Prevalence and Correlates of Benzodiazepine Use, Misuse, and Use Disorders Among Adults in the United States

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ABSTRACT

Objective: Although benzodiazepine misuse and use disorders are associated with adverse health effects, it is unknown what proportion of benzodiazepine users misuse them or meet criteria for benzodiazepine use disorders. The goal of this study was to examine the prevalence and correlates of benzodiazepine use, misuse, and use disorders among US adults.

Methods: Data from 102,000 adults 18 years and older who participated in the 2015–2016 National Surveys on Drug Use and Health were used. IMS Health Total Patient Tracker data were also examined. Descriptive analyses and multinomial logistic regressions were applied.

Results: Among US adults in 2015–2016, 12.5% (annual average, 95% CI, 12.19%–12.81%) used benzodiazepines, 2.1% (95% CI, 2.03%–2.25%) misused benzodiazepines at least once, and 0.2% (95% CI, 0.15%–0.22%) had benzodiazepine use disorders. Among benzodiazepine users, 17.1% (95% CI, 16.30%–17.93%) misused benzodiazepines, and 1.5% (95% CI, 1.26%–1.72%) had benzodiazepine use disorders. Benzodiazepine use was associated with emergency room visits, suicidal ideation, use of most substances, and mental disorders. Benzodiazepine misuse without use disorders was associated with younger age, male sex, being black, poor educational attainment, being uninsured and unemployed, being single, having family income below $50,000, and having suicidal ideation and other specific substance use problems. Correlates of benzodiazepine use disorders were similar, but most correlates were associated with benzodiazepine use disorders more strongly than with misuse without use disorders.

Conclusions: While benzodiazepine use is highly prevalent among US adults, benzodiazepine use disorders are relatively rare among benzodiazepine users. Our results help characterize benzodiazepine users and identify adults at risk for misuse and use disorders.

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Benzodiazepines are often used for the short-term treatment of anxiety and insomnia.[1–3] However, their management is complicated by (1) their risk for misuse, often defined as using a psychotropic medication without a prescription, in greater amounts, more often, or longer than prescribed or for a reason other than as directed by a doctor,[4,5] and (2) their risk for the development of benzodiazepine use disorders.[4,6,7] Benzodiazepine misuse and use disorders are associated with multiple adverse health effects,[8,9] including decreased motor coordination and traffic accidents,[9,10] overdose,[11,12] and premature mortality.[13] They are also associated with increased prevalence of other substance use, mood, and anxiety disorders.[14,15] These findings require clinicians and policy makers to balance appropriate use of benzodiazepines with the need to minimize misuse.

Several studies have examined the prevalence and correlates of benzodiazepine misuse and use disorders.[4,7,16] However, none has estimated the national prevalence of benzodiazepine use, examined whether correlates of use are similar to those of misuse and use disorders, or investigated motivations for benzodiazepine misuse in a national sample. The lack of nationally representative data has precluded to date the estimation of what proportion of users meet criteria for misuse or use disorders and which users are at greatest risk for benzodiazepine misuse or use disorders. An important recent study provided the first estimates of benzodiazepine use in the United States, describing the age and sex of benzodiazepine users.[1] Because the study was based on pharmacy data, it could not examine other important sociodemographic characteristics, assess diagnostic information of users, or estimate the prevalence or correlates of misuse and use disorders among benzodiazepine users.

In this study, we take advantage of a large nationally representative sample of US adults to examine (1) the prevalence and correlates of benzodiazepine use, (2) the prevalence and correlates of benzodiazepine misuse and use disorders among benzodiazepine users, and (3) the motivations for misuse and the source of benzodiazepines for the most recent misuse. This information has important implications for developing effective prevention and intervention strategies that improve the population's health and reduce harms associated with benzodiazepine misuse.

METHODS

Study Population

We examined data from adults 18 years or older who participated in the 2015–2016 National Surveys on Drug Use and Health (NSDUH), which was conducted by the Substance Abuse and Mental Health Services Administration. Starting in 2015, NSDUH collects information on benzodiazepine use, providing the first opportunity

Clinical Points

- No prior study has estimated the national prevalence of benzodiazepine use, examined whether correlates of use are similar to those of misuse and use disorders, or investigated motivations for benzodiazepine misuse in a national sample.
- Benzodiazepine use is highly prevalent among US adults, but benzodiazepine use disorders are relatively rare among benzodiazepine users. Benzodiazepine misuse is more common and appears related to attempts to relieve symptoms of tension or to help with sleep, suggesting that improved treatment of these symptoms might decrease benzodiazepine misuse.
- Because benzodiazepine use is associated with several indicators of poor general health, mental health problems, and substance use disorders, adults who use benzodiazepines should be assessed at baseline and on an ongoing basis for a broad range of psychiatric and general medical conditions.

to obtain nationally representative data on benzodiazepine use, misuse, and motivations for benzodiazepine misuse among the US civilian, noninstitutionalized population 12 years or older.

NSDUH data collection was approved by the Institutional Review Board at RTI International. Oral informed consent was received from each study participant. Data were collected by interviewers in personal visits to households and non-institutional group quarters, through audio computer-assisted self-administered interviews. The annual average weighted response rate for the 2015–2016 NSDUH was 54.3%.[17,18] Details regarding NSDUH methods are provided elsewhere.[17]

We also examined data from the IMS Health Total Patient Tracker to assess the number of unique adults who were dispensed benzodiazepines in outpatient retail pharmacies in 2015.[12] Examining both NSDUH and IMS data helped better understand the size of the US adult population using benzodiazepines recently.

Measures

The 2015–2016 NSDUH collected information on past-year use of benzodiazepines (including the use of one's own prescription medication as directed by a doctor as well as misuse) as part of the tranquilizer assessment module (ie, products containing alprazolam, lorazepam, clonazepam, and diazepam) and the sedatives assessment module (ie, products containing flurazepam, temazepam, and triazolam). NSDUH assessed use and misuse of these specific benzodiazepines. NSDUH defined misuse as "in any way that a doctor did not direct you to use them, including (1) use without a prescription of the respondent's own; (2) use in greater amounts, more often, or longer than the respondent was told to take them; or (3) use in any other way a doctor did not direct the respondent to use them."[18]

NSDUH also asked past-year benzodiazepine misusers the name of the specific benzodiazepine misused during their most recent misuse. NSDUH then asked about the main motivation for misusing benzodiazepines during their most recent misuse: to relax or relieve tension, to experiment or to see what the drug is like, to feel good or get high, to help with sleep, to help with feelings or emotions, to increase or decrease effect(s) of other drug(s), because respondent is "hooked" or has to have it, or other reason.[18] Furthermore, NSDUH collected the source of benzodiazepines obtained for their most recent misuse: given by a friend/relative for free, prescribed by physician(s), stolen from a friend/relative, bought from a friend/relative, bought from a drug dealer/stranger, or stolen from doctor's office/clinic. If respondents reported that they were given by friends/relatives for free, NSDUH asked them where friends/relatives obtained the benzodiazepines.

