National Trends in and Correlates of Nonmedical Use of Prescription Stimulants, Nonmedical Use Frequency, and Use Disorders

Beth Han, MD, PhD, MPH[a,*]; Christopher M. Jones, PharmD, MPH[b]; Carlos Blanco, MD, PhD[c]; and Wilson M. Compton, MD, MPE[c]

ABSTRACT

Objective: To examine national trends in and correlates of nonmedical use of prescription stimulants, nonmedical use frequency, and use disorders among individuals aged 12–64 years.

Methods: Data from 783,400 persons aged 12–64 who participated in the 2003–2014 National Surveys on Drug Use and Health (NSDUH). Descriptive analyses and bivariable and multivariable logistic regression and zero-truncated negative binomial regression models were applied.

Results: Our multivariable results show that among individuals aged 12–64, the national prevalence of nonmedical use of prescription stimulants in 2003–2004 was higher than in 2007–2008 and was similar to that in 2009–2011, but was lower than in 2013–2014. Among those who used prescription stimulants nonmedically, the frequency of nonmedical use of prescription stimulants in 2003–2004 was lower than that in 2005–2006 and was similar to that in 2007–2014, and the prevalence of prescription stimulant use disorders in 2003–2004 was higher than that in 2005–2010, but was similar to that in 2011–2014. Among nonmedical prescription stimulant users aged 12–64 in 2013–2014, 53.2% reported that their source of stimulants used nonmedically last time was from relatives/friends for free. Our study also identified correlates of prescription stimulant nonmedical use, use frequency, and use disorders. Co-occurring substance use disorders are common among those with prescription stimulant nonmedical use problems.

Conclusions: Among individuals aged 12–64 in the United States, after adjusting for covariates, the prevalence of nonmedical use of prescription stimulants in 2013–2014 was higher than that in 2003–2004. The results of this study help inform and target efforts to reduce prescription stimulant nonmedical use, use frequency, and use disorders.

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[a]Substance Abuse and Mental Health Services Administration, Rockville, Maryland
[b]Office of the Assistant Secretary for Planning and Evaluation, US Department of Health and Human Services, Washington, DC
[c]National Institute on Drug Abuse, Bethesda, Maryland
**Corresponding author:* Beth Han, MD, PhD, 5600 Fishers Lane, 15E85C, Rockville, MD 20857 (beth.han@samhsa.hhs.gov).

Prescription stimulants, schedule II medications due to their high abuse potential, are widely prescribed psychotropic medications for the treatment of attention-deficit/hyperactivity disorder (ADHD) in children and adolescents.[1] During the last decade, the US Food and Drug Administration also approved these medications for the treatment of ADHD in adults.[2,3] Recent research indicates that stimulant prescribing has increased among commercially insured youths and adults between 2010 and 2014,[2] and now total prescription stimulant sales for adults have surpassed those for youth.[3,4]

The nonmedical use of prescription stimulants has been a long-standing concern in the United States.[4–7] Nonmedical use among youth and college students has been the subject of multiple studies.[8–26] However, less research has focused on trends across the age range of youth and nonelderly adults. Furthermore, although increases in prescription opioid prescribing have been associated with increases in nonmedical use and related harms,[27] little research has examined the impact of increases in prescription stimulant prescribing on nonmedical use. Thus, examining trends in and correlates of the prevalence of prescription stimulant nonmedical use, nonmedical use frequency, and use disorder can inform policies to reduce nonmedical use and use disorders, while ensuring access to prescription stimulants for those who need them.

Using nationally representative data of individuals aged 12–64 years, this study examined the following questions:

1. What are the national trends in the prevalence of nonmedical use of prescription stimulants, frequency of nonmedical use, and use disorders overall and by age, sex, and race/ethnicity?
2. What are the correlates of nonmedical use of prescription stimulants?
3. What are the correlates of the frequency of nonmedical use of prescription stimulants among individuals who use prescription stimulants nonmedically?
4. What are the correlates of prescription stimulant use disorders among individuals who use prescription stimulants nonmedically?
5. What are the sources for the most recently nonmedically used prescription stimulants among nonmedical users?

Understanding these questions can help inform and target efforts to reduce nonmedical use of prescription stimulants and related health and social consequences, identify persons with increased risk for prescription stimulant use disorders, and develop effective clinician training programs as well as public health policies, programs, and public messages.

Clinical Points

- After adjusting for covariates, the national prevalence of nonmedical use of prescription stimulants among the population aged 12–64 increased during 2003–2014.
- Our multivariable results show that among those who used prescription stimulants nonmedically, the frequency of nonmedical use of prescription stimulants and stimulant use disorders did not differ between 2003–2004 and 2013–2014.
- Co-occurring substance use disorders are common among those with prescription stimulant use problems.

METHODS

Data Sources

First, we examined data on persons aged 12–64 who participated in the 2003–2014 National Surveys on Drug Use and Health (NSDUH). NSDUH is conducted by the Substance Abuse and Mental Health Services Administration (SAMHSA). NSDUH provided nationally representative data on nonmedical use of prescription stimulants and use disorders among the civilian, noninstitutionalized population aged 12 or older in the United States. The data collection protocol of the NSDUH was approved by the Institutional Review Board at RTI International. The annual mean weighted response rate of the 2003–2014 NSDUH was 65.6% (ranging from 58.3% to 70.2%)[28] according to the definition of response rate 2 for in-person household surveys by the American Association for Public Opinion Research.[29] Details regarding NSDUH data collection are provided elsewhere.[28]

Second, we examined data from the 2003–2014 Drug Enforcement Administration's Automation of Reports and Consolidated Ordering Systems (ARCOS). ARCOS is a comprehensive drug reporting system that monitors the sale of certain controlled substances from their point of manufacture through commercial distribution channels to the point of sale or distribution at the hospital, retail pharmacy, practitioner, or institution level. For this analysis, sales in grams for the prescription stimulants amphetamine, dextroamphetamine, methylphenidate, and dexmethylphenidate were included.[30]

Measures

NSDUH defined 12-month nonmedical use of prescription stimulants as use in the prior 12 months "that was not prescribed for you or that you took only for the experience or feeling it caused."[28] If respondents reported using prescription stimulants nonmedically in the past year, they were asked to state the number of days they used them nonmedically. Consistