11-21-2016

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Digital Object Identifier (DOI)
https://doi.org/10.1080/10826084.2016.1240694

Notes/Citation Information
Published in *Substance Use & Misuse*, v. 52, issue 4, p. 548-552.

HHS Public Access

Author manuscript

Subst Use Misuse. Author manuscript; available in PMC 2018 March 21.

Published in final edited form as:

Subst Use Misuse. 2017 March 21; 52(4): 548–552. doi:10.1080/10826084.2016.1240694.

Subjective report of side effects of prescribed and non-prescribed psychostimulant use in young adults

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Abstract

Backgroud—Side effects of prescribed and non-prescribed psychostimulant use are understudied.

Objectives—The study examined side effects of prescribed and non-prescribed psychostimulant use in a college sample with attention to possible gender differences.

Methods—2716 undergraduates (1448 male) between the ages of 17 and 57 years (M=19.43 years, SD= 1.7 years) completed an online survey that included questions about the subjective side effects of prescribed and non-prescribed psychostimulant use.

Results—Results suggested that prescribed users more frequently reported side effects, compared to non-prescribed users. For prescribed users, females more frequently reported appetite, somatic, and anxiety-related side effects compared to males. For non-prescribed users, while females reported more somatic and anxiety-related side effects, males more frequently reported loss of sex drive and sweating as side effects.

Conclusions/Importance—These findings suggest prescribed users of psychostimulants more frequently report side effects with prominent gender differences in line with gender roles.

Keywords

Psychostimulants; side effects; non-prescribed use; gender differences

Prescribed and non-prescribed use of psychostimulant medications has been increasing among young adults on college campuses with rates as high as a third. For example, DeSantis, Webb, and Noar (2008) reported that 34% of their college-student sample had used Adderall and other Attention Deficit/Hyperactivity Disorder (ADHD) medications nonmedically for enhanced academic performance and for recreational use. Similarly,

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Advokat, Guidry, and Martino (2008) revealed that 43% of the 1,387 undergraduate students in their study had accessed ADHD stimulant medications without a prescription. A recent meta-analysis suggests rates of psychostimulant misuse on college campuses to be approximately 17% (Benson, Flory, Humphreys, & Lee, 2015). This meta-analysis further found several psychological and social variables associated with misuse, including ADHD symptoms, alcohol and marijuana use, Greek organization membership, and academic performance (Benson et al., 2015). While reasons why college students use non-prescribed psychostimulants require further investigation, Teter et al. (2005) found the three most reported motives for non-prescribed use were to help with concentration, increase alertness, and to provide a high. This appears to be an important and fairly prevalent issue in college samples.

Despite the growing prevalence of use of psychostimulants for treatment and for non-prescribed use, differences in how the side effects of these medications are experienced for prescribed and non-prescribed users are understudied. Rapport and Moffitt (2002) examined side effects of prescribed methylphenidate use in children with ADHD and found that these side effects included weight loss, reductions in height velocity, elevated heart rate, increased blood pressure, reduced appetite, sleep disturbance, headaches, dizziness, and stomachaches, grouped into three classes: height/weight, cardiovascular, and somatic complaints. Morton and Stockton (2000) reported that, although side effects of methylphenidate are generally well tolerated, nonprescription use of methylphenidate produces effects that are similar to the effects of cocaine, which can be dangerous and even deadly.

While basic side effects of psychostimulants have been examined and differences in prescribed and non-prescribed use have been suggested in children (Morton & Stockton, 2000), adult populations are understudied. Particularly, side effects of nonprescription psychostimulant use have not been examined, despite the possibility that such side effects may well differ from those prescribed psychostimulants under physician care. The lack of such information is particularly alarming given the growing trend for nonprescription use of psychostimulants on college campuses among young adults. In addition, there has been some indication of gender differences in drug responses (Anderson, 2008; Franconi et al., 2007; Haack et al., 2009; Tran et al., 1998); yet, the possibility that there may be gender differences in side effects to psychostimulants has never been studied, to our knowledge. Research suggests adverse drug reactions are higher in females than males, which might be due to sex differences in weight, metabolism, and body fat (Anderson, 2008), as well as socialization processes leading to differences in acknowledgement and reporting of discomfort, and gender differences in the prevalence of anxiety and depression (Barsky, Peekna, & Borus, 2001). Therefore, the goal of the present study was to address these gaps in the literature by examining differences in reported side effects of prescribed and non-prescribed psychostimulant use in a college sample with attention to possible gender differences.

