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# Examining the link between nonmedical use of sedatives, tranquilizers, and pain relievers with dispositions toward impulsivity among college students

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## HIGHLIGHTS

- Impulsive trait-nonmedical depressant use relations vary by depressant type.
- Dispositions toward impulsivity differentially relate to depressant use by gender.
- Lumping of depressant substances should be avoided in future research.

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## ABSTRACT

*Background:* The association between impulsive dispositions and the use of the central nervous system (CNS) depressant alcohol has been examined extensively; however, the links between other depressant use (sedatives, tranquilizers, and pain relievers) and impulsivity have been less studied, and findings have been equivocal. This may be due, in part, to varying operationalizations of "impulsivity," as well as issues related to the lumping versus splitting of various depressant substances when assessing use. The effect of gender on the impulsivity-depressant use relation has also yielded mixed results and remains understudied. The current study sought to determine whether lumping versus splitting of depressant substances and distinct impulsivity-related dispositions, as well as participant gender, impact the depressant-impulsivity relation.
*Method:* Participants were 778 undergraduate students (72% female, 80% White, 23% Hispanic), who completed a battery of self-report assessments online, including the UPPS-P.
*Results:* Hierarchical linear models indicated that specific impulsive dispositions differentiated between users and non-users of specific depressant substances, and these relations varied by gender. For example, sensation seeking significantly differentiated between users and non-users of pain relievers for females only, whereas sensation seeking differentiated between users and non-users of tranquilizers among males but not females.
*Conclusions:* In addition to informing substance use research practices by providing evidence that lumping of depressant substances leads to loss of vital information, as well as demonstrating nuanced gender differences, findings can also inform screening and personality-targeted treatment practices.


## 1. Introduction

In the United States, emerging adults (i.e., 18–25 year olds; Arnett, 2000) are more likely to engage in nonmedical prescription drug use in comparison to any other age group, and three of the most frequently abused prescription types (i.e., tranquilizers, sedatives, opioids; Center for Behavioral Health Statistics and Quality [CBHSQ], 2015) are central nervous system depressants (Jann, Kennedy, & Lopez, 2014). Past-year prevalence of nonmedical depressant use (NMDU) among emerging adults are 2.8%, 1.2%, and 0.2%, for pain relievers, tranquilizers, and sedatives, respectively, and NMDU is linked to multiple odious outcomes within this population. In addition to potentiating risk of substance use disorders, NMDU is associated with multiple negative consequences, including academic impairment (i.e., analgesics and

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stimulants; Arria, O'Grady, Caldeira, Vincent, & Wish, 2008b), increased frequency of risky automobile-related behaviors (i.e., NMDU and stimulants; Laz, Shemontee, Rahman, & Berenson, 2013), transitioning to heroin use (particularly among opioid users; Cicero, Ellis, Surratt, & Kurtz, 2014), and unintended overdose (see Jann et al., 2014). Recent data indicate that overdose rates are increasing (Centers for Disease Control and Prevention [CDC], 2016), with most deaths attributed to ingestion of opioid analgesics (Hall et al., 2008), followed by benzodiazepines (a type of tranquilizer; Jann et al., 2014).

Although some research suggests that males are more prone to NMDU (McCabe, West, Teter, & Boyd, 2014) and development of disordered use (Back, Payne, Simpson, & Brady, 2010), emerging evidence suggests the gender gap in NMDU and depressant overdose is narrowing (CDC WONDER, 2016), with female rates exceeding male rates of use in some samples (Hall, Howard, & McCabe, 2010; Kokkevi, Fotiou, Arapaki, & Richardson, 2008). Women are also more likely to exhibit a rapid transition from initial-to-disordered use (i.e., telescoping; Greenfield, Back, Lawson, & Brady, 2010). This phenomenon has been observed with sedatives, tranquilizers, and pain relievers (Hernandez-Avila, Rounsaville, & Kranzler, 2004; Kandel, Warner, & Kessler, 1998). Given these observations, more research attention to gender-based predictors of NMDU is warranted.

### 1.1. NMDU and impulsivity

Although specific personality traits appear to increase the likelihood of substance misuse generally (see Littlefield & Sher, 2016), traits related to the construct of "impulsivity" (or related constructs, such as sensation seeking) seem especially relevant to substance use behaviors, including NMDU. Regarding gender differences, research findings in impulsivity-related dispositions have been equivocal (Perry & Carroll, 2008), with some suggesting that males exhibit higher (Zuckerman, Eysenck, & Eysenck, 1978), lower (Reynolds, Ortengren, Richards, & de Wit, 2006) or equivalent levels of traits reflecting impulsivity in comparison to females (Fillmore & Weafer, 2004). Mixed findings may be due, in part, to various operationalizations and assessments of *impulsivity*, an idiomatic term used to describe multiple characteristics (Sharma, Kohl, Morgan, & Clark, 2013).

In recognition of this problem, the UPPS-P assesses five distinct dispositions toward impulsivity: negative urgency (NU; tendency to act rashly when experiencing negative emotion), positive urgency (PU; tendency to act rashly when experiencing positive emotion), lack of planning (LPlan; tendency to act without planning or careful thinking), lack of perseverance (LPer; inability to remain on task until completion), and sensation seeking (SS; tendency to pursue exciting, risky activities; Lynam, Smith, Whiteside, & Cyders, 2006; Whiteside & Lynam, 2001; Whiteside, Lynam, Miller, & Reynolds, 2005), and has accrued empirical evidence in support of its construct validity. Measurement invariance testing demonstrated that the UPPS-P is invariant across gender, and that males, compared to females, reported significantly higher levels of PU and SS (Cyders, 2013). Thus, research supports significant gender differences regarding mean-levels of impulsivity-like traits that may relate to NMDU. Previous research examining the impulsivity-NMDU relation found that sensation seeking (as measured by Zuckerman-Kuhlman Personality Questionnaire–Short version; Zuckerman, 2002) was associated with greater likelihood of nonmedical prescription anxiolytic use, including tranquilizers (operationalized as binary past-year use; Arria, Caldeira, Vincent, O'Grady, & Wish, 2008a), among undergraduates, adjusting for gender. Among young adults from the general population, both sensation seeking and impulsivity (as measured by the Substance Use Risk Profile Scale; Woicik, Stewart, Pihl, & Conrod, 2009) were associated with anxiolytic and sedative prescription misuse (operationalized as binary abuse and dependence criteria; McLarnon, Monaghan, Stewart, & Barrett, 2011), though no gender effects were tested. Unfortunately, many studies do not examine gender-interaction effects and may simply adjust model estimates based on gender. Further, various impulsive dispositions are largely underexplored in terms of their relation to NMDU.

### 1.2. NMDU, impulsivity, and gender

Although studies have sought to better understand the impulsivity-substance use relation, many do not consider gender effects (e.g., Berg, Latzman, Bliwise, & Lilienfeld, 2015; McLarnon et al., 2011), whereas others adjust for participant gender or test gender interactions (Arria et al., 2008a; Verdejo-García, Bechara, Recknor, & Pérez-García, 2007). All UPPS-P dispositions have been associated with illicit substance use among college students (including misuse of prescription drugs) when adjusting for gender (Zapolski, Cyders, & Smith, 2009). Shin, Chung, and Jeon (2013) found that, when adjusting estimates for gender, SS and LPlan were predictive of past-year illicit substance use, whereas urgency (i.e., scores reflecting NU) was not. However, NU has been linked to illicit substance use among college students, though gender effects were not examined beyond rates of use (Kaiser, Milich, Lynam, & Charnigo, 2012). Thus, few studies have examined the role of gender in the relation between impulsivity and illicit substance use, broadly defined (let alone NMDU), and even fewer have examined gender-by-impulsivity interactions.

Just as "lumping" various impulsivity-related constructs together can impede scientific progress (Cyders, 2015; Smith, McCarthy, & Zapolski, 2009), the lumping of illicit substances, including depressants, into one category may be a suboptimal scientific practice (though pragmatic when using smaller samples). Indeed, evidence suggests that personality traits may differentially relate to substance use as a function of the type of substance under consideration (Littlefield & Sher, 2016; Terracciano, Löckenhoff, Crum, Bienvenu, & Costa, 2008). Unfortunately, the tendency to "lump vs. split" in the substance use-personality literature varies considerably, with little consensus on "best practice" approaches.