NSDUH collected lifetime and past-year use of tobacco, alcohol, cannabis, cocaine, heroin, hallucinogens, and inhalants, as well as lifetime and past-year use and misuse of other psychotherapeutic medications (prescription opioids, tranquilizers, sedatives, and stimulants). Furthermore, NSDUH also collected past-year major depressive episode (MDE) and specific substance use disorders (ie, alcohol, cannabis, cocaine, heroin, hallucinogens, inhalants, and psychotherapeutic medications) based on assessments of individual diagnostic criteria from the *DSM-IV*.[19] Nicotine dependence among cigarette smokers was assessed using the Nicotine Dependence Syndrome Scale.[20] These measures have good validity and reliability.[21–23] We defined adults with benzodiazepine misuse but without tranquilizer/sedative use disorders as "adult benzodiazepine misusers without use disorders." We defined those with past-year benzodiazepine use disorders as individuals who misused benzodiazepine-only tranquilizers in the past year and had prescription tranquilizer use disorders or who misused benzodiazepine-only sedatives in the past year and had prescription sedative use disorders.

The 2015 NSDUH asked all adult respondents about suicidality and captured respondents' self-rated health and the number of past-year emergency room (ER) visits. Additionally, NSDUH collected sociodemographic characteristics, including age, sex, race/ethnicity, educational attainment, employment status, family income, marital status, health insurance status, metropolitan statistical area, and census region.

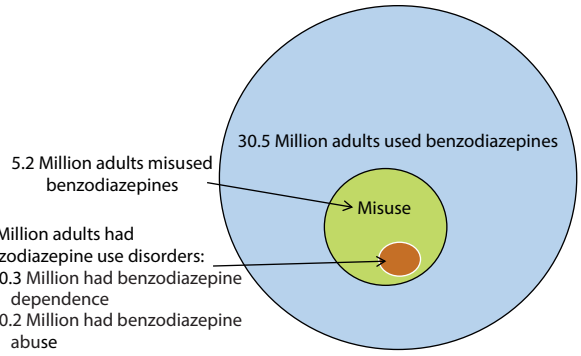
Statistical Analyses

First, we estimated the annual average prevalence of benzodiazepines use, non-use, misuse, and use disorders among adults in 2015–2016 by each of the sociodemographic and behavioral health characteristics described previously. Second, bivariable multinomial logistic regression models were applied to examine sociodemographic and behavioral health characteristics (1) distinguishing adults with benzodiazepine use from adults without benzodiazepine use (non-use) and (2) distinguishing adult benzodiazepine users without misuse, adult benzodiazepine misusers without use disorders, and adult benzodiazepine misusers

with benzodiazepine use disorders. As a sensitivity analysis, we repeated these procedures including adults who reported any misuse of benzodiazepines (ie, regardless whether they misused other tranquilizers/sedatives) in the past year and had past-year tranquilizer use disorders or sedative use disorders. These results, which are similar to those presented here, are available on request.

Third, among past-year adult benzodiazepine misusers in the United States, we estimated the main motivations for the most recent misuse and assessed the source of benzodiazepines obtained for the most recent misuse stratified by the status of benzodiazepine use disorders. This study used SUDAAN software[24] to account for the complex sample design and sample weights of NSDUH.

Figure 1. Benzodiazepine Use, Misuse, and Use Disorders Among Adults in the United States: Annual Averages, 2015–2016[a]



[a]Circles are approximately proportionally sized by area.

RESULTS

Prevalence of Benzodiazepine Use, Misuse, and Use Disorders Among US Adults

Based on the 102,000 sampled adults from the 2015–2016 NSDUH, we estimated that in the 12 months prior to the survey interview, approximately 30.5 (annual average, 95% CI, 29.63–31.29) million US adults used benzodiazepines, 5.2 (95% CI, 4.94–5.48) million misused benzodiazepines at least once, and 0.5 (95% CI, 0.38–0.52) million met criteria for benzodiazepine use disorders (0.3 [95% CI, 0.23–0.33] million for benzodiazepine dependence and 0.2 [95% CI, 0.13–0.21] million for benzodiazepine abuse) (Figure 1). Approximately 12.5% (95% CI, 12.19%–12.81%) used benzodiazepines, 2.1% (95% CI, 2.03%–2.25%) misused benzodiazepines at least once, and 0.19% (95% CI, 0.15%–0.22%) had a benzodiazepine use disorder. Among benzodiazepine users, 17.1% (95% CI, 16.30%–17.93%) misused benzodiazepines at least once, and 1.5% (95% CI, 1.26%–1.72%) had benzodiazepine use disorders. In addition, based on IMS data, we further estimated that 25.7 million adults were dispensed benzodiazepines in outpatient retail pharmacies in the United States in 2015.

Characteristics of Adults With Past-Year Benzodiazepine Use

Past-year benzodiazepine use was associated with older age, women, non-Hispanic whites, having high school or more education, having Medicaid only, being widowed/divorced/separated, not being full-time employed, having family income below $20,000, residing in the non-West regions, not living in large metropolitan areas, reporting less than excellent self-rated health, having ER visit(s), use of most substances, and having suicidal ideation and most of the psychiatric disorders assessed in this study (Table 1).

Characteristics of Adults With Past-Year Benzodiazepine Misuse and Benzodiazepine Use Disorders

Benzodiazepine misuse without use disorders was associated with younger age, male sex, being non-Hispanic black or Hispanic, having less than high school education, being uninsured, being part-time employed or unemployed, being single, having family income below $50,000, residing in a metropolitan area, having no past-year ER visits, and having past-year suicidal ideation, major depressive episodes, and other specific substance use problems (Table 2). Correlates of benzodiazepine use disorders were similar to correlates of benzodiazepine misuse without use disorders, except that benzodiazepine use disorders were associated with being non-Hispanic other (rather than Hispanic), having Medicaid, and having ER visit(s) and that most of these correlates were associated with benzodiazepine use disorders more strongly than with benzodiazepine misuse without use disorders (Table 2).

Main Motivation for Benzodiazepine Misuse

Among past-year benzodiazepine misusers, 46.3% reported that the motivation for their most recent misuse was to relax or relieve tension, followed by helping with sleep (22.4%) (Figure 2). About 5.7% reported "experimentation" as their main motivation for misuse, and 11.8% reported using them to "get high" or because of being "hooked." Supplementary Table 1 shows that the motivation for benzodiazepine misuse varied by the status of benzodiazepine use disorders. Compared to adults with misuse without use disorders, adults with benzodiazepine use disorders were more likely to report a drug related motivation (24.6% vs 18.5%) or to help with emotions (20.3% vs 9.6%) and were less likely to report misusing them to relax (38.2% vs 47.1%) or to help with sleep (14.9% vs 23.1%).

Source of Benzodiazepines Among Adult Misusers

Among past-year adult benzodiazepine misusers, the most commonly reported sources for the most recent benzodiazepine misuse included obtaining it from friends or relatives for free (53.0%) and from 1 doctor (19.7%) (Figure 3). Among those who obtained benzodiazepines from friends or relatives for free, 80.4% reported that their friends or relatives received prescription benzodiazepines

Table 1. Bivariable Logistic Regression Model Showing Characteristics Distinguishing Adults Without Past-Year Benzodiazepine Use From Adults With Past-Year Benzodiazepine Use in the United States: 2015–2016 NSDUH (N = 102,000[a])

Characteristic	Adults With Benzodiazepine Use, Weighted % (SE)	Adults Without Benzodiazepine Use, Weighted % (SE)	Benzodiazepine Use vs No Use, OR (95% CI)[b]
Sociodemographic Characteristics			
Age			
18–29 y	10.4 (0.20)	89.6 (0.20)	**0.7 (0.69–0.78)**
30–49 y	12.2 (0.21)	87.8 (0.21)	**0.9 (0.82–0.92)**
≥ 50 y+	13.7 (0.29)	86.3 (0.29)	1.0
Sex			
Men	9.5 (0.19)	90.5 (0.19)	**0.6 (0.55–0.61)**
Women+	15.3 (0.24)	84.7 (0.24)	1.0
Race/ethnicity			
NH white+	15.4 (0.20)	84.6 (0.20)	1.0
NH black	7.2 (0.34)	92.8 (0.34)	**0.4 (0.39–0.48)**
Hispanic	87.7 (0.32)	92.3 (0.32)	**0.5 (0.42–0.50)**
NH other	6.6 (0.39)	93.4 (0.58)	**0.4 (0.34–0.44)**
Education			
< High school+	9.9 (0.43)	90.1 (0.43)	1.0
High school	12.1 (0.29)	87.9 (0.29)	**1.3 (1.13–1.39)**
Some college	14.1 (0.27)	85.9 (0.27)	**1.5 (1.35–1.66)**
College graduate	12.3 (0.30)	87.7 (0.30)	**1.3 (1.15–1.43)**
Health insurance			
Private only+	11.4 (0.19)	88.6 (0.19)	1.0
Uninsured	9.8 (0.38)	90.2 (0.38)	**0.8 (0.77–0.92)**
Medicaid only	15.3 (0.43)	84.7 (0.43)	**1.4 (1.31–1.52)**
Other	14.4 (0.37)	85.6 (0.37)	**1.3 (1.23–1.41)**
Marital status			
Married+	11.4 (0.21)	88.6 (0.21)	1.0
Widowed	14.9 (0.81)	85.1 (0.81)	**1.4 (1.19–1.56)**
Divorced/separated	17.2 (0.50)	82.8 (0.50)	**1.6 (1.49–1.75)**
Never married	11.8 (0.23)	88.2 (0.23)	1.1 (0.99–1.11)
Employment status			
Full-time+	10.3 (0.17)	89.7 (0.17)	1.0
Part-time	13.1 (0.39)	86.9 (0.39)	**1.3 (1.22–1.43)**
Disabled for work	32.5 (1.07)	67.5 (1.07)	**4.2 (3.80–4.66)**
Unemployment	12.7 (0.67)	87.3 (0.67)	**1.3 (1.13–1.44)**
Other	12.4 (0.32)	87.6 (0.32)	**1.2 (1.15–1.32)**
Family income			
< $20,000	13.7 (0.37)	86.3 (0.37)	**1.2 (1.07–1.25)**
$20,000–$49,999	12.6 (0.28)	87.4 (0.28)	1.1 (0.98–1.12)
$50,000–$74,999	11.9 (0.36)	88.1 (0.36)	1.0 (0.91–1.07)
≥ $75,000+	12.1 (0.25)	87.9 (0.25)	1.0
Region			
Northeast	13.6 (0.39)	86.4 (0.39)	**1.3 (1.20–1.45)**
Midwest	11.9 (0.30)	88.1 (0.30)	**1.1 (1.03–1.24)**
South	13.5 (0.26)	86.5 (0.26)	**1.3 (1.21–1.42)**
West+	10.7 (0.33)	89.3 (0.33)	1.0
Metropolitan statistical area			
Large metro	11.8 (0.22)	88.2 (0.22)	**0.9 (0.83–0.97)**
Small metro	13.6 (0.27)	86.4 (0.27)	1.1 (0.97–1.14)
Non-metro+	13.0 (0.38)	87.0 (0.38)	1.0
Health Indicators			
Self-rated health			
Excellent+	7.9 (0.26)	92.1 (0.26)	**1.0**
Very good	11.0 (0.22)	89.0 (0.22)	**1.4 (1.32–1.57)**
Good	13.4 (0.29)	86.6 (0.29)	**1.8 (1.67–1.98)**
Fair/poor	21.6 (0.59)	78.4 (0.59)	**3.2 (2.94–3.55)**
No. PY ER visits			
0+	10.6 (0.17)	89.4 (0.17)	1.0
1	15.8 (0.45)	84.2 (0.45)	**1.6 (1.48–1.71)**
2	17.7 (0.61)	82.3 (0.61)	**1.8 (1.67–1.99)**
≥ 3	27.9 (0.94)	72.1 (0.94)	**3.3 (2.98–3.61)**
Major depressive episode			
Yes	34.0 (0.82)	66.0 (0.82)	**4.2 (3.91–4.56)**
No+	10.9 (0.15)	89.1 (0.15)	1.0
Suicide ideation			
Yes	31.2 (0.93)	68.8 (0.93)	**3.4 (3.13–3.73)**
No+	11.7 (0.15)	88.3 (0.15)	1.0

(continued)

Table 1 (continued).