Method

Participants

Participants were 2716 undergraduates (1448 male) between the ages of 17 and 57 years (*M*=19.43 years, *SD*= 1.7 years) at a large Southern university in the United States enrolled in an introductory course. The majority of participants were Caucasian (83.5%), and most were freshman (45.6%) or sophomores (29.3%; Table 1). Three hundred ten (11.4%) participants reported an ADHD diagnosis, and 197 (7.3%) reported taking prescribed psychostimulant medication to treat ADHD (15% of those diagnosed). Of those taking prescribed stimulants, the majority reported taking lisdexamfetamine (Vyvanse, 46%) or amphetamine and dextroamphetamine (Adderall, 43%). Eight hundred twenty-six (30.4%) of the participants had taken non-prescribed psychostimulants, which did not include any of the individuals who had taken prescribed psychostimulants. Of those taking non-prescribed stimulants, the majority reported taking amphetamine/dextroamphetamine (Adderall, 85%) followed by lisdexamfetamine (Vyvanse, 49%), with the remainder of non-prescribed users taking methylphenidate (Concerta, 17%; Ritalin, 16%; Methylin, 1%), dexmethylphenidate (Focalin, 4%), dextroamphetamine (Dexedrine, 1%), or atomoxetine (Starttera, 1%). Seven percent of non-prescribed users reported they did not know the name of the stimulant they have taken. All participants completed informed consent, in conformity with local IRB, NIH, and APA ethical guidelines.

Measures

The DeSantis et al. (2008) online survey was utilized to examine subjective side effects of nonprescription use of psychostimulants in undergraduate students. Relevant to our study, participants were asked “Have you ever taken prescribed medication for ADHD?” Participants were also asked “Have you ever taken a non-prescribed medication for ADHD?” For each question, participants were asked to respond with a yes or no. Following each of these questions, they were asked “How often have you experienced the following side effect from your use of ADHD medication?” Side effects queried included: Loss of sex drive; Loss of appetite; Depression; Dry mouth; Diarrhea; Dizziness; Headaches; Heartburn; Irritability; Nausea; Insomnia; Sweating: Increased heart rate; Nervousness; and Paranoia. Participants rated their experience of each side effect on a five-point Likert-type scale, ranging from 1 (Never) to 5 (Always).

Results

Differences in side effects for prescribed vs. non-prescribed users

Loss of appetite, insomnia, and rapid heart rate were the most commonly reported side effects of prescribed and non-prescribed psychostimulant use (Table 2). T-tests indicated that there were significant differences in self-reported side effects between prescribed and non-prescribed users in loss of sex drive ($t[1010] = 3.31$, $p = .001$), depression ($t[1010] = 9.80$, $p < .001$), dry mouth ($t[1010] = 2.09$, $p < .05$), diarrhea ($t[1005] = 3.99$, $p < .001$), dizziness ($t[1011] = 4.68$, $p < .001$), headaches ($t[1008] = 4.84$, $p < .001$), heart burn ($t[1007] = 4.92$, $p < .001$), irritability ($t[1011] = 8.16$, $p < .001$), nausea ($t[1007] = 2.21$, $p < .001$), sweating ($t[1011] = 2.57$, $p < .05$), nervousness ($t[1010] = 5.52$, $p < .001$), and paranoia rate ($t[1011]$

= 4.24, $p < .001$). Of these symptoms, prescribed users reported these side effects more frequently in all instances.

Gender differences in side effects of psychostimulants for prescribed users

T-test indicated that there were significant gender differences in loss of appetite ($t[192] = -2.40$, $p < .05$), dizziness ($t[192] = -2.40$, $p < .05$), nausea ($t[191] = -2.44$, $p < .05$), nervousness ($t[191] = -2.06$, $p < .05$), and headaches ($t[191] = -4.43$, $p < .01$; Table 3) for prescribed users with females reporting experiencing these side effects more frequently than males.

Gender differences in side effects of psychostimulants for non-prescribed users

T-tests indicated that there were significant gender differences in side effects in nausea ($t[814] = -2.49$, $p < .05$), insomnia ($t[818] = -2.13$, $p < .05$), sweating ($t[817] = 2.33$, $p < .05$), paranoia ($t[817] = -2.05$, $p < .05$), loss of sex drive ($t[817] = 5.01$, $p < .001$), dizziness ($t[817] = -3.25$, $p = .001$), headaches ($t[815] = -3.48$, $p = .001$), and nervousness ($t[817] = -3.82$, $p < .001$; Table 4) for non-prescribed users. The side effects of nausea, insomnia, paranoia, dizziness, headaches, and nervousness were more commonly reported by females compared to males, while loss of sex drive and sweating were more commonly reported by males, compared to females.

