Sources of Nonmedically Used Prescription Stimulants: Differences in Onset, Recency and Severity of Misuse in a Population-Based Study*

Lian-Yu Chen[a,b], **Eric C. Strain**[c], **Rosa M. Crum**[b,c,d], **Carla L. Storr**[b,e], and **Ramin Mojtabai**[b,c]

[a]Taipei City Psychiatric Center, Taipei City Hospital, No.309, Songde Rd., Xinyi Dist., Taipei City, Taiwan

[b]Department of Mental Health, Johns Hopkins Bloomberg School of Public Health, 624, N. Broadway, 7th floor, Baltimore, MD 21205

[c]Department of Psychiatry and Behavioral Sciences, Johns Hopkins School of Medicine, 5510 Nathan Shock Drive Baltimore, MD 21224

[d]Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, 615, N. Wolfe Street W6035, Baltimore, MD 21205

[e]School of Nursing, University of Maryland, 655 West Lombard Street 645C, Baltimore, MD, 21201

Abstract

Aim—Epidemiological data indicate that nonmedical use of prescription stimulants has increased over the past decade. However, little is known regarding the source of the misused stimulants and whether different sources correspond to differences in risk profiles and associated social and health problems.

Method—Data from the 2006 to 2011 National Survey on Drug Use and Health were used. A total of 4,945 participants who used prescription stimulants nonmedically and also reported their

Correspondence to: Lian-Yu Chen, Taipei City Psychiatric Center, Taipei City Hospital, General Psychiatry Department, No.309, Songde Rd., Xinyi Dist., Taipei City, Taiwan, Tel: 886-2-2726-3141, Fax: 886-2-2759-1315, lianyu0928@gmail.com.

source of misused stimulants were categorized by the source: friend/relative, physician and illegal. Logistic regression models compared the socio-demographic, mental health and behavioral problems, and stimulant use-related problems (onset, recency, frequency, severity) according to the source of the misused stimulants.

Results—The most common sources of stimulants were friends/relatives, followed by physicians and illegal sources. Compared to participants reporting friends/relatives as the source, participants reporting an illegal source were more likely to be male, unemployed, have less than a high school education, a history of criminal behavior and an earlier age of use onset. Participants reporting a physician source were more likely to have mental health problems and mental health service use. Higher odds of past-month stimulant use, frequent use (10 days per year), drug dependence and substance service use were found in individuals reporting physician and illegal sources.

Conclusions—Identifying the source of misused stimulants may be useful in detecting distinct subgroups of nonmedical prescription stimulant users, which may inform development of tailored prevention and treatment programs and contribute to individual treatment planning.

Keywords

Prescription stimulants; Nonmedical use; Drug source; Mental health; Criminal behavior

1. Introduction

Prescription drugs are the second most commonly abused category of drugs after marijuana (SAMHSA, 2012). Prescription stimulants are a major contributor to this statistic. In 2012 about 1.2 million Americans reported using nonmedical prescription stimulants in the past year (SAMHSA, 2013). There has been a remarkable growth in nonmedical use of these medications over the past decade particularly among young adults and adolescents (Arria and Wish, 2006; Boyd et al., 2006; McCabe et al., 2005; SAMHSA, 2009a; Teter et al., 2006).

Previous studies have made a considerable contribution to investigating the epidemiology and risk factors associated with nonmedical use of prescription stimulants. In a recent review, the prevalence of past-year nonmedical prescription stimulant use ranged from 5% to 9% in adolescents and 5% to 35% in college-age adults (Wilens et al., 2008). College population studies have shown that the nonmedical prescription stimulant users are more likely to be male, white, members of fraternities and sororities, and earning lower grades (McCabe et al., 2005; Teter et al., 2006). The reported motives for use in this population range from cognitive enhancement and study aid to recreational use (Teter et al., 2005; White et al., 2006). Previous studies have consistently demonstrated that nonmedical prescription stimulant users are more likely to report other substance use and involvement in risky behaviors (McCabe et al., 2007, 2005; Teter et al., 2005).

Numerous studies have also revealed that a friend or relative is generally the primary source for the nonmedically used prescription stimulants (DeSantis and Hane, 2010; Garnier-Dykstra et al., 2012; Garnier et al., 2010; McCabe et al., 2006; White et al., 2006). A previous college-based study found that 61.7% of college students diagnosed with ADHD reported diverting their prescription stimulants (Garnier et al., 2010), suggesting that

physicians could directly or indirectly become the sources for some stimulant misuse. Although availability of stimulants over the internet without a prescription has been reported (Schepis et al., 2008), the internet remains a relatively minor source for prescription drugs as a whole (Inciardi et al., 2010).

