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Factors associated with sedative use and misuse among heroin users

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Abstract

Background—Rates of both opioid and sedative use and misuse are rising. Comorbid opioid and sedative use is associated with especially severe consequences (e.g., overdose and poor health outcomes). Heroin users report multiple motivations for sedative use, including self-medication. We aimed to understand differences in lifetime substance use characteristics between heroin users with different sedative use histories.

Methods—Substance use data were collected from 385 non-treatment seeking heroin users. Subjects were divided into four lifetime sedative-use groups: *no use*, *medical use only*, *non-medical use only*, *and mixed medical and non-medical use*. We examined patterns of use of various substances of abuse (tobacco, alcohol, marijuana, cocaine, heroin, and sedatives) and individual characteristics associated with each.

Results—Non-medical sedative use (alone or in addition to medical use) was associated with more negative consequences from using all substances. Medical sedative use alone was not related to increased overdose or emergency room visits associated with heroin use. Non-medical sedative use was associated with increases in 15 of the 21 measured heroin consequences and only one of those—health problems—was also associated with medical sedative use.

Conclusions—Concomitant non-medical sedative use and heroin use is associated with significantly greater negative outcomes than those experienced by heroin users who report use of sedatives only as prescribed. Understanding these differences offers insight into risks related to using both substances and may help treatment providers create targeted harm reduction interventions for this population.

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Keywords

Heroin; Sedatives; Benzodiazepines; Health outcomes; Consequences

1. Introduction

Between 1996 and 2013, the yearly percentage of adults filling at least one prescription for benzodiazepines (BZDs) increased from 4.1% to 5.6% and total BZD quantity tripled (Bachhuber et al., 2016a). There has been a parallel increase in non-medical BZD use (SAMHSA, 2016). Dangers of BZD misuse are well-documented (Bachhuber et al., 2016b; Lader, 2014; Longo and Johnson, 2000; Murphy et al., 2016) and compounded when the drug is combined with an opioid. Combining BZDs with opioids is associated with significantly increased risks of negative health outcomes, including overdose (Darke et al., 2009).

About 828,000 people over age 12 in the U.S. used heroin within the past year (SAMHSA, 2016) and, in 2013, over 500,000 people sought treatment for heroin use (Lipari and Hughes, 2015). Nearly 20% of emergency department visits attributed to illegal drug use were due to heroin (SAMHSA, 2014). Negative consequences of heroin use are amplified by concomitant use of sedatives including BZDs (Jones et al., 2012; Lintzeris and Nielsen, 2010; McCance-Katz et al., 2010; Megarbane et al., 2003), and this particular drug combination is associated with increased emergency department visits, heroin overdose, and worse physical and mental health (Darke et al., 2009; Ghitza et al., 2008; Jann et al., 2014; Jones and McAninch, 2015).

Heroin users report heterogeneous motivations for sedative use: 1) enhancing opioid “high,” 2) decreasing opioid withdrawal symptoms, and 3) self-medicating psychiatric distress (e.g., anxiety) (Fatseas et al., 2009; Mateu-Gelabert et al., 2017; Stein et al., 2016). The rising use of sedatives with other illegal substances is supported by treatment data from 1998 to 2008, which show 82.1% of all treatment admissions reported BZDs as the secondary drug of abuse (SAMHSA, 2011). From 2000 to 2010, treatment admissions for combined misuse of prescription opioids and BZDs increased more than 500% (SAMHSA, 2012). Given the growing nature of the problem and complex reasons for using these substances, it is imperative to improve insight into this polydrug use pattern and differences between those who use prescribed sedatives as indicated *versus* those who misuse prescription sedatives.

Despite the risks of concomitant heroin and sedative use and different outcomes in those who use sedatives and those who do not, few studies have tried to determine whether negative outcomes of sedative use are related to overall dysfunction of the individual (e.g., related comorbidities) or directly result from combining these drugs. Studies that addressed this issue did not distinguish medical from non-medical sedative use (NMSU); the latter term includes both prescription misuse and recreational use. Improving our understanding of who uses these drugs concurrently and some of the risks associated with this drug combination may help treatment providers to intervene and reduce risks of use.

1.1 Aims and hypothesis

Our first aim was to examine whether current heroin users who had used sedatives concurrently with heroin differed in their overall substance use profiles from those who had never used sedatives. We hypothesized that individuals using medical or non-medical sedatives (or both) would report more negative outcomes than those who never used sedatives. Our second aim was to establish whether the groups of sedative users (no sedative use, medical and/or non-medical) differed in lifetime substance use characteristics and outcomes. We hypothesized that heroin users with NMSU would report more negative outcomes than those indicating solely medical use. Finally, as heroin users may self-medicate through NMSU, we hypothesized that all sedative users (medical-only, NMSU and mixed groups) would report more physical and psychiatric health problems than those who reported no lifetime sedative use.

2. Methods

2.1. Participant selection

The study included 385 non-treatment-seeking, heroin-using participants aged 18 to 55 years screened for several clinical pharmacology studies between 2005 and 2015 in Detroit, MI. Analyses showed no significant changes within this population over the 10-year period in substance abuse patterns measured in this study. Participants who passed an initial structured telephone screen were invited for in-person screening with formal assessments (described below). Participants passed the initial telephone screen if they endorsed regular heroin use with no current desire to seek treatment, had no major cardiac or pulmonary disorders that would be contraindicated in the laboratory studies, and denied current psychiatric disorders (either treated or untreated). Participants were included in analyses if their urine sample was opioid positive (>300 ng/ml), breath alcohol level was negative (<.02%; Alco Sensor III Breathalyzer) and they were cognitively intact as defined by IQ score > 80 on the Shipley Institute of Living Scale (Zachary, 1991).

2.2 Measures

2.2.1. Substance use patterns and progression—A standardized self-report battery (Drug History and Use Questionnaire; available on request) was used to collect information about each individual's current and previous use of tobacco, alcohol, marijuana, sedatives, cocaine, and heroin. Participants were also asked about lifetime use of prescribed and non-prescribed neuropsychiatric medications. For each substance, questions probed age of initial use (defined as first time each substance was tried), age of regular use (defined as *at least weekly use*), lifetime treatment seeking (yes or no) and number of quit attempts. Across all substances, not all participants identified age of initial or regular use; thus, where applicable we report percentages and absolute numerator/denominator for the available sample for each measure. For heroin, participants were also asked about frequency of use (number of times used per day and number of days used per week), and total number of bags of heroin used per day (one bag was classified as 0.1g of heroin). Injection heroin use was coded as *never* or *ever*.

Participants were classified as having used sedatives if they endorsed any lifetime use of BZDs, barbiturates, or clonidine. Participants were presented a list of sedatives and could endorse individual drugs (where applicable, both medical names and street names for the product were provided; Appendix 1[1]). Although clonidine is not a BZD or barbiturate, it is classified as a sedative and anxiolytic in addition to being an antihypertensive agent (Jamadarkhana and Gopal, 2010; Jitendra et al., 2015; Wang et al., 2017) and a medication used in opioid detoxification. For this study, medical (prescription) sedative use refers to participants reporting that sedatives were prescribed by a physician and taken exactly as indicated; non-medical (or recreational) use refers to any other type of sedative use (e.g., purchased on the street or taking more than prescribed).

The chronological relationship between sedative and heroin use was also established by asking whether first sedative exposure (medical or non-medical) occurred before or after heroin use initiation. Based on their reported lifetime history of sedative use, participants were classified into one of four groups: *no sedative use, medical use only, non-medical use only, and mixed medical and non-medical use*.

2.2.2. Heroin-use consequences and treatment seeking—Lifetime substance use consequences were assessed using a drug-specific checklist (Appendix 2[1]). Number of negative consequences varied across substances: tobacco (16 items), alcohol (20 items), marijuana (22 items), sedatives (7 items), cocaine (18 items; Lister et al., 2015) and heroin (21 items; Moses et al., 2017; Woodcock et al., 2015). Participants were asked to indicate if they had “ever” or “never” experienced each consequence as a *direct result of using that specific substance* (e.g., accidental overdose, missed work, financial problems). This checklist measured only lifetime incidence of the consequences and did not ask when those consequences first occurred.

2.2.3. Physical and psychological health—Participants completed a structured medical history form that queried current and lifetime diagnoses of various disorders. Due to low overall endorsement of individual items, certain medical conditions were combined for analyses. For example, “liver problem” includes hepatitis, cirrhosis, and pancreatitis.

