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PRESCRIPTION TRANQUILIZER/SEDATIVE MISUSE PREVALENCE AND CORRELATES ACROSS AGE COHORTS IN THE US

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Abstract

Background: Prescription tranquilizer/sedative (e.g., alprazolam, zolpidem) misuse (i.e., use in ways not intended by the prescriber or without a prescription) is understudied, with little research identifying misuse correlates. Identification of key correlates could identify subgroups more likely to engage in misuse, allowing for targeted treatment. This work examines tranquilizer/sedative use and misuse prevalence rates and misuse correlates across U.S. age cohorts, using nationally representative data.

Methods: Data were from the 2015–16 National Survey on Drug Use and Health (n=114,043). Analyses used design-based logistic regression for past-year tranquilizer/sedative misuse correlates across participants or those engaged in past-year use; past-month misuse correlates were also examined in those with past-year misuse.

Results: Young adults (18–25 years) had the highest prevalence of past-year and past-month tranquilizer/sedative misuse, with 42.8% of those with past-year use also engaged in misuse. Mental health correlates were associated with past-year misuse, while substance use, particularly opioid misuse, was associated with both past-year and past-month misuse. Substance use correlate strength was most likely to vary by age group, with older adults (65 years and older) having fewer significant correlates overall.

Conclusions: This work highlighted young adults and those with other substance use as most likely to engage in tranquilizer/sedative misuse. In particular, those endorsing suicidality and

reporting opioid misuse are a subgroup of concern, given their especially elevated rates of misuse and the increased risk for overdose imparted by tranquilizer/sedative medication. Workplace-based interventions for young adults and school-based universal prevention may be warranted to limit tranquilizer/sedative misuse in these groups.

Keywords

Tranquilizer; benzodiazepine; sedative; misuse; age cohorts

1. INTRODUCTION

Prescription drug misuse (PDM) has received increasing attention recently, with commentators labelling PDM as an epidemic (Kanouse & Compton, 2015; Von Korff & Franklin, 2016). Much of the focus has been on opioid PDM, given its outsized role in PDM prevalence and consequences, including overdose. As a result, prescription tranquilizer (i.e., primarily capturing benzodiazepine medication, such as alprazolam, used often for anxiety treatment) and sedative PDM (i.e., medications primarily indicated for insomnia, such as zolpidem) remains understudied (e.g., Maree, Marcum, Saghafi, Weiner, & Karp, 2016). In the US, tranquilizer/sedative use disorder treatment increased by 67% from 2003 to 2012 (SAMHSA, 2014), and adult fatal benzodiazepine overdose increased by over 400% from 1996 to 2013 (Bachhuber, Hennessy, Cunningham, & Starrels, 2016), with a nearly 300% increase due to benzodiazepine and opioid co-ingestion (Jones & McAninch, 2015). Data also indicate a 90% increase in US emergency department visits involving benzodiazepines from 2005 to 2011 (Day, 2014), with an increase of over 300% from benzodiazepine and opioid co-ingestion (Jones & McAninch, 2015).

Adolescent tranquilizer and sedative PDM is associated with poor psychosocial correlates, including major depression, poorer academic achievement, and problematic substance use (Hall, Howard, & McCabe, 2010; McCabe & West, 2014; Rigg & Ford, 2014; Schepis & Krishnan-Sarin, 2008). In adults, research on such misuse has occurred primarily in non-US samples (Fride Tvete, Bjorner, & Skomedal, 2015; McLarnon, Monaghan, Stewart, & Barrett, 2011; Nattala, Murthy, Thennarasu, & Cottler, 2014; Tahiri et al., 2017), with similarly concerning correlates.

Many aspects of tranquilizer/sedative PDM remain unexplored. No tranquilizer PDM research could be found comparing PDM and correlates across the lifespan in a US sample, with only one US study on zolpidem PDM (Schepis, 2014). Research evaluating tranquilizer/sedative PDM across the lifespan could have significant clinical utility, as characterization of older adults engaged in tranquilizer/sedative PDM could help prevent significant associated consequences (e.g., falls and fractures, neurocognitive impairments, and increased overdose risk; Airagnes, Pelissolo, Lavallee, Flament, & Limosin, 2016; Maree et al., 2016) by identifying those most likely to misuse. Identification of tranquilizer/sedative PDM correlates across age cohorts could establish whether correlates differ and require different foci by age, or are similar across ages, allowing for consistent prevention targets.

1.1 Aims

We aimed to fill these gaps in the literature through analyses of the 2015–16 National Survey on Drug Use and Health (NSDUH), with tranquilizer/sedative use and PDM combined, due to low sedative use/misuse prevalence and per previous research (Schepis & Hakes, 2013; Tetrault et al., 2008). First, we estimated the prevalence of lifetime and past-year tranquilizer/sedative use and PDM across six age groups: adolescents (12–17), young adults (18–25), and adults aged 26–34, 35–49, 50–64, and 65 and older. Second, we evaluated past-year tranquilizer/sedative misuse correlates across the population and in those engaged in any past-year tranquilizer/sedative use. Third, we examined past-month tranquilizer/sedative misuse correlates among those endorsing past-year misuse, with those 50 and older aggregated due to sample size concerns.

2. METHODS

The NSDUH is an annual survey of substance use and associated behaviors in a representative sample of the US non-institutionalized population. It uses an independent, multistage area probability sample with population-based weights to provide nationally-representative estimates. All sensitive questions (e.g., those on PDM) were asked via audio computer-assisted self-interviewing (ACASI) to maximize honest reporting, with skip-outs and consistency checks to promote full responding and data consistency. More information on the NSDUH, including on psychometrics, is available elsewhere (CBHSQ, 2016; 2017; SAMHSA, 2010).

2.1 Participants

For 2015–16, 114,043 respondents were included in the NSDUH public use files. Females composed 51.3% of the sample, with Caucasians (63.5%), Hispanic/Latinos (16.4%) and African-Americans (12.0%) comprising the three largest racial/ethnic groups (all weighted). For characteristics by age group, see online-only Supplemental Table A.