Previous studies have shown that sources of nonmedically used prescription drugs could distinguish the risk profiles of the users. A study focused on prescription opioids showed that those who obtained the opioids from a physician were twice as likely to report an opioid use disorder (Becker et al., 2011). Schepis et al. (2009) have evaluated sex or ethnic differences in sources of prescription drugs among adolescents and whether different sources correspond to differences in the risk profiles of other substance use. However, there is limited research on the implications of variations in specific source of nonmedically used stimulants in the general population. In particular, the implications for stimulant use associated problems remain unexplored, including the onset, frequency, recency, and severity of stimulant use—factors that are associated with social and health consequence of stimulant misuse (van der Meer et al., 2011).

Age of onset, recency, frequency and severity are frequently used indices in evaluating substance use disorders as they signal different concomitant substance use profiles and health and social consequences. For example, Lewinsohn.et al. (1999) examined the relationship between life-time use, recency, frequency and age of onset of adolescent cigarette smoking and later occurrence of substance use disorders). Also, the presence of cognitive deficits associated with lifetime stimulant use is dependent on the frequency of use (van der Meer et al., 2011).

While adolescents and adults differ in health problems, their healthcare access and use of healthcare, and criminal behavior, our preliminary tests found many correlates of sources of nonmedically used simulants to be similar among adolescent and adult nonmedical prescription stimulant users (Supplementay Table 1[1]). Thus, this report combines both adolescent and adult data from the 2006 to 2011 National Surveys on Drug Use and Health (NSDUH) to answer the following questions: 1) Do individuals reporting different sources of misused stimulants show different socio-demographic, mental health and behavioral profiles? and 2) Is the source of the nonmedically used stimulants associated with factors such as age of onset of use, recency of use, and severity of the nonmedical stimulant use?

2. Methods

2.1. Sample

We analyzed data from the NSDUH public use data files for 2006 to 2011 (N= 338,495). We restricted our sample to participants who reported using prescription stimulants nonmedically in the past year after excluding those who used methamphetamine only (N=4,945). We conducted the analyses combining adolescent and adult data, as our previous analyses indicated few differences in sources of nonmedically used stimulants among adolescent and adult participants of NSDUH (Supplementary Table 1[2]). The NSDUH is an

---

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

annual cross-sectional survey sponsored by the Substance Abuse and Mental Health Services Administration (SAMHSA) and is designed to provide estimates of the prevalence of alcohol and drug use in the household population of the United States, 12 years of age and older. The survey employs a 50-state design with an independent multistage area probability sample for each of the 50 states and the District of Columbia. African-Americans, Hispanics, and youth are over-sampled to increase the precision of estimates for these groups. The response rate for household screening ranged from 87% to 91%, and for completed interviews from 74% to 76%, across the 6 years. Survey items were administered by computer-assisted personal interviewing (CAPI) conducted by an interviewer and audio computer-assisted self-interviewing (ACASI) for sensitive questions. Use of ACASI was designed to provide respondents with highly private and confidential means of responding to questions and to increase the level of honest reporting of illegal drug use and other sensitive behaviors. Respondents were offered a $30 incentive payment for participation in the survey. Detailed information about the sampling and survey methodology of NSDUH can be found elsewhere (SAMHSA, 2007, 2008, 2009b, 2010, 2011, 2012).

2.2. Assessments

2.2.1. Nonmedical prescription stimulant use—Lifetime nonmedical prescription stimulant use was ascertained through the use of a specified list of stimulants. To aid recall, pictures of the medications were provided. The stimulants included Ritalin or methylphenidate, amphetamines, dextroamphetamine, Cylert, methamphetamine, Methedrine or Desoxyn, Dexedrine, and selected diet pills. Participants were asked: "Have you ever, even once, used [Drug name] that was not prescribed for you or that you took only for the experience or feeling it caused?" Participants were also asked if they had used any other stimulants. We further ascertained past-year nonmedical prescription stimulant use if the respondents answered positively to the above question and indicated that the time since last use was within 12 months.

2.2.2. Sources of misused stimulants—NSDUH respondents who reported using prescription stimulants nonmedically in the past 12 months were asked a series of questions on how they had obtained these drugs most recently. In order to make our study comparable with previous literature (Garnier-Dykstra et al., 2012; McCabe et al., 2006), the 10 mutually exclusive choices were categorized into the following 3 groups: friend/relative source ("got from friend or relative for free, rdquo; "bought from friend or relative" or "took from friend or relative without asking"), physician source ("got from one doctor" or "got from more than one doctor"), and illegal source ("bought from drug dealer or other stranger," "bought on the internet," "wrote fake prescription," "stole from doctor's office, clinic, hospital, or pharmacy"). These groupings focus upon the source, rather than the mechanism by which the medication was obtained. We excluded those who reported "other" source from the analyses as the source was not specified.

2.2.3. Socio-demographic characteristics—Socio-demographic variables included in the analyses were sex, age (12-17, 18-25, 26), race/ethnicity (non-Hispanic white,

minorities), and annual household income ($19,999, $20,000-$34,999, $ 35,000-$69,999, $70,000). For adults aged 18 and above we additionally included marital status (single, non-single), employment status (partial or full employment, unemployed, not in labor force), education (less than high school, high school, college and above).

