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## Nonmedical Prescription Stimulant Use Among Youth in the Emergency Department: Prevalence, Severity and Correlates

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### Abstract

This study examined the prevalence, severity and correlates of nonmedical prescription stimulant use (NPSU) among youth in the Emergency Department (ED). Participants 14–20 years old presenting to the ED completed a survey. A multinomial logistic regression was used to compare those without NPSU, with mild NPSU and with moderate/severe NPSU on demographics, risk factors and ED utilization. There were 4,389 participants; 8.3% reported past-year NPSU and 44% of those with past 3-month NPSU reported at least monthly use. After controlling for demographics, participants with mild NPSU or moderate/severe NPSU had higher odds of all substance use risk factors compared to those with no NPSU. Also, those with moderate/severe NPSU were more likely to report dating violence and nonmedical use of opioids or sedatives and less likely to use marijuana compared to those with mild NPSU. Healthcare setting screening and intervention efforts should consider NPSU concomitant with other substance use and explore the association of dating violence with NPSU.

### Keywords

Emergency Medicine; Young Adults; Nonmedical Prescription Stimulant Use; Substance Abuse; Violence

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## 1. Introduction

In 2012, approximately 6.8 million Americans reported non-medical use of prescription drugs in the past month which exceeds the number of Americans using cocaine, heroin, hallucinogens, and inhalants combined (Substance Abuse and Mental Health Services Administration, 2013b). In 2011, there were 3.1 million persons aged 12 years and older who used drugs for the first time and approximately one in five of these initiated nonmedical use of prescription drugs (Substance Abuse and Mental Health Services Administration, 2012). Nonmedical prescription drug use is defined as using pharmaceuticals without a prescription, in a different manner than was prescribed or using to get high, is a growing public health problem. Although sedatives and opioids are among the classes of prescription drugs most often used in this manner, nonmedical prescription stimulant use (NPSU) is on the rise and in 2013, 7.4% of high school seniors reported nonmedical use of Adderall in the past year (Johnston, O'Malley, Miech, Bachman, & Schulenberg, 2014).

The prevalence of NPSU varies widely depending upon the study population and risk of NPSU can vary among groups. McCabe and colleagues report a lifetime prevalence of NPSU of 2.4% among secondary school students (McCabe, Boyd, & Young, 2007) which is similar to the prevalence of 2.6% noted by Kroutil and colleagues among Americans aged 12-17 years (Kroutil et al., 2006). The prevalence of NPSU in college students is higher with rates varying between 5 and 35% (Arria et al., 2008; DeSantis, Webb, & Noar, 2008; McCabe, Teter, & Boyd, 2006; Sweeney, Sembower, Ertischek, Shiffman, & Schnoll, 2013; Wilens et al., 2008). Similarly, there has been an increase in medical use and prescribing of controlled substances including stimulants among adolescents and young adults (Fortuna, Robbins, Caiola, Joynt, & Halterman, 2010). A survey of adolescents showed that one in seven students reported diversion (McCabe et al., 2011) or exchange of prescribed medications to others for use by a person not intended by the prescriber. With a growing supply of medications among adolescents and young adults and an increasing prevalence of NPSU, we need to understand the prevalence, severity and risk factors associated with NPSU among youth in any healthcare setting.

The Emergency Department (ED) represents a unique setting to study, screen and intervene for high-risk behaviors among adolescents and young adults. Approximately one in four teens aged 15-17 do not have a primary care physician (McCormick, Kass, Elixhauser, Thompson, & Simpson, 2000) and thus seek medical care in the ED. Emergency Department visits associated with nonmedical use of prescription drugs is on the rise and in 2011 there were over 1.2 million ED visits involving the nonmedical use of pharmaceuticals including prescription medications and over-the-counter drugs. Additionally, nonmedical use of prescription stimulants account for over 40,000 Emergency Department visits per year and this number has increased 307% since 2004 (Substance Abuse and Mental Health Services Administration, 2013a). To date, there are no effective screening procedures for identifying adolescents and young adults in the ED at risk for NPSU. Furthermore, rates of substance use among patients using the ED for care are high regardless of reason for visit (Carroll, Raj, Noel, & Bauchner, 2011; Whiteside et al., 2009). However, there are no current studies that describe the prevalence and severity of NPSU among a sample of youth in the ED.

