White)									
NH[e] Black	< 0.01	0.51* (0.36, 0.73)	< 0.01	0.40* (0.34, 0.46)	< 0.01	0.34* (0.26, 0.45)	< 0.01	0.48 (0.20, 1.13)	0.09
Hispanic	< 0.01	0.32* (0.22, 0.47)	< 0.01	0.39* (0.34, 0.45)	< 0.01	0.36* (0.26, 0.52)	< 0.01	0.43* (0.20, 0.92)	0.03
Other	< 0.01	0.43* (0.29, 0.63)	< 0.01	0.41* (0.35, 0.49)	< 0.01	0.37* (0.27, 0.51)	< 0.01	0.28* (0.11, 0.71)	< 0.01
Age (reference = 18-25 years old)									
26-34 yo[f]	0.92	1.50* (1.13, 2.00)	< 0.01	1.57* (1.42, 1.73)	< 0.01	0.79* (0.66, 0.93)	< 0.01	0.64 (0.36, 1.17)	0.15
35-49 yo	< 0.01	1.29* (1.03, 1.62)	0.03	2.03* (1.83, 2.26)	< 0.01	0.36* (0.28, 0.45)	< 0.01	0.96 (0.54, 1.70)	0.88
50-64 yo	< 0.01	0.81 (0.55, 1.19)	0.28	2.26* (2.02, 2.54)	< 0.01	0.22* (0.14, 0.33)	< 0.01	0.59 (0.25, 1.42)	0.24
65 + yo	< 0.01	0.07* (0.02, 0.25)	< 0.01	0.79* (0.64, 0.97)	0.02	0.05* (0.01, 0.20)	< 0.01	0.10 (0.01, 1.98)	0.13
Past-year Alcohol Use Disorders (ref=no)									
Yes	< 0.01	6.07* (4.69, 7.85)	< 0.01	2.21* (1.94, 2.52)	< 0.01	6.16* (5.16, 7.35)	< 0.01	13.99* (8.80, 22.25)	< 0.01
Survey Year (ref = 2015)									
2016	0.06	0.85 (0.70, 1.03)	0.11	0.95 (0.88, 1.02)	0.15	1.03 (0.85, 1.24)	0.78	0.77 (0.49, 1.20)	0.24

a: BZD: Benzodiazepine Medications; b: PO: Prescription Opioids; c: aRRR: adjusted Relative Risk Ratios; d: CI: Confidence Intervals: NH: Non-Hispanic; f: yo: years old. *: $p < 0.05$.

$50,000) was associated with lower risk of BZDs, POs, and concurrent medical use. NH whites were at higher risk of BZDs, POs, and concurrent non-medical use compared to all other ethnicity categories. See Table 3 for detailed results on covariates gender, income, race/ethnicity, age, alcohol use disorder and study year.

3.2.3. Use disorders

Medicaid respondents had higher risk of BZDs Use Disorder (aRRR = 1.69, 95%CI = [1.08, 2.63]) when compared to Uninsured. Medicare (aRRR = 3.81, 95%CI = [1.13, 12.87]) and Medicaid (aRRR = 2.60, 95%CI = [1.82, 3.72]) categories had higher risk of BZD Use Disorder when compared to Private insurance. Regarding POs, the risk of POs use disorder was significantly lower for those with Private insurance (aRRR = 0.50, 95%CI = [0.37, 0.67]) and higher for those Medicaid insured (aRRR = 2.05, 95%CI = [1.54, 2.74]), when compared to Uninsured respondents. When the Private insurance category was set as the reference, respondents with Medicare (aRRR = 3.51, 95%CI = [1.69, 7.26]) and Medicaid (aRRR = 4.12, 95%CI = [3.33, 5.11]) insurances presented a considerably higher risk of POs use disorder. With regards to concurrent use disorders, subjects in the Medicaid category were at higher risk of concurrent BZDs and POs Use Disorder, when compared to uninsured (aRRR = 2.14, 95%CI = [1.11, 4.13]) and to those with private insurance (aRRR = 3.68, 95%CI = [1.93, 6.78]).

Males presented lower risk of BZDs use disorders (aRRR = 0.71, 95%CI = [0.55, 0.93]) and higher risk of POs use disorder (aRRR = 1.40, 95%CI = [1.20, 1.64]) compared to women. NH whites were at higher risk of BZDs and POs Use Disorders compared to all other ethnicity categories. They were also at higher risk of concurrent use disorders compared to Hispanics and Other, but not NH Black. Higher income was associated with high risk of BZDs and POs use disorders, but not concurrent use disorders. See Table 3 for detailed results on covariates gender, income, race/ethnicity, age, alcohol use disorder and study year.