The Structured Clinical Interview for Diagnostic and Statistical Manual IV (DSM-IV; First et al., 1996) was used to identify current and lifetime psychiatric and substance use disorders. As the SCID was conducted on the second screening visit day, these data were available for only a subset of the overall sample (50%; N=196). Individuals who met DSM-IV criteria for substance abuse or dependence were classified as having a substance use disorder.

2.3. Data analysis

Independent *t*-tests and chi-square analyses were used to examine group differences in continuous (e.g., age of initiation) and categorical (e.g., presence/absence of health

[1]Supplementary material can be found by accessing the online version of this paper at http://dx.doi.org and by entering doi:…

problems) variables for comparisons between individuals with a history of sedative use and those with no history of use.

Continuous variables across the four sedative use types (no sedative use, medical only, non-medical only, or medical and non-medical) were compared separately using one-way analyses of variance (ANOVAs). Bonferroni *post hoc* tests were used to compare groups following a significant omnibus test. To compare across these four groups, for each binary-coded heroin consequence we ran an omnibus chi-square analysis and, if significant, pairwise chi-square group comparisons.

Descriptive data are presented as mean ± one standard deviation. Continuous variables with a non-normal distribution were $\log_{10}$ or square-root transformed prior to analysis. To improve readability, tables and figures display non-transformed means and differences, but statistical analyses used normally distributed variables. All analyses were conducted using SPSS v.24, with a criterion of $p < .05$ to reject the null hypothesis.

3. Results

3.1. Demographic characteristics

The average participant was a 42.2±9.8 year old African American (57.1%) male (71.2%) with 12.3±1.7 years of education. All participants were current, regular heroin users with an average age of heroin use initiation of 23.8±7.9 years old and regular use beginning about 2.3 years later (26.1±8.0 years). Mean lifetime duration of heroin use was 16.1±11.3 years, and 69.1% had used heroin intravenously at least once. Most participants reported a history of using tobacco (97.7%), alcohol (93.5%), marijuana (91.4%), cocaine (89.1%), and NMSU (54.3%).

3.2. Overall sedative use

To examine heterogeneity within the sample, we first determined whether participants who previously ever used sedatives (in any form) differed from those who had never used sedatives. The most commonly endorsed sedatives were BZDs (Table 1), and a large portion of the sample had used more than one type of sedative. Of the 18 people who endorsed medical clonidine use, 11 had also used BZDs or barbiturates. Only one person endorsed non-medical use of clonidine. Those who had ever used sedatives were younger (41.4±9.9 *vs.* 43.5±9.5 years, $t(383)=2.06$; $p=041$), more likely to be Caucasian (52.3% *vs.* 27.1%, $\chi^2=23.37$; $p<.001$), and had more years of education (12.5±1.5 *vs.* 12.0±1.9, $t(379)=2.661$; $p=008$) than those who had never used sedatives. There were no sex differences between the two groups. Consistent with prior literature, those who had used sedatives endorsed more consequences of heroin use than those who had never used sedatives (8.9±4.7 *vs.* 6.4±4.6, $t(381)=5.20$; $p<.001$).

3.3. Types of sedative use and misuse

Next, we differentiated medical and non-medical sedative use to test our prediction that these types of sedative use would be associated with different overall substance use profiles. The sample was divided into four groups based on lifetime sedative use (see Table 2 for

demographic characteristics) and one-way ANOVAs were used to examine whether the groups significantly differed in substance use characteristics (Table 3).

Within the total sample, 37.4% (*n*=144) had never used sedatives; this group was significantly more likely to be African American (72.9%) and male (71.5%) than each of the three sedative-using groups (Table 1). There were no differences in current age, level of education, age of heroin-use onset, time to regular heroin use, or current level of heroin use among any of the four sedative-use groups. Participants with no history of sedative use were significantly less likely to have ever injected heroin relative to the three sedative-user groups. This group had tried to quit using heroin 8.9±17.6 times, and 64.7% had previously sought treatment for heroin use.

Of the total sample, 8.3% (*n*=32) reported only medical use of sedatives during their lifetime. Of these, mean age of receiving first sedative prescription was 30.6±14.3 years. There were no differences in number of heroin quit attempts or treatment seeking between this group and non-users or NMSU. One-third (*n*=9/27) of this group reported receiving their first sedative prescription before initiating heroin use. Among these medical sedative users, 59.4% (*n*=19/32) were using sedatives at the time of screening, and 77.8% (*n*=21/27) had used medical sedatives regularly.