Nonmedical use of prescription drugs is a known risk factor for poly-substance use. A recent analysis from the National Survey on Drug Use and Health indicate that over 90% of Americans over 12 years of age with NPSU also reported illicit drug use or other nonmedical prescription drug use including opioids and sedatives (Sweeney et al., 2013). Prior research among college student samples have found a relationship between NPSU and alcohol use (including binge drinking, alcohol misuse, and alcohol dependence), marijuana use, cocaine use and other illicit drug use (Arria et al., 2008; McCabe, Knight, Teter, & Wechsler, 2005). Among urban youth, NPSU precedes illicit stimulant use and polysubstance use is common among youth with nonmedical prescription drug use (Lankenau et al., 2012). Polysubstance use likely represents a cluster of problem-behaviors which is consistent with Jessor's risky behavior theory among youth (Jessor, 1991). Despite evidence that NPSU is commonly associated with polysubstance use among students, there is limited information on nonmedical prescription drug use in ED samples (Bonar et al., 2013; Whiteside, Walton, et al., 2013) and there are currently no published studies on the relationships between NPSU and other substance abuse among youth in the ED for care.

While little is known about the relationship between NPSU and other non-substance related risk factors, previous ED-based studies have documented the association of violence, injury and substance use among youth. Urban adolescents in the ED with a history of violence with peers and dating partners have an increased risk of alcohol-related problems and marijuana use (Whiteside, Ranney, et al., 2013). Also, youth seeking care for violence-related injuries have a higher rate of substance misuse than youth in the ED for other reasons (Cunningham et al., 2014). Among adults and youth there is a documented link between acute binge drinking, cocaine use and interpersonal or dating violence (Chermack, Grogan-Kaylor, et al., 2010; Chermack et al., 2008; Epstein-Ngo et al., 2013). Youth taking stimulants prescribed by a physician have higher rates of ED use and injury-related care than those who do not take chronic prescribed stimulants (Miller, Brehaut, Raina, McGrail, & Armstrong, 2004). However, there is no information on injury, violence and ED care for youth with nonmedical use of prescription stimulants.

To further understand the relationships between NPSU, substance use and violence in a non-school sample and to inform future ED-based NPSU studies, more information is needed on patients with this risk behavior in the ED setting. The aims of the present study are to: 1) determine the prevalence and severity of NPSU among youth ages 14-20 utilizing the ED for care; and, 2) identify risk factors associated with different NPSU risk profiles. Based on prior literature and problem behavior theory (Jessor, 1991), it is hypothesized that NPSU will be associated with other types of substance use as well as injury and dating violence involvement; with increasing severity of NPSU being more strongly associated with other risk factors. Specifically, we hypothesize that those with the highest severity of NPSU risk will be significantly associated with multiple independent risk factors including use of alcohol, marijuana, cocaine, nonmedical non-prescription cough/cold medicine use, nonmedical prescription opioid or sedative use, dating violence and previous injury from fighting.

## 2. Materials and Methods

### 2.1 Study Setting and population

The current study includes data from youth recruited in the ED who were screened for a large randomized control trial (RCT) for underage drinking (Whiteside, Walton, et al., 2013). All patients were screened at the University of Michigan Emergency Department and Children's Emergency Services which is a large academic medical center in the suburban community of Ann Arbor, Michigan.

### 2.2 Subject Recruitment

Patients between 14 and 20 years of age presenting to the ED for care were identified by research assistants (RAs) using the electronic medical record and approached in waiting and treatment areas. Those not medically stable for recruitment in the ED and required admission were approached during the subsequent 72 hours if they became stable. Patients were excluded if they had an insufficient level of consciousness or cognition for consent, if they were less than 18 years of age and a parent or guardian was not available for consent, presented in police custody or presented for an acute sexual assault. Based on patient volumes, recruitment primarily occurred between the hours of 2pm and 12am, seven days a week (with the exception of major holidays) from September 2010 through March 2013. Sampling of midnight shifts (2AM-12PM) occurred on a rotating schedule of one Saturday and Sunday per month (during the first 20 months of the study). Sampling of daytime shifts initially occurred seven days a week, but was subsequently reduced to two rotating days per week.