3.3. Use disorders among past-year medical and non-medical BZDs and/or POs users – exploratory analysis

No differences were found between insurance groups for BZD only Use Disorders among past-year BZDs/POs users, with Private and Uninsured set as the reference categories. (Table 4).

Individuals in the Private insurance category were at lower risk of POs only use disorders compared to Uninsured (aRRR = 0.46, 95%CI = [0.33, 0.65]). When the Private insurance category was set as the reference, respondents from the Medicaid category (aRRR = 2.61, 95%CI = [2.00, 3.41]) presented a significantly higher risk of POs only use disorders.

Individuals with Medicaid insured had a robustly higher risk of simultaneous BZDs and POs use disorders compared to privately insured population (aRRR = 2.85, 95%CI = [1.51, 5.39]). No significant differences among insurance categories were found when Uninsured was set as the reference category.

Gender differences were only observed for POs only use disorders (aRRR = 2.03, 95%CI = [1.67, 2.47]), comparing male to female. With NH white as the reference category, Hispanics were at lower risk of BZDs only use disorder (aRRR = 0.44, 95%CI = [0.24, 0.78]). NH Black (aRRR = 0.64, 95%CI = [0.44, 0.93]) and Hispanic (aRRR = 0.51, 95%CI = [0.35, 0.74]) individuals were at lower risk of POs only use disorders. Higher age was associated with BZDs only, POs only and concurrent use disorders. See Table 4 for detailed results on covariates income, ethnicity, alcohol use disorders and survey year.

4. Discussion

The main findings of this manuscript can be summarized as follows: i) prevalences of past-year use of BZDs and especially POs and concurrent use were concerningly high ii) patients from all insured categories were at higher risk of medical use of BZDs and POs when compared to uninsured individuals; iii) compared to those with private insurance, individuals with Medicaid insurance were at significantly higher risk of BZDs and POs medical use, non-medical use and use disorders, as well as concurrent BZDs and POs medical use, non-medical use and use disorders.

We found that 12.6% of the United States population aged 12 or older used a BZD drug in the past year in 2015–2016, which represents an increase compared to 2013 prevalences obtained from a different database (Bachhuber et al., 2016). Even more startling is that 36.9% of the American population made any medical or non-medical use of POs in the past year in this time period, which accounts for more than 120 million Americans. This highlights the highly common use of prescription opioids in the US population, which is higher than use in other industrialized countries (van Amsterdam and van den Brink, 2015). It is believed that the widespread use of PO for pain treatment (Baker, 2017) in recent decades is behind the sharp increases in PO use, the prevalence of opioid dependence (Kolodny et al., 2015) and the rate of overdoses (Seth et al., 2018). In addition, it is estimated that 8.3% of the population had any medical or non-medical use of a BZD drug and a PO in the past-year during the given period. Risk of an overdose deaths among opioids users is higher among those who make concurrent BZD use (Hernandez et al., 2018). Yet, prescription of opioids is still higher for patients receiving BZDs than for the general population (Ladapo et al., 2018).

As expected, nearly all the insured categories (Private, Medicare and Medicaid) presented higher odds of medical use of BZDs and POs as compared to the Uninsured population. This is in line with previous literature comparing prescription rates of POs in patients from Medicare/Medicaid to Uninsured (Hackman et al., 2014). Having insurance was also positively associated with having more PO prescriptions in a study using Prescription Drugs Monitoring Programs (PMDPs) data (Hawk et al., 2018). However, those with Private insurance presented lower risk of BZDs only, POs only and concurrent non-medical use and use disorders, compared to Uninsured. These findings may highlight the role of healthcare availability in the relationship individuals establish with substances (Sanders et al., 2014) (Table 5).

Medicaid insured individuals presented higher risk of BZDs, POs and concurrent medical use, non-medical use and use disorders compared to Private. We know beforehand that low SES is a common cause of participation in Medicaid (Sommers and Oellerich, 2013) and POs use (Rogers et al., 2013). Due to the cross-sectional nature of this study, it is not possible to infer to what extent those results are attributable to the inherent risks of the population that receives services through the Medicaid system (Garcia et al., 2014) or to actual issues in medical care provided by Medicaid that could contribute to and perpetuate problematic patterns of POs use (Mack et al., 2015) (e.g., lack of treatment alternatives for pain management). Lower income individuals have more limited access to other costlier pain management therapies not covered by insurance, which may increase the use of POs at higher doses and for longer periods.