### 1.3. Rationale for the current study

Although some evidence points to gender differences in impulsivity and use of specific depressant substances, other research findings do not support this. Because equivocal evidence may be due to varying operationalizations of impulsivity and NMDU (i.e., lumping versus splitting of impulsivity, as well as illicit substances), the current study has three aims: (1) determine whether gender differences exist in prevalence of NMDU and impulsive-disposition scores, (2) investigate whether these NMDU-impulsivity relations are moderated by gender via planned contrasts, and (3) determine whether lumping, versus splitting, of depressant substances when testing specific relations with impulsive dispositions yields different conclusions.

## 2. Materials and methods

### 2.1. Participants

Participants ($N = 778$; identified as 72% female; 80% White; 10% Black; 4% Asian; 23% Hispanic; 81% exclusively heterosexual; $M$ age $= 19.84$, $SD = 1.67$ [age range = 18–25]; 38% freshmen) consisted of undergraduate students from a large, southwestern university. Participants completed self-report measures via an online survey. All procedures and measures were approved by the university's Institutional Review Board. Participants received course credit for their participation.

### 2.2. Measures

#### 2.2.1. Dispositions toward impulsivity

The UPPS-P Impulsive Behavior Scale (UPPS-P) is composed of 59 items, which assess five impulsive dispositions (NU, PU, SS, LPlan, and LPer). Items were measured on a four-point scale ('strongly agree' to

'strongly disagree;' Lynam et al., 2006), and coded such that higher scores reflect higher construct levels. Standardized coefficient alphas ranged from 0.81 (LPer) to 0.93 (PU) in this study.

#### 2.2.2. Nonmedical depressant use

Self-report items adapted from the substance use section of the Alcohol Use Disorder and Associated Disabilities Interview Schedule-IV (AUDADIS-IV; Grant et al., 2003) were used to assess use of sedatives, tranquilizers, pain relievers, and other illicit substances. Ten binary items, which assessed lifetime use of each substance, were preceded by the following prompt: "Have you EVER used any of these medicines or drugs that were not prescribed to you or taken as part of a doctor's orders?" Items relevant to the current study include: (1) "Have you ever used sedatives, for example, sleeping pills, barbiturates, Seconal®, Quaaludes, or Chloral Hydrate?," (2) "Have you ever used tranquilizers or anti-anxiety drugs, for example, Valium®, Librium®, or muscle relaxants?," and (3) "Have you ever used painkillers, for example, Codeine, Darvon®, Percodan®, Oxycontin®, Dilaudid®, Demerol®, Celebrex®, or Vioxx®?"

### 2.3. Analytic procedure

Chi-square tests of independence were used to test for gender differences in prevalence of NMDU. To test the extent to which users of depressant substances for nonmedical purposes differed on impulsivity levels compared to non-users, hierarchical linear modeling was used, specifying restricted maximum likelihood estimation and an unstructured error covariance (SAS PROC MIXED; Singer, 1998). This approach is consistent with other investigations of personality dimensions and psychopathology (e.g., see Trull & Sher, 1994), yet allows us to relax unlikely assumptions (e.g., the repeated-measures ANOVA framework used by Trull and Sher assumes sphericity, whereas the current approach does not). Each UPPS-P disposition score was standardized ($M = 0, SD = 1$) to facilitate interpretation across analyses. Age was included as a covariate in every model and was nonsignificant in all analyses.

These models allowed for an examination of individual differences in impulsive dispositions as a function of type of substance use. First, the model was tested without consideration of depressant type to assess relations between gender and impulsive dispositions. Next, depressant substances were aggregated (i.e. "lumped") and disaggregated (i.e., "split") to examine differential relations with impulsive dispositions. Finally, gender interactions were added to all models to determine whether the magnitude of the mean-level associations between impulsive dispositions and likelihood of NMDU (i.e., lifetime use of specific substance) differed as a function of gender. Given that we were interested in the relations with impulsive dispositions, rather than aggregated impulsivity, we planned several a priori contrasts; specifically, we tested differences in each UPPS-P disposition between users and non-users of depressant substances based on gender. Effect sizes (Cohen, 1988) were also calculated.