2.2 Measures

2.2.1 Primary Outcomes—To aid recall, the NSDUH used trade and generic drug names and medication pictures, including Xanax®, Valium® or alprazolam for tranquilizers, and Ambien®, Lunesta® or zolpidem for sedatives. Initially, *lifetime tranquilizer/sedative use* and *past-year tranquilizer/sedative use* were assessed. Then, in those with lifetime but not past-year use, only *lifetime tranquilizer/sedative misuse* was assessed; in those with past-year tranquilizer/sedative use, *past-year tranquilizer/sedative misuse* was assessed instead. For both timeframes, this instruction is used: “The next question asks about using [drug class] in any way a doctor did not direct you to use them...including: Using it without a prescription of your own; Using it in greater amounts, more often, or longer than you were told to take it; Using it in any other way a doctor did not direct you to use it.” *Past-month tranquilizer/sedative misuse* was assessed among respondents who reported past-year tranquilizer/sedative misuse.

2.2.2 Age Categories—*Current age* groups were restricted by the NSDUH public use file variables: the six-level CATAG6 variable used for the first three tables (ages 12–17, 18–

25, 26–34, 35–49, 50–64, and 65 and older) or the five-level CATAG3 variable for Table 4 (12–17, 18–25, 26–34, 35–49, and 50 and older).

2.2.3 Correlates—Correlate selection used previous PDM research, with greater attention to research assessing PDM by age cohort across the lifespan (e.g., Mowbray & Quinn, 2015; Schepis, 2014) and past work on tranquilizer/sedative misuse (e.g., Boyd, West, & McCabe, 2018; Rigg & Ford, 2014). Correlates were grouped into sociodemographics, physical health, mental health, and substance use.

Sociodemographics: *sex, ethnicity* (white versus non-white), *poverty status, metro area size, educational status or attainment* (currently in school/college graduate versus not in school/non-college graduate), and *religiosity*. Religiosity was a four-item variable used by Gruzca et al. (2016) with good psychometrics ($\alpha > 0.9$ for 2015–16).

Physical health: *self-reported health* (poor versus fair to excellent), *overweight/obese body mass index* (BMI; ≥ 25), and *past-year hospitalization*.

Mental health: *past-year major depression, past-year mental health treatment, past-year serious psychological distress (SPD; adult only), past-year level of impairment from mental health symptoms* (adult only), and *past-year suicidal ideation* (adult only). Major depression was assessed based on the DSM-IV (American Psychiatric Association [APA], 2000), with good psychometrics (Zanarini & Frankenburg, 2001). SPD comes from the K6 assessment (Kessler et al., 2003) for the worst month in the past year. Scores ≥ 13 (of 24) are positive for SPD. Past-year mental health-related impairment comes from the World Health Organization's Disability Assessment Scale (*WHODAS*), a continuous 13-item assessment in the NSDUH (CBHSQ, 2016; Novak, Colpe, Barker, & Gfroerer, 2010). Suicidal ideation is queried by asking adults if in the past year “did you seriously think about trying to kill yourself?”

Substance use: *past-month binge drinking, past-year marijuana use, past-year prescription opioid use, past-year prescription stimulant use, past-year prescription opioid misuse, past-year prescription stimulant misuse, and past-year any DSM-IV substance use disorder (SUD) diagnosis*. Past-month binge drinking was an occasion (“at the same time or within a couple of hours”) of consuming 5/4 (men/women) or more alcoholic drinks. Prescription opioid or stimulant use and PDM were assessed via similar questions to those for tranquilizers/sedatives (above). Past-year SUD is assessed using DSM-IV criteria (APA, 2000), with strong psychometrics (SAMHSA, 2010).

2.3 Analyses

Analyses utilized STATA 15.1 (College Station, TX). Data were weighted, clustered on primary sampling units, and stratified; adjusted person-level weights (weight/2) created unbiased population-based estimates. The Taylor series approximation, with adjusted degrees of freedom, was used to create robust variance estimates. Initial analyses (Table 1) employed weighted cross-tabulations to estimate prevalence and 95% confidence intervals

for tranquilizer/sedative use and PDM; Bonferroni-corrected *post hoc* design-based logistic regressions tested for age cohort-based differences.

Further analyses used design-based logistic regression to examine the relationships between correlates and tranquilizer/sedative use and tranquilizer/sedative PDM. Correlates were entered in a univariable fashion for each age group, followed by analysis across the age groups including an interaction term (i.e., correlate * age groups) to examine whether correlate strength varied by age group. These analyses examined correlates of past-year tranquilizer/sedative PDM across the population (Table 2) and in only those endorsing past-year tranquilizer/sedative use (use= 0, PDM= 1; Table 3). Finally, analyses examined past-month tranquilizer/sedative PDM correlates in those endorsing past-year tranquilizer/sedative misuse (Table 4). Analyses for physical health, mental health and substance use correlates controlled for the sociodemographics.

3. RESULTS

3.1 Tranquilizer/Sedative Use and Misuse Prevalence by Age Group

Per Table 1, adolescents aged 12–17 had the lowest lifetime and past-year tranquilizer/sedative use prevalence rates (7.9% and 6.0%, respectively), with the highest rates in adults aged 50–64 (37.2% and 22.8%, respectively) or 65 and older (35.3% and 21.9%, respectively). Conversely, tranquilizer/sedative PDM prevalence across age cohorts displayed an inverted U-shaped pattern: adults aged 65 and older had the lowest rates (lifetime: 2.2%, past-year: 0.9%), followed by adolescents (lifetime: 2.3%, past-year: 1.9%). Lifetime misuse rates were highest in adults aged 26–34 (8.1%), but past-year and past-month tranquilizer/sedative PDM rates were highest in young adults aged 18–25 (5.8% and 1.8%, respectively).

One of every 2.4 young adults (or 41.3%) endorsing lifetime and 1 of every 2.3 young adults (or 42.8%) endorsing past-year tranquilizer/sedative use also engaged in misuse (the NSDUH does not separate use from combined PDM and use). Conversely, adults 65 and older who used tranquilizer/sedative medication were least likely to engage in lifetime (6.3%) or past-year (4.2%) PDM.

3.2 Past-Year Tranquilizer/Sedative Misuse Correlates by Age Group Across the Population

White ethnicity was associated with elevated odds of past-year tranquilizer/sedative misuse in three of six age groups (18–25, 26–34, 35–49; please see Table 2). In contrast, male sex (18–25, 26–34, 35–49), being in school or a college graduate (12–17, 18–25, 26–34, 35–49) and higher levels of religiosity (except those 65 and older) were associated with lowered odds of past-year tranquilizer/sedative misuse in at least three groups. White ethnicity, poverty status, metro area residence and being in school or a college graduate all interacted with age group, suggesting different relationships by age.