2.2.4. Past-year criminal behaviors, mental health and substance use problems—Participants reported on how many times they had attacked someone with the intent to seriously hurting them, how many times they had sold illegal drugs, and how many times they had stolen or tried to steal anything worth more than $50 in the past year. Consistent with past research (Martins et al., 2009), participants who reported any of the three behaviors were categorized as having criminal behavior (0 for none of these behaviors and 1 for engaging in these behaviors 1 time or more). Past-year arrest was included to capture involvement with the law and justice systems. Based on the number of times in the past 12 months respondents had been arrested and booked for breaking the law, without counting minor traffic violations, past year arrest was categorized as 0 for none and 1 for one or more.

In the section of the survey assessing health care use, participants were asked if in the past year they had been told by a medical doctor or health care professional that they had an anxiety disorder or depression and whether they received any mental health treatment or substance use disorder treatment in the past year. The NSDUH team created separate indicators for past-year alcohol and drug dependence based on the responses to items that assessed the Diagnostic and Statistical Manual of Mental Disorders–IV (DSM-IV) criteria (American Psychiatric Association, 1994). A composite illegal drug dependence measure was created to demarcate individuals who were not dependent on any other drugs from those dependent on any one or more of the following eight substances: marijuana, crack/cocaine, heroin, hallucinogens, inhalants, prescription pain relievers, prescription tranquilizers and sedatives.

2.2.5. Onset, recency and severity of nonmedical use of stimulants—Based on past research (Grant and Dawson, 1998), early onset of stimulant use was defined by first time of use before or at age 13. Past-month stimulant use was defined as use within the past 30 days. Stimulant use disorders included both stimulant abuse and dependence, defined based on criteria specified in the DSM-IV (American Psychiatric Association, 1994). Frequency of use in the past month or year was a free response question in which participants entered the exact number of days the substance was used. We defined frequent use as using stimulant 10 days or more in the past year, consistent with past literature (Schepis and Krishnan-Sarin, 2009).

2.3. Statistical analyses

Analyses focused on exploring differences between the three past-year nonmedical prescription stimulant user groups categorized by their most recent source: a friends/ relatives, physician, or illegal source group. We also examined the prevalence of nonmedical prescription drug use (opioids, sedatives, tranquilizers) among nonmedical stimulant users using cross-tabulation analysis. The group of friends/relatives source, the largest group, was

set as the reference category. We used a series of logistic regression models to compare the groups with regard to socio-demographic characteristics, mental health problems, mental health and substance disorder service use, criminal behaviors and other substance dependence. Another set of models examined the onset, recency, and severity of stimulant use in each of these groups. The adjusted models were controlled for age, sex, race-ethnicity, education, marital status, employment status, household income, past-year clinician-identified depression or anxiety disorders, criminal behaviors, arrest, mental health and substance service use.

All percentages reported are weighted. Taylor series linearization method, as implemented in Stata 13 (StataCorp, 2013) was used to take into account the complex survey design of NSDUH.

3. Results

3.1. Sources of nonmedically used prescription stimulants

About 7.8% (n = 24,224) of participants from NSDUH 2006-2011 reported lifetime nonmedical use of prescription stimulants, and 1.1% (n=6,384) reported use in the past year. A specific source of misused stimulants was identified by 4,945 respondents, including 3,772 adults and 1,173 adolescents. The most commonly reported specific sources were getting from a friend/relative for free (52.5%), buying from a friend/relative (17.5%), and getting from just one doctor (10.3%; Table 1). A relatively small proportion of prescription stimulant users reported obtaining the medication from more than one doctor (2.9%) or the internet (1.8%). When these sources were summarized into the four predefined categories, the most commonly reported sources were friends/relatives sources (75.1%), followed by physicians (11.2%), illegal sources (9.8%), and "other" sources (3.9%).

Overall, more than 50% of nonmedical prescription stimulants users also reported using other prescription drugs (opioids, sedatives, tranquilizers). Those who obtained stimulants from illegal sources had the highest prevalence of nonmedical use of other prescription drugs (66.3%), followed by those who obtain their stimulants via physician sources (58.8%) or friends/relatives sources (57.5%).

3.2. Correlates of source of nonmedically used prescription stimulants

Participants reporting an illegal source were predominantly male (58.3%), while no sex difference was observed in the other two groups (Table 2). Participants reporting a physician source or illegal source were more likely to be aged 12-17 (vs aged 18-25) compared to those reporting a friends/relatives source.