### 2.3 Screening Procedure

The study protocol and all materials received approval from the Institutional Review Board at the University of Michigan and we obtained a Certificate of Confidentiality from the National Institutes of Health. Participants over 18 years of age or parents/guardians of participants under 18 years of age provided written, informed consent and assent was obtained for those under 18 years of age. Participants then self-administered a screening questionnaire using a tablet computer. If the participant necessitated any medical care or procedures (e.g., blood draw) during survey administration the RA paused the computer survey. At completion, participants chose a gift (\$1.00 value; e.g., lotion, deck of cards).

### 2.4 Measures

**2.4.1 Dependent Variable**—The main outcome variable, Nonmedical Prescription Stimulant Use (NPSU), was assessed using the NIDA-modified Alcohol Smoking and Substance Involvement Screening Test (NM-ASSIST) which was adapted from the World Health Organization Alcohol Smoking and Substance Involvement Screening Test (ASSIST) (Ali et al., 2002). As part of the computerized screening questionnaire, all participants were asked three questions regarding nonmedical use of prescription drugs. These items were preceded by the following statement: 'In the past 12 months, have you used any of the following substances to get high, or taken them when they were prescribed to someone else, or taken more than what was prescribed to you?' Patients then responded

yes or no to items for ‘prescription stimulants (Ritalin, Concerta, Dexedrine, Adderall, diet pills, etc).’ Participants were classified as ‘no NPSU’ if they answered ‘no’ to past 12 month NPSU. Those answering ‘yes’ to this question (i.e. reporting NPSU in the past 12 months) received all NM-ASSIST (Ali et al., 2002) questions for NPSU in the past three months. Consistent with NM-ASSIST scoring, the responses of these questions were summed. Those with a score of 0-3 were categorized as mild risk of having or developing a substance use disorder, participants with a score of 4-26 were categorized as moderate risk of having or developing a substance use disorder and participants with a score of 27 or higher were categorized as high risk of having or developing a substance use disorder.

**2.4.2 Independent Variables**—Items from national surveys (Bearman, Jones, & Udry, 1997; United States Department of Health Human Services. National Institutes of Health. National Institute on Drug Abuse, 2010) were used to collect demographic characteristics, including gender, age, education status, and race. Participants were also asked about academic performance and those who reported getting mostly D's or below were categorized as failing grades.

One question from the Adolescent Injury Checklist (AIC) (Jelalian et al., 1997) was used to assess previous injury from a fight over the past year. Dating Violence was assessed using 8 questions from the Conflict in Adolescent Dating Relationships Inventory (CADRI) (Wolfe et al., 2001). Four of these questions focused on aggression or violence toward a dating partner and four questions focused on victimization or violence from a dating partner (e.g., slapped, kicked, pushed, shoved). These items were dichotomized into any dating violence involvement (yes/no) over the past year which has been done in prior work (Cunningham et al., 2014; Ranney et al., 2013; Whiteside, Walton, et al., 2013).

Chung and colleagues’ (Chung, Colby, Barnett, & Monti, 2002) modified Alcohol Use Disorders Identification Test-Consumption (AUDIT-C) (Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998) was used to detect alcohol misuse over the past 3 months. This version uses a total score of 3 or higher as indicating alcohol misuse by those under 18 years of age and 4 or more for those aged 18 years or older (Chung et al., 2002). Using the NM-ASSIST (Ali et al., 2002), participants also reported on past 12 month use of cannabis/marijuana, cocaine use and nonmedical use of prescription sedatives and opioids (yes/no; as defined above for NPSU). Given the similar sedating effects of these substances, answers for nonmedical prescription sedative and opioid use were dichotomized into yes/no for nonmedical prescription opioid or sedative use. Participants were also asked “In the past 12 months have you used non-prescription cough or cold medicine (i.e. robotripping, DXM, Delsym, Coricidin etc.) to get high” and responses to this question were dichotomized to yes/no.

To determine if the current ED visit was related to substance use (Walton et al., 2008), patients were asked (yes/no): ‘Did you use any drugs within six hours prior to coming to the ED’ and ‘Did you use any prescription drugs within six hours of coming to the ED today’.