Self-reported poor physical health and past-year hospitalizations were associated with increased odds of past-year tranquilizer/sedative misuse in three (18–25, 26–34, 35–49) or four age groups (12–17, 18–25, 35–49, 50–64), respectively. Increased odds were also found

in the five mental health outcomes examined across ages, except for past-year SPD or suicidality in adults 65 and older; odds were highest for past-year suicidal ideation in three of five groups. Similarly, all examined substance use outcomes were associated with increased past-year tranquilizer/sedative misuse odds, except for binge drinking in adults 65 and older. The greatest odds elevations were for opioid PDM, with at least 15 times greater odds for each age group. All physical health, mental health (except for past-year SPD) and substance use correlates evidenced a significant interaction with age group.

Additional analyses of past-year tranquilizer/sedative PDM, opioid PDM, and suicidal ideation found increasing suicidality with increasing PDM engagement. As captured in Figure 1, only 3.4% of those without PDM endorsed past-year suicidal ideation, while 11.8% endorsing opioid-only PDM and 12.6% endorsing tranquilizer/sedative-only PDM endorsed suicidal ideation. In contrast, 20.8% of those engaged in both opioid and tranquilizer/sedative PDM endorsed past-year suicidal ideation.

3.3 Past-Year Tranquilizer/Sedative Misuse Correlates by Age Group among Those Engaged in Past-Year Use

After restricting the sample to only those endorsing any past-year tranquilizer/sedative use ($n=16,883$; Table 3), a similar pattern emerged to that for correlates across the population. In particular, male sex and religiosity were protective against past-year tranquilizer/sedative misuse among those with any past-year use, with five age groups evidencing significantly lowered odds (all groups except adolescents and adults 65 and older, respectively). Educational enrollment/attainment was associated with lower odds of past-year misuse among all engaged in use in three groups (12–17, 18–25, 26–34), while white race/ethnicity conferred increased odds in three age groups (18–25, 26–34, 35–49). All examined sociodemographic correlates, except for sex, significantly interacted with age group.

Physical health correlates were generally not associated with past-year tranquilizer/sedative misuse in those with past-year use, while the examined mental health correlates were often associated with increased odds. This was especially true for the 26–34 and 35–49 age groups and for suicidal ideation. Conversely, receiving past-year mental health treatment was associated with lower misuse odds for three age groups: 12–17, 18–25 and 26–34. Substance use correlates were generally associated with increased odds of past-year tranquilizer/sedative misuse among those with past-year use. Relationships were less likely to be significant in adults 65 and older, and past-year opioid misuse often had the highest odds ratios. All physical health, mental health and substance use correlates (except for impairment from mental health symptoms and SUD diagnosis) evidenced a significant interaction with age group.

3.4 Past-Month Tranquilizer/Sedative Misuse Correlates by Age Group among Those Engaged in Past-Year Misuse

Notably fewer correlates were associated with past-month tranquilizer/sedative misuse among those with past-year misuse ($n=3,556$; Table 4). Living in a large metro area was associated with lower odds in three of five groups (12–17, 18–25, 26–34), and school enrollment (18–25, 35–49) and religiosity (35–49, 50 and older) were protective in two age

groups. Religiosity also interacted with age group. While the examined physical and mental health correlates generally were not associated with past-month tranquilizer/sedative misuse, the substance use correlates had some notable associations. Past-year opioid misuse was associated with elevated odds of past-month tranquilizer/sedative misuse across age groups, and past-year opioid misuse, past-year stimulant misuse and past-year SUD diagnosis interacted with age group.

4. DISCUSSION

This research found significant differences in tranquilizer/sedative use, misuse, and correlates of misuse by age. While older age was associated with higher lifetime and past-year tranquilizer/sedative use prevalence, lifetime misuse peaked in young adults aged 18–25 years (7.8%) and those aged 26–34 years (8.1%). Indeed, 41.3% of young adults reporting lifetime tranquilizer/sedative use also engaged in lifetime misuse. Past-year tranquilizer/sedative misuse was most likely in young adults, at 5.8%; 42.8% of all young adults engaged in past-year use also engaged in past-year misuse. Similar results were found in 18 year-old participants in the nationally-representative Monitoring the Future survey, with 44.9% of those with lifetime medical tranquilizer/sedative use also engaged in nonmedical misuse (McCabe, Veliz, Boyd, & Schulenberg, 2017). Young adults also had the highest rates of past-month misuse. Thus, young adults are most in need of tranquilizer/sedative misuse prevention and intervention efforts.

Across ages, females and those of white race/ethnicity had greater odds of tranquilizer/sedative PDM, while those in school or with college degrees and those with higher religiosity generally had lower odds. The finding that females had greater odds of tranquilizer/sedative PDM is at odds with most work indicating greater use across a variety of substances in men (e.g., Kuhn, 2015), but it is more consistent with the lack of clear sex differences in PDM (Han, Compton, Jones, & Cai, 2015; Saha et al., 2016). Physical health correlates did not consistently highlight tranquilizer/sedative PDM, perhaps because the predominant tranquilizer/sedative indications are for mental (e.g., anxiety and insomnia) and not physical health conditions.

In contrast, mental health correlates highlighted those engaged in past-year misuse within the general population, and substance use correlates were most effective at differentiating those endorsing past-year misuse from either the general population or the sample engaged in any past-year tranquilizer/sedative use. Both the mental health and substance use correlates evidenced a diminishing relationship with tranquilizer/sedative PDM in older age groups, especially those 65 and older and especially for the mental health correlates. This finding may be an issue of statistical power and/or it may reflect qualitative age-based differences in PDM processes. Opioid PDM was a particularly robust correlate of tranquilizer/sedative PDM across timeframes and age groups, consistent with Huang and colleagues (2006). The regular co-occurrence of opioid and tranquilizer/sedative PDM is a concerning finding, given their synergistic depressant effects and co-use in many intentional overdoses (McClure, Niles, Kaufman, & Gudim, 2017).

On a related note, perhaps most alarming was the near dose-response relationship between past-year tranquilizer/sedative and/or opioid PDM and suicidal ideation, with 8 to 9% increases in ideation for each medication class misused. This finding is consistent with past work linking opioid PDM to suicidal ideation in adolescents and adults (Ford & Perna, 2015; Guo et al., 2016; Zullig & Divin, 2012). The current work adds to the literature by linking tranquilizer/sedative PDM to suicidal ideation across the population, further highlighting the risk of such PDM, not least because of the overdose potential inherent in tranquilizer/sedative medication (Warner, Trinidad, Bastian, Minino, & Hedegaard, 2016).