Characteristic	Adults With Benzodiazepine Use, Weighted % (SE)	Adults Without Benzodiazepine Use, Weighted % (SE)	Benzodiazepine Use vs No Use, OR (95% CI)[b]
Substance Use Problems			
Tobacco use and disorder			
Past-month nicotine dependence	21.4 (0.51)	78.6 (0.51)	**3.5 (3.16–3.76)**
PY tobacco use, no dependence	14.4 (0.32)	85.6 (0.32)	**2.1 (1.97–2.30)**
LT use, but no PY use	13.1 (0.27)	86.9 (0.27)	**1.9 (1.77–2.06)**
Never tobacco use+	7.3 (0.21)	92.7 (0.21)	1.0
Alcohol use and disorders			
PY alcohol use disorders	23.9 (0.73)	75.1 (0.73)	**4.8 (4.23–5.45)**
PY alcohol use, but no disorder	12.4 (0.18)	87.6 (0.18)	**2.2 (1.95–2.40)**
LT use, but no PY use	14.1 (0.44)	85.9 (0.44)	**2.5 (2.22–2.83)**
Never alcohol use+	6.1 (0.30)	93.9 (0.30)	1.0
Cannabis use and disorders			
PY cannabis use disorders	30.4 (1.26)	69.6 (1.26)	**5.1 (4.51–5.80)**
PY use, no disorder	22.8 (0.49)	77.2 (0.49)	**3.5 (3.21–3.70)**
LT use, no PY use	15.3 (0.28)	84.7 (0.28)	**2.1 (1.98–2.24)**
Never cannabis use+	7.9 (0.17)	92.1 (0.17)	1.0
Cocaine use and disorders			
PY cocaine use disorders	45.3 (3.44)	54.7 (3.44)	**7.4 (5.62–9.69)**
PY use, no disorder	39.0 (1.47)	61.0 (1.47)	**5.7 (5.03–6.45)**
LT use, no PY use	23.1 (0.54)	76.9 (0.54)	**2.7 (2.50–2.86)**
Never cocaine use+	10.1 (0.15)	89.9 (0.15)	1.0
Heroin use and disorders			
PY heroin use or disorders	60.5 (3.21)	39.5 (3.21)	**11.2 (8.59–14.53)**
LT use, no PY use	28.9 (1.67)	71.1 (1.67)	**3.0 (2.53–3.50)**
Never heroin use+	12.0 (0.15)	88.0 (0.15)	1.0
Hallucinogen use and disorders			
PY hallucinogen disorders	56.0 (4.92)	44.0 (4.92)	**11.3 (7.59–16.67)**
PY use, no disorder	34.6 (1.35)	65.4 (1.35)	**4.7 (4.14–5.29)**
LT use, no PY use	22.9 (0.49)	77.1 (0.49)	**2.6 (2.47–2.80)**
Never hallucinogen use+	10.1 (0.15)	89.9 (0.15)	1.0
Inhalant use and disorders			
PY inhalant use/ use disorders	34.3 (2.41)	65.7 (2.41)	**4.1 (3.35–5.09)**
LT use, no PY use	24.3 (0.62)	75.7 (0.62)	**2.5 (2.36–2.74)**
Never inhalant use+	11.2 (0.16)	88.8 (0.16)	1.0
Rx opioid misuse and use disorders			
PY use disorders	60.4 (2.27)	39.6 (2.27)	**27.7 (22.75–33.69)**
PY misuse, no PY use disorder	36.1 (0.99)	63.9 (0.99)	**10.2 (9.20–11.38)**
PY use, lifetime misuse	30.6 (1.25)	69.4 (1.25)	**8.0 (6.99–9.10)**
PY use, no lifetime misuse	18.9 (0.34)	81.1 (0.34)	**4.2 (3.90–4.57)**
LT use, no PY use	9.0 (0.25)	91.0 (0.25)	**1.8 (1.63–1.94)**
Never use+	5.2 (0.17)	94.8 (0.17)	1.0
Rx stimulant misuse and use disorders			
PY misuse and use disorders	38.8 (1.24)	61.2 (1.24)	**5.4 (4.84–5.99)**
PY use, lifetime misuse	39.7 (2.79)	60.3 (2.79)	**5.6 (4.43–7.04)**
PY use, no lifetime misuse	29.7 (0.97)	70.3 (0.97)	**3.6 (3.26–3.95)**
LT use, no PY use	21.6 (0.85)	78.4 (0.85)	**2.3 (2.11–2.59)**
Never Rx stimulant use+	10.5 (0.16)	89.5 (0.16)	1.0

[a]Substance Abuse and Mental Health Services Administration requires that any description of overall sample sizes based on the restricted-use data files be rounded to the nearest 100, which is intended to minimize potential disclosure risk.
[b]Each bolded odds ratio or adjusted odds ratio is significantly different ($P < .05$) from the corresponding reference group (with + sign).
Abbreviations: CI = confidence interval, ER = emergency room, LT = lifetime, NH = non-Hispanic, NSDUH = National Survey on Drug Use and Health, OR = odds ratio, PY = past year, Rx = prescription, SE = standard error.
Symbol: + = reference group.

from 1 doctor. Supplementary Table 2 shows that the source for the most recent benzodiazepine misuse varied by the status of benzodiazepine use disorders. Compared to adults with benzodiazepine misuse without use disorders, adults with benzodiazepine use disorders were more likely to obtain them from doctors (40.8% vs 18.5%) or from drug dealers/strangers (16.7% vs 6.8%) and were less likely to obtain them from friends or relatives for free (20.9% vs 56.1%).

DISCUSSION

This is the first study using nationally representative data to examine the prevalence and correlates of benzodiazepine use, estimate the prevalence of misuse and use disorders among benzodiazepine users, and compare the correlates of benzodiazepine use without misuse to those of benzodiazepine misuse and use disorders. Based on NSDUH data, we found that the prevalence of benzodiazepine use

Table 2. Bivariable Multinomial Logistic Regression Model Showing Characteristics That Distinguish Benzodiazepine Misuse Without Use Disorders, Benzodiazepine Use Disorders, and Benzodiazepine Use Without Misuse Among Past-Year Adult Benzodiazepine Users in the United States, 2015–2016 NSDUH (N = 12,100[a])