The fact that risks of BZDs, POs and concurrent non-medical use and use disorders are higher in Medicaid category when compared to Private is a reason for concern. It has been reported that the poorest SES quartile has twice the rate of co-morbid BZDs use in medical encounters due to Opioid intoxications compared to the richest quartile (Feng et al., 2016). Regardless of the direction of causality between Medicaid and higher risk of the non-medical use and use disorders outcomes, this association indicates a path for future policies within Medicaid. Previous research on the Medicaid population corroborates this preoccupation, alerting about the prescription of benzodiazepines for patients with SUDs and anxiety disorders (O'Brien et al., 2017) and suggesting policymakers to target high-risk prescribers and patients (Stein et al., 2017).

Individuals in Medicare also partake into higher medical use of BZDs, POs or both, and risks for non-medical use and use disorders comparing them to Private are also well-documented by our analyses. POs-related hospitalizations among Medicare clients were already reported as a meaningful growing risk (Peters et al., 2018), as well as

Table 4
Multinomial logistic regression Adjusted Relative Risk Ratios for "Simultaneous Use Disorders" (0-no BZDs or POs use disorders; 1- Only BZD use disorders; 2- Only PO use disorders; 3- Simultaneous BZD and PO use disorders) by insurance status, controlling for gender, yearly income, race/ethnicity, age and survey year in past-year medical or non-medical BZDs and/or POs users aged 18 or older (n = 83,311).

	Use Disorders (compared to no BZD/ PO use disorder)								
	BZD[a]s only			PO[b]s only			BZDs and POs Use Disorders		
	aRRR[c]	95% CI[d]	*p*-value	aRRR	95% CI	*p*-value	aRRR	95% CI	*p*-value
Insurance (ref = uninsured)									
Private	0.69	(0.40, 1.20)	0.19	0.46*	(0.33, 0.65)	< 0.01	0.55	(0.25, 1.24)	0.15
Medicare	1.88	(0.76, 4.63)	0.17	0.80	(0.41, 1.54)	0.50	1.03	(0.14, 7.65)	0.97
Medicaid	1.01	(0.57, 1.80)	0.96	1.20	(0.87, 1.65)	0.27	1.44	(0.74, 2.78)	0.27
Insurance (ref = Private)									
Medicare	2.70	(0.96, 7.62)	0.06	1.73	(0.86, 3.48)	0.12	1.86	(0.25, 13.98)	0.54
Medicaid	1.46	(0.92, 2.31)	0.11	2.61*	(2.00, 3.41)	< 0.01	2.85*	(1.51, 5.39)	< 0.01
Uninsured	1.44	(0.83, 2.50)	0.19	2.18*	(1.54, 3.07)	< 0.01	1.80	(0.81, 4.02)	0.15
Gender (ref = female)									
Male	0.83	(0.55, 1.27)	0.39	2.03*	(1.67, 2.47)	< 0.01	1.08	(0.72, 1.61)	0.72
Yearly Income (ref = 0-$20,000)									
$20,000-49,999	0.76	(0.45, 1.30)	0.32	0.82	(0.61, 1.11)	0.21	0.90	(0.52, 1.59)	0.73
$50,000-74,999	0.46*	(0.24, 0.86)	0.02	0.76	(0.53, 1.10)	0.14	1.51	(0.71, 3.23)	0.29
$75,000 +	0.62	(0.34, 1.12)	0.11	0.69*	(0.48, 0.99)	0.04	0.53	(0.21, 1.29)	0.16
Race (reference = NH White)									
NH[e] Black	0.69	(0.40, 1.18)	0.18	0.64*	(0.44, 0.93)	0.02	0.60	(0.25, 1.43)	0.25
Hispanic	0.44*	(0.24, 0.78)	< 0.01	0.51*	(0.35, 0.74)	< 0.01	0.63	(0.29, 1.35)	0.23
Other	1.07	(0.58, 1.98)	0.82	0.81	(0.52, 1.25)	0.34	0.41	(0.16, 1.02)	0.06
Age (reference = 18-25 years old)									
26-34 yof	0.42*	(0.26, 0.70)	< 0.01	1.43*	(1.04, 1.95)	0.03	0.58	(0.32, 1.05)	0.07
35-49 yo	0.30*	(0.18, 0.50)	< 0.01	1.06	(0.84, 1.32)	0.64	0.82	(0.45, 1.48)	0.51
50-64 yo	0.16*	(0.08, 0.31)	< 0.01	0.62*	(0.41, 0.95)	0.03	0.49	(0.20, 1.21)	0.12
65 + yo	0.02*	(0.00, 0.18)	< 0.01	0.09*	(0.02, 0.35)	< 0.01	0.14	(0.01, 2.01)	0.15
Past-year Alcohol Use Disorders (ref = no)									
Yes	3.63*	(2.40, 5.49)	< 0.01	2.86*	(2.10. 3.88)	< 0.01	9.26*	(5.76, 14.90)	< 0.01
Survey Year (ref = 2015)									
2016	1.27	(0.92, 1.75)	0.15	0.97	(0.78, 1.21)	0.81	0.82	(0.52, 1.30)	0.41

a: BZD: Benzodiazepine Medications; b: PO: Prescription Opioids; c: aRRR: adjusted Relative Risk Ratios; d: CI: Confidence Intervals: NH: Non-Hispanic; f: yo: years old.
* : $p < 0.05$.