Among older cohorts, the examined correlates had fewer significant relationships with past-year or past-month tranquilizer/sedative misuse. While substance use correlates were still most likely to be associated with misuse in those 65 and older, with opioid PDM remaining the most salient correlate, few correlates in general were significant in older adults. The relative lack of significant correlates could stem from at least two non-mutually exclusive factors. One, while fewer older adults engaged in tranquilizer/sedative misuse, the direction of the results were often the same as those found in younger groups. Thus, the limited significant findings likely result from lower statistical power in older adults.

Conversely, and as we (Schepis, 2014) and others (Maree et al., 2016) have speculated, older adult tranquilizer/sedative misuse processes may qualitatively differ from those in younger individuals. While the relationship directions were similar to those of younger groups, the magnitude was often lower. Older adults had the highest tranquilizer/sedative use prevalence, consistent with past research (Olfson, King, & Schoenbaum, 2015) and increasing rates of insomnia (Roth, 2007) and depression (where these medications may support antidepressants; Olfson et al., 2015). Despite this, older adults had the lowest PDM rates, supporting the idea of qualitative differences from younger groups. Maree et al. (2016) noted increased physical health conditions and insomnia in older adults as potential drivers of tranquilizer/sedative misuse. Insomnia is not assessed in the NSDUH, and other physical health conditions are poorly assessed. It may be that limited NSDUH physical health assessment obscured identification of correlates; furthermore, as insomnia increases with age (Roth, 2007), the lack of an insomnia assessment may have excluded a key older adult PDM correlate.

4.1 Limitations and Future Directions

First, the data are cross-sectional and self-report. Self-report bias was possible, and no causal inferences should be made. In particular, the data cannot indicate whether suicidal ideation preceded PDM or the converse. Nonetheless, research indicates that self-report substance use data are reliable and valid, though underreporting and participant misclassification is likely (Johnston & O'Malley, 1985; O'Malley, Bachman, & Johnston, 1983); in addition, use of medication pictures, numerous trade and generic medication names and ACASI methods reduce self-report bias (Center for Behavioral Health Statistics and Quality, 2014, 2015). Second, self-selection bias was likely, as some selected individuals refused participation in either the screening or interview phases. Third, while the NSDUH makes extra efforts to sample older adults in assisted living or other controlled access dwellings, older adults in non-household settings were probably undersampled

(Cunningham et al., 2015). Finally, insomnia is not assessed, physical health conditions are poorly assessed, and only limited (and generally past-year) mental health variables are assessed in the NSDUH, limiting the potential for understanding their relationships with tranquilizer/sedative misuse.

In addition to research addressing these limitations, future work that further explores the suicidal ideation and PDM interface would have great clinical value. Also, future work should address PDM of multiple tranquilizer/sedative medications and its correlates, as well as the influence of mental health treatment on these findings.

4.2 Clinical Implications and Summary

Young adults aged 18–25 and adults aged 26–34 are most likely to engage in tranquilizer/sedative misuse. Furthermore, younger individuals not currently in school or a college graduate evidenced increased misuse odds. Workplace-based interventions may be most efficacious in reaching these transitional-age groups (Bray, Galvin, & Cluff, 2011). A brief, internet-based intervention to limit workplace PDM (Lucas, Neeper, Linde, & Bennett, 2017) appears promising, but needs further evaluation. Combined school- and family-based prevention approaches that teach life skills and increase parental engagement are also recommended, as they cost-effectively delay PDM initiation through adolescence (Crowley, Jones, Coffman, & Greenberg, 2014). Finally, screening and brief motivational interviewing-based interventions that promote appropriate medication use should be considered, as they can lower opioid PDM risk and can be delivered by non-prescribers (Chang, Compton, Almeter, & Fox, 2015). More significant interventions may be needed (e.g., cognitive-behavioral therapy; Darker, Sweeney, Barry, Farrell, & Donnelly-Swift, 2015) for those with signs of PDM (e.g., early refill requests).

While older adults had the lowest tranquilizer/sedative PDM rates, despite the highest use rates, their increased likelihood of consequences makes them an important population for intervention. The American Geriatrics Society listed tranquilizer/sedative medications as generally inappropriate for older adult use (American Geriatrics Society Beers Criteria Update Expert Panel, 2015), and our finding of past-year use in nearly 22% of those 65 and older suggests that a first step is shifting to safer treatments for insomnia and anxiety, such as cognitive-behavioral therapies (Kaczurkin & Foa, 2015; Taylor & Pruiksma, 2014). Attention to opioid use and misuse may highlight older adults at-risk for tranquilizer/sedative PDM and is particularly warranted, given the risks associated with co-use of these medications (Sun et al., 2017). Finally, those with suicidal ideation and engaged in opioid misuse are a group of particular concern, given that tranquilizer/sedative medication potentiates the overdose risk of opioid medication (Park, Saitz, Ganoczy, Ilgen, & Bohnert, 2015).