## 3. Results

Descriptive statistics for the UPPS-P are provided in Table 1. Prevalence of NMDU and associated chi-square analyses are contained in Table 2. Effect sizes between impulsive dispositions and likelihood of NMDU, based on gender, are provided in Table 3.

### 3.1. Impulsivity and gender

Testing the relation between gender and dispositions of impulsivity indicated that males endorsed higher scores than females for PU ($t = 3.09$, $p < 0.01$) and SS ($t = 5.20$, $p < 0.0001$); males and females did not significantly differ on the other dispositions. Notably, gender-by-impulsivity disposition interactions were included in subsequent models to test three-way interactions between impulsive dispositions, gender, and type of depressant substance. Two-way interactions between gender and impulsive dispositions were significant in all models. To eliminate redundancy, we do not report the main effect of gender or the two-way interactions in the following results.

**Table 1**
Descriptive statistics for UPPS-P.

| | Overall Mean (*SD*) | Males Mean (*SD*) | Females Mean (*SD*) | *t*-test |
|---|---|---|---|---|
| Negative Urgency | 27.52 (7.09) | 27.57 (7.62) | 27.50 (6.88) | 0.11 |
| Positive Urgency | 28.59 (9.34) | 30.24 (9.71) | 27.96 (9.13) | 3.00* |
| Sensation Seeking | 33.10 (7.02) | 35.16 (6.56) | 32.31 (7.04) | 5.16** |
| Lack of Planning | 22.84 (5.56) | 22.97 (5.01) | 22.79 (5.76) | 0.37 |
| Lack of Perseverance | 20.06 (4.86) | 20.10 (4.61) | 20.04 (4.96) | 0.15 |

*Note.* $^*p < 0.01$, $^{**}p < 0.0001$; Raw UPPS-P scores provided for means and standard deviations.

### 3.2. Depressants

Results from hierarchical linear models indicated that impulsivity facet-NMDU relations were largely consistent across lifetime and 30-day use assessments in both, "lumped" and "split" approaches. Therefore, all significant effects and contrasts reported were significant in lifetime and 30-day use analyses unless otherwise noted (in which case *p*-values provided are lifetime, then 30-day, respectively).

NMDU of any kind (i.e., "lumped") related to overall impulsivity scores ($ps < 0.01$), and this effect was qualified by a significant interaction between impulsivity dispositions and NMDU ($ps < 0.01$). Tests of differences of least squares means indicated that, compared to non-users, depressant users scored significantly higher on the dispositions of NU ($ps < 0.01$) and SS ($ps < 0.001$), as well as marginally higher scores on LPer ($ps = 0.06, 0.07$). PU and LPlan were not significant. Although the three-way interaction between gender, impulsivity disposition, and NMDU was non-significant, ($ps = 0.91, 0.97$), we proceeded to examine results of planned comparisons. This trend was consistent in the subsequent analyses and will not be reported to eliminate redundancy. Female depressant users scored higher on the dispositions of SS ($ps < 0.0001$) and NU ($ps < 0.001$), and marginally higher in LPer ($ps = 0.09, 0.07$) compared to female non-users. Male lifetime (but not 30-day) depressant users were also significantly higher in SS compared to male non-users ($p < 0.05$), but not NU. NMDU was not significantly related to PU, LPer, and LPlan scores across gender.

