HHS Public Access

Author manuscript

Pharmacol Biochem Behav. Author manuscript; available in PMC 2022 May 01.

Published in final edited form as:

Pharmacol Biochem Behav. 2021 May ; 204: 173169. doi:10.1016/j.pbb.2021.173169.

Prevalence and drug use correlates of extra-medical use of prescription medications for sleep among adults in the United States: Results of the 2015–2018 National Survey on Drug Use and Health

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Abstract

Background: This paper examines the epidemiology of extra-medical use of prescription medications for sleep among a nationally representative sample of U.S. adults.

Methods: We analyzed data from the 2015–2018 National Surveys on Drug Use and Health. The sample includes 3410 U.S. adults who reported extra-medical use of prescription medications for sleep. Multinomial logistic regression models identified correlates of type of drug used [i.e., sedatives and/or tranquilizers-only (ST-only), prescription pain relievers-only (PPR-only), or sedatives, tranquilizers, and prescription pain relievers (ST + PPR)], and logistic regression models identified correlates of reasons for extra-medical use (i.e., sleep-only vs. sleep and recreational).

Results: About 60% (95%CI = 58.9, 63.5) of the sample reported extra-medical use of ST-only, followed by PPR-only (29.9%, 95%CI = 27.5, 32.5), and ST + PPR (8.9%, 95%CI = 7.7, 10.4). Recreational use was reported by 28.4% (95% CI = 26.5, 30.4) of the sample. The odds of extra-medical use of PPR-only (aRRR = 3.1, 95%CI = 2.1, 4.5) and ST + PPR (aRRR = 1.9, 95%CI = 1.2, 3.1) as opposed to ST-only, were greater among Non-Hispanic Blacks than Non-Hispanic Whites. Compared to non-alcohol users, those with a past-12 months diagnosis of alcohol use disorder were more likely to use ST + PPR rather than ST-only (aIRR = 2.0, 95%CI = 1.1, 3.7). Non-Hispanic Blacks (aOR = 0.6, 95%CI = 0.4, 08) and individuals living in rural areas (aOR = 0.5, 95%CI = 0.3, 09) were less likely to report extra-medical use of prescription medications for recreational reasons than Non-Hispanic Whites and those residing in large metropolitan areas, respectively.

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Declaration of competing interest

No conflicts of interest to disclose.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pbb.2021.173169.

Conclusions: Extra-medical use of PPR-only and ST + PPR as an aid to sleep, is prevalent among Non-Hispanic Blacks, young adults, and those residing in rural areas. Most individuals reported that extra-medical use of prescription medications was primarily motivated by sleep reasons, rather than by sleep and recreational reasons. Potential interventions include access to sleep treatments, education on the effectiveness and risk associated with extra-medical use and co-use of prescription medications for sleep, and research on sleep-related disparities.

Keywords

Misuse; Sedatives; Tranquilizers; Pain relievers; Opioids; Sleep

1. Introduction

National estimates indicate that nearly one-third of adults fail to obtain sufficient amounts of sleep, and between 6% to 10% have been diagnosed with a sleep disorder that is clinically significant (Laposky et al., 2016; Liu et al., 2016). The public health relevance of healthy sleep and the appropriate diagnosis and treatment of sleep disorders is supported by decades of research on the major role of sleep in the development and progression of multiple diseases, including psychiatric and drug use disorders, and as a potential driver of health disparities (Laposky et al., 2016; Liu et al., 2013; Liu et al., 2016; Williams et al., 2015).

Research on the relationship between sleep and use of psychoactive drugs suggests that sleep disturbances may precede or result as a consequence of drug use involvement, dependence, and relapse. This relationship is complex and mounting evidence indicate a bi-directional causality (Krystal, 2012). Sleep disturbances have been associated with drug use initiation (Wong et al., 2009), and severity of drug dependence and propensity to relapse (Dolsen and Harvey, 2017; Gordon, 2019). On the other hand, early drug use onset has been linked to sleep disturbances later in life (Ogeil et al., 2019; Winiger et al., 2019).

Sedatives, tranquilizers, and hypnotic medications are commonly prescribed as a treatment for sleep disorders. The analyses of the National Ambulatory Medical Care Survey, showed that the rates for benzodiazepine prescriptions in outpatient settings doubled from 2003 to 2015 (3.8% vs. 7.4%). In addition, benzodiazepines are increasingly prescribed with other sedating medications (Agarwal and Landon, 2019). Increases in prescription rates of benzodiazepines coincide with increases in benzodiazepine-related overdose mortality rates between 1999 and 2016 (0.6 per 100,000 adults in vs. 4.4 per 100,000) (Agarwal and Landon, 2019; Bachhuber et al., 2016). Overdoses and fatal overdoses have been associated with extra-medical use and co-use of prescribed medications with alcohol, opioids, and other central nervous system depressants (Day, 2014). In 2017, 6 million individuals who reported extra-medical use of tranquilizers and 1.6 million individuals who reported extra-medical use of sedatives contributed to this particular class of drugs being deemed the third most misused drug by adolescents and adults in the United States (Votaw et al., 2019). Rates of extra-medical use of tranquilizers and sedatives are significantly higher among young adults (18–25 years) those with a history of mental health problems (e.g., major depression episode), and those reporting extra-medical use of opioids (Schepis et al., 2018; Votaw et al., 2019). Among young adults, rates of extra-medical use of prescription medications for sleep

in the US exceed those observed in multiple European countries (Lehne et al., 2018; Schepis et al., 2018).

Using data from the 2015 to 2018 National Survey on Drug Use and Health (NSDUH), this study examines the prevalence and correlates of type of drug used and reason of use among a nationally representative sample of U.S. adults who reported extra-medical use of sedatives, tranquilizers, and pain relievers for sleep purposes. Identifying the magnitude and correlates of extra-medical use of sedatives, tranquilizers and pain relievers for sleep is a priority given that extra-medical use of prescription medications represents a pressing problem (Cottler et al., 2013) that has reached epidemic levels (Lipari et al., 2017).

2. Materials and methods

2.1. Study population and sample procedures

We analyzed the 2015–2018 National Surveys on Drug Use and Health (NSDUH, which is a series of yearly cross-sectional surveys designated to yield a representative sample of all non-institutionalized individuals aged 12 years and above in the United States. The NSDUH's sampling frame includes non-household group quarters such as homeless shelters, students' dorms, and households. In this study, our nationally representative sample consisted of 3410 adults who indicated that their last extra-medical use of sedatives, tranquilizers, and pain relievers was "to help with my sleep" from a list in which multiple medical and recreational reasons could be selected. This "sleep" specific question is included only in the modules for sedatives, tranquilizers, or pain relievers. Specifically, extra-medical use was defined as use of prescription medications that did not follow a doctor's direction, including use without a prescription, in greater amounts, more often, or longer than recommended, or in any other way a doctor did not recommend. Participation rates each year were around 70%. The data collection protocol of the NSDUH was approved by the institutional review board at the Research Triangle Institute (RTI) International. Written informed consent was obtained from each study participant and other guidelines outlined in the Declaration of Helsinki were followed. A more detailed description of the survey methodology is provided elsewhere (Substance Abuse and Mental Health Services Administration, 2016).

2.2. Assessments and measures

The NSDUH surveys are completed by participants using a standardized confidential audio computer-assisted self-interviews and consist of multiple assessments of 18 types of drugs, including sedatives, tranquilizers, and pain relievers. A detailed list of the medications included in the survey is described in Appendix 1. Specifically, participants provided information regarding their lifetime history use, past 12-months use, and past 12-months DSM-IV diagnosis of abuse or dependence. Assessment of extra-medical use of prescription-medications in the NSDUH was modified since 2015 to include a more comprehensive definition and keep it consistent with the assessment used in other national surveys. The outcome variable, "type of drug used extra medically for sleep" was generated from the assessment of extra medical use of sedatives, tranquilizers, and pain relievers in the selected sample, and further recoded into a three-category variable, including:

sedatives and/or tranquilizers-only (ST-only), prescription pain relievers-only (MPPR-only), or sedatives, tranquilizers and prescription pain relievers (ST + PPR) combined. The outcome "reason for last extra-medical use of prescription medications" was derived from a list of reasons that included sleep as a reason, as well as recreational reasons (e.g., to get high, to experiment, etc.). This variable was further recoded into two categories to distinguish participants who indicated extra-medical use of prescription medications exclusively for sleep reasons (i.e., sleep-only) and those who used for both sleep and recreational reasons (i.e., sleep and recreational).

Covariates of interest included in the analyses were gender (male vs. female), self-identified race/ethnicity (Non-Hispanic Whites - NHW, Non-Hispanic Blacks - NHB, Hispanics - H, and Non-Hispanic Others - NHO), age group (18 to 25, 26 to 34, 35 to 49, 50+), population density in the area of residence (Core-Based Statistical Area Population Density - CBSA of 1+ million - Metropolitan or large metropolitan; CBSA<1 million - Metropolitan or small metropolitan; or Not in CBSA or rural), poverty level (determined by the age, family size, the number of children in the household and total family income and categorized into living in poverty, Income up to 2× Federal Poverty Threshold - FPT, and Income more than 2× FPT), health insurance coverage (yes vs. no), past 12-month serious psychological distress (yes vs. no), self-reported health status (fair/poor health, vs. good/very good/excellent health), past 12-month use of tobacco, alcohol, cannabis, or any "other" regulated drug (i.e., cocaine, crack, heroine, hallucinogens, LSD, PCP, Ecstasy, tryptamine hallucinogens DMT, AMT, ketamine, *Salvia divinorum*, ketamine, or inhalants). Each variable was further recoded into three mutually exclusive categories: no use in the past 12-months; use in the past 12-months, but no indication of use disorder; and use with a history of past 12-months diagnosis of a DSM-IV use disorder.

2.3. Statistical analyses

Descriptive analyses first characterized the total sample (Table 1), as well as the sample by type of drug used extra medically for sleep and reason for last non-medical use of prescription medications. All estimates were obtained with due attention to the complex survey design and sample weights. Variance estimates and 95% confidence intervals (CI) for this study are based on the Taylor series approximation appropriate for complex survey data. Unadjusted and adjusted multinomial logistic regression models were conducted to assess the association between type of drug used extra medically for sleep and multiple sociodemographic health-related and drug use correlates. Selection of variables included in the models was primarily driven by prior studies on the subject (Schepis et al., 2018; Serdarevic et al., 2017; Votaw et al., 2019). In addition, following, Hosmer and Lemeshow (2000) suggestions, covariates with a Wald test from univariate logistic regressions and *p*-value cut-off point of 0.25 were included in the multivariable models. Finally, covariates were retained in the model if they were significant (<the 0.1 alpha level) and the change in any remaining parameter estimate was greater than 15% when compared to the full model (Bursac et al., 2008). In order to gauge the relative influence of increased awareness of harms associated with the extra-medical use of prescription medications over time and potential methodological variations across the surveys, sensitivity analyses that excluded each survey year at a time were conducted for both outcomes. Unadjusted and adjusted

logistic regression models were conducted to identify correlates of reasons for extra-medical use (i.e., sleep-only vs. sleep and recreational) among the selected sample. Associations are expressed as relative risk ratios and odds ratios, respectively. Analyses were conducted in Stata, version 14.

3. Results

3.1. Characteristics of the study population

Table 1 describes the characteristics of the study sample. More than half of participants were female. Three-quarters self-identified as Non-Hispanic Whites, followed by 11.2% Hispanics, 7.3% Non-Hispanic Blacks, and 5.1% Non-Hispanic Others. About one fifth were in the age categories 18 to 25, 26 to 34 and 35 to 49, and less than one-third in die 50+ years old group. The majority lived in large (56.1%) and small (39.6%) metropolitan areas, and only 4.3% lived in rural areas. About two-thirds had incomes of more than two times the federal poverty threshold and nearly 16% were living below the poverty line. Approximately 13.4% reported not having health insurance coverage. More than one-third reported a history of serious psychological distress in the 12 months preceding the survey and 17% reported a fair to poor health status. More than half reported tobacco use in the past 12-months, and nearly one-fifth had a history of nicotine dependence. The large majority reported alcohol use and one-fifth reported a history of alcohol use disorder. Half of the sample reported cannabis use in the 12-months prior to the survey and about 10% had a history of a cannabis use disorder.

3.2. Prevalence and correlates of extra medical use of prescription medications by type of drugs

As shown in Table 3, among adults who reported extra-medical use of prescription medications as an aid to sleep, 61.2% (95%CI = 58.9, 63.5) reported extra-medical use of ST-only, 29.9% (95%CI = 27.5, 32.5) reported extra-medical use of PPR-only, and 8.9% (95%CI = 7.7, 10.4) reported extra-medical use of ST + PPR. Characteristics of the study sample by type of drug are presented in Table 2. Results of multivariable multinomial regression models showed that compared to adults 50+ year olds, those 18 to 25 years old were more likely (aRRR = 1.5, 95%CI = 1.0, 2.1) to use ST + PPR rather than ST-only. The odds of extra-medical use of PPR-only (aRRR = 3.1, 95%CI = 2.1, 4.5) and ST + PPR (aRRR = 1.9, 95%CI = 1.2, 3.1) as oppose to ST-only were greater among Non-Hispanic Blacks than Non-Hispanic Withes. Compared to those living in large metropolitan areas, those living in rural areas were three times more likely to report extra-medical use of ST + PPR rather than ST-only (aRRR = 3.2, 95%CI = 1.6, 6.1). Compared to those living below the poverty level, individuals in the highest socioeconomic group (i.e., income more than 2-times the federal poverty threshold) were significantly less likely (aRRR = 0.7, 95%CI = 0.6, 1.0) to use PPR-only rather than ST-only. The odds of extra-medical use of PPR-only (aRRR = 1.3, 95%CI = 1.1, 1.6) and ST + PPR (aRRR = 1.7, 95%CI = 1.1, 2.6) as opposed to ST-only was significantly higher among those with a past 12-month history of a serious psychological distress when compared to those without a history of distress. Compared to those who rated their health status as “excellent/good”, those reporting “fair/poor health” were 50% more likely (aRRR = 1.5, 95%CI = 1.1, 2.1) to use PPR-only rather than ST-only.

Compared to those who did not use alcohol in the 12 months prior to the survey, those with a past-12 month diagnosis of an alcohol use disorder were more likely to use ST + PPR rather than ST-only (aIRR = 2.0, 95%CI = 1.1, 3.7). Those who reported a history of a past 12-months use disorder of other drugs were less likely (aIRR = 0.7, 95%CI = 0.5, 0.9) to report extra-medical use of PPR-only rather than ST-only, but more likely to report extra-medical use of ST + PPR as opposed to ST-only, when compared to those who did not use those drugs in the 12-months preceding the survey. Sensitivity analyses excluding every survey year at a time did not show any significant variations in the study results.

3.3. Prevalence and correlates of extra medical use of prescription medications by reason for last extra-medical use

While the majority of the selected sample (71.6%, 95% CI = 69.7, 73.5) reported extra-medical use of prescription drugs only for sleep reasons, 28.4% (95% CI = 26.5, 30.4) reported using both for sleep and recreational reasons. Compared to females, males were 30% (aOR = 1.3, 95%CI = 1.0, 1.6) more likely to report combined sleep and recreational reasons. Relative to those in the older age group (50+ years olds), individuals in the youngest age groups were almost 2 to 3 times more likely to report extra-medical use for both sleep and recreational reasons (aOR range = 1.7 to 2.8). Non-Hispanic Blacks (aOR = 0.6, 95%CI = 0.4, 08), individuals living in rural areas (aOR = 0.5, 95%CI = 0.3, 0.9) and those who used alcohol in the past 12-months but without a history of past 12-months alcohol use disorder (aOR = 0.5, 95%CI = 0.3, 0.7) were less likely to report extra-medical use of prescription medications for recreational reasons than Non-Hispanic Whites, housed in large metropolitan areas or those who never used alcohol, respectively. Individuals with a past 12-month history of a serious psychological distress were 66% more likely to report also recreational use of prescription medications than their counterparts. Relative to non-users, the users of tobacco, cannabis and “other” drugs in the past 12-months and those with a past 12-month history of a use disorder were 1.5 to 3 times more likely to use prescription medications for combined sleep and recreational reasons. Finally, those who reported extra-medical use of PPR-only (aOR = 1.6, 95%CI = 1.3–2.1) and ST + PPR (aOR = 3.1, 95%CI = 2.1, 4.4) were more likely to use these prescription medications for both sleep and recreational reasons compared to those who used ST-only.

4. Discussion

The main findings of this manuscript could be summarized as follows: 1) nearly 40% of the sample reported using prescription pain relievers or prescription pain relievers combined with sedatives and tranquilizers as an aid to sleep. 2) The large majority (71.6%) of individuals reporting extra-medical use of prescription medications to “help” them sleep, use these medications exclusively for sleep reasons rather than for both sleep and recreational purposes. 3) Sociodemographic factors, such as male gender, younger age, Non-Hispanic Black self-identified race-ethnicity, residence in rural areas, and income below the poverty level were associated with the “type of drug used extra medically for sleep” and “reason for last extra-medical use of prescription medications”, 4) Past 12-month history of DSM-IV abuse or dependence on alcohol and “other” drugs increased significantly the odds of extra-medical use of ST + PPR as opposed to ST-only use. 5) A gradient-increase in the odds

of combined sleep and recreational use was observed across escalating levels of tobacco, cannabis and “other” drugs use in the 12-month preceding the survey.

Nearly 40% of the sample reported exclusive use of pain relivers or in combination with sedatives and tranquilizers as an aid to sleep. Studies on the effects of opioids on sleep have shown conflicting results (Cheatle and Webster, 2015), some of them reporting a beneficial effect, which might explain why these drugs have been used for sleep among a significant proportion of the study population. For other study participants, a reduction in pain might have also been associated with an improvement in sleep (Serdarevic et al., 2017). Specifically, some studies suggest that opioid users report an increase in daytime somnolence and improved sleep quality (Gana et al., 2006; Turk and Cohen, 2010), nonetheless, increasing evidence indicate that opioids disrupts sleep. This sleep disruption is often underlain by increased sleep onset latency and rapid eye movement (REM) latency, reduced slow wave sleep (SWS) and REM, reduced total sleep time (TST) and awakenings after sleep onset or arousals during sleep (Angarita et al., 2016; Conroy and Arnedt, 2014; Dimsdale et al., 2007; Kay et al., 1981; Morasco et al., 2014; Staedt et al., 1996; Shaw et al., 2005). Opioid use has also been linked to a higher prevalence of central sleep apnea (CSA) and ataxic breathing (Bohra et al., 2014; Farney et al., 2003; Mogri et al., 2008; Walker et al., 2007; Walker and Farney, 2009). In addition, co-use of sedatives, tranquilizers and prescription pain relievers has been associated with drug overdose and fatal overdoses. Respiratory depression is the primary mechanism of sedatives and opioid overdose fatalities (Kerr et al., 2005). In sum, the low effectiveness of prescription pain relievers in improving sleeping quality, the elevated risk associated with co-use of these medications, and the large proportion of adults reporting extra-medical use of prescription medications exclusively for sleep reasons, suggest that preventive education and behavioral sleep interventions at primary care settings among individuals using exclusively prescription pain relievers, or in combination with sedatives and tranquilizers, can potentially modify recent trends on overdose-related fatalities. The extent to which prescription-pain relievers are used as a sleep aid primarily among participants experiencing chronic pain should be further investigated.

Multiple sociodemographic factors were associated with the “type of drug used extra medically for sleep” and “reason for last extra-medical use of prescription medications”. Notably, Non-Hispanic Blacks were about two to three times more likely than Non-Hispanic Whites to use prescription pain relievers only or combined with sedatives or tranquilizers rather than using sedatives and tranquilizers only for sleep. However, Non-Hispanics Blacks were less likely than Non-Hispanic Whites to report extra-medical use of these prescription medications for both sleep and recreational reasons. Given that sleep-related problems are highly prevalent among minority populations (Liu et al., 2016), additional public health interventions addressing these concerning findings are well justified. Furthermore, in view of the increasing rates of overdose deaths in recent years among Non-Hispanic Blacks, which double the rates of increase in the overall population and exceed the rates of increase of other racial-ethnic groups (Rossen et al., 2019; SAMHSA, 2020), additional studies exploring specific pathways leading to the onset of use disorders and subsequent overdose-related death in this specific racial-ethnic group are needed. For instance, while the disproportionate increase in opioid misuse has been linked to excessive prescribing of opioids for pain and the rise in the use of non-regulated opioids (i.e. heroin), it is worth

exploring whether extra-medical use of prescription pain reliever medications for sleep reasons represents an additional pathway leading to dependence or death.

A history of DSM-IV abuse or dependence on alcohol and "other" drugs in the past 12-months preceding the survey significantly increased the odds of ST + PPR extra-medical use as opposed to ST-only use. These associations remained significant after having controlled by a history of serious psychological distress in the 12-months preceding the survey, which could influence the use of sedatives and tranquilizers as well. Extra medical use of tranquilizers and sedatives has been priorly correlated with polysubstance misuse (Grant et al., 2019; Blanco et al., 2018). Co-use of sedatives, tranquilizer and alcohol or "other" drugs can exacerbate potential negative consequences, such as dependence and death. Research shows that concurrent extra medical use of prescription medications and street drugs are the leading causes for E.D. visits, overdose, and death (Bachhuber et al., 2016; Grant et al., 2019; Jones et al., 2012; Palamar et al., 2019; Votaw et al., 2019). We also observed a gradient-increase in the odds of combined sleep and recreational use was observed across escalating levels of tobacco, cannabis and "other" drugs use in the 12-months prior to the survey. Altogether, the findings highlight the need for clinical and population-based studies that increase our understanding on the timing and cascade of reasons motivating co-use, as well as the pharmacological interactions driving these patterns. Ultimately these results will contribute to guide the development of targeted sleep behavioral and pharmacological interventions among individuals using drugs (Milani et al., 2020). For instance, qualitative studies have shown that polydrug users believe that sedatives and tranquilizers potentiate the intoxicating effect of other drugs, (Votaw et al., 2019), other studies suggest that sleep disturbances, which are common among individuals with drug use disorders, manifest primarily during withdrawal periods (Chakravorty et al., 2018), and might eventually lead to extra-medical use of prescription medications for sleep reasons.