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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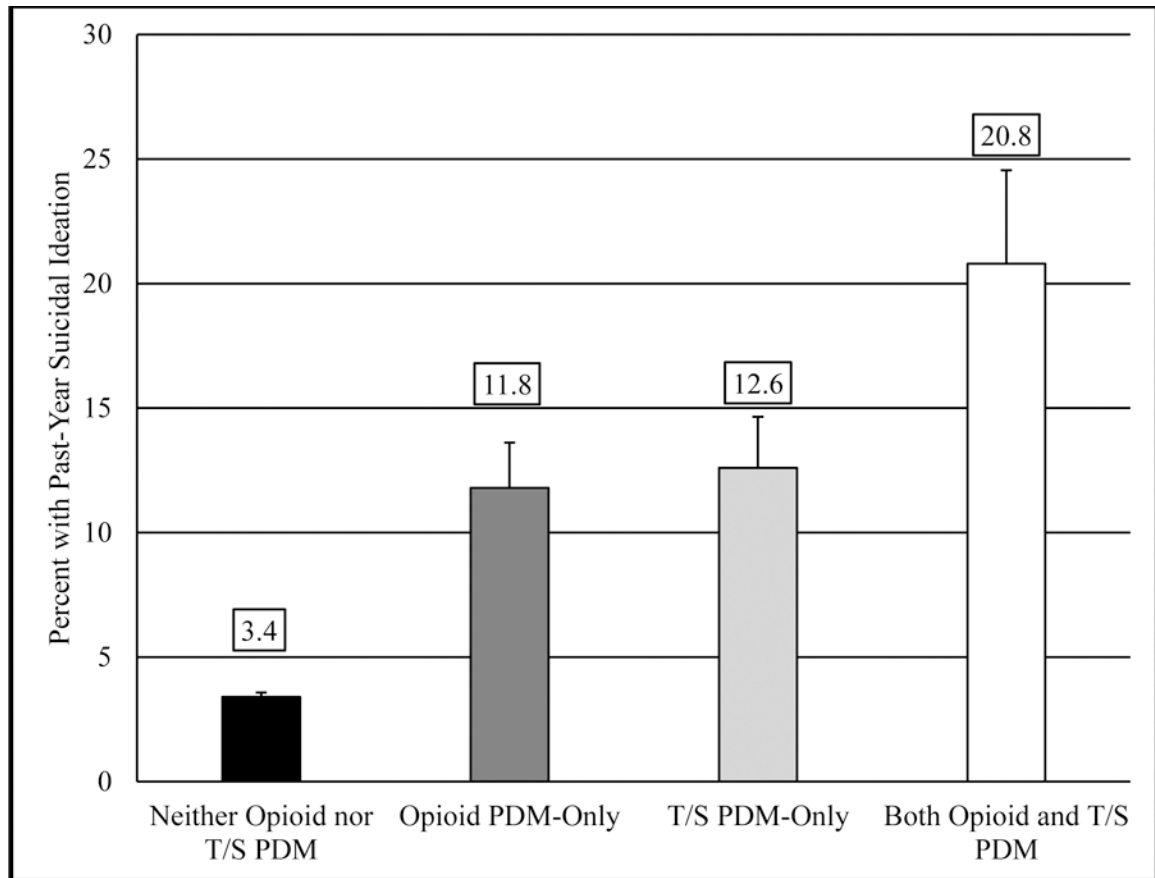


Figure 1.
Prevalence of Past-Year Suicidal Ideation by Past-Year Prescription Drug Misuse Status
Notes: Error bars represent 95% confidence intervals; T/S = Tranquilizer/Sedative

Prevalence of lifetime and past year sedative/tranquilizer use and lifetime, past year and past 30-day misuse by age group

Table 1.

	12–17 years (adolescents) (a)	18–25 years (young adults) (b)	26–34 years (c)	35–49 years (d)	50–64 years (e)	65 and older (f)	Post hoc Comparisons
Sample Size	27,857	28,213	17,835	22,530	10,398	7,210	
Lifetime use							
weighted % of population (95% CI)	2,229 7.9 (7.5–8.3)	5,388 19.0 (18.3–19.7)	4,871 27.3 (26.4–28.2)	7,395 31.6 (30.8–32.3)	3,901 37.2 (36.1–38.4)	2,549 35.3 (34.0–36.6)	a < b < c < f < d, e
Lifetime misuse							
weighted % of population (95% CI)	638 2.3 (2.1–2.5)	2,143 7.8 (7.4–8.3)	1,385 8.1 (7.6–8.6)	1,279 5.4 (5.1–5.8)	549 5.3 (4.8–5.9)	167 2.2 (1.8–2.7)	f < a < e < d < b < c
weighted % of those with lifetime use (95% CI)	29.6 (27.3–31.9)	41.3 (39.5–43.2)	29.6 (27.9–31.3)	17.2 (16.0–18.4)	14.3 (13.0–15.8)	6.3 (5.2–7.6)	f < e < d < a < b, c
Past year use							
weighted % of population (95% CI)	1,682 6.0 (5.6–6.4)	3,816 13.5 (13.0–14.0)	2,943 16.6 (15.9–17.3)	4,445 18.8 (18.2–19.4)	2,413 22.8 (21.8–23.8)	1,574 21.9 (20.7–23.1)	a < b < c; f; c, f < e
Past year misuse							
weighted % of population (95% CI)	523 1.9 (1.7–2.1)	1,543 5.8 (5.4–6.2)	687 4.0 (3.7–4.4)	541 2.4 (2.1–2.6)	197 1.9 (1.6–2.3)	65 0.9 (0.7–1.2)	f < a, e < d < b, c
weighted % of those with past-year use (95% CI)	31.4 (28.4–34.6)	42.8 (40.6–45.2)	24.2 (22.5–26.0)	12.6 (11.5–13.8)	8.4 (7.0–10.0)	4.2 (3.1–5.5)	b < a, c < d < e < f
Past 30-day misuse							
weighted % of population (95% CI)	171 0.7 (0.5–0.8)	471 1.8 (1.5–2.0)	232 1.4 (1.2–1.6)	205 0.9 (0.8–1.0)	62 0.5 (0.4–0.7)	18 0.3 (0.1–0.6)	f < a-e; a < b-d; d, e < b, c

Source: NSDUH, 2015–16 cohorts.

Notes: Post hoc comparisons controlled for race/ethnicity and sex and were only noted when the p-value was at or below a Bonferroni-corrected value of 0.00333 (0.05/15 = 0.00333). Unweighted samples and weighted percentages are provided, with 95% confidence intervals following the weighted percentages.

Table 2.

Correlates of past year prescription sedative/tranquilizer misuse by age group across the US population

	12-17 years (adolescents)	18-25 years (young adults)	26-34 years	35-49 years	50-64 years	65 and older	Interaction term
Sample Size	27,857	28,213	17,835	22,530	10,398	7,210	
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	
Sociodemographic Correlates							
Male Sex	1.14 (0.96-1.34)	0.76 (0.68-0.87)***	0.67 (0.57-0.80)***	0.83 (0.72-0.97)*	0.79 (0.62-1.03)	0.61 (0.37-1.03)	$t = -1.91, p = 0.062$
White Ethnicity	0.93 (0.77-1.12)	1.45 (1.26-1.66)**	1.46 (1.22-1.76)***	1.90 (1.58-2.29)***	0.92 (0.71-1.19)	0.76 (0.42-1.39)	$t = -3.85, p < 0.001$
Poverty	1.15 (0.92-1.44)	0.96 (0.86-1.06)	1.11 (0.92-1.33)	1.36 (1.10-1.69)**	1.76 (1.26-2.46)***	1.45 (0.51-4.11)	$t = 5.73, p < 0.001$
Large Metro Area	0.88 (0.74-1.05)	0.83 (0.75-0.93)**	0.90 (0.78-1.03)	0.94 (0.81-1.08)	1.20 (0.95-1.51)	1.78 (1.03-3.07)*	$t = 2.15, p = 0.036$
School/College Graduate	0.54 (0.42-0.70)***	0.66 (0.59-0.73)***	0.59 (0.51-0.68)***	0.77 (0.63-0.93)**	0.76 (0.55-1.06)	1.19 (0.68-2.07)	$t = 8.43, p < 0.001$
Religiosity	0.93 (0.91-0.95)***	0.92 (0.91-0.94)***	0.91 (0.90-0.93)***	0.92 (0.90-0.94)***	0.92 (0.90-0.96)***	0.98 (0.93-1.04)	$t = 0.65, p = 0.05$
Physical Health Correlates							
Self-reported Poor Health	1.47 (0.95-2.26)	1.30 (1.04-1.63)*	1.59 (1.19-2.12)**	1.65 (1.21-2.25)**	1.36 (0.85-2.18)	1.79 (0.95-3.36)	$t = -6.68, p < 0.001$
Overweight/Obese BMI	1.22 (0.89-1.67)	0.74 (0.66-0.84)***	0.81 (0.67-0.99)	0.92 (0.75-1.13)	1.07 (0.69-1.67)	1.24 (0.66-2.31)	$t = -13.07, p < 0.001$
Past-year Hospitalization	2.75 (1.97-3.85)***	1.46 (1.18-1.80)***	1.15 (0.86-1.54)	1.65 (1.21-2.24)**	1.64 (1.06-2.54)*	1.78 (0.93-3.43)	$t = -7.43, p < 0.001$
Mental Health Correlates							
Past-year Mental Health Treatment	2.66 (2.16-3.27)***	2.71 (2.25-3.27)***	2.86 (2.31-3.56)***	3.09 (2.92-4.65)***	3.98 (2.63-6.02)***	5.23 (3.02-9.05)***	$t = 2.42, p = 0.019$
Past-year Major Depression	2.78 (2.15-3.60)***	2.38 (2.01-2.83)***	3.13 (2.50-3.92)***	4.23 (3.32-5.38)***	3.52 (2.13-5.81)***	3.12 (1.20-8.10)*	$t = -2.08, p = 0.043$
Past-year Serious Psychological Distress		2.62 (2.25-3.04)***	3.20 (2.66-3.85)***	4.10 (3.25-5.18)***	3.45 (1.96-6.06)***	2.12 (0.84-5.89)	$t = -0.22, p = 0.830$
Past-year WHO Disability Assessment Scale		1.08 (1.07-1.09)***	1.10 (1.08-1.11)***	1.12 (1.10-1.13)***	1.14 (1.11-1.17)***	1.10 (1.04-1.16)***	$t = 20.01, p < 0.001$
Past-year Suicidal Ideation		2.98 (2.59-3.42)***	2.95 (2.26-3.85)***	4.94 (3.64-6.69)***	4.78 (2.50-9.12)***	2.83 (0.82-9.79)	$t = -4.68, p < 0.001$

	12–17 years (adolescents)	18–25 years (young adults)	26–34 years	35–49 years	50–64 years	65 and older	Interaction term
Substance Use Correlates							
Past-month Binge Alcohol Use	9.21 (7.07–12.00)***	3.03 (2.60–3.52)***	2.27 (1.86–2.76)***	2.28 (1.76–2.95)***	2.50 (1.80–3.47)***	2.14 (0.95–4.86)	$t = 2.06, p = 0.044$
Past-year Marijuana Use	19.61 (14.96–25.72)***	9.40 (8.04–10.98)***	5.90 (4.53–6.91)***	5.39 (4.32–6.72)***	3.22 (2.02–5.15)***	5.06 (2.08–12.33)***	$t = 9.21, p < 0.001$
Past-year Opioid Use	8.39 (6.23–11.28)***	5.43 (4.67–6.31)***	5.00 (4.11–6.08)***	4.74 (3.68–6.10)***	3.19 (2.22–4.58)***	3.91 (2.09–7.31)***	$t = 5.17, p < 0.001$
Past-year Stimulant Use	14.43 (10.95–19.03)***	7.08 (6.20–8.08)***	5.90 (4.56–7.12)***	5.47 (4.31–6.94)***	4.68 (3.06–7.15)***	3.77 (1.79–7.97)***	$t = -4.68, p < 0.001$
Past-year Opioid Misuse	31.05 (22.51–42.81)***	16.35 (13.99–19.11)***	18.89 (15.90–22.44)***	22.11 (17.66–27.67)***	16.15 (11.09–23.54)***	15.96 (6.21–41.03)***	$t = 14.30, p < 0.001$
Past-year Stimulant Misuse	29.52 (22.59–38.58)***	9.28 (7.96–10.81)***	9.69 (7.50–12.52)***	16.72 (11.16–25.03)***	16.15 (7.16–36.42)***	all cases engaged	$t = 5.26, p < 0.001$
Past-year DSM-IV SUD	25.47 (18.89–34.33)***	8.55 (7.24–10.10)***	7.01 (5.72–8.59)***	9.45 (7.76–11.52)***	8.71 (5.95–12.76)***	7.88 (3.17–19.58)***	$t = 11.22, p < 0.001$

Source: NSDUH, 2015–16 cohorts.

Notes: BMI = Body Mass Index; WHO = World Health Organization; SUD = Substance Use Disorder

Non-use or appropriate use was coded as 0, while misuse was coded as 1.

Listed odds ratios indicate the odds of the characteristic in the first column (e.g., male sex) being present in those engaged in past-year tranquilizer/sedative misuse, versus those not engaged in past-year misuse.

Table 3.