Of the total sample, 33.0% (*n*=127) had only ever used sedatives non-medically; their mean age of sedative use initiation was 25.7±9.9 years. This group had similar rates of heroin quit attempts and treatment seeking to the non-using group. Of those who endorsed only NMSU, 42.9% (*n*=54/126) were using at the time of screening and 61.7% (*n*=71/115) had a history of regular use. About half (51.8%, *n*=58/112) endorsed initiating NMSU prior to heroin. Only 1.7% of this group had sought treatment for NMSU and 85.7% denied previous attempts to quit using non-medical sedatives.

The mixed medical and non-medical sedative use group comprised the remaining 21.3% (*n*=82) of the sample. This group was less likely to be male (64.6%) than NMSU. Compared to the other use groups, mixed medical and non-medical sedative users were significantly more likely to have sought treatment and made more heroin quit attempts. Mean age of initial medical sedative use was 30.4±9.9 years and mean age of NMSU was 23.5±9.5 years. Of this group, 30.9% (*n*=21/68) reported receiving their first sedative prescription before initiating heroin use, and 56.9% (*n*=41/72) began NMSU before heroin use. With regard to medical use, 51.3% (*n*=41/80) were currently using medically and 84.5% (*n*=60/71) had ever used medical sedatives regularly. On the other hand, in the NMSU group, only 34.1% (*n*=28/82) were using when screened, and 66.7% (*n*=50/65) endorsed a history of regular use. There was no difference in non-medical sedative quit attempts or treatment seeking between this group and the NMSU group.

We found no group differences in lifetime, regular, or current use rates of other substances (tobacco, alcohol, marijuana, and cocaine). We also found no group differences in total amount of heroin used daily or frequency of heroin use. The most consistent group difference involved substance use-related consequences across all substances measured. This effect was only related to NMSU (independently or in addition to medical use). To confirm

that these differences were unrelated to amount or frequency of heroin use, we compared these variables across the four groups and found no significant differences. Participants reporting only medical sedative use did not report more consequences from any substance compared to non-users, and they reported significantly fewer total heroin consequences than participants who endorsed both types of sedative use (mixed group).

We further examined group differences in heroin-specific consequences (Table 4) and found significant differences for 15 of the 21 consequences. Only one consequence—health problems—was more prevalent among medical users than non-users. All other increases in consequence endorsement (compared to non-sedative users) were uniquely associated with NMSU, alone or in combination with medical use. In addition, we found differences between some of the sedative-user groups. Six consequences were more likely to be endorsed by the mixed medical and non-medical sedative-user group than the medical sedatives group: lost job, warning at work, missed work, family problems, drove under the influence, and fight or quarrel.

In a subset of the sample with available data, we examined physical and psychological health problems among the four groups (Table 5). Out of all health problems, medical users only endorsed increased liver problems, (i.e., endorsement was significantly higher among those who used medically alone and the mixed medical and non-medical group, but was not increased in the NMSU group). Although it is unsurprising that only individuals who reported any type of sedative use met DSM-IV criteria for sedative use disorder, participants in the mixed medical and non-medical use group were at highest risk of meeting criteria for a sedative use disorder.

4. Discussion

This study characterized effects of different types of sedative use among heroin users on substance use patterns and outcomes. Given the possible overlap between medical and non-medical sedative use, we divided our sample into four sedative-use groups based on lifetime criteria: *no sedative use*, *medical use only*, *non-medical use only*, and *mixed medical and non-medical use*. Separating individuals who only used medically from those who used medically and non-medically enabled us to ascertain whether heroin users who reported using sedatives only as prescribed are at similar risk as those who reported using non-medically. We thought it was important to separate those who had used sedatives in both forms from the individual groups because they may represent a completely different subset of users. These four groups differed in substance use characteristics,. such as total consequences across all substances and age of initiation for alcohol and cocaine. Non-medical use (either alone or in addition to medical use) significantly increased risk of negative outcomes.