Compared to the group who obtained stimulants from friends/relatives, the physician source group was more likely to report clinician-identified depression (Odds ratio [OR]: 1.63, 95% confidence interval [95% CI]: 1.05, 2.52), or anxiety disorder (OR: 4.37, 95% CI: 2.66, 7.18) and receiving mental health treatment (OR: 2.92, 95% CI: 1.96, 4.35). The illegal source group was significantly less likely to be female (OR: 0.48, 95% CI: 0.32, 0.72), have college or above education (OR: 0.37, 95% CI: 0.20, 0.69) and more likely to be unemployed (OR: 2.79, 95% CI: 1.18, 6.60). The illegal source group also had higher odds

of criminal behaviors (OR: 2.62, 95% CI: 1.67, 4.10), and arrests (OR: 2.27, 95% CI: 1.47, 3.49) (Table 2). Both the physician source and the illegal source groups were more likely to meet the criteria for drug dependence (physician source group OR: 1.73, 95% CI: 1.15, 2.61; illegal source group OR: 2.36, 95% CI: 1.52, 3.66), and to receive substance abuse treatment in the past year (physician OR: 2.10, 95% CI: 1.30, 3.39; illegal OR: 2.50, 95% CI: 1.49, 4.18).

3.3. Stimulant use onset, recency, and severity

In the adjusted models, the physician source group were more likely to report past-month stimulant use (adjusted OR [aOR]: 3.30, 95% CI: 2.23, 4.86), frequent use (10 days in the past year) (aOR: 3.05, 95% CI: 1.93, 4.81), and to meet the criteria for a stimulant use disorder (aOR: 2.71, 95% CI: 1.49, 4.93), compared to the friends/relatives source group. The illegal source group was more likely to report early onset (onset age 13) (aOR: 2.10, 95% CI: 1.05, 4.18), frequent use (aOR: 2.36, 95% CI: 1.58, 3.54) and to meet criteria for stimulant use disorder (aOR: 2.71, 95% CI: 1.75, 4.20) compared to the friends/relatives source group. We conducted pair-wise comparisons between the physician source and the illegal source groups. In these comparisons, the physician source group was found to be more likely to report past-month use compared to the illegal source group (P=.002). The other comparisons were not statistically significant.

4. Discussion

To the best of our knowledge, this is the first study using nationally representative data to examine the implications of the sources of nonmedically used stimulants with regard to socio-demographic and mental health characteristics of users and seriousness of prescription stimulant use. Consistent with past research (DeSantis and Hane, 2010; Garnier-Dykstra et al., 2012; McCabe et al., 2006; White et al., 2006), in this study friends/relatives were found to be the major sources of misused stimulants, comprising 78.1% of all users.

Those who reported an illegal source for their stimulants were more likely than those obtaining the drug from friends/relatives to be male, unemployed, and less likely to have a higher education. They were also more than two times as likely to report criminal behaviors and history of arrests. It is important to acknowledge that the association between illegal source of stimulants and criminal behavior rating might be simply because the value of the stolen stimulants exceeded $50, thus qualifying as a criminal behavior according to our definition. This group comprised only 10.2% of all nonmedical prescription stimulant users.

The physician source group had markedly greater mental health burden including depression, anxiety disorder, and mental health service use compared to the friends/relatives source group. This finding could indicate the use of prescription stimulants for self-medication by some in this group. In another study, up to 50% of frequent nonmedical prescription stimulant users reported depressed mood (Teter et al., 2010). Additionally, many users self-diagnose themselves as having an attention disorder (Judson and Langdon, 2009). In a 2009 survey study, 39% of college students who misused stimulants did so with the desire to self-treat target symptom such as concentration (McCabe et al., 2009). It is also possible that the physician source group had greater access to medical providers, which in

turn could provide a greater opportunity for being diagnosed with mental disorders (Wang et al., 2005). Future studies need to explore the reasons for the greater prevalence of mental health problems in the physician source group.

Obtaining stimulants from physicians or via illegal methods were both strongly correlated with recent use (in the past month), frequent use (10 days or more in the past year) as well as meeting stimulant use disorder criteria. Those obtaining these drugs via illegal methods were more likely to report an early-onset of stimulant use. Early onset of any substance use has been found to be linked to subsequent dependence on other drugs (Anthony and Petronis, 1995); thus, it is not surprising that the illegal source group was also more likely to have other drug dependence and substance service use compared to the friends/relatives source group.

The finding that the physician source group had significantly higher odds of stimulant use problems and particularly past-month use is intriguing. It is possible that a physician is a more sustainable source of drugs, leading users who obtain their misused drug from this source to continue using, which in turn may then eventually lead to a stimulant use disorder. On the other hand, the psychological vulnerabilities of this group may contribute to the persistent use of stimulants for self-medication. The more serious and persistent nature of stimulant misuse among individuals who report obtaining their drugs from physicians points to the need for better monitoring of dispensation and use of these drugs in medical practice. In one study, almost half of physicians found it difficult to discuss the abuse potential of prescription drugs with their patients (McCabe et al., 2002). This finding suggests that physicians should receive more training to identify nonmedical users, to discuss the potential danger of the stimulants, and to educate their patients regarding the risks associated with misuse and the legal responsibility of drug diversion.

In clinical practice, identifying the source of misused stimulants may also serve as a useful indicator of the specific needs and vulnerabilities of the patients. For example, patients who report obtaining their misused stimulants illegally or from doctors appear to be an increased risk of other substance use disorders.