Trained RAs then performed a chart abstraction using the electronic medical record. RAs retrospectively abstracted the reason for the ED visit and disposition (i.e. discharged, admitted) from the EMR and coded it as medical illness (e.g., abdominal pain) or injury

(ICD–9– CM E800–E999). Research staff were trained on the classification of external causes of injuries, International Classification of Diseases, Ninth Revision, Clinical Modification (ICD–9–CM)(Public Health Service and Health Care Financing Administration, 1998). Also, any previous ED visit in the year prior to the day of recruitment was recorded and dichotomized into yes/no for the presence of at least one past year ED visit.

## 2.5 Data Analysis

All data were analyzed using SAS Version 9.3 (SAS Institute, Inc., Cary, NC). The primary dependent variable of NPSU was categorized into ‘no NPSU’, ‘mild NPSU’ and ‘moderate/severe NPSU’. Descriptive statistics of all independent variables including, demographics, risk factors and ED visit characteristics were calculated for all participants across the three risk groups. To evaluate bivariate associations of those with NPSU, chi-square tests and ANOVAs were conducted. Further analyses controlled for gender, age, race and academic performance and included all risk factors and chart review variables that were significant in the bivariate analysis with the exception of ‘drug use within six hours of the visit’ and ‘nonmedical use of prescription drugs within 6 hours of ED visit’ given the low frequency of patients that answered ‘yes’ to these outcomes. Multinomial logistic regression analyses evaluated the relationships of these independent variables with ‘mild NPSU’ compared to ‘no NPSU’, ‘moderate/severe NPSU’ compared to ‘no NPSU’ and ‘moderate/severe NPSU’ compared to ‘mild NPSU’. Diagnostics including the variance inflation factor (VIF) and a correlation matrix were calculated for all variables retained in the final regression and there was no evidence of multicollinearity among these variables.

## 3. Results

### 3.1 Characteristics of the Sample

There were 5096 eligible patients approached for participation during the recruitment period and 4389 (86.1% response rate) completed the screening. Chi-square analyses compared missed participants to screened participants on gender and age group distribution (14-17 year-olds vs. 18-20 year-olds). Missed participants were more likely to be in the younger group (27.6%) rather than older group (22.3%;  $\chi^2 = 21.05, p < .001$ ) and were more likely to be male (28.7%) than female (21.4%;  $\chi^2 = 40.88, p < .001$ ). Patients who refused participation and screened patients did not significantly differ on gender or age distribution. The average age of the entire study sample was 17.5 years (standard deviation (SD) 2.0), 2542 (57.9%) were female and 3185 (72.6%) identified as Caucasian.

### 3.2 Non-medical Prescription Stimulant Use Characteristics

In this sample, 365 (8.3%) reported NPSU in the past year and of those the majority (n=257, 83%) reported NPSU in the past 3 months. Based on NM-ASSIST scores for NPSU over the past 3 months, 189 participants were classified as mild risk. Few participants fell into the high risk range (n = 8). For further analyses the high-risk patients were combined with those in the moderate risk range (n = 168) for a total of 176 participants in the moderate/high risk range for NPSU. Among the participants with any NPSU in the past 3 months (n=257), 55.6% (n = 143) used less than monthly, 14.8% (n=38) reported monthly use and 30.0%

(n=76) reported weekly or daily use. Also, 21.8% (n=56) had a strong desire or urge to misuse prescription stimulants on a weekly to daily basis and 8.6% (n=22) had weekly or daily health, social, legal or financial problems secondary to NPSU. A total of 12.0% (n=31) had failed to do what was normally expected of them in the past 3 months because of NPSU, 12.5% (n=32) noted that a friend or relative had expressed concern about their NPSU and 9.7% (n=25) reported failed attempts to cut down, control or stop misuse of prescription stimulants.

### 3.3 Bivariate Results

Table 1 displays results of the bivariate associations across the three groups. Patients with any NPSU tended to be older (F-value = 21.08, df = 2,  $p < 0.0001$ ) and were more likely to identify as Caucasian ( $\chi^2 = 43.47$ , df = 4,  $p < 0.0001$ ) compared to those with no NPSU. Patients with no NPSU were more likely to be in school ( $\chi^2 = 19.79$ , df = 2,  $p < 0.0001$ ) and less likely to have failing grades or have dropped out of school ( $\chi^2 = 15.89$ , df = 2,  $p = 0.0004$ ) compared to those with mild NPSU or moderate/severe NPSU.