This study has bears a number of limitations. First, the cross-sectional design of the NSDUH precluded us from establishing a causal relationship. Second, the assessment of extra-medical use of prescription medications was self-reported, and therefore, as a non-normative behavior, it is subject to recall and social desirability bias. Third, die assessments of last extra-medical use of prescription medications for sleep may lead to under-reporting of other episodes in which sleep problems might have motivated extra-medical use of prescription medications. Fourth, in our analyses we have included self-perceived health status and a past-year history serious psychological distress as covariates, however, it is important to consider the potential for residual confounding. Fifth, the NSDUH sampling frame does not include active-duty military personnel, homeless persons not living in shelters, or institutionalized individuals (e.g. adolescents and young adults in the criminal justice system), who generally exhibit higher rates of drug use and drug use disorders than the general non-institutionalized population (Compton et al., 2010). Finally, the response rates of the NSDUH have declined substantially over the last years, which increases the potential for non-response bias.

Despite the above mention limitations, this study contributes to document the extra-medical use of prescription medications for sleep reasons by identifying populations at-risk, including specific sociodemographic groups and alcohol, cannabis or "other" drug users.

Our findings revealed that extra-medical use of prescription pain relivers alone or combined with sedatives and tranquilizers as an aid to sleep, is a common practice, particularly among young individuals, those who self-identified as Non-Hispanic Blacks, those who reside in rural areas, and those who use alcohol and other regulated drugs and experience drug use disorders. Most individuals reported that their last extra-medical use of these prescription medications was primarily motivated by sleep reasons, rather than combined sleep and recreational reasons. The findings contribute to identify at-risk populations, as well as to recognize potential public health areas of intervention, including increased access to behavioral and pharmacological treatments for sleep problems, education on the effectiveness and risk associated with extra-medical use of one or multiple prescription medications, and research on the biological and structural determinants of sleep-related disparities in the general population and among drug users.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Financial support for this research was provided by the National Institute on Drug Abuse (NIDA) from the United States National Institutes of Health, grants K01DA046715, K01DA045219 and T32DA035167. The content of this paper is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. No conflicts of interest to disclose.

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Table 1

Descriptive characteristics of the study sample, National Survey of Drug Use and Health, 2015–2018.

Characteristics	Total		
	n = 3410		
	%	lb	ub
Gender			
Male	44.9	42.8	46.9
Female	55.1	53.1	57.2
Self-identified race-ethnicity			
Non- Hispanic Whites	76.4	74.2	78.5
Non- Hispanic Blacks	7.3	6.2	8.5
Non-Hispanic Others	5.1	4.2	6.1
Hispanics	11.2	9.9	12.7
Age category (in years)			
18 to 25	23.1	21.6	24.8
26 to 34	24.0	22.1	25.9
35 to 49	23.2	21.5	25.1
50 and higher	29.7	26.6	32.8
Population density in area of residence			
Rural	4.3	3.6	5.2
Small metropolitan	39.6	37.0	42.2
Large metropolitan	56.1	53.5	58.7
Poverty level			
Living in poverty	15.6	14.2	17.1
Income up to 2 times federal poverty threshold	19.4	17.8	21.0
Income more than 2 times federal poverty threshold	64.7	62.9	66.6
Missing	0.3	0.2	0.5
Health insurance coverage			
No	13.4	12.0	14.9
Yes	86.6	85.1	88.0
Past 12-months serious psychological distress			
No	63.1	60.9	65.3
Yes	36.9	34.7	39.1
Self-reported health status			
Excellent/good	83.0	80.9	84.9
Fair/poor	17.0	15.1	19.1
Missing	0.0	0.0	0.0
Past 12-months tobacco use			
No use	42.0	39.3	44.7
Use, no evidence of use disorder	35.3	33.2	37.6
Nicotine dependence	22.7	20.7	24.8
Past 12-months alcohol use			

Characteristics	Total		
	n = 3410		
	%	lb	ub
No use	13.4	11.3	15.7
Use, no evidence of use disorder	61.5	58.6	64.4
Alcohol abuse or dependence	25.1	22.7	27.8
Past 12-months cannabis use			
No use	49.2	47.0	51.4
Use, no evidence of use disorder	41.0	38.9	43.2
Cannabis abuse or dependence	9.8	8.6	11.1
Past 12-months use of other drugs			
No use	71.9	69.6	74.2
Use, no evidence of use disorder	11.7	10.1	13.5
Abuse or dependence	16.4	14.8	18.1
Type of drug			
Sedatives and/or tranquilizers only	61.2	58.9	63.5
Prescription pain relievers only	29.9	27.6	32.3
Sedatives, tranquilizers and prescription pain relievers	8.9	7.7	10.4
Reasons for extra-medical use			
Sleep-only	71.6	69.7	73.5
Sleep and recreational	28.4	26.5	30.3
Year of survey			
2015	26.1	24.0	28.4
2016	26.2	23.7	28.9
2017	24.8	22.5	27.3
2018	22.8	20.9	24.8

Table 2

Characteristics of the stud y sample by type of prescription medication used extra-medically for sleep, and factors associated with type of prescription medication used extra-medically for sleep among the selected sample, National Survey of Drug Use and Health, 2015–2018.