Correlates of past year prescription sedative/tranquilizer misuse by age group among past year sedative/tranquilizer users only

	12–17 years (adolescents) (a)	18–25 years (young adults) (b)	26–34 years (c)	35–49 years (d)	50–64 years (e)	65 and older (f)	Post Hoc Differences
Sample Size	1,682 OR (95% CI)	3,816 OR (95% CI)	2,943 OR (95% CI)	4,455 OR (95% CI)	2,413 OR (95% CI)	1,574 OR (95% CI)	
Sociodemographic Correlates							
Male Sex	1.01 (0.84–1.20)	0.53 (0.46–0.61)***	0.48 (0.40–0.58)***	0.68 (0.60–0.80)***	0.70 (0.54–0.92)*	0.60 (0.36–0.99)*	$t = 0.45, p = 0.66$
White Ethnicity	0.90 (0.74–1.08)	1.30 (1.14–1.48)***	1.25 (1.05–1.49)*	1.51 (1.26–1.84)***	0.79 (0.62–1.02)	0.66 (0.36–1.20)	$t = -23.76, p < 0.001$
Poverty	1.13 (0.89–1.45)	0.94 (0.83–1.08)	0.95 (0.78–1.16)	1.20 (0.96–1.50)	1.48 (1.03–2.11)*	1.56 (0.54–4.47)	$t = -17.43, p < 0.001$
Large Metro Area	0.95 (0.78–1.17)	0.90 (0.80–1.02)	1.01 (0.87–1.17)	1.05 (0.92–1.26)	1.34 (1.08–1.68)***	1.91 (1.09–3.34)*	$t = -16.83, p < 0.001$
In School/College Graduate	0.69 (0.51–0.94)*	0.77 (0.69–0.86)***	0.77 (0.65–0.91)**	0.93 (0.77–1.13)	0.93 (0.66–1.31)	1.23 (0.69–2.20)	$t = -17.91, p < 0.001$
Religiosity	0.94 (0.92–0.96)***	0.92 (0.90–0.93)***	0.91 (0.90–0.93)***	0.93 (0.91–0.95)***	0.94 (0.91–0.97)***	0.99 (0.93–1.05)	$t = -19.51, p < 0.001$
Physical Health Correlates							
Self-reported Fair or Poor Health	0.78 (0.48–1.28)	0.76 (0.56–1.03)	0.86 (0.62–1.20)	0.83 (0.59–1.16)	0.66 (0.42–1.04)	1.11 (0.55–2.23)	$t = -12.98, p < 0.001$
Overweight/Obese BMI	0.99 (0.68–1.46)	0.63 (0.54–0.73)***	0.81 (0.66–1.01)	0.83 (0.67–1.03)	1.12 (0.70–1.79)	1.34 (0.71–2.50)	$t = -19.80, p < 0.001$
Past-year Hospitalization	0.87 (0.57–1.32)	0.78 (0.61–1.01)	0.80 (0.58–1.12)	0.84 (0.61–1.14)	0.92 (0.59–1.43)	1.11 (0.55–2.23)	$t = -13.62, p < 0.001$
Mental Health Correlates							
Past-year Mental Health Treatment	0.76 (0.58–0.99)*	0.55 (0.44–0.67)***	0.59 (0.45–0.76)***	0.85 (0.67–1.08)	1.13 (0.77–1.67)	1.58 (0.92–2.74)	$t = -2.08, p = 0.043$
Past-year Major Depression	1.02 (0.74–1.41)	1.05 (0.86–1.29)	1.30 (1.01–1.67)*	1.64 (1.28–2.09)***	1.36 (0.82–2.27)	1.20 (0.45–3.21)	$t = -13.81, p < 0.001$
Past-year Serious Psychological Distress		1.10 (0.92–1.31)	1.42 (1.18–1.70)***	1.55 (1.20–2.01)***	1.42 (0.80–2.53)	0.80 (0.31–2.07)	$t = -10.77, p < 0.001$
Past-year WHO Disability Assessment Scale		1.01 (1.00–1.02)	1.02 (1.01–1.04)**	1.04 (1.02–1.05)***	1.06 (1.02–1.09)***	1.01 (0.95–1.07)	$t = 0.80, p = 0.427$
Past-year Suicidal Ideation		1.43 (1.16–1.77)***	1.45 (1.05–1.99)*	1.95 (1.38–2.75)***	2.27 (1.16–4.46)*	1.20 (0.33–4.36)	$t = -9.72, p < 0.001$
Substance Use Correlates							
Past-month Binge Alcohol Use	3.54 (2.46–5.09)***	2.25 (1.87–2.72)***	1.79 (1.47–2.18)***	1.92 (1.51–2.44)***	2.49 (1.72–3.60)***	1.91 (0.84–4.34)	$t = -5.73, p < 0.001$
Past-year Marijuana Use	7.52 (5.49–10.29)***	4.88 (3.97–6.01)***	3.44 (2.70–4.38)***	3.50 (2.77–4.41)***	1.95 (1.23–3.09)**	3.22 (1.13–9.18)*	$t = -2.72, p = 0.009$
Past-year Opioid Use	1.51 (1.09–2.09)*	1.60 (1.33–1.92)***	1.59 (1.25–2.03)***	1.55 (1.20–1.99)***	1.06 (0.72–1.58)	1.56 (0.82–2.97)	$t = -14.19, p < 0.001$

	12–17 years (adolescents) (a)	18–25 years (young adults) (b)	26–34 years (c)	35–49 years (d)	50–64 years (e)	65 and older (f)	Post Hoc Differences
Past-year Stimulant Use	2.64 (1.92–3.63)***	2.35 (1.94–2.84)***	2.49 (1.93–3.22)***	2.32 (1.78–3.03)***	1.94 (1.20–3.13)**	1.46 (0.63–3.37)	$t = -9.64, p < 0.001$
Past-year Opioid Misuse	6.03 (4.34–8.40)***	5.44 (4.44–6.66)***	8.15 (6.53–10.17)***	11.60 (9.08–14.82)***	7.90 (5.11–12.20)***	6.76 (2.57–17.82)***	$t = 2.17, p = 0.035$
Past-year Stimulant Misuse	7.08 (4.94–10.14)***	5.21 (4.13–6.57)***	5.56 (3.84–8.04)***	8.28 (5.38–12.75)***	7.39 (3.18–17.15)***	all cases engaged	$t = -5.17, p < 0.001$
Past-year DSM–IV SUD	8.11 (6.07–10.84)***	4.70 (3.75–5.89)***	4.16 (3.22–5.36)***	5.57 (4.47–6.94)**	6.17 (4.19–9.09)***	3.78 (1.35–10.59)*	$t = -0.70, p = 0.489$

Source: NSDUH, 2015–16 cohorts.

Notes: BMI = Body Mass Index; WHO = World Health Organization; SUD = Substance Use Disorder

*Appropriate use was coded as 0, while misuse was coded as 1. Non-tranquilizer/sedative users were not included.