Almost one-third of our sample endorsed medical sedative use and >50% of the sample endorsed NMSU. Sedative users were more likely to be Caucasian, consistent with research showing race differences in non-medical use (McCabe et al., 2017; McCabe and West, 2014; Young et al., 2012). Although there were no sex differences between those who used sedatives and those who did not, there were differences between those who endorsed NMSU

alone and those who endorsed either medical use or mixed medical and non-medical use; those who endorsed medical use (alone or in combination with non-medical use) were more likely to be female. The impact of sex on non-medical use remains unclear in existing literature (Young et al., 2012); however, evidence suggests women are more likely to have received a sedative prescription than men (Olfson et al., 2015; Peters et al., 2015). More than two-thirds of the participants who endorsed medical use received their first sedative prescription after initiating heroin use, and almost half the sample was using sedatives (medically or non-medically) at the time of study screening. Given the known risks of sedative use in combination with heroin, this finding is alarming, and it is important to establish ways to reduce these potential risks.

The greater number of consequences endorsed was specific to NMSU, although one consequence—health problems—was also related to medical sedative use. Health problems could be either a cause or a result of concurrent sedative and heroin use. Notably, neither increased risk of heroin overdose nor emergency room visits were associated with medical-only sedative use. The current findings are supported by data from studies that divided sedative-use patterns similarly, albeit in different populations. McCabe et al. (2017) found risks associated with sedative use in adolescents were uniquely related to NMSU (alone or in addition to medical use); NMSU in adolescents predicted substance use symptoms in adulthood, whereas medical use was unrelated to future substance use.

Understanding the risks of NMSU and earlier substance use progression of this group could provide insight into the most appropriate time and method for intervention. Although subjects in this sample were not seeking treatment, it may be possible to alter patterns of use to reduce negative outcomes. When a heroin user encounters the healthcare system due to consequences of concurrent sedative and heroin use, there is an opportunity to promote harm reduction. For those who misuse sedatives to enhance heroin's effects, efforts can focus on naloxone distribution and education to minimize overdose risks (e.g., never using alone). Although naloxone does not attenuate sedative effects, it does reverse opioid agonist effects, thereby lessening the residual sedative effect's likelihood to result in overdose. Despite this group's status as having the highest risk, there are opportunities to decrease risks associated with this concurrent use.

Sedatives may be used to minimize a subset of affective symptoms and somatic signs of opioid withdrawal (e.g., anxiety, restlessness, muscle spasms) or pain states, and heroin users may self-medicate for these reasons. Although sedatives are known to increase negative health effects of alcohol and heroin (Darke et al., 2009; Lader, 2014; SAMHSA, 2011), they are also effective for treating signs/symptoms of withdrawal from both substances (Paulozzi et al., 2014; Peles et al., 2014; Wang et al., 2017). Increased heroin consequences observed in non-medical sedative users in this study could have motivated sedative use to help reduce heroin use and opioid withdrawal symptoms. Heroin users already using sedatives to attenuate withdrawal symptoms may be predisposed to reduce their use and perhaps more open to discussing treatment.

Heroin users may also self-medicate to reduce psychiatric symptoms. Sedatives play a prominent role in treating symptoms of mental illness (Brett and Murnion, 2015; Mateu-

Gelabert et al., 2017; O'Brien et al., 2017) and there are very high rates of psychiatric disorders in substance-using populations (Goldner et al., 2014; Grant et al., 2004; Maremmani et al., 2015; Scott et al., 2016). Although we used SCID diagnostic criteria, diagnostic reliability is limited due to low endorsement and smaller sample size. Despite this limitation, elevated rates of psychiatric problems among the sedative users suggest an increased risk for mental health problems in this group. This finding inspires further questions about the directionality of the consequence differences; substance users with mental illness are more likely to have more negative consequences and worse treatment outcomes (Kaye et al., 2014; Norman et al., 2007; Schellekens et al., 2015; Ullman et al., 2013). It is possible that associated psychiatric distress, rather than sedative use, contributes to elevated heroin consequences. Harm reduction efforts for this population might include prescribed sedatives and therapy for symptom management without requiring the person to quit heroin or sedative use. Heroin users not seeking treatment may still benefit from medical sedative use; furthermore, this concurrent use may not be inherently harmful if carefully monitored.

These findings illustrate the importance of understanding whether the negative outcomes associated with sedative and heroin use are directly related to combined use of these drugs or a consequence of the overall dysfunction of the individual. Given our understanding of some of the motivations for using sedatives and opioids, this overall dysfunction may have led to using both substances. In the context of this study, it was not possible to disentangle these variables; nonetheless, the prevalence of psychiatric symptoms in this particular subset of the heroin using population underscores the need for further study in this area.