	Sedatives and/or Tranquilizers - only		Prescription pain relievers - only		Sedatives, tranquilizers and Prescription pain relievers		Sedatives and/or Tranquilizers - only vs. Prescription pain relievers - only				Sedatives and/or Tranquilizers - only vs. Sedatives, tranquilizers and Prescription pain relievers			
	%	95%CI	%	95%CI	%	95%CI	RRR	95% CI	aRRR	95% CI	RRR	95% CI	aRRR	95% CI
Gender														
Female	55.9	53.1, 58.7	55.3	51.2, 59.0	49.5	42.6, 56.3	Ref				Ref			
Male	44.1	44.7, 50.6	44.7	40.6, 48.8	50.5	43.7, 57.4	1.0	0.8, 1.3	1.2	0.9, 1.5	1.3	0.9, 1.8	1.3	0.9, 1.8
Age														
12 to 17														
18 to 25	21.3	19.3, 23.3	24.4	21.6, 27.4	32.2	26.1, 39.0	1.3	1.0, 1.7	1.5	1.0, 2.1	2.6	1.5, 4.5	1.5	0.8, 2.8
26 to 34	23.7	21.5, 26.2	24.6	21.3, 28.3	23.5	18.4, 29.5	1.2	0.9, 1.6	1.3	0.9, 1.9	1.7	0.9, 3.1	1.2	0.6, 2.4
35 to 49	23.1	21.0, 25.4	22.8	20.2, 25.6	25.6	20.4, 31.6	1.1	0.9, 1.4	1.2	0.9, 1.6	1.9	1.1, 3.4	1.6	0.8, 2.9
50+	31.9	28.8, 35.3	28.2	23.5, 33.5	18.7	11.8, 28.3	Ref				Ref			
Self-identified race-ethnicity														
Non- Hispanic Whites	79.8	77.1, 82.1	69.7	65.4, 73.6	76.1	68.4, 82.4	Ref				Ref			
Non- Hispanic Blacks	4.5	3.6, 5.6	12.8	10.2, 16.0	7.9	5.5, 11.1	3.2	2.3, 4.6	3.1	2.1, 4.5	1.8	1.1, 2.9	1.9	1.2, 3.1
Hispanics	11.6	9.7, 13.8	11.1	9.2, 13.4	8.9	5.5, 14.2	1.1	0.8, 1.5	1.1	0.8, 1.5	0.8	0.5, 1.4	0.8	0.5, 1.5
Non-Hispanic Others	4.1	3.1, 5.5	6.4	4.5, 8.9	7.1	4.2, 11.9	1.8	1.0, 3.0	1.6	0.9, 2.8	1.8	1.0, 3.3	1.6	0.9, 2.9
Population density in area of residence														
Rural	3.4	2.4, 4.6	5.2	3.9, 7.0	8.0	5.0, 12.6	1.5	0.9, 2.4	1.5	0.9, 2.5	2.9	1.6, 5.4	3.2	1.6, 6.1
Small metropolitan	40.8	37.1, 44.5	35.2	31.4, 39.2	45.9	39.1, 52.9	0.8	0.6, 1.0	0.8	0.6, 1.0	1.4	1.0, 1.9	1.4	0.9, 2.0
Large metropolitan	55.8	52.2, 59.6	59.6	55.4, 63.5	46.1	39.5, 52.8	Ref				Ref			
Poverty level														
Living in poverty	13.2	11.5, 14.9	19.2	16.4, 22.3	19.7	14.9, 25.8	Ref				Ref			
Income up to 2 times federal poverty threshold	19.1	17.0, 21.	19.3	16.6, 22.4	21.2	15.8, 27.9	0.7	0.5, 1.0	0.8	0.5, 1.1	0.7	0.5, 1.2	0.8	0.5, 1.4