All risk factors including violence and substance use were significantly related to both mild NPSU and moderate/severe NPSU compared to no NPSU. Most patients were discharged from the ED and there was no difference in rates of discharge from the ED across the three groups ( $\chi^2 = 1.28$ , df = 2,  $p = 0.53$ ). Patients with moderate/severe NPSU were more likely to have been to the ED in the past 12 months ( $\chi^2 = 5.67$ , df = 2,  $p = 0.02$ ) compared to other groups. Also, while the absolute numbers were small, participants with mild or moderate/severe NPSU were more likely to use any drugs within 6 hours of the ED visit ( $\chi^2 = 33.71$ , df = 1,  $p < 0.0001$ ) and more likely to report nonmedical prescription drug use within six hours of the ED visit ( $\chi^2 = 399.29$ , df = 1,  $p < 0.0001$ ).

### 3.4 Multinomial Regression Analysis Results

The results of the multinomial model are presented in Table 2. Compared to participants without NPSU, participants with mild NPSU (aOR 3.57, 95% CI 1.69-7.75) and moderate/severe NPSU (aOR 4.69, 95% CI 2.08-10.59) were more likely to identify as Caucasian. However, there was no difference in race when comparing those with mild NPSU to those with moderate/severe NPSU. Female participants had decreased odds of moderate/severe NPSU (aOR 0.69, 95% CI 0.49-0.97) compared to those without NPSU but there was no difference between those with mild NPSU and no NPSU.

Participants with mild NPSU had higher odds of all substance use risk factors compared to those with no NPSU. Specifically, those in the mild NPSU group had increased odds of alcohol misuse (aOR 2.50, 95% CI 1.68, 3.72), marijuana use (aOR 6.01, 95% CI 3.77-9.58), cocaine use (aOR 3.19, 95% CI 1.81-5.62), nonmedical non-prescription cough/cold medicine use (aOR 1.65, 95% CI 1.14-2.39) and nonmedical prescription opioid or sedative use (aOR 7.92, 95% CI 5.42-11.59). Similarly, all substance use risk factors were associated with moderate/severe NPSU compared to no NPSU including alcohol misuse (aOR 3.57, 95% CI 2.34-5.44), marijuana use (aOR 2.63, 95% CI 1.71-4.04), cocaine use (aOR 2.92, 95% CI 1.63-5.22), nonmedical non-prescription cough/cold medicine use (aOR 1.83, 95% CI 1.26-2.66) and nonmedical prescription opioid or sedative use (aOR 6.65, 95%

CI 4.51-9.80). Also, there were no differences in violence risk factors between those with mild NPSU compared to those with no NPSU. However, those with moderate/severe NPSU had increased odds of past year dating violence compared to those without NPSU (aOR 1.53, 95% CI 1.03-2.27). There was no difference in ED utilization comparing those without NPSU to mild or moderate/severe NPSU.

Further, those with moderate/severe NPSU had almost two times increased odds of dating violence (aOR 1.83, 95% CI 1.12-3.00) compared to those with mild NPSU and a decreased odds of marijuana use (aOR 0.44, 95% CI 0.24-0.80) compared to those with mild NPSU. There were no further differences in substance use, violence or ED utilization noted between these two risk groups.

#### 4. Discussion

The present study explored the prevalence, severity and correlates of NPSU among a sample of 14-20 year old patients in the ED. These results add to the literature on nonmedical use of prescription stimulants by studying this important public health problem in a novel setting. In this sample, approximately 1 of every 12 adolescents and young adults seeking care in the ED reported NPSU in the past year and over 80% of these youth reported NPSU in the past 3 months. Additionally, nearly half of youth with NPSU in the past 3 months reported moderate/severe risk of having or developing a substance use disorder from nonmedical use of prescription stimulants. This severity of use highlights the need for effective screening and further studies in healthcare settings including the ED.

The frequency of NPSU among this ED sample was similar to the frequency of use seen in college students (Teter, Falone, Cranford, Boyd, & McCabe, 2010). Also, nearly 1 of every 10 youth (8.6%) in this study reported problems associated with NPSU including financial, health or legal problems. This is consistent with work from college samples where NPSU is associated with academic problems such as skipping class (Arria et al., 2013). Importantly, this builds on previous college-based studies as this analysis included patients as young as 14 and college-aged young adults not necessarily in school. A large number of youth with NPSU were moderate/high risk and cited problems associated with NPSU. Therefore these novel findings indicates that screening and intervention should not be solely targeted on a college population and should include high school aged youth and youth in non-school settings.