Characteristic	Adults With Benzodiazepine Use Without Misuse, Weighted % (SE)	Adults With Benzodiazepine Misuse Without Disorders, Weighted % (SE)	Adults With Benzodiazepine Use Disorders, Weighted % (SE)	Benzodiazepine Misuse Without Use Disorders[b] vs Benzodiazepine Use Without Misuse, OR (95% CI)[c]	Benzodiazepine Use Disorders[b] vs Benzodiazepine Use Without Misuse, OR (95% CI)[c]
Sociodemographic Characteristics					
Age					
18–29 y	55.3 (0.99)	40.0 (0.95)	3.9 (0.35)	**9.7 (8.06–11.66)**	**11.3 (6.53–19.43)**
30–49 y	83.5 (0.63)	14.4 (0.60)	1.6 (0.21)	**2.3 (1.89–2.84)**	**3.1 (1.73–5.57)**
≥ 50 y+	92.4 (0.57)	6.9 (0.55)	0.6 (0.15)	1.0	1.0
Sex					
Men	76.7 (0.84)	20.8 (0.82)	1.9 (0.23)	**2.0 (1.72–2.22)**	**2.7 (1.32–5.46)**
Women+	86.5 (0.45)	12.0 (0.42)	1.2 (0.13)	1.0	1.0
Race/ethnicity					
NH white+	83.8 (0.45)	14.5 (0.43)	1.3 (0.13)	1.0	1.0
NH black	79.9 (1.52)	17.2 (1.40)	3.0 (0.62)	**1.2 (1.01–1.53)**	**2.4 (1.48–3.80)**
Hispanic	77.9 (1.77)	19.9 (1.69)	1.5 (0.37)	**1.5 (1.19–1.84)**	1.3 (0.75–2.15)
NH other	81.7 (1.69)	15.4 (1.54)	2.6 (0.63)	1.1 (0.85–1.40)	**2.0 (1.21–3.42)**
Education					
< High school+	81.1 (1.57)	16.3 (1.52)	2.0 (0.43)	1.0	1.0
High school	82.6 (0.82)	14.9 (0.77)	2.0 (0.28)	0.9 (0.70–1.15)	1.0 (0.56–1.66)
Some college	80.6 (0.68)	17.4 (0.65)	1.5 (0.20)	1.1 (0.85–1.36)	0.8 (0.45–1.25)
College graduate	86.4 (0.74)	12.5 (0.71)	0.8 (0.16)	**0.7 (0.56–0.93)**	**0.4 (0.20–0.66)**
Health insurance					
Private only+	81.4 (0.63)	17.1 (0.61)	1.3 (0.15)	1.0	1.0
Uninsured	61.6 (1.81)	31.8 (1.73)	3.4 (0.61)	**2.4 (1.99–2.84)**	**3.4 (2.14–5.29)**
Medicaid only	79.9 (1.06)	17.0 (1.00)	2.5 (0.32)	1.0 (0.86–1.20)	**2.0 (1.37–2.84)**
Other	92.8 (0.71)	6.2 (0.67)	0.7 (0.21)	**0.3 (0.25–0.41)**	**0.5 (0.27–0.94)**
Marital status					
Married+	91.9 (0.53)	8.3 (0.51)	0.5 (0.10)	1.0	1.0
Widowed	93.0 (1.22)	6.0 (1.14)	0.9 (0.44)	0.7 (0.46–1.07)	1.7 (0.59–4.91)
Divorced/separated	86.0 (1.01)	11.7 (0.95)	1.7 (0.34)	**1.5 (1.17–1.86)**	**3.6 (2.06–6.28)**
Never married	63.4 (0.94)	32.7 (0.90)	3.3 (0.31)	**5.6 (4.82–6.59)**	**9.2 (5.93–14.19)**
Employment status					
Full-time+	80.1 (0.64)	18.2 (0.62)	1.4 (0.17)	1.0	1.0
Part-time	77.2 (1.28)	21.0 (1.24)	1.4 (0.27)	**1.2 (1.02–1.41)**	1.1 (0.68–1.71)
Disabled for work	91.5 (1.01)	6.3 (0.90)	1.3 (0.39)	**0.3 (0.22–0.42)**	0.8 (0.43–1.57)
Unemployment	67.0 (2.33)	26.7 (2.18)	4.8 (0.97)	**1.8 (1.38–2.22)**	**4.2 (2.49–6.98)**
Other	88.2 (0.76)	10.3 (0.73)	1.2 (0.21)	**0.5 (0.43–0.61)**	0.8 (0.53–1.22)
Family income					
< $20,000	78.3 (0.99)	18.8 (0.93)	2.2 (0.33)	**1.5 (1.29–1.86)**	**2.5 (1.57–3.82)**
$20,000–$49,999	81.6 (0.80)	16.2 (0.77)	1.8 (0.22)	**1.3 (1.08–1.49)**	**1.9 (1.25–2.80)**
$50,000–$74,999	85.4 (1.01)	13.1 (0.94)	1.3 (0.33)	1.0 (0.80–1.20)	1.3 (0.72–2.42)
≥ $75,000+	85.4 (0.70)	13.4 (0.68)	1.0 (0.16)	1.0	1.0
Region					
Northeast	82.2 (1.09)	15.8 (1.04)	1.7 (0.30)	1.0 (0.78–1.19)	1.2 (0.68–2.00)
Midwest	84.1 (0.79)	14.3 (0.75)	1.4 (0.27)	0.9 (0.71–1.03)	1.0 (0.55–1.65)
South	83.2 (0.70)	14.9 (0.64)	1.5 (0.18)	0.9 (0.76–1.06)	1.0 (0.63–1.61)
West+	81.8 (1.02)	16.3 (0.94)	1.4 (0.28)	1.0	1.0
Metropolitan statistical area					
Large metro	81.8 (0.63)	16.3 (0.59)	1.5 (0.17)	**1.4 (1.17–1.68)**	1.2 (0.78–1.90)
Small metro	83.1 (0.75)	15.1 (0.70)	1.5 (0.21)	**1.3 (1.06–1.55)**	1.2 (0.73–1.90)
Non-metro+	85.8 (0.89)	12.1 (0.84)	1.3 (0.25)	1.0	1.0
Health Indicators					
Self-rated health					
Excellent+	80.0 (1.17)	18.3 (1.14)	1.5 (0.30)	1.0	1.0
Very good	79.8 (0.81)	18.5 (0.77)	1.3 (0.18)	1.0 (0.84–1.21)	0.9 (0.56–1.46)
Good	82.7 (0.79)	15.2 (0.76)	1.6 (0.23)	**0.8 (0.67–0.97)**	1.1 (0.66–1.76)
Fair/poor	88.7 (0.80)	9.3 (0.74)	1.5 (0.25)	**0.5 (0.36–0.57)**	0.9 (0.55–1.58)
No. PY ER visits					
0+	82.7 (0.56)	16.0 (0.54)	1.1 (0.13)	1.0	1.0
1	83.7 (0.90)	13.6 (0.84)	2.0 (0.29)	**0.8 (0.71–0.99)**	**1.8 (1.21–2.61)**
2	81.9 (1.23)	15.6 (1.16)	1.8 (0.35)	1.0 (0.82–1.19)	**1.6 (1.02–2.63)**
≥ 3	82.3 (1.44)	14.2 (1.28)	2.7 (0.66)	0.9 (0.71–1.12)	**2.5 (1.42–4.29)**
Major depressive episode					
Yes	78.3 (1.05)	16.9 (0.92)	3.9 (0.46)	**1.2 (1.06–1.43)**	**4.2 (3.03–5.86)**
No+	84.0 (0.45)	14.8 (0.44)	1.0 (0.10)	1.0	1.0

(continued)

Table 2 (continued).