	Sedatives and/or Tranquilizers - only		Prescription pain relievers - only		Sedatives, tranquilizers and Prescription pain relievers		Sedatives and/or Tranquilizers - only vs. Prescription pain relievers - only				Sedatives and/or Tranquilizers - only vs. Sedatives, tranquilizers and Prescription pain relievers			
	%	95%CI	%	95%CI	%	95%CI	RRR	95% CI	aRRR	95% CI	RRR	95% CI	aRRR	95% CI
Income more than 2 times federal poverty threshold	67.6	65.0, 70.0	61.0	57.7, 64.4	58.2	51.7, 64.3	0.6	0.5, 0.8	0.7	0.6, 1.0	0.6	0.4, 0.8	0.8	0.5, 1.3
Health insurance coverage														
No	13.3	11.6, 15.2	12.6	10.4, 15.2	16.6	11.7, 22.8	Ref				Ref			
Yes	86.7	84.8, 88.4	87.4	84.8, 89.6	83.4	77.2, 88.3	1.1	0.8, 1.4	1.1	0.9, 1.5	0.8	0.5, 1.2	1.0	0.6, 1.7
Past 12-months serious psychological distress														
No	66.6	63.9, 69.2	60.1	56.2, 63.8	49.5	42.0, 57.1	Ref				Ref			
Yes	33.4	30.8, 36.1	40.0	36.3, 43.8	50.5	42.9, 57.9	1.3	1.1, 1.6	1.3	1.1, 1.6	2.0	1.5, 2.8	1.7	1.1, 2.6
Self-reported health status														
Excellent/good	85.0	82.9, 86.9	79.3	74.6, 83.3	81.9	76.0, 86.6	Ref				Ref			
Fair/Poor	14.9	13.1, 17.1	20.7	16.7, 25.4	18.1	13.4, 23.9	1.5	1.1, 2.0	1.5	1.1, 2.1	1.3	0.8, 1.9	1.2	0.8, 1.9
Past 12-months tobacco use														
No use	42.3	38.7, 46.0	45.3	40.7, 49.9	28.8	22.4, 36.2	Ref				Ref			
Use, no evidence of use disorder	36.3	33.5, 39.2	31.0	27.3, 35.1	43.7	36.7, 51.0	0.8	0.6, 1.0	0.6	0.5, 0.8	1.8	1.2, 2.6	1.0	0.7, 1.6
Nicotine dependence	21.4	18.8, 24.3	23.7	20.5, 27.4	27.5	20.5, 35.7	1.0	0.8, 1.4	0.9	0.6, 1.2	1.9	1.1, 3.1	1.0	0.6, 1.6
Past 12-months alcohol use														
No use	14.2	11.7, 17.0	13.2	10.2, 16.8	8.4	4.9, 14.0	Ref				Ref			
Use, no evidence of use disorder	62.7	59.4, 66.0	60.1	55.1, 64.9	57.7	49.5, 65.5	1.0	0.8, 1.4	1.2	0.8, 1.6	1.5	0.8, 2.9	1.6	0.8, 3.1
Alcohol abuse or dependence	23.1	20.3, 26.2	26.7	22.4, 31.5	33.9	28.1, 40.2	1.2	0.9, 1.8	1.5	1.0, 2.2	2.5	1.4, 4.3	2.0	1.1, 3.7
Past 12-months cannabis use														
No use	51.1	47.9, 54.1	49.8	45.1, 54.6	34.8	28.6, 41.5	Ref				Ref			
Use, no evidence of use disorder	39.6	36.5, 42.8	41.4	36.8, 46.2	49.1	42.9, 55.3	1.1	0.8, 1.4	1.1	0.8, 1.5	1.8	1.3, 2.6	1.3	0.9, 1.9

	Sedatives and/or Tranquilizers - only		Prescription pain relievers - only		Sedatives, tranquilizers and Prescription pain relievers		Sedatives and/or Tranquilizers - only vs. Prescription pain relievers - only				Sedatives and/or Tranquilizers - only vs. Sedatives, tranquilizers and Prescription pain relievers			
	%	95%CI	%	95%CI	%	95%CI	RRR	95% CI	aRRR	95% CI	RRR	95% CI	aRRR	95% CI
Cannabis abuse or dependence	9.3	7.9, 10.9	8.8	7.0, 11.0	16.1	12.6, 20.4	1.0	0.7, 1.3	0.9	0.6, 1.3	2.5	1.7, 3.8	1.3	0.9, 2.1
Past 12-months use of other drugs														
No	72.4	69.1, 75.4	75.8	72.2, 79.1	56.0	49.4, 62.5	Ref				Ref			
Use, no evidence of use disorder	11.6	9.6, 13.9	11.2	8.5, 14.5	13.9	10.1, 18.8	0.9	0.6, 1.4	0.9	0.6, 1.3	1.6	1.0, 2.3	1.3	0.8, 1.9
Abuse or dependence	16.0	13.9, 18.4	13.0	10.4, 16.1	30.1	25.1, 35.6	0.8	0.6, 1.1	0.7	0.5, 0.9	2.4	1.8, 3.3	1.6	1.1, 2.2
Year of survey														
2015	24.9	22.5, 27.7	28.4	24.3, 32.9	26.4	20.4, 33.3	Ref				Ref			
2016	27.4	24.4, 30.6	24.3	21.0, 27.9	25.1	18.2, 33.6	0.8	0.6, 1.1	0.8	0.6, 1.1	0.9	0.6, 1.3	0.9	0.6, 1.3
2017	24.7	22.2, 27.4	24.4	20.7, 28.4	27.0	19.9, 35.6	0.9	0.6, 1.2	0.9	0.6, 1.2	1.0	0.6, 1.6	1.0	0.7, 1.6
2018	23.0	20.8, 25.3	22.9	19.4, 26.8	21.5	15.3, 29.4	0.9	0.7, 1.2	0.9	0.6, 1.2	0.9	0.5, 1.4	0.8	0.5, 1.5

Notes: RRR = Relative Risk Ratio; aRRR = adjusted Relative Risk Ratio.

Table 3

Characteristics of the stud y sample by reason for last extra-medical use of prescription medications, and factors associated with reason for last extra-medical use of prescription medications among the selected sample, National Survey of Drug Use and Health, 2015–2018.