### 3.3. Sedative use

Sedative use was significantly related to impulsivity, ($ps < 0.05$), which was qualified by a sedative use-by-impulsive disposition interaction ($p < 0.05$). Compared to non-users, sedative users scored significantly higher on dispositions of SS ($ps < 0.001$). Lifetime (but not 30-day) endorsement of sedative use was associated with higher levels of NU ($p < 0.05$). PU, LPlan, and LPer did not distinguish between users

**Table 2**
Descriptive statistics for nonmedical depressant use.

| | Sample *n* (%) | Males | Females | $\chi^2$ | *p-value* |
|---|---|---|---|---|---|
| Any NMDU (Past 30-Day) | 197 (24%) | 52 (23%) | 145 (25%) | 0.16 | 0.69 |
| Sedatives | 88 (11%) | 23 (10%) | 65 (11%) | 0.06 | 0.80 |
| Tranquilizers | 81 (10%) | 17 (8%) | 64 (11%) | 1.81 | 0.18 |
| Pain Relievers | 133 (17%) | 40 (18%) | 93 (16%) | 0.69 | 0.41 |
| Any NMDU (Lifetime) | 216 (27%) | 60 (27%) | 156 (26%) | 0.01 | 0.92 |
| Sedatives | 95 (12%) | 27 (12%) | 68 (12%) | 0.04 | 0.83 |
| Tranquilizers | 89 (11%) | 21 (9%) | 68 (12%) | 0.77 | 0.38 |
| Pain Relievers | 148 (18%) | 47 (21%) | 101 (17%) | 1.63 | 0.20 |

*Note.* $\chi^2$ = chi-square test of independence statistic. NMDU = Nonmedical depressant use.

**Table 3**
Effect sizes for nonmedical depressant type by impulsivity facet (Cohen's d).

| Substance Type | NU | PU | SS | LPER | LPLAN |
|---|---|---|---|---|---|
| *Any LT NMDU* | | | | | |
| Males | 0.13 | 0.02 | **0.33** | 0.14 | 0.02 |
| Females | **0.35** | 0.12 | **0.42** | 0.16 | 0.10 |
| *Any 30-Day NMDU* | | | | | |
| Males | 0.18 | 0.02 | **0.27** | 0.16 | 0.00 |
| Females | **0.36** | 0.15 | **0.41** | 0.17 | 0.11 |
| *LT Sedative* | | | | | |
| Males | 0.07 | 0.12 | **0.48** | 0.07 | 0.05 |
| Females | **0.37** | 0.11 | **0.56** | **0.31** | 0.13 |
| *30-Day Sedative* | | | | | |
| Males | 0.02 | 0.04 | **0.44** | 0.00 | 0.01 |
| Females | **0.36** | 0.11 | **0.55** | **0.31** | 0.12 |
| *LT Tranquilizer* | | | | | |
| Males | 0.29 | 0.03 | 0.51 | 0.12 | 0.08 |
| Females | **0.57** | **0.37** | 0.26 | **0.36** | 0.27 |
| *30-Day Tranquilizer* | | | | | |
| Males | 0.30 | 0.02 | 0.45 | 0.18 | 0.08 |
| Females | **0.60** | **0.38** | 0.29 | **0.36** | 0.27 |
| *LT Pain Reliever* | | | | | |
| Males | 0.01 | 0.03 | 0.27 | 0.14 | 0.07 |
| Females | 0.16 | 0.01 | **0.47** | 0.03 | 0.03 |
| *30-Day Pain Reliever* | | | | | |
| Males | 0.01 | 0.04 | 0.26 | 0.13 | 0.13 |
| Females | 0.17 | 0.02 | **0.44** | 0.02 | 0.04 |

*Note:* Bolded effect sizes indicate significant mean comparisons (i.e., $p < 0.05$), such that these facets were significantly higher among users versus non-users. LT = lifetime; NMDU = Nonmedical depressant use; NU = Negative Urgency; PU = Positive Urgency; SS = Sensation Seeking; LPER = Lack of Perseverance; LPLAN = Lack of Planning.

and non-users. Consistent with the "lumped" NMDU analyses, findings indicated that female sedative users scored significantly higher in SS ($ps < 0.001$), NU ($ps < 0.01$), and LPer ($ps < 0.05$) than females who had not used sedatives, whereas only SS scores significantly differentiated between male users and non-users of sedatives ($ps < 0.05$).