Several limitations of this study should be considered. First, substance use variables were all self-reported, which may introduce recall bias or a social desirability effect (i.e., report of sedative use as medical rather than non-medical). Second, the cross-sectional nature of the data prohibits causal inferences. Third, our sample of non-treatment-seeking heroin users does not represent the entire heroin-using population, although most heroin users nationally are not in treatment (National Institute on Drug Abuse, 2011). Fourth, only participants who denied experience of current major physical or psychiatric problems, including severe use of other substances (e.g., sedatives, alcohol) passed the telephone screening; thus, an important segment of the sedative-using population may have been excluded before these in-person assessments. Fifth, data collected provide only lifetime use information for the specific substances and their associated consequences. Thus, we cannot make causal interferences or determine whether certain substances were used simultaneously. Lastly, there were racial differences in sedative use. Due to other racial differences in our population's substance use characteristics (Moses et al., under review), we cannot exclude the possibility that some differences observed were related to race instead of (or in addition to) sedative use.

In conclusion, this study identified significant differences in substance use progression and consequences between different sedative-use groups and highlights risks of NMSU among chronic heroin users. Awareness of these differences and understanding multiple motivations associated with sedative use by heroin-users can provide healthcare workers with appropriate tools to reduce risks. Given the lack of temporal tracking in our study, it was not possible to determine whether characteristics of medical sedative users resulted from heroin

and sedative use or whether these characteristics were related to factors leading to sedative prescription. Future studies should focus on this temporal relation to understand the risks of concurrent medical sedative use and heroin. Sedatives may play a positive role in helping a carefully screened subset of heroin users manage their physical and psychiatric symptoms. If the health risks of concurrent sedative and heroin use are due primarily to NMSU, then we can use this knowledge to improve treatment of heroin users.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Highlights

- More than 50% of regular heroin users report sedative use
- There are unique characteristics associated w/ medical and non-medical sedative use
- Non-medical sedative use is a risk factor for negative drug use consequences
- Medical use only is associated with more heroin-related health problems

Table 1

Frequency of types of sedatives endorsed both medically and non-medically

	Medical (N=114)	Non-Medical (N=209)
Barbiturates	6 (5%)	12 (6%)
Benzodiazepines	7 (6%)	20 (10%)
Catapres	18 (16%)	1 (1%)
Seconal	2 (2%)	8 (4%)
Pentobarbital	0 (0%)	3 (1%)
Phenobarbital	1 (1%)	7 (3%)
Quaalude	0 (0%)	0 (0%)
Yellow Jackets	0 (0%)	0 (0%)
Tuinol	0 (0%)	1 (1%)
Valium	22 (19%)	92 (44%)
Xanax	25 (22%)	111 (53%)
Dalmane	4 (4%)	2 (1%)
Librium	8 (7%)	13 (6%)
Ativan	13 (11%)	30 (14%)
Halcion	1 (1%)	3 (1%)
Durdin	0 (0%)	0 (0%)
Somas	0 (0%)	0 (0%)
Somer	0 (0%)	0 (0%)
Dilantin	1 (1%)	0 (0%)
Mellaril	0 (0%)	0 (0%)
Other	48 (42%)	33 (16%)

Table 2

Demographics of the four sedative use groups. Differences in continuous (one-way ANOVA) and binary (chi-square tests) demographics are also shown

	No Sedative Use	Medical Use Only	Non-Medical Use Only	Mixed Medical & Non-Medical Use	*F* or χ^2 (*p*)
N	*144*	*32*	*127*	*82*	-
Age	43.5±9.5	41.0±11.8	40.8±10.0	42.4±90	1.90 (.13)
Race (African American)	73% [b]	53% [a]	49% [a]	44% [a]	**24.30 (<.001)**
Sex (Male)	72% [ab]	56% [a]	79% [b]	65% [a]	**8.74 (.03)**
Education	12.0±1.9	12.7±1.6	12.5±1.4	12.4±1.6	2.53 (.06)

Note: For significant overall analyses (bolded), non-shared superscripts indicate significant differences between group means (i.e., source of main effect).