Benzodiazepine non-medical use in Medicare (Palamar et al., 2019). Highly prevalent concurrent use of BZDs and Opioids in the Medicare population was also reported (Hernandez et al., 2018).

Strong points in this study include analysis at individual level from a representative national sample. The use of complex survey design analysis techniques buttresses statistical inference and external validity of our findings, which can be generalizable for the USA population. Separating medical use, non-medical use and use disorders provide a clear picture of the specificity of each association. While medical use may be understood as a proxy to treatment access, this does not apply for non-medical use (Liebling et al., 2016). Use disorders of prescription drugs are strongly related to burdensome morbidity and mortality outcomes (Han et al., 2015), hence the importance of distinguishing BZDs and POs use categories. Furthermore, analysis of concurrent use more emphatically exposes risks of morbidity and mortality for insurance categories at higher risk.

Our paper has some potential limitations. A cross-sectional analysis does not allow assessment of causality since we cannot determine temporality and estimate incidences. Given that, this analysis is primarily focused on estimating the past-year prevalence and formulating

Table 5
Summary of the risk factors for medical, non-medical and use disorders of benzodiazepines, prescription opioids and concurrent use of both among NSDUH sample (2015–2016) 18 years or older (n = 83,311).

Risk of Medical Use	Risk of Non-medical use	Risk of Use disorder
All three (BZD, POs and Concurrent use) • Uninsured < private < Medicare and Medicaid • Risk factors: male, high income and other ethnicity than NH White	BZD • Risk factor: female PO • Medicaid and Medicaid > private • Medicaid > uninsured • Risk factor: male Concurrent use • Medicaid > private All three • Private < uninsured • Risk factors: high income and NH white	BZD • Medicaid > uninsured • Medicaid and Medicare > private • Risk factor: female, NH white, high income PO • Uninsured > private • Uninsured < Medicaid • Medicare and Medicare > private • Risk factor: male, NH White, high income Concurrent use • Medicaid > uninsured • Medicaid > private

hypotheses for further research rather than bringing up ultimate conclusions regarding the association between insurance status and the dependent variables of interest. Furthermore, our analysis is limited to national-level data. We assume that a state-level sample would refine this analysis even more, by accounting for state-specific features that may act as confounders for the association of interest. Another limitation of our study is the underestimation of the prevalence of BZDs and/or POs use and related dependence/abuse. This may be because this information was obtained from self-report of abuse/dependence criteria, rather than from the evaluation of a qualified professional. However, NSDUH uses the ACASI method that has been shown to increase true reporting of sensitive information (Center for Behavioral Health Statistics and Quality, 2017) We did not account for patients receiving dual insurance (Carico et al., 2018) or out-of-pocket prescriptions (Cotton et al., 2017). Social Desirability bias should also be considered when collecting data about substance abuse (Latkin et al., 2017), even though this matter is addressed by the ACASI system.

5. Conclusion

BZDs and POs have high potential for abuse and dependence and are especially harmful when prescribed together. Uninsured patients have lower risk of medical use of BZDs and POs compared to those insured; nevertheless, they are under higher risk of non-medical use and use disorders of BZDs alone, POs alone and BZDs and POs combined, compared to patients in the Private category. Medicaid covered individuals are at higher risk of BZDs alone, POs alone and BZDs and POs combined medical use, non-medical use, and use disorders compared to those with private insurance. This scenario is particularly worrisome due to the elevated overdose risk among co-users of BZDs and POs. Our findings endorse previous research that alerts about the need for policies that aim to mitigate co-use of BZDs and POs, especially in the low-income population. Criteria for risk evaluation of POs use disorders have been identified (Klimas et al., 2019) and should be taken into account by prescribers. Future research should focus on longitudinal assessment of the drug-related variables and insurance category.

Contributors

VST: statistical coding, data analysis, manuscript writing; TMF: data analysis, manuscript review; JS: statistical coding, manuscript review; SSM: conception, overall supervision, manuscript review. All authors have read and approved the final manuscript.

Disclosure statement

We wish to draw the attention of the Editor to the following facts which may be considered as potential conflicts of interest and to significant financial contributions to this work. [OR] We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us.

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Declaration of Competing Interest

No conflict declared.

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