### 3.4. Tranquilizer use

Tranquilizer use significantly related to impulsivity ($ps < 0.01$), though a significant tranquilizer use-by-impulsive disposition interaction was detected ($p < 0.01$) in the lifetime model (which was marginally significant in the 30-day model [$p = 0.06$]). Compared to non-users of tranquilizers, users scored higher in the dispositions of SS ($ps < 0.05$), NU ($ps < 0.05$), and marginally higher in LPer ($ps = 0.06$). Planned comparisons indicated that female tranquilizer users were significantly higher in NU ($ps < 0.0001$), PU ($ps < 0.01$), LPer ($ps < 0.01$), and were marginally higher in SS ($ps = 0.06$, 0.05), compared to non-using females. Males who used tranquilizers were only marginally higher in SS compared to non-using males ($ps = 0.05$, 0.10). NU, PU, LPlan, and LPer did not significantly distinguish between tranquilizer users versus non-user for males, whereas only LPlan failed to differentiate between female users and non-users.

### 3.5. Pain reliever use

Although the main effect of pain reliever use was nonsignificant ($ps = 0.09$, 0.25), there was a significant pain reliever use-by-impulsive disposition interaction ($ps < 0.05$). SS was significantly higher ($ps < 0.01$) among users than non-users; moreover, female pain reliever users scored significantly higher in SS compared to non-using females ($ps < 0.001$). No dispositions significantly differentiated male users and non-users of pain relievers.

## 4. Discussion

Findings highlight the role of specific impulsive dispositions, including SS among males, and SS, NU, PU, and LPer among females, which differentially predicted nonmedical use of specific depressant substances among college students. Early identification of individuals engaging in NMDU may reduce the frequency of depressant-related consequences; moreover, identifying characteristics of emerging adults who engage in NMDU may be particularly helpful for females, as rates of use are increasing (Hall et al., 2010). Thus, primary aims of this study were to determine whether (a) gender differences in prevalence of NMDU and disposition-level impulsivity scores were apparent, (b) associations between impulsive dispositions and NMDU associations were moderated by gender, and (c) lumping versus splitting of depressant substances yielded different findings with regard to relations with disposition-level impulsivity traits. Our results are consistent with those of Cyders (2013), such that males endorsed higher levels of SS and PU than females. Consistent with data indicating a narrowing of the depressant use gender gap (Johnston, O'Malley, Bachman, Schulenberg, & Miech, 2016), we found no gender differences in prevalence of use for sedatives, tranquilizers, or pain relievers.

Given differential associations between impulsivity-related traits and use of specific depressant substances, our results support the splitting, rather than lumping, of NMDU in research. For example, though SS and NU were associated with overall NMDU, for females, this lumping approach failed to capture respective differences in PU and LPer between female users and non-users of tranquilizers that were apparent in analyses that utilized a splitting approach. Further, given evidence that some dispositions significantly distinguished substance users from non-users among females, but not males, findings also indicate that gender differences in impulsivity-NMDU relations should be further examined.

The current study expands upon previous findings that impulsivity and SS are elevated among individuals who misuse anxiolytics and/or sedatives (McLarnon et al., 2011). Further, the current study expands upon previous research by examining five impulsive dispositions, rather than one (i.e., sensation seeking; Arria et al., 2008a) or two (i.e., sensation seeking and "impulsivity;" McLarnon et al., 2011). Indeed, ours is the first, to our knowledge, to use the UPPS-P, which is considered the gold-standard measure of impulsive traits, to examine NMDU, as well as substance-specific relations (e.g., differential relations between impulsivity facets and anxiolytic versus sedative use, which are often "lumped" together).

Despite that omnibus tests of gender interactions were non-significant, planned contrasts suggested that relations between specific NMDU and impulsive dispositions differed across gender. Although some may argue against examining planned comparisons in the presence of non-significant omnibus tests, Tomarken and Waller (2003) indicate that problems occur "when researchers rely too heavily on the results of omnibus tests of hypotheses" (p. 579). Examination of planned comparisons is useful when the assessed construct is comprised of diverse indicators (as with impulsivity-related traits). Additionally, we focused on relations of NMDU with specific dispositions, rather than an overall score of "impulsivity," as assessed by the UPPS-P. Although we acknowledge that the examined gender-NMDU interactions failed to reach conventional statistical significance, we also provided effect sizes and marginal effects in light of the American Statistical Association's statement which promotes moving into a "post $p < 0.05$ era" (Wasserstein & Lazar, 2016).