Characteristic	Adults With Benzodiazepine Use Without Misuse, Weighted % (SE)	Adults With Benzodiazepine Misuse Without Disorders, Weighted % (SE)	Adults With Benzodiazepine Use Disorders, Weighted % (SE)	Benzodiazepine Misuse Without Use Disorders[b] vs Benzodiazepine Use Without Misuse, OR (95% CI)[c]	Benzodiazepine Use Disorders[b] vs Benzodiazepine Use Without Misuse, OR (95% CI)[c]
Suicide ideation					
Yes	69.1 (1.56)	24.4 (1.44)	5.0 (0.70)	**2.1 (1.77–2.50)**	**5.6 (3.95–7.90)**
No+	84.4 (0.43)	14.2 (0.41)	1.1 (0.10)	1.0	1.0
Tobacco use and disorder					
Past-month nicotine dependence	71.8 (1.10)	23.6 (1.04)	3.5 (0.38)	**4.7 (3.68–5.87)**	**9.4 (4.90–17.40)**
PY tobacco use	72.4 (1.01)	25.1 (0.96)	2.0 (0.30)	**4.9 (3.90–6.14)**	**5.3 (2.72–10.35)**
LT use, but no PY use	89.6 (0.64)	9.6 (0.61)	0.6 (0.14)	**1.5 (1.18–1.93)**	1.3 (0.62–2.80)
Never tobacco use+	92.9 (0.64)	6.6 (0.62)	0.5 (0.15)	1.0	1.0
Alcohol use and disorders					
PY alcohol use disorders	57.6 (1.61)	36.0 (1.55)	4.9 (0.56)	**10.4 (8.14–13.30)**	**5.9 (3.65–9.61)**
PY alcohol use, no disorders	83.6 (0.52)	15.3 (0.51)	0.9 (0.11)	**3.0 (2.42–3.79)**	0.8 (0.48–1.21)
LT use, no PY use; never use+	92.7 (0.63)	5.6 (0.54)	1.3 (0.28)	1.0	1.0
Cannabis use and disorders					
PY cannabis use disorders	38.7 (2.48)	48.7 (2.51)	9.2 (1.35)	**13.6 (10.74–17.32)**	**26.9 (16.95–42.58)**
PY use, no disorder	64.2 (1.11)	32.6 (1.08)	2.6 (0.30)	**5.5 (4.77–6.35)**	**4.6 (3.17–6.55)**
LT use, no PY use; never use+	90.7 (0.41)	8.4 (0.38)	0.8 (0.11)	1.0	1.0
Cocaine use and disorders					
PY cocaine use disorders	32.1 (4.68)	48.6 (4.88)	13.7 (2.84)	**13.9 (8.73–22.18)**	**52.2 (28.91–94.12)**
PY use, no disorder	38.4 (2.31)	56.1 (2.27)	4.4 (0.80)	**13.5 (10.83–16.76)**	**14.2 (8.80–22.80)**
LT use, no PY use	76.8 (0.92)	20.1 (0.89)	2.3 (0.31)	**2.4 (2.09–2.78)**	**3.7 (2.57–5.38)**
Never cocaine use+	89.4 (0.42)	9.7 (0.40)	0.7 (0.09)	1.0	1.0
Heroin use and disorders					
PY heroin use or disorders	42.9 (3.85)	40.5 (3.54)	12.7 (2.18)	**5.8 (4.12–8.05)**	**23.6 (14.60–38.06)**
LT use, no PY use	55.3 (3.26)	35.2 (3.08)	6.7 (1.44)	**3.9 (2.92–5.17)**	**9.7 (5.81–16.09)**
Never heroin use+	84.8 (0.41)	13.9 (0.36)	1.1 (0.10)	1.00	1.0
Hallucinogen use and disorders					
PY hallucinogen use/disorders	32.8 (2.06)	59.1 (2.05)	6.6 (0.88)	**19.3 (15.49–24.03)**	**29.4 (19.29–44.69)**
LT use, no PY use	72.5 (0.92)	23.9 (0.91)	2.7 (0.33)	**3.5 (3.06–4.07)**	**5.5 (3.71–8.09)**
Never hallucinogen use+	90.8 (0.41)	8.5 (0.40)	0.6 (0.09)	1.0	1.0
Inhalant use and disorders					
PY inhalant use/ use disorders	33.7 (3.97)	56.8 (4.29)	6.5 (1.89)	**13.0 (8.95–18.90)**	**15.8 (8.27–30.24)**
LT use, no PY use	65.3 (1.32)	30.4 (1.31)	3.2 (0.36)	**3.6 (3.09–4.16)**	**4.0 (2.88–5.46)**
Never inhalant use+	87.4 (0.42)	11.3 (0.38)	1.1 (0.12)	1.0	1.0
Rx opioid misuse and use disorders					
PY use disorders	39.8 (2.79)	34.2 (2.60)	19.6 (2.24)	**3.6 (2.71–4.88)**	**31.9 (19.34–52.64)**
PY misuse, no PY use disorder	45.3 (1.65)	51.7 (1.65)	2.4 (0.39)	**4.8 (4.02–5.82)**	**3.5 (2.12–5.76)**
PY use, lifetime misuse	73.9 (1.93)	23.0 (1.83)	1.9 (0.53)	**1.3 (1.03–1.68)**	1.7 (0.87–3.31)
PY use, no lifetime misuse	94.6 (0.40)	4.9 (0.39)	0.4 (0.10)	**0.2 (0.18–0.27)**	**0.3 (0.16–0.52)**
LT use, no PY use	91.1 (0.86)	8.7 (0.86)	0.2 (0.07)	**0.4 (0.31–0.52)**	**0.1 (0.04–0.29)**
Never use+	79.9 (1.06)	18.8 (1.03)	1.2 (0.24)	1.0	1.0
Rx stimulant misuse and use disorders					
PY misuse and use disorders	33.6 (1.86)	58.0 (1.91)	5.5 (0.78)	**12.9 (10.70–15.43)**	**12.4 (8.40–18.21)**
PY use, lifetime misuse	52.1 (4.48)	42.6 (4.49)	5.1 (1.57)	**6.1 (4.15–8.88)**	**7.4 (3.77–14.68)**
PY use, no lifetime misuse	86.6 (1.18)	11.3 (1.12)	1.7 (0.37)	1.0 (0.76–1.23)	1.5 (0.91–2.42)
LT use, no PY use	85.3 (1.38)	13.9 (1.36)	0.6 (0.23)	1.2 (0.95–1.55)	0.5 (0.22–1.17)
Never use+	87.0 (0.46)	11.7 (0.43)	1.2 (0.13)	1.0	1.0