Table 3

Descriptive statistics, one-way ANOVAs (continuous variables only) and chi-square (binary variables) of substance use characteristics by sedative use group (*N*=385)

Substance	Characteristics	No Sedative Use	Medical Use Only	Non-Medical Use Only	Mixed Medical & Non-Medical Use	*F* or χ^2 (*p*)
Tobacco	Age of first use (M±SD)	16.5±5.5	17.2±7.7	15.1±4.2	15.4±5.0	2.69 (.05)
	Consequences (M±SD)	3.5±4.0^{a}	50±43^{abc}	5.6±4.6^{bc}	6.9±4.5^{c}	**11.65 (<.001)**
	Quit attempts (M±SD)	3.0±8.9	1.7±2.8	3.7±9.9	3.7±5.8	1.33 (.27)
Alcohol	Age of first use (M±SD)	15.5±4.7^{a}	16.2±7.4^{ab}	14.1±5.1^{b}	13.9±4.5^{ab}	**4.59 (<.01)**
	Consequences (M±SD)	1.8±3.5^{a}	2.7±2.1^{abc}	3.6±4.6^{bc}	4.1±4.7^{c}	**7.91 (<.001)**
	Quit attempts (M±SD)	0.9±2.7^{a}	0.8±1.1^{ab}	1.3±2.8^{ab}	2.5±5.4^{b}	**2.72 (.04)**
Marijua na	Age of first use (M±SD)	15.5±4.1	15.4±3.0	14.7±3.2	14.6±2.8	1.55 (.20)
	Consequences (M±SD)	1.9±3.2^{a}	22±37^{abc}	3.6±4.4^{bc}	3.9±4.6^{c}	**7.09 (<.001)**
	Quit attempts (M±SD)	1.4±3.9	0.4±0.7	1.9±9.4	2.7±11.5	0.93 (.43)
Cocaine	Age of first use (M±SD)	26.3±8.0^{a}	25.0±8.9^{ab}	22.9±6.8^{b}	23.0±6.9^{b}	**5.01 (<.01)**
	Consequences (M±SD)	2.2±3.4^{a}	2.7±2.9^{ab}	3.6±3.9^{b}	3.9±4.5^{b}	**3.90 (.01)**
	Quit attempts (M±SD)	3.7±5.6	3.1±4.8	4.2±10.5	10.0±23.0	1.62 (.18)
Heroin	Age of first use (M±SD)	24.0±8.1	24.0±7.3	23.6±8.0	23.7±7.5	0.08 (.97)
	Consequences (M±SD)	6.4±4.6^{a}	7.2±3.9^{ab}	8.7±4.8^{bc}	10.0±4.5^{c}	**12.31 (<.001)**
	Quit attempts (M±SD)	8.9±17.6^{a}	8.4±17.1^{ab}	8.2±14.2^{a}	15.3±25.3^{b}	**4.41 (.01)**
	Treatment sought? % (n)	65% (88)^{a}	73% (22)^{ab}	66% (81)^{a}	88% (66)^{b}	**14.40 (<.01)**
	Injection use? % (n)	53% (82)^{a}	84% (27)^{b}	70% (90)^{b}	82% (67)^{b}	**19.75 (<.001)**
Non-Medical Sedatives	Age of first use (M±SD)	--	--	25.7±9.9	23.5±9.5	--
	Consequences (M±SD)	--	--	0.4±0.9	0.4±0.7	--
	Quit attempts (M±SD)	--	--	0.9±4.8	0.9±2.9	--

Note: For significant overall analyses (bolded), non-shared superscripts indicate significant Bonferroni *post hoc* differences or chi-square differences between group means (i.e., source of main effect)

Table 4

consequence list and participant item endorsement (*N*=385) by sedative use group