	Sleep - only		Sleep and recreational		Reason for use (sleep - only reference)			
	%	95%CI	%	95%CI	OR	95%CI	AOR	95% CI
Gender								
Female	58.1	55.1, 61.1	47.7	44.2, 51.2	Ref		Ref	
Male	41.9	38.9, 44.9	52.3	48.8, 55.9	1.5	1.2, 1.9	1.3	1.0, 1.6
Age								
12 to 17								
18 to 25	17.2	15.8, 18.8	38.0	34.7, 41.5	6.2	4.3, 8.9	2.8	1.8, 4.4
26 to 34	22.2	20.0, 24.5	28.6	25.7, 31.7	3.6	2.6, 5.1	2.1	1.39, 3.2
35 to 49	24.3	22.3, 26.5	20.5	17.1, 24.0	2.4	1.6, 3.6	1.7	1.06, 2.8
50+	36.3	32.9, 39.7	12.9	9.4, 17.5	Ref			
Self-identified race-ethnicity								
Non- Hispanic Whites	75.8	72.9, 78.4	78.0	75.0, 80.8	Ref		Ref	
Non- Hispanic Blacks	7.8	6.5, 9.3	6.1	4.8, 7.8	0.8	0.6, 1.0	0.6	0.4, 0.8
Hispanics	11.4	9.8, 13.4	10.7	8.5, 13.4	0.9	0.7, 1.3	0.8	0.6, 1.1
Non-Hispanic others	5.0	3.9, 6.4	5.2	3.8, 7.1	1.0	0.7, 1.5	0.6	0.4, 1.0
Population density in area of residence								
Rural	4.6	3.7, 5.8	3.6	2.6, 5.0	0.3	0.5, 1.2	0.5	0.3, 0.9
Small metropolitan	39.9	36.8, 43.1	38.7	35.0, 42.6	1.3	0.8, 1.9	0.9	0.7, 1.1
Large metropolitan	55.5	52.3, 57.6	57.7	53.8, 61.5	Ref		Ref	
Poverty level								
Living in poverty	13.7	12.2, 15.2	20.4	17.4, 23.7	Ref		Ref	
Income up to 2 times federal poverty threshold	18.8	16.9, 20.8	20.7	17.6, 24.2	0.7	0.5, 1.2	0.8	0.5, 1.1
Income more than 2 times federal poverty threshold	67.3	65.2, 69.4	58.4	54.4, 62.2	0.6	0.5, 0.7	0.8	0.6, 1.2
Health insurance coverage								
No	12.0	10.4, 13.9	16.8	14.2, 19.8	Ref		Ref	
Yes	88.0	86.1, 89.6	83.2	80.2, 85.8	0.7	0.5, 0.9	1.3	0.9, 1.7
Past 12-months serious psychological distress								

	Sleep - only		Sleep and recreational		Reason for use (sleep - only reference)			
	%	95%CI	%	95%CI	OR	95%CI	AOR	95% CI
No	68.9	66.5, 71.2	48.6	44.6, 52.6	Ref		Ref	
Yes	31.1	28.8, 33.5	51.4	47.4, 55.4	2.3	1.9, 2.8	1.7	1.3, 2.2
Self-reported health status								
Excellent/Good	82.6	79.91 85.0	84.0	80.5, 87.0	Ref		Ref	
Fair/Poor	17.4	15.0, 20.1	16.0	13.0, 19.5	0.9	0.7, 1.2	0.7	0.5, 1.1
Missing								
Past 12-months tobacco use								
No use	50.3	46.9, 53.6	21.1	17.9, 24.6	Ref		Ref	
Use, no evidence of use disorder	31.0	28.3, 33.8	46.4	43.2, 49.8	3.6	2.8, 4.6	1.7	1.2, 2.2
Nicotine dependence	18.7	16.4, 21.4	32.5	29.5, 35.7	4.1	3.1, 5.5	1.9	1.4, 2.8
Past 12-months alcohol use								
No use	13.5	11.3, 16.1	12.9	9.9, 16.7	Ref		Ref	
Use, no evidence of use disorder	65.8	62.7, 68.9	50.6	46.2, 54.9	0.8	0.6, 1.1	0.5	0.3, 0.7
Alcohol abuse or dependence	20.7	18.0, 23.6	36.5	32.8, 40.4	1.8	1.3, 2.7	0.6	0.4, 1.0
Past 12-months cannabis use								
No use	57.9	54.9, 60.8	27.4	23.7, 31.4	Ref		Ref	
Use, no evidence of use disorder	35.9	33.2, 38.8	53.8	49.4, 58.1	3.2	2.4, 4.1	1.5	1.1, 1.9
Cannabis abuse or dependence	6.2	5.3, 7.2	18.8	15.6, 22.4	6.4	4.8, 8.5	1.9	1.2, 2.8
Past 12-months use of other drugs								
No use	82.8	80.8, 85.0	44.4	40.1, 48.8	Ref		Ref	
Use, no evidence of use disorder	9.1	7.6, 10.9	18.2	15.2, 21.5	3.7	2.8, 4.9	2.3	1.8, 3.1
Abuse or dependence	8.1	6.7, 9.6	37.4	33.8, 41.2	8.7	6.5, 11.6	4.4	3.2, 6.1
Type of drug								
Sedatives and/or tranquilizers only	64.9	62.1, 67.6	51.8	47.7, 55.9	Ref		Ref	
Prescription pain relievers only	29.2	26.6, 32.0	31.6	27.8, 35.7	1.4	1.1, 1.7	1.6	1.3, 2.1
Sedatives, tranquilizers and prescription pain relievers	5.9	4.8, 7.3	16.6	13.7, 20.1	3.5	2.6, 4.8	3.1	2.1, 4.4
Year of survey								
2015	26.3	23.8, 29.1	25.6	21.4, 30.0	Ref		Ref	
2016	26.9	24.1, 29.9	24.5	20.7, 28.7	0.9	0.7, 1.3	0.9	0.6, 1.3
2017	25.4	22.6, 28.3	23.4	20.4, 26.7	1.0	0.7, 1.3	0.9	0.7, 1.3

	Sleep - only		Sleep and recreational		Reason for use (sleep - only reference)			
	%	95%CI	%	95%CI	OR	95%CI	AOR	95% CI
2018	21.4	18.9, 24.1	26.5	23.2, 30.0	1.3	0.9, 1.8	1.2	0.8, 1.8

Notes: OR = Odds Ratio; aOR = adjusted Odds Ratio.