[a]Substance Abuse and Mental Health Services Administration requires that any description of overall sample sizes based on the restricted-use data files be rounded to the nearest 100, which intends to minimize potential disclosure risk.
[b]Benzodiazepine use disorders are defined as adults who misused benzodiazepine-only tranquilizers in the past year and had Rx tranquilizer use disorders or who misused benzodiazepine-only sedatives in the past year and had Rx sedative use disorders.
[c]Each bolded odds ratio is significantly different ($P < .05$) from the corresponding reference group (with + sign).
Abbreviations: CI = confidence interval, LT = lifetime, NH = non-Hispanic, NSDUH = National Survey on Drug Use and Health, OR = odds ratio, PY = past year, Rx = prescription, SE = standard error.
Symbol: + = reference group.

among US adults was 12.5% or approximately 30.5 million adults (annual averages during in 2015–2016), whereas based on the IMS data, we found that nearly 26 million adults were dispensed benzodiazepines in outpatient retail pharmacies in the United States in 2015. Because retail pharmacy data do not include adults obtaining benzodiazepines from hospitals, clinics, and other non-retail settings, the overall number of US adults who use benzodiazepines based on the NSDUH is expected to be greater than our IMS estimate. These estimates are higher than the 5.2% of adult benzodiazepine users in 2008 reported by Olfson et al[1] but consistent with a prior study showing upward trends in benzodiazepine use during 2002–2014.[12]

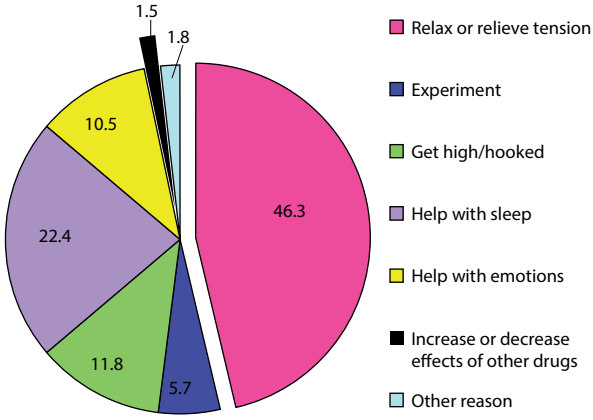
Benzodiazepine use was associated with several indicators of poor general health and mental health problems, as well as substance use disorders of all substances assessed. While some of these correlates may be related to clinical reasons for prescribing benzodiazepines, others are causes for concern.

For instance, the associations of benzodiazepine use with alcohol and opioid use and use disorders are particularly worrisome because of the risk for drug interactions and increased overdose risk when these substance are combined. Adults who use benzodiazepines should be assessed at baseline and on an ongoing basis for a broad range of psychiatric and general medical conditions. The high prevalence of benzodiazepine use and the high number of individuals with untreated anxiety disorders and insomnia in the United States[25,26] suggest the need for more effective treatments and better access to high-quality, evidence-based treatments for these disorders.

Among adults who used benzodiazepines, only 1.5% met criteria for benzodiazepine use disorders, suggesting that most patients are unlikely to become addicted to benzodiazepines. However, because benzodiazepines are widely used, even a low prevalence of benzodiazepine use disorder among benzodiazepine users results in large absolute numbers of individuals with benzodiazepine use disorders in the general adult population. Our results suggest that younger users, socioeconomically disadvantaged users, and those with psychopathology (particularly substance use disorders) are at increased risk for benzodiazepine misuse, use disorders, and associated harms. Furthermore, compared to persons who misused without a use disorder, persons with benzodiazepine use disorder were more likely to report addiction-related motivations for benzodiazepine use and to report direct access through their own prescriptions as the sources for their pills. These findings suggest the importance of screening for benzodiazepine use disorders as well as targeted preventive and early interventions, without unduly restricting access for individuals with legitimate medical need for benzodiazepines.

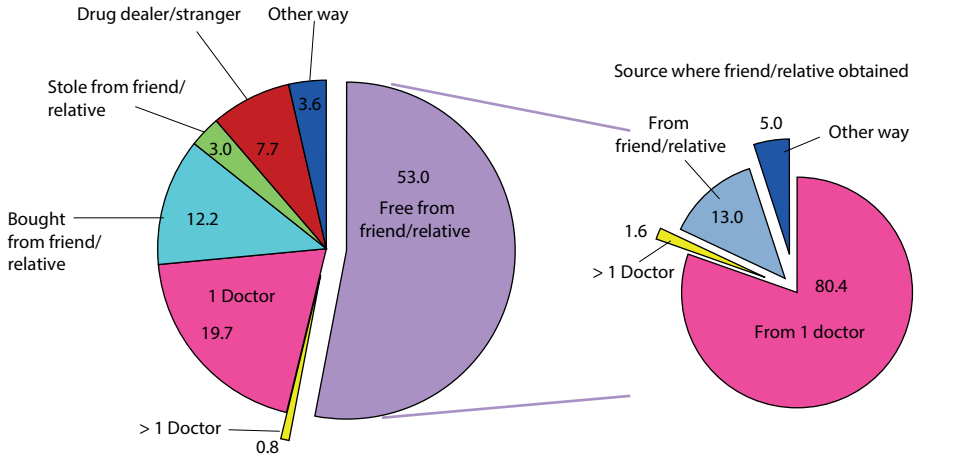
Of particular importance with respect to benzodiazepine-related harms are the strong associations between benzodiazepine misuse and use disorders with heroin and prescription opioid use disorders, which may help explain the increased risk of lethal overdoses associated with combined opioid and benzodiazepine use.[11,12] The strong associations of benzodiazepine misuse and use disorders with cannabis use and cannabis use disorders are also of considerable interest, given the evolving legal landscape of cannabis use and increases in the prevalence of cannabis use[27,28] and cannabis use disorders in the United States.[28] The association with cocaine use disorders may reflect the use of benzodiazepines to modify its effects. Moreover, MDE and suicidal ideation were associated with increased odds of benzodiazepine use disorders. Our findings suggest the need to screen for benzodiazepine use disorders among adults with mental disorders, particularly substance use disorders; to screen for other mental disorders among adults taking benzodiazepines; and to ensure that all mental disorders,

Figure 2. Main Reason for Misusing Benzodiazepine the Most Recent Time in the Past Year Among US Adults With Past-Year Benzodiazepine Misuse Whose Last Prescription Tranquilizer or Sedative Misuse Was Benzodiazepine, 2015–2016, Annual Average Weighted Percentage (n = 2,900)



5.2 Million adults with past-year benzodiazepine misuse

Figure 3. Most Recent Source of Benzodiazepine Among US Adults With Past-Year Benzodiazepine Misuse Whose Last Prescription Tranquilizer or Sedative Misuse Was Benzodiazepine, 2015–2016, Annual Average Weighted Percentage (n = 2,800)



including co-occurring substance use disorders, are properly treated using evidence-based approaches.