Interestingly, females were less likely to have moderate/severe NPSU compared to those without NPSU and participants that identified as Caucasian compared to other racial categories had increased odds of mild NPSU and moderate/severe NPSU compared to those without NPSU. School-based studies have also found a Caucasian and male predominance for NPSU (Teter, McCabe, LaGrange, Cranford, & Boyd, 2006). While this may reflect the demographics of youth being prescribed stimulants and other psychotropic medications (Chirdkiatgumchai et al., 2013), this is also consistent with the demographics of nonmedical use of prescription opioids (McCabe, West, Teter, & Boyd, 2012).



As hypothesized, the present study revealed that other substance use was highly correlated with NPSU. Those with both mild and moderate/severe NPSU had significant associations of use of all substances measured. Previous studies have documented the association of poly-substance use (including NPSU) among school populations and college samples (Arria et al., 2008; McCabe et al., 2005; Sweeney et al., 2013). ED-based studies have also documented associations among various substances among youth and adolescents (Chun et al., 2010; Whiteside, Walton, et al., 2013); however, few of these studies have examined NPSU. Youth with mild and moderate/severe NPSU had increased odds of marijuana use compared to youth without NPSU. Interestingly, those with moderate/severe NPSU had decreased odds of marijuana use compared to those with mild NPSU. It is unclear why those with the highest level of risk would be less likely to use marijuana than those with lower risk and this could be addressed in future research. It is possible that those at highest risk have developed a physiological dependence on stimulants that is not relieved by a drug such as marijuana which lacks similar stimulant properties. Along those lines, motivations for NPSU may be quite different between the higher versus lower risk groups and may or may not overlap with marijuana use motives. It is also important to note that marijuana use was assessed via a dichotomous item reflecting any past-year use as opposed to frequency of use. Compared to the no NPSU group where only 29.8% had used marijuana, very high proportions of both mild (85.2%) and moderate/severe risk (76.7%) reported marijuana use.

Nonmedical nonprescription cough/cold medication use was correlated with both mild and moderate/severe NPSU. Nonmedical use of over-the-counter cough and cold medications such as Dextromethorphan is also associated with alcohol and illicit drug use and has been increasing with a peak age of onset in mid-adolescence (Bryner et al., 2006). It is likely that nonprescription cough and cold medications such as Dextromethorphan are easier to obtain than prescription stimulants, given potential lack on monitoring by parents in the home and the ability to purchase these medications over the counter without a prescription. Future studies should explore the timing and age of initiation for the nonmedical use of these substances as this is the first analysis to highlight nonmedical nonprescription cough and cold medicine use as an independent risk factor for NPSU.

The nonmedical use of opioids or sedatives were associated with both mild and moderate/severe NPSU in this sample which is consistent with other school based studies (McCabe et al., 2007). As rates of prescribing for all controlled substances increases among youth (Fortuna et al., 2010), it is important to recognize the risk for diversion or the exchange of prescribed medications to others. Previous studies have shown that many adolescents divert their prescribed controlled medications including stimulants to friends (Boyd, McCabe, Cranford, & Young, 2007; McCabe et al., 2011) and medical use of opioids precedes nonmedical prescription opioid use approximately 80% of the time (McCabe et al., 2012). Healthcare encounters can be a time to discuss substance use and medication safety with patients of all ages. Therefore, screening for substance use including non-medical prescription drug use should be considered when prescribing any type of controlled substance including stimulants.

In addition to substance use, violence and injury were also assessed in this population. While the association between illicit stimulant use and partner violence is established

(Chermack, Walton, Beyer, Porter, & Blow, 2010; Epstein-Ngo et al., 2013), this is the first study to document the association of NPSU with dating violence. Dating violence was associated with both mild NPSU and moderate/severe NPSU compared to those without NPSU. However, those with dating violence had an increased risk of moderate/severe NPSU compared to those with mild NPSU suggesting increasing dating violence risk with increasing severity of NPSU. In studies of adolescents with substance use, cocaine users were more likely to report being the victim of violence from a dating partner than non-cocaine users (Epstein-Ngo et al., 2013). Acute intoxication produces agitation (Chermack & Giancola, 1997) and may be a precipitant for dating violence. Alternatively, these behaviors may represent the clustering of risk behaviors among youth (Jessor, 1991). More studies are needed to further investigate the association of dating violence and NPSU to understand if this is clustering of risk behaviors or is related to the pharmacology of stimulants especially given the prevalence of these two behaviors among adolescents and young adults.