Findings showed that specific impulsive dispositions, including SS among males, and SS, NU, and LPer among females, are related to the use of specific depressant substances. Speculatively, we believe the current results have potential clinical implications, as identifying risk factors for young adults who have engaged in past-month for NMDU is crucial for prevention and intervention efforts. Given findings that multiple impulsivity facets related to NMDU, whereas only SS was a

significant correlate for male users of specific substances, it may be that additional impulsivity-related traits (i.e., NU, PU, and LPer) contribute to pathways of use for females. Thus, the UPPS-P may provide clinical utility in the assessment and treatment of NMDU by identifying the most relevant impulsive dispositions potentiating risk of specific types of problematic substance use, as well as directing intervention strategies. Increasing the precision of personality-linked patterns of substance misuse may serve to decrease NMDU and related problems through personality-targeted interventions, which have shown success in reducing substance use among adolescents (Conrod, Castellanos-Ryan, & Strang, 2010). Specifically, although the current personality-targeted substance use interventions target impulsivity and SS, targeting problems related to other impulsive dispositions, such as NU, in the form of emotion-regulation skills training, may be particularly beneficial for females.

Results of this study should be considered in light of its limitations. Although the current study examined endorsement of past 30-day and lifetime NMDU, we did not analyze frequency or severity (due to low base rates) and did not assess for specific prescription substances used. Additionally, the item assessing sedative use included the term "sleeping pills," which some participants may have interpreted as ingesting over-the-counter sleeping aids (e.g., melatonin). Our results may not be generalizable to the non-college-attending, emerging-adult population; however, we believe that use of a non-clinical sample allows us to better understand prevalence rates and correlates of NMDU among college students, more generally. Further, the cross-sectional design of this study limits the inferences regarding any causal relation between impulsivity-related traits and NMDU; prospective studies could further examine the dynamic relation between impulsivity-related traits and NMDU. Attempts to replicate the current findings, as well as examine potential impulsivity-related differences as a function of frequency and/or severity of use are warranted when feasible. Future areas of research include determining the utility in identifying impulsivity profiles as a function of the specific nonmedical prescription substance used (e.g., Xanax, Adderall, Fentanyl), as well as the role of motives for use (McCabe, Cranford, Boyd, & Teter, 2007).

Although some may view the use of a college sample as an impediment to the generalizability of these results, understanding NMDU among college-attending emerging adults is essential, given the prevalence and related consequences reported in this age group. We also note a strength of our sample was that it included a sizable proportion of Hispanic individuals (a growing ethnicity in the United States at risk for alcohol and substance misuse; Chartier & Caetano, 2010; Chen & Jacobson, 2012), though examining interactions as function of ethnicity was beyond the scope of the study. Finally, although a majority of participants were White females, given the narrowing gender gap in NMDU, research focused on female substance users is warranted.

### 4.1. Conclusions

The current research contributes a nuanced examination of relations between dispositions of impulsivity and likelihood of NMDU to the extant literature and provides initial evidence that these relations may differ between male and female emerging-adult college students. In addition to informing research and clinical practices, this study is the first, to our knowledge, to examine the effect of gender on the impulsivity-NMDU relation across specific types of depressant substances and dispositions of impulsivity. Although replication is necessary, findings suggest that specific impulsivity dispositions are associated with risk of overall NMDU (i.e., NU and SS), as well as specific NMDU (supporting splitting of illicit substances when feasible), and that these associations may be distinct for males and females.

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**Contributors**
Authors Littlefield, Brown, and Talley collected the data. Blanchard managed the literature search and wrote the first draft of the manuscript, which was revised by all authors. Blanchard completed the statistical analyses, with support from Littlefield and Stevens. All authors have contributed to, revised, and approved the final manuscript.

**Conflict of interest**
All authors declare that they have no conflicts of interest.

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