Factor Loading	Consequences	No Sedative Use	Medical Use Only	Non-Medical Use Only	Mixed Medical & Non-Medical Use	χ^2 (*p*)
Factor 1	Visited emergency room	17% (24)	27% (6)	34% (35)	34% (23)	7.40 (.06)
	Overdose	20% (28)[a]	22% (7)[ab]	39% (50)[b]	39% (32)[b]	**16.42 (<.01)**
	Health problem	13% (19)[a]	31% (10)[b]	25% (31)[b]	31% (25)[b]	**11.81 (.01)**
	Accident or injury	6% (9)[a]	13% (4)[ab]	13% (17)[ab]	20% (16)[b]	**8.81 (.03)**
	Arrested/legal problems	32% (46)	34% (11)	39% (49)	50% (41)	7.05 (.07)
	Unexpected reaction	24% (34)[a]	34% (11)[ab]	36% (45)[b]	49% (40)[b]	**14.88 (<.01)**
Factor 2	Lost job	36% (50)[a]	31% (10)[a]	45% (57)[ab]	55% (45)[b]	**9.73 (.02)**
	Warning at work	23% (33)[a]	22% (7)[ab]	36% (46)[bc]	48% (39)[c]	**16.18 (<.01)**
	Missed work	42% (60)[a]	45% (14)[ac]	61% (78)[bc]	70% (57)[b]	**19.59 (<.001)**
	High at work	44% (62)[a]	59% (19)[ab]	68% (86)[b]	77% (63)[b]	**28.64 (<.001)**
Factor 3	Missed school	15% (21)	13% (4)	18% (23)	22% (18)	2.59 (.46)
	High at school	17% (24)	10% (3)	20% (25)	24% (20)	3.76 (.29)
	Suspended or expelled	6% (9)	3% (1)	6% (7)	12% (10)	4.63 (.20)
Factor 4	Financial problems	78% (111)[a]	91% (29)[ab]	89% (113)[b]	95% (78)[b]	**15.68 (<.01)**
	Family problems	69% (99)[a]	72% (23)[ab]	81% (103)[bc]	89% (73)[c]	**13.42 (<.01)**
	Drove under influence	65% (93)[a]	69% (22)[ab]	80% (102)[bc]	88% (72)[c]	**17.43 (<.01)**
	Couldn't stop using	67% (96)[a]	75% (24)[ab]	79% (100)[b]	82% (67)[b]	**7.95 (.05)**
Factor 5	Seizures and fits	3% (4)	3% (1)	6% (7)	9% (7)	3.87 (.28)
	Shakes and tremors	20% (28)[a]	25% (8)[ab]	36% (45)[b]	21% (17)[a]	**10.68 (.01)**
	Memory lapse or blackouts	22% (31)[a]	36% (11)[ab]	34% (43)[b]	45% (37)[b]	**13.67 (<.01)**
Did Not Load	Fight or quarrel	20% (28)[a]	13% (4)[a]	36% (46)[b]	46% (38)[b]	**24.44 (<.001)**

Note: For significant overall analyses (bolded), non-shared superscripts indicate significant chi-square differences between group means (i.e., source of main effect).

Table 5

Lifetime physical and psychological health characteristics by sedative use group

Health Characteristics		No Sedative Use	Medical Use Only	Non-Medical Use Only	Mixed Medical & Non-Medical Use	χ^2 (*p*)
Physical (N=296)	Sexually transmitted disease	15% (18)	9% (2)	18% (17)	12% (7)	1.68 (.64)
	Dental problems	45% (53)[a]	57% (13)[ab]	61% (59)[b]	70% (41)[b]	**10.72 (.01)**
	Head injury	10% (12)[a]	9% (2)[ab]	19% (18)[ab]	27% (16)[b]	**9.57 (.02)**
	Liver conditions	8% (9)[a]	30% (7)[b]	8% (8)[a]	28% (16)[b]	**21.10 (<.001)**
	Lung problems	17% (20)[a]	26.% (6)[ab]	18% (17)[a]	41% (24)[b]	**14.62 (<.01)**
	Hay fever/Sinusitis	8% (9)[a]	13.% (3)[ab]	18% (17)[b]	27% (16)[b]	**12.11 (.01)**
	Chronic pain	10 % (12)[a]	13.% (3)[ab]	12% (12)[a]	29% (17)[b]	**11.45 (.01)**
Psychological (N=196)	Alcohol use disorder	39% (26)	53% (8)	56% (37)	65% (31)	7.69 (.05)
	Cannabis use disorder	38% (25)	40% (6)	55% (36)	60% (28)	6.67 (.08)
	Cocaine use disorder	64% (42)	60% (9)	58% (38)	62% (30)	0.57 (.90)
	Sedative use disorder	0% (66)[a]	13% (2)[b]	27% (18)[bc]	44% (21)[c]	**34.59 (<.001)**
	Major depressive disorder	17% (11)	20% (3)	12% (8)	31% (15)	6.60 (.09)
	Post-traumatic stress disorder	2% (1)[a]	7% (1)[ab]	3% (2)[ab]	13% (6)[b]	**7.80 (.05)**

Note 1: Data for these variables represent a subset of the overall sample (*N*s shown in table).

Note 2: For significant overall analyses (bolded), non-shared superscripts indicate significant chi-square differences between group means (i.e., source of main effect).