Discussion

Study results suggested that prescribed users more frequently reported side effects, compared to non-prescribed users. For prescribed users, females more frequently reported appetite, somatic, and anxiety-related side effects compared to males. However, for non-prescribed users, while females reported more somatic and anxiety-related side effects, males more frequently reported loss of sex drive and sweating as side effects.

Counter to our hypotheses, prescribed users more frequently reported side effects than non-prescribed users. Although prior work suggested that non-prescribed users might experience more severe side effects (Morton & Stockton, 2000), young adults prescribed psychostimulants for ADHD reported more severe side effects in our sample. One possible explanation for this is that prescribed users might feel like they have less control or choice in the matter of their psychostimulant use, leading them to perceive side effects as unwanted, while non-prescribed users- who are using because they choose to do so- may perceive any side effects as wanted consequences of using the drug (e.g., loss of appetite in order to lose weight). In fact, recent research suggests that young adults are able to report side effects when they adequately remember them or have sufficient experience with the side effects (Friedman, McGillivary, Murayama, & Castel, 2015); therefore, prescribed users may have more experience with side effects. Further, since the three most common motives college students report for using non-prescribed psychostimulants are to help with concentration, increase alertness, and provide a high (Teter et al., 2005) and those who report non-prescribed psychostimulant use also report higher rates of alcohol use and other drugs (Benson et al., 2015; Teter et al., 2005), it is possible that non-prescribed users do not remember the side effects, or attribute the side effects to alcohol or other drugs. Due to this

study's use of a convenience sample, it is possible and likely that dosage, based on body weight and optimal therapeutic dosage, differed between prescribed and non-prescribed users and accounts for the higher reported side effects of prescribed users. Lastly, prescribed users likely take psychostimulants more regularly than non-prescribed users. As a result, prescribed users may be more likely to experience side effects with frequency. It should be noted that these possibilities are speculative, and future research should more critically examine these competing explanations. However, this information sheds light on why psychostimulants may be exceptionally prone to abuse on college campus, as their non-prescribed use is perceived to confer benefits without much additional cost via side effects.

This study found that females were more likely to report appetite, somatic, and anxiety-related side effects for both prescribed and non-prescribed use, compared to males. This finding may be viewed as in line with gender roles and societal norms such that females might be more likely to endorse any and all side effects, compared to males, since it is viewed as more normative for females to complain or admit to weakness, compared to males who are supposed to be more stoic (DeSantis, 2007). Alternatively, it is possible that females may actually experience more side effects compared to males since they metabolize drugs more slowly (Anderson, 2008; Franconi et al., 2007). Interestingly, among non-prescribed users, males reported side effects related to sex drive and sweating, results that are in line with gender roles and stereotypes which suggest males are more sensitive to side effects affecting their performance and competition status (Nayak et al., 2000; Robinson et al., 2004; Vierhaus, Lohaus, & Schmitz, 2011).

While the current study built on previous research by examining side effects for both prescribed and non-prescribed users, while also considering gender differences, the current study was limited due to reliance on self-report measures, which may have resulted in an underreporting of non-prescribed use and side effects. Additionally, we were unable to collect information on differences in dosages or specific medications taken, as many non-prescribed users did not know this information.

Despite these limitations, the current study suggests some implications for strategies useful for preventing non-prescribed use on college campuses. Since non-prescribed users are not experiencing side effects as adverse, other ways of intervening and discouraging non-prescribed use should be examined (e.g., publicizing the negative health consequences of use). In addition, future work should examine the possibility that dosage of psychostimulants should be adjusted based on sex in order to mitigate gender differences in side effects.

Acknowledgments

We are indebted to the participants who made this study possible.

Funding: This work was supported by the National Institute of Health/National Institute on Drug Abuse [K12 DA 035150] to M Martel.

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Table 1

Demographics

***N* (%)**	
Sex	
Male	1448 (53.3)
Female	1268 (46.7)
Age [*M* (*SD*)]	19.43 (1.7)
Race	
White	2269 (83.5)
African American	228 (8.4)
Student Classification	
Freshman	1239 (45.6)
Sophomore	796 (29.3)
Junior	480 (17.7)
Senior	199 (7.3)
Diagnosed with ADHD?	310 (11.4)
Taking prescribed ADHD meds?	197 (7.3)
Ever took non-prescribed ADHD meds?	826 (30.4)

Note. *N*= 2716.