†Listed odds ratios indicate the odds of the characteristic in the first column (e.g., male sex) being present in those engaged in past-year tranquilizer/sedative misuse, versus those engaged in past-year medical use only.

Table 4. Correlates of past month prescription sedative/tranquilizer misuse by age group among those engaged in past year misuse

	12–17 years (adolescents) (a)	18–25 years (young adults) (b)	26–34 years (c)	35–49 years (d)	50 years and older (e)	Post Hoc Differences
Sample Size	523	1,543	687	541	262	
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	
Sociodemographic Correlates						
Male Sex	1.76 (1.16–2.65)**	1.25 (0.97–1.61)	0.83 (0.64–1.08)	0.99 (0.72–1.35)	1.24 (0.76–2.03)	$t = -1.53, p = 0.13$
White Ethnicity	0.95 (0.68–1.35)	1.20 (0.96–1.50)	1.04 (0.73–1.46)	1.33 (0.89–2.00)	1.23 (0.70–2.15)	$t = -0.33, p = 0.74$
Poverty	1.04 (0.65–1.64)	1.22 (0.91–1.63)	1.08 (0.74–1.56)	1.26 (0.83–1.91)	0.96 (0.53–1.71)	$t = -1.44, p = 0.15$
Large Metro Area	0.65 (0.42–0.99)*	0.69 (0.52–0.92)*	0.57 (0.42–0.79)***	0.90 (0.66–1.21)	0.82 (0.57–1.17)	$t = -0.42, p = 0.68$
In School/College Graduate	1.60 (0.84–3.02)	0.60 (0.49–0.73)***	0.88 (0.65–1.20)	0.66 (0.44–0.99)*	1.03 (0.69–1.56)	$t = -0.95, p = 0.35$
Religiosity	1.02 (0.97–1.07)	0.98 (0.95–1.02)	0.98 (0.94–1.02)	0.94 (0.91–0.99)*	0.91 (0.86–0.96)**	$t = -4.61, p < 0.001$
Physical Health Correlates						
Self-reported Fair or Poor Health	1.22 (0.54–2.76)	1.57 (0.98–2.54)	2.30 (1.20–4.44)*	1.84 (1.00–3.37)*	0.86 (0.43–1.73)	$t = 0.96, p = 0.34$
Overweight/Obese BMI	1.02 (0.61–1.73)	1.14 (0.88–1.48)	1.21 (0.76–1.91)	0.86 (0.54–1.39)	1.03 (0.51–2.11)	$t = 0.17, p = 0.86$
Past-year Hospitalization	0.77 (0.36–1.63)	1.06 (0.66–1.68)	1.61 (0.87–2.99)	1.22 (0.60–2.49)	0.79 (0.37–1.68)	$t = 0.01, p = 0.99$
Mental Health Correlates						
Past-year Mental Health Treatment	0.98 (0.61–1.59)	1.21 (0.92–1.61)	1.36 (0.84–2.19)	1.75 (1.01–3.06)*	0.80 (0.40–1.60)	$t = 1.32, p = 0.19$
Past-year Major Depression	0.65 (0.43–0.98)*	0.88 (0.61–1.26)	1.25 (0.78–2.01)	1.26 (0.77–2.07)	0.78 (0.36–1.73)	$t = 0.46, p = 0.65$
Past-year Serious Psychological Distress		0.90 (0.65–1.24)	1.57 (1.05–2.33)*	1.32 (0.84–2.07)	1.23 (0.56–2.74)	$t = 2.31, p = 0.025$
Past-year WHO Disability Assessment Scale		1.00 (0.97–1.02)	1.02 (0.99–1.05)	1.02 (0.98–1.05)	1.01 (0.96–1.07)	$t = 1.48, p = 0.14$
Past-year Suicidal Ideation		0.99 (0.67–1.46)	1.44 (0.88–2.34)	0.94 (0.58–1.52)	1.25 (0.55–2.56)	$t = 1.38, p = 0.18$
Substance Use Correlates						
Past-month Binge Alcohol Use	1.80 (1.11–2.93)*	1.37 (1.02–1.83)*	0.90 (0.61–1.32)	1.34 (0.87–2.07)	1.15 (0.64–2.07)	$t = 0.90, p = 0.37$
Past-year Marijuana Use	1.66 (0.88–3.12)	1.29 (0.91–1.82)	1.76 (1.22–2.54)**	0.96 (0.56–1.66)	0.98 (0.41–2.38)	$t = 0.97, p = 0.34$
Past-year Opioid Use	1.80 (0.93–3.46)	1.68 (1.10–2.55)*	1.16 (0.71–1.90)	1.44 (0.91–2.29)	1.18 (0.53–2.61)	$t = 1.36, p = 0.18$
Past-year Stimulant Use	1.35 (0.91–2.02)	1.30 (0.99–1.71)	1.42 (0.93–2.18)	1.08 (0.64–1.82)	0.96 (0.39–2.40)	$t = 0.81, p = 0.42$
Past-year Opioid Misuse	1.89 (1.06–3.37)*	2.05 (1.45–2.90)***	1.85 (1.20–2.86)**	1.97 (1.21–3.19)**	2.99 (1.59–5.61)***	$t = 5.01, p < 0.001$

	12–17 years (adolescents) (a)	18–25 years (young adults) (b)	26–34 years (c)	35–49 years (d)	50 years and older (e)	Post Hoc Differences
Past–year Stimulant Misuse	1.79 (1.12–2.86)*	1.30 (0.96–1.76)	2.09 (1.38–3.17)***	1.56 (0.86–2.84)	1.61 (0.43–6.02)	<i>t</i> = 2.51, p = 0.015
Past–year DSM–IV SUD	1.56 (0.94–2.62)	1.64 (1.13–2.36)**	1.53 (1.05–2.25)*	1.48 (0.99–2.19)	1.80 (0.88–3.70)	<i>t</i> = 3.34, p = 0.002

Source: NSDUH, 2015–16 cohorts.

Notes: BMI = Body Mass Index; WHO = World Health Organization; SUD = Substance Use Disorder

Past–year, but not past–month, misuse was coded as 0, while past–month misuse was coded as 1. Non–tranquillizer/sedative users and appropriate users were not included.

Listed odds ratios indicate the odds of the characteristic in the first column (e.g., male sex) being present in those engaged in past–month tranquilizer/sedative misuse, versus those engaged in past–year, but not past–month, misuse.