While benzodiazepine use was associated with women, probably due to greater prevalence of anxiety disorders[29] and higher probability of treatment seeking among women than among men,[25] benzodiazepine use disorders were associated with men, possibly reflecting the greater prevalence of substance use disorders among men.[30] Increasing prevalence of benzodiazepine use with age may be due to long-term use of benzodiazepines among those who start them,[1] whereas age-related decreases in the odds of benzodiazepine use disorders are consistent with greater impulsivity[31] and rates of substance use disorders among younger individuals.[32] Being divorced or separated or being never married was also associated with benzodiazepine use disorders, consistent with findings for other substance use disorders.[32]

Among benzodiazepine users, 17.1% reported misusing benzodiazepines at least once in 2015. Less than 20% of these individuals reported that their main motivation for their most recent misuse was to experiment, get high, or modify the effect of other drugs, whereas more than two thirds reported that their main reason for misuse was to help sleep or to relieve tension, suggesting that better management of insomnia and anxiety symptoms could have a substantial effect on reducing benzodiazepine misuse. Cognitive-behavioral therapy, selective serotonin reuptake inhibitors, and other evidence-based antianxiety medications may be particularly useful for these patients.[33]

Among benzodiazepine misusers, 20.5% obtained them directly from a doctor, whereas 53.0% obtained them from a friend or relative for free, 80.4% of whom, in turn, obtained them from a doctor. Our results, consistent with the findings on sources of prescription opioids that are misused, underscore the importance of interventions targeting medication sharing, selling, and diversion.[34,35] Other important interventions include routine use of prescription drug–monitoring programs to identify patients who have aberrant prescription patterns suggesting misuse of benzodiazepines or other controlled substances, and screening patients for increased risk for misusing prescription medications before prescribing benzodiazepines.

Better training of primary care physicians, who prescribe the majority of benzodiazepine prescriptions, is essential to achieve these goals.[1] Furthermore, because only about 10% of individuals with substance use disorders receive substance use disorder treatment in any given year,[35] primary care physicians are crucial to identify, motivate for treatment, and refer individuals who misuse benzodiazepines to appropriate treatment. Recently approved Medicare payments for behavioral health integration may also facilitate consultations between primary care physicians and psychiatrists for the management of complex patients.[36]

This study has several limitations. First, because of the cross-sectional nature of NSDUH, this study cannot establish causal relationships. Second, some CIs around the strong associations with other substance use disorders are wide, resulting from bivariable analyses, which are suggestive of moderators of these associations. Third, our analyses are based on *DSM-IV* criteria. Analyses based on *DSM-5* criteria may have yielded different results.

In conclusion, while benzodiazepine use is highly prevalent among US adults, benzodiazepine use disorders are relatively rare among benzodiazepine users. Benzodiazepine misuse is more common and appears related to attempts to relieve symptoms of tension or to help with sleep, suggesting that improved treatment of these symptoms might decrease benzodiazepine misuse. The most common sources of misused benzodiazepines are friends or relatives who give them to friends or relatives for free or sell them to the individual who misuses them. Our results help to better characterize benzodiazepine users, identify adults at risk for misuse and use disorders, and stimulate further research to prevent diversion and misuse of benzodiazepines.

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Supplementary Material

Article Title: Prevalence and Correlates of Benzodiazepine Use, Misuse, and Use Disorders Among Adults in the United States

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List of Supplementary Material for the article

1. **Table 1** Main Motivation for Benzodiazepine Misuse Among Adults With Past 12-Month Misuse and Use Disorder Whose Last Prescription Tranquilizer or Sedative Misuse Was Benzodiazepine

2. **Table 2** Source of Benzodiazepine Obtained for the Most Recent Episode of Misuse Among Adults With Past 12-Month Misuse and Use Disorders Whose Last Prescription Tranquilizer or Sedative Misuse Was Benzodiazepine

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Supplementary Table 1. Main motivation for benzodiazepine misuse among adults with past 12-month misuse and use disorder whose last prescription tranquilizer or sedative misuse was benzodiazepine

Main motivation for misuse	Among adults reporting misuse without use disorder (n=2,600[a]) Weighted % (SE)	Among adults reporting benzodiazepine use disorder (n=300[a]) Weighted % (SE)
Relax or relieve tension	47.1 (1.42)[b]	38.2 (4.14)
Experiment; get high; hooked; increase/decrease effects of other drugs	18.5 (0.95)[b]	24.6 (3.18)
Help with sleep	23.1 (1.29)[b]	14.9 (3.11)
Help with emotions	9.6 (0.78)[b]	20.3 (3.16)
Other reasons	1.8 (0.40)	2.1 (0.91)

[a] SAMHSA requires that any description of overall sample sizes based on the restricted-use data files has to be rounded to the nearest 100, which intends to minimize potential disclosure risk. [b]The estimate is statistically different from the corresponding estimate for those with benzodiazepine use disorders (p<0.05). Abbreviation: SE= standard error.

Supplementary Table 2. Source of benzodiazepine obtained for the most recent episode of misuse among adults with past 12-month misuse and use disorders whose last prescription tranquilizer or sedative misuse was benzodiazepine

Source for the most recent episode of misuse	Adults reporting misuse without use disorder (n=2,600[a]) Weighted % (SE)	Adults reporting benzodiazepine use disorder (n=300[a]) Weighted % (SE)
Free from friend/relative	56.1 (1.43)[b]	20.9 (3.31)
From doctor(s)	18.5 (1.28)[b]	40.8 (4.12)
Bought from friend/relative	11.8 (0.82)	16.3 (2.84)
From drug dealer/stranger	6.8 (0.70)[b]	16.7 (2.68)
Took from friend/relative without asking	3.0 (0.44)	2.3 (1.20)
Other ways	3.8 (0.51)	2.9 (1.15)

[a] SAMHSA requires that any description of overall sample sizes based on the restricted-use data files has to be rounded to the nearest 100, which intends to minimize potential disclosure risk. [b] The estimate is statistically different from the corresponding estimate for those with benzodiazepine use disorders (p<0.05). Abbreviation: SE= standard error.