The availability of prescription drugs on the internet has dramatically increased in recent years (McCabe and Boyd, 2005; Schepis and Krishnan-Sarin, 2009). Nevertheless, internet appears to be a relatively minor source of prescription stimulants in this sample.

Similarly, doctor-shopping which has been recognized as an important signal of misuse and prescription drug fatalities (Hall et al., 2008) was the source of only 0.7% of misused stimulants in this study.

Several limitations to this study and of the NSDUH data should be noted. First, the NSDUH asks for the most recent source of misused stimulants, but not the most commonly used source. Second, Adderall, a commonly used stimulant, was not included in the list of stimulants specifically enquired about and was included in the "other stimulants." There is some evidence that this approach to ascertaining Adderall may have missed a large proportion of Adderall users (Kroutil et al., 2010). Third, given the cross-sectional nature of the NSDUH, causal-relationship cannot be established here. Thus, for example, it is not

clear from these data whether mental health problems preceded or followed stimulant misuse. Fourth, all of the data were based on self-report, which is open to recall or social-desirability bias. However, the validity of these reports has been established in a previous study (Harrison, 2007). Fifth, although we combined adults and adolescents in this study due to similarity in the distribution of sources across age groups and similarity in the correlates of stimulant use, the stimulant source may be differentially associated across age groups with other characteristics of participants that were not examined in this study. Finally, questions used by the NSDUH do not differentiate between those who obtained their stimulant from friends versus relatives. The implications and correlates of these two sources may be different (Schepis and Krishnan-Sarin, 2009).

In the context of the limitations noted earlier, findings from this study suggest that different sources of misused stimulants are associated with different risk profiles and the extent and severity of stimulant use involvement. Those who obtained their misused stimulants from a physician source carry a greater burden of mental health problems, whereas there is a stronger correlation between criminal activities and obtaining stimulants from illegal sources. Both these groups tend to have more serious stimulant use problems than the group who obtained their stimulants from friends or relatives. The implications of these differences in the source of misused stimulants may inform future prevention and treatment campaigns.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

References

Anthony JC, Petronis KR. Early-onset drug use and risk of later drug problems. Drug Alcohol Depend. 1995; 40:9–15. [PubMed: 8746919]

American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. American Psychiatric Association; Washington, DC: 1994.

Arria AM, Wish ED. Nonmedical use of prescription stimulants among students. Pediatr Ann. 2006; 35:565–571. [PubMed: 16986451]

Becker WC, Tobin TG, Fiellin DA. Nonmedical use of opioid analgesics obtained directly from physicians: prevalence and correlates. Arch Intern Med. 2011; 171:1034–1036. [PubMed: 21670373]

Boyd CJ, McCabe SE, Cranford JA, Young A. Adolescents' motivations to abuse prescription medications. Pediatrics. 2006; 118:2472–2480. [PubMed: 17142533]

DeSantis AD, Hane AC. "Adderall is definitely not a drug": justifications for the illegal use of ADHD stimulants. Subst Use Misuse. 2010; 45:31–46. [PubMed: 20025437]

Garnier-Dykstra LM, Caldeira KM, Vincent KB, O'Grady KE, Arria AM. Nonmedical use of prescription stimulants during college: four-year trends in exposure opportunity, use, motives, and sources. J Am Coll Health. 2012; 60:226–234. [PubMed: 22420700]

Garnier LM, Arria AM, Caldeira KM, Vincent KB, O'Grady KE, Wish ED. Sharing and selling of prescription medications in a college student sample. J Clin Psychiatry. 2010; 71:262–269. [PubMed: 20331930]

Grant BF, Dawson DA. Age of onset of drug use and its association with DSM-IV drug abuse and dependence: results from the National Longitudinal Alcohol Epidemiologic Survey. J Subst Abuse. 1998; 10:163–173. [PubMed: 9854701]

Hall AJ, Logan JE, Toblin RL, Kaplan JA, Kraner JC, Bixler D, Crosby AE, Paulozzi LJ. Patterns of abuse among unintentional pharmaceutical overdose fatalities. JAMA. 2008; 300:2613–2620. [PubMed: 19066381]

Harrison, LD.; Martin, SS.; Enev, T.; Harrington, D. The General Population. Substance Abuse and Mental Health Services Administration, Office of Applied Studies; Rockville, MD: 2007. Comparing Drug Testing And Self-Report Of Drug Use Among Youths And Young Adults.

Inciardi JA, Surratt HL, Cicero TJ, Rosenblum A, Ahwah C, Bailey JE, Dart RC, Burke JJ. Prescription drugs purchased through the internet: who are the end users? Drug Alcohol Depend. 2010; 110:21–29. [PubMed: 20227199]

Judson R, Langdon SW. Illicit use of prescription stimulants among college students: prescription status, motives, theory of planned behaviour, knowledge and self-diagnostic tendencies. Psychol Health Med. 2009; 14:97–104. [PubMed: 19085316]

Kroutil LA, Vorburger M, Aldworth J, Colliver JD. Estimated drug use based on direct questioning and open-ended questions: responses in the 2006 National Survey on Drug Use and Health. Int J Methods Psychiatr Res. 2010; 19:74–87. [PubMed: 20222148]

Lewinsohn PM, Rohde P, Brown RA. Level of current and past adolescent cigarette smoking as predictors of future substance use disorders in young adulthood. Addiction. 1999; 94:913–921. [PubMed: 10665079]

Martins SS, Storr CL, Zhu H, Chilcoat HD. Correlates of extramedical use of OxyContin versus other analgesic opioids among the US general population. Drug Alcohol Depend. 2009; 99:58–67. [PubMed: 18706774]

McCabe SE, Boyd CJ. Sources of prescription drugs for illicit use. Addict Behav. 2005; 30:1342–1350. [PubMed: 16022931]

McCabe SE, Boyd CJ, Couper MP, Crawford S, D'Arcy H. Mode effects for collecting alcohol and other drug use data: web and U.S. mail. J Stud Alcohol. 2002; 63:755–761. [PubMed: 12529076]

McCabe SE, Boyd CJ, Teter CJ. Subtypes of nonmedical prescription drug misuse. Drug Alcohol Depend. 2009; 102:63–70. [PubMed: 19278795]

McCabe SE, Boyd CJ, Young A. Medical and nonmedical use of prescription drugs among secondary school students. J Adolesc Health. 2007; 40:76–83. [PubMed: 17185209]

McCabe SE, Knight JR, Teter CJ, Wechsler H. Non-medical use of prescription stimulants among US college students: prevalence and correlates from a national survey. Addiction. 2005; 100:96–106. [PubMed: 15598197]

McCabe SE, Teter CJ, Boyd CJ. Medical use, illicit use and diversion of prescription stimulant medication. J Psychoactive Drugs. 2006; 38:43–56. [PubMed: 16681175]

Substance Abuse and Mental Health Services Administration. Results from the 2006 National Survey on Drug Use and Health: National Findings. Office of Applied Studies; Rockville, MD: 2007. NSDUH Series H-32DHHS Publication No. SMA 07-4293

Substance Abuse and Mental Health Services Administration. Results from the 2007 National Survey on Drug Use and Health: National Findings. Office of Applied Studies; Rockville, MD: 2008. NSDUH Series H-34DHHS Publication No. SMA 08-4343

Substance Abuse and Mental Health Services Administration. The NSDUH Report: Nonmedical Use of Adderall® among Full-Time College Students. Office of Applied Studies; Rockville, MD: 2009a.

Substance Abuse and Mental Health Services Administration. Results from the 2008 National Survey on Drug Use and Health: National Findings. Office of Applied Studies; Rockville, MD: 2009b. NSDUH Series H-36HHS Publication No. SMA 09-4434

Substance Abuse and Mental Health Services Administration. Results from the 2009 National Survey on Drug Use and Health: Volume I Summary of National Findings. Office of Applied Studies; Rockville, MD: 2010. NSDUH Series H-38AHHS Publication No. SMA 10-4856

Substance Abuse and Mental Health Services Administration. Results from the 2010 National Survey on Drug Use and Health: Summary of National Findings. Rockville, MD: 2011. NSDUH Series H-41HHS Publication No. SMA 11-4658

Substance Abuse and Mental Health Services Administration. Results from the 2011 National Survey on Drug Use and Health: Summary of National Findings. Rockville, MD: 2012. NSDUH Series H-44HHS Publication No. SMA 12-4713

Substance Abuse and Mental Health Services Administration. Results from the 2012 National Survey on Drug Use and Health: Summary of National Findings. Rockville, MD: 2013. NSDUH Series H-46HHS Publication No. SMA 13-4795

Schepis TS, Krishnan-Sarin S. Sources of prescriptions for misuse by adolescents: differences in sex, ethnicity, and severity of misuse in a population-based study. J Am Acad Child Adolesc Psychiatry. 2009; 48:828–836. [PubMed: 19564803]

Schepis TS, Marlowe DB, Forman RF. The availability and portrayal of stimulants over the Internet. J Adolesc Health. 2008; 42:458–465. [PubMed: 18407040]

StataCorp. Stata Statistical Software: Release 13. StataCorp LP; College Station, TX: 2013.

Teter CJ, Falone AE, Cranford JA, Boyd CJ, McCabe SE. Nonmedical use of prescription stimulants and depressed mood among college students: frequency and routes of administration. J Subst Abuse Treat. 2010; 38:292–298. [PubMed: 20129754]

Teter CJ, McCabe SE, Cranford JA, Boyd CJ, Guthrie SK. Prevalence and motives for illicit use of prescription stimulants in an undergraduate student sample. J Am Coll Health. 2005; 53:253–262. [PubMed: 15900989]

Teter CJ, McCabe SE, LaGrange K, Cranford JA, Boyd CJ. Illicit use of specific prescription stimulants among college students: prevalence, motives, and routes of administration. Pharmacotherapy. 2006; 26:1501–1510. [PubMed: 16999660]

van der Meer FJ, Meijer JH, Meijer CJ, van den Brink W, Velthorst E. Cognitive functioning associated with stimulant use in patients with non-affective psychosis, their unaffected siblings and healthy controls. Psychol Med. 2013; 22:1–11.

Wang PS, Lane M, Olfson M, Pincus HA, Wells KB, Kessler RC. Twelve-month use of mental health services in the United States: results from the National Comorbidity Survey Replication. Arch Gen Psychiatry. 2006; 62:629–640. [PubMed: 15939840]

White BP, Becker-Blease KA, Grace-Bishop K. Stimulant medication use, misuse, and abuse in an undergraduate and graduate student sample. J Am Coll Health. 2006; 54:261–268. [PubMed: 16539218]

Wilens TE, Adler LA, Adams J, Sgambati S, Rotrosen J, Sawtelle R, Utzinger L, Fusillo S. Misuse and diversion of stimulants prescribed for ADHD: a systematic review of the literature. J Am Acad Child Adolesc Psychiatry. 2008; 47:21–31. [PubMed: 18174822]

- Nonmedical prescription stimulant users have different characteristics by sources.

- Different sources indicate different severity of stimulant use problems.

- Future directions include development of prevention programs by sources.

Table 1

Different types of prescription stimulant sources of past-year nonmedical prescription stimulant users in a sample of the US population aged 12 and above (N= 4,945): data from 2006–2011 National Survey on Drug Use and Health.

Sources	N	Weighted % (95% confidence interval)
Friends/relatives source	3813	75.1(72.8,77.3)
Got the stimulants from a friend or relative for free	2480	52.5 (50.2,54.9)
Bought the stimulants from a friend or relative	1044	7.5 (15.9,19.3)
Took the stimulants from a friend or relative without asking	289	5.0 (4.1,6.2)
Physician source	475	11.2(9.8,12.6)
Got one or more prescriptions for stimulants from just one doctor	427	10.3 (9.0,11.8)
Got prescriptions for stimulants from more than one doctor	48	2.9 (0.6,1.5)
Illegal source	485	9.8(8.1,11.5)
Wrote fake prescriptions for stimulants	20	0.5 (0.2,1.2)
Stole the stimulants from a doctor's office, clinic, hospital, or pharmacy	38	0.9 (0.5,1.6)
Bought the stimulants from a drug dealer or other stranger	363	6.7 (5.5,8.0)
Bought the stimulants on the Internet	64	1.8 (1.2,2.6)
Other source	172	3.9 (2.9,5.3)
Got the stimulants in some other way	172	3.9 (2.9,5.3)

Table 2

Characteristics of past-year nonmedical prescription stimulant users by their stimulant source in a sample of the US population aged 12 and above (N= 4,773): data from 2006–2011 National Survey on Drug Use and Health.

Characteristics	Friends/ Relatives source (N=3,813) N (Wgt%)	Physician source (N=475) N (Wgt%)	Physician source vs Friends/ Relatives source OR (95% CI)	Illegal source (N=485) N (Wgt%)	Illegal source vs Friends/ Relatives source OR (95% CI)
Sex					
Male	1,792(49.0)	220(46.7)	1.00	281(58.3)	1.00
Female	2,021(51.0)	255(53.3)	1.01(0.67,1.50)	204(41.7)	0.48(0.32,0.72)[‡]
Age					
12-17	846(11.6)	135(13.3)	1.00	132(14.4)	1.00
18-25	2,442(48.2)	245(33.2)	0.58(0.40,0.85)[†]	281(40.6)	0.60(0.44,0.82)[†]
26	525(40.3)	95(53.5)	1.17(0.73,1.89)	72(45.3)	0.84(0.45,1.56)
Race					
Non-Hispanic White	3,103(83.2)	350(78.9)	1.00	389(83.1)	1.00
Minorities	710(16.8)	125(21.1)	1.05(0.64,1.73)	96(16.9)	1.04(0.62,1.74)
Marital status[a]					
Married	270(18.9)	52(27.5)	1.00	41(28.7)	1.00
No longer married	152(9.1)	27(20.4)	2.01(0.85,4.75)	28(14.5)	0.71(0.22,2.22)
Never married	2,545(71.4)	261(52.1)	0.50(0.25,1.00)	284(56.8)	0.48(0.19,1.21)
Employment[a]					
Full/Partial	2,054(72.2)	210(65.8)	1.00	227(63.0)	1.00
Unemployed	291(8.1)	43(9.2)	0.93(0.48,1.78)	54(18.4)	2.79(1.18,6.60)[*]
Not in labor force	622(19.7)	87(25.1)	1.26(0.73,2.15)	72(18.6)	1.26(0.68,2.34)
Education[a]					
<High school	350(11.1)	50(14.3)	1.00	84(18.9)	1.00
High school	763(23.5)	94(26.9)	1.83(0.90,3.73)	115(26.5)	0.56(0.31,0.99)[*]

Characteristics	Friends/Relatives source (N=3,813) N (Wgt%)	Physician source (N=475) N (Wgt%)	Physician source vs Friends/Relatives source OR (95% CI)	Illegal source (N=485) N (Wgt%)	Illegal source vs Friends/Relatives source OR (95% CI)
College	1,854(65.4)	196(58.8)	1.20(0.65,2.20)	154(54.6)	0.37(0.20,0.69)[†]
Income					
<$20,000	1,260(28.8)	160(27.1)	1.00	125(23.3)	1.00
$20,000-$49,999	1,107(30.6)	142(33.4)	1.07(0.67,1.73)	169(37.4)	1.73(0.92,3.19)
$50,000-$74,999	508(13.2)	68(14.6)	1.35(0.72,2.53)	61(9.8)	1.02(0.63,1.65)
$75,000	938(27.4)	105(24.9)	0.82(0.46,1.46)	130(29.6)	1.24(0.75,2.05)
Past-year depression					
No	3,128(86.4)	350(73.3)	1.00	361(78.1)	1.00
Yes	650(13.6)	110(26.7)	1.63(1.05,2.52)[*]	124(21.9)	1.28(0.80,2.07)
Past-year anxiety disorder					
No	3,362(89.1)	352(69.2)	1.00	411(86.2)	1.00
Yes	451(10.9)	123(30.8)	4.37(2.66,7.18)[‡]	74(13.8)	1.29(0.85,1.97)
Past-year mental health treatment					
No	2,787(72.7)	262(51.3)	1.00	339(71.7)	1.00
Yes	1,026(27.3)	213(48.7)	2.92(1.96,4.35)[‡]	146(28.3)	1.02(0.65,1.61)
Past-year SUD treatment					
No	3,413(90.3)	408(86.9)	1.00	381(81.4)	1.00
Yes	400(9.7)	67(13.1)	2.10(1.30,3.39)[†]	104(18.6)	2.50(1.49,4.18)[†]
Past-year criminal behavior					
No	2,370(89.1)	309(69.2)	1.00	204(53.4)	1.00
Yes	1,443(10.9)	166(30.8)	1.07(0.67,1.70)	281(46.6)	2.62(1.67,4.10)[*]
Past-year arrest					
No	3,233(86.4)	398(87.3)	1.00	348(75.5)	1.00
Yes	580(13.6)	77(12.8)	1.09(0.73,1.64)	137(24.5)	2.27(1.47,3.49)[*]

Characteristics	Friends/ Relatives source (N=3,813) N (Wgt%)	Physician source (N=475) N (Wgt%)	Physician source vs Friends/ Relatives source OR (95% CI)	Illegal source (N=485) N (Wgt%)	Illegal source vs Friends/ Relatives source OR (95% CI)
Past-year alcohol dependence					
No	2,950(78.3)	362(77.6)	1.00	361(78.4)	1.00
Yes	863(21.7)	113(22.4)	1.50(0.93,2.42)	124(21.6)	1.28(0.78,2.12)
Past-year drug dependence					
No	2,796(76.9)	339(71.6)	1.00	279(65.0)	1.00
Yes	1,017(23.1)	136(28.4)	1.73(1.15,2.61)*	206(35.0)	2.36(1.52,3.66)*

*
p<0.05,

†
p<0.01,

‡
p<0.001

[a]Education, marital status, and employment status were examined in adults aged 18 and above only. Drug dependence did not include stimulant dependence.

Table 3

Onset, recency and severity of past-year nonmedical prescription stimulant use based on source of misused stimulants in a sample of the US population aged 12 and above (N= 4,773): data from 2006–2011 National Survey on Drug Use and Health.

	Early Onset (≤ age 13)		Past-month use		10 days in the past year		Past-year stimulant use disorder	
	Odds Ratio (95% CI)	Adjusted Odds ratio[a] (95% CI)	Odds ratio (95% CI)	Adjusted Odds ratio[a] (95% CI)	Odds ratio (95% CI)	Adjusted Odds ratio[a] (95% CI)	Odds ratio (95% CI)	Adjusted Odds ratio[a] (95% CI)
Physician source vs Friends/ Relatives source	1.82(1.16,2.84)[†]	1.06(0.52,2.19)	3.25(2.39,4.41)[‡]	3.30(2.23,4.86)[‡]	3.10(2.09,4.60)[‡]	3.05(1.93,4.81)[‡]	2.88(1.82,4.58)[‡]	2.71(1.49,4.93)[†]
Illegal source vs Friends/ Relatives source	2.36(1.41,3.95)[†]	2.10(1.05,4.18)[*]	1.66(1.12,2.47)[*]	1.53(0.99,2.37)	2.36(1.58,3.54)[‡]	2.17(1.42,3.31)[‡]	2.80(1.93,4.06)[‡]	2.71(1.75,4.20)[‡]

[*]
p<0.05,

[†]
p<0.01,

[‡]
p<0.001

[a]
Adjusted models included sex, age race, education, marital status, employment, income, past-year major depression, anxiety disorder, criminal behaviors, arrest, mental health and substance service use.