In the bivariate analysis, a previous ED visit in the past 12 months was associated with increased odds of both mild and moderate/severe NPSU. However, this finding did not persist in the multinomial model. It is important to note that nearly one in four participants with mild and moderate/severe NPSU had at least one previous ED visit in the past year. Every ED visit represents a possible opportunity to identify patients involved in NPSU. Rates of substance abuse are high among people that use the ED for care (Rockett, Putnam, Jia, Chang, & Smith, 2005) and identifying health service utilization patterns for young adults at risk for NPSU is an important step for developing screening and interventions in healthcare settings.

#### 4.1 Limitations

While this analysis provides novel information on NPSU including a description of the prevalence and severity of NPSU in youth in the ED, as well as a description of the association of NPSU with dating violence, nonmedical prescription sedative or opioid use and other substance use, there are a few limitations that should be mentioned. Importantly, the cross-sectional nature of the data does not allow for causal conclusions. The definition of NPSU for this study was broad and specific motivations for use were not obtained. This broad definition did not allow for targeted study on specific subgroups (i.e. medical misusers with a prescription; non-medical users without a prescription). Future studies should consider using methods that could assess the temporal relationship between NPSU and dating violence, which could inform future interventions. This study includes data from participants recruited at a single ED and therefore may not be generalizable to settings containing different demographic or socioeconomic groups. Additionally, data from the chart review, including previous ED visits was limited to the University of Michigan system and does not capture use of non-affiliated ED's. Self-reported data could be viewed as a limitation. However, several reviews support the validity and reliability of self-report methods among youth when privacy is assured and assessments are self-administered on a computer (Brener, Billy, & Grady, 2003; Buchan, M, Tims, & Diamond, 2002; Dennis et al., 2002; Gray & Wish, 1998; Thornberry & Krohn, 2000).

## 4.2 Conclusions

Overall, nearly 1 in 12 adolescents and young adults in the ED reported past-year NPSU. Nearly half of those with NPSU in the past 3 months had moderate/severe risk of having or developing a substance use disorder and nearly 1 in 10 noted a wide range of problems associated with use. Among youth with NPSU, polysubstance use is common and those with NPSU had increased odds of alcohol misuse, marijuana use, cocaine use, nonmedical nonprescription cough/cold medicine use and nonmedical sedative or opioid use. Future studies should determine age of initiation of these substances including the age and timing of initiation of nonmedical prescription and non-prescription drug use. In healthcare settings, physicians should recognize polysubstance use as a marker for NPSU in youth and consider the risks of NPSU when prescribing controlled substances. Importantly, there were increased odds of NPSU with dating violence and those with dating violence had higher odds of moderate/severe NPSU than mild NPSU. Future studies should consider this association and interventions should consider addressing multiple risk behaviors among adolescents and young adults.

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**Highlights**

- Approximately 1 in 12 adolescents/young adults in the ED reported past-year NPSU
- Nearly half of those with NPSU in the past 3 months had moderate/severe risk NPSU
- In healthcare settings, poly-substance use is a marker for NPSU.
- Future studies should consider addressing multiple risk behaviors from the ED

**Table 1**

## Demographics and Risk Factors for Past Year Non-medical Prescription Stimulant Use

Variable	No past year NPSU N=4024 n(%) /m(SD)	Mild NPSU N=189 n(%) /m(SD)	Moderate/Severe NPSU N=176 n(%) / m(SD)
<b>Demographics</b>			
Age ***	17.5 (2.0)	18.2 (1.6)	18.1 (1.8)
Female **	2365 (58.8%)	96 (50.8%)	81 (46.0%)
Caucasian Race ***	2873 (71.4%)	164 (86.8%)	148 (84.1%)
African-American	657 (16.3%)	8 (4.2%)	7 (4.0%)
Other	494 (12.3%)	17 (9.0%)	21 (11.9%)
Public Assistance (parent or self)	1059 (26.3%)	51 (27.0%)	53 (30.1%)
Currently in School ***	3503 (87.1%)	146 (77.3%)	142 (80.7%)
Failing grades, or dropped out of school ***	327 (8.1%)	27 (14.3%)	25 (14.2)
<b>Risk Factors</b>			
Injured from a fight ***	251 (6.2%)	27 (14.3%)	32 (18.2%)
Dating Violence (dating aggression or dating victimization) ***	580 (14.4%)	49 (25.9%)	61 (34.7%)
Alcohol Misuse ***	960 (23.9%)	137 (72.5%)	130 (73.9%)
Marijuana Use ***	1199 (29.8%)	161 (85.2%)	135 (76.7%)
Cocaine Use ***	42 (1.0%)	36 (19.1%)	34 (19.3%)
Nonmedical prescription cough or cold medicine misuse ***	562 (14.0%)	64 (33.9%)	64 (36.4%)
Nonmedical Prescription Opioid or Sedative Use ***	250(6.2%)	94(49.7%)	87(49.4%)
<b>Visit Characteristics and ED Utilization</b>			
In ED for injury	1362 (33.9%)	67 (35.5%)	64 (36.4%)
Discharged from Emergency Department	3396 (84.4%)	154 (81.5%)	150 (85.2%)
Previous ED visit in past 12 months *	885 (22.0%)	44 (23.4%)	52 (29.6%)
Nonmedical use of prescription drugs within 6 hours of ED visit ***	25 (0.6%)	4 (2.1%)	9 (5.1%)
Use of drugs within 6 hours of ED visit ***	57 (1.4%)	15 (7.9%)	22 (12.5%)

\*  
p<0.05\*\*  
p<0.01\*\*\*  
p<0.001



**Table 2**

Multinomial Regression Predicting Risk Category for Nonmedical Prescription Stimulant Use (NMSU).

Variable	Mild Past year NPSU <sup>a</sup> aOR (95% CI)	Moderate/Severe Past Year NPSU <sup>a</sup> aOR (95% CI)	Moderate/Severe Past Year NPSU <sup>b</sup> aOR (95% CI)
<b>Demographics</b>			
Age	1.02 (0.92-1.13)	0.99 (0.90-1.10)	0.97 (0.85-1.11)
Female	0.90 (0.64-1.25)	0.69 (0.49-0.97)*	0.77 (0.50-1.19)
Caucasian Race Vs AA	3.57 (1.69-7.75)***	4.17 (1.85-9.35)***	1.15 (0.40-3.33)
Caucasian vs Other	1.49 (0.86-2.60)	1.21 (0.72-2.03)	0.81 (0.41-1.62)
Failing grades, or dropped out of school	0.80 (0.48-1.35)	0.79 (0.47-1.35)	0.99 (0.53-1.85)
<b>Risk Factors</b>			
Injured from a fight	0.81 (0.47-1.39)	0.97 (0.58-1.62)	1.21 (0.65-2.20)
Dating Violence (dating aggression or dating victimization)	0.84 (0.55-1.27)	1.53 (1.03-2.27)*	1.83 (1.12-3.00)*
Alcohol Misuse	2.50 (1.68-3.72)***	3.57 (2.34-5.44)***	1.43 (0.83-2.46)
Marijuana Use	6.01 (3.77-9.58)***	2.63 (1.71-4.04)***	0.44 (0.24-0.80)**
Cocaine Use	3.19 (1.81-5.62)***	2.92 (1.63-5.22)***	0.92 (0.51-1.66)
Nonmedical prescription cough or cold medicine use	1.65 (1.14-2.39)**	1.83 (1.26-2.66)**	1.11 (0.70-1.75)
Prescription Opioid or Sedative use	7.92 (5.42-11.59)***	6.65 (4.51-9.80)***	0.84 (0.52-1.35)
<b>Visit Characteristics and ED utilization</b>			
Previous ED visit in past 12 months	0.75 (0.50-1.11)	1.10 (0.75-1.61)	1.47 (0.91-2.39)

OR: Odds ratio, CI: Confidence Interval

<sup>a</sup> reference group is No Past Year NPSU<sup>b</sup> reference group is mild NPSU

\* p&lt;0.05

\*\* p&lt;0.01

\*\*\* p&lt;0.001