Table 2

Significant Differences in Side Effects Based on Prescribed vs. Non-prescribed Use

***M* (*SD*)**	**Prescribed *n*=193**	**Non-prescribed *n*=819**	***p***
Side effects			
Loss of sex drive	1.93 (1.07)	1.65 (1.06)	.001**
Loss of appetite	3.78 (1.08)	3.59 (1.41)	.07
Depression	2.29 (1.06)	1.59 (.99)	.00**
Dry mouth	2.97 (1.37)	2.72 (1.53)	.04*
Diarrhea	1.83 (1.10)	1.52 (.94)	.00**
Dizziness	2 (.97)	1.64 (.97)	.00**
Headaches	2.28 (1.09)	1.85 (1.12)	.00**
Heartburn	1.6 (.84)	1.31 (.71)	.00**
Irritability	2.63 (1.19)	1.85 (1.19)	.00**
Nausea	1.76 (.93)	1.59 (.97)	.03*
Insomnia	3.27 (1.07)	3.45 (1.44)	.10
Sweating	2.53 (1.24)	2.25 (1.39)	.01*
Increased heart rate	3.01 (1.21)	2.89 (1.46)	.32
Nervousness	2.59 (1.18)	2.03 (1.27)	.00**
Paranoia	2.09 (1.18)	1.71 (1.10)	.00**

Note. 1=Never. 5=Always.

* $p < .05$,

** $p < .01$.

Table 3

Gender Differences in Side Effects: Prescribed Users

***M* (*SD*)**	**Male *n*=103**	**Female *n*=90**	***p***
Side effect			
Loss of sex drive	1.96 (1.11)	1.89 (1.02)	.64
Loss of appetite	3.61 (1.15)	3.98 (.95)	.02*
Depression	2.16 (1.07)	2.44 (1.04)	.06
Dry mouth	2.87 (1.31)	3.09 (1.43)	.28
Diarrhea	1.80 (1.09)	1.87 (1.12)	.69
Dizziness	1.84 (.91)	2.18 (1.02)	.02*
Headaches	1.97 (.97)	2.64 (1.12)	.00**
Heartburn	1.63 (.86)	1.57 (.82)	.64
Irritability	2.46 (1.09)	2.81 (1.28)	.04
Nausea	1.61 (.81)	1.92 (1.04)	.02*
Insomnia	3.16 (1.06)	3.40 (1.07)	.12
Sweating	2.63 (1.24)	2.41 (1.24)	.21
Increased heart rate	2.97 (1.19)	3.04 (1.23)	.68
Nervousness	2.42 (1.10)	2.77 (1.24)	.04*
Paranoia	2.02 (1.14)	2.16 (1.22)	.39

Note. 1=Never. 5=Always.

* $p < .05$.

** $p < .01$.

Table 4

Gender Differences in Side Effects: Non-Prescribed Users

***M* (*SD*)**	**Male *n*=459**	**Female *n*=360**	***p***
Side effects			
Loss of sex drive	1.81 (1.15)	1.44 (.91)	.00**
Loss of appetite	3.55 (1.40)	3.63 (1.41)	.42
Depression	1.61 (.99)	1.56 (.98)	.52
Dry mouth	2.76 (1.48)	2.68 (1.59)	.50
Diarrhea	1.56 (.93)	1.48 (.96)	.22
Dizziness	1.54 (.86)	1.76 (1.08)	.002**
Headaches	1.73 (1.01)	2.01 (1.24)	.001**
Heartburn	1.34 (.76)	1.27 (.64)	.14
Irritability	1.84 (1.13)	1.87 (1.25)	.68
Nausea	1.51 (.86)	1.68 (1.09)	.02*
Insomnia	3.35 (1.41)	3.57 (1.47)	.03*
Sweating	2.35 (1.42)	2.12 (1.33)	.02*
Increased heart rate	2.81 (1.42)	3.00 (1.50)	.06
Nervousness	1.88 (1.16)	2.22 (1.37)	.00**
Paranoia	1.64 (1.03)	1.80 (1.17)	.04*

Note. 1=Never. 5=Always.

* $p < .05$.

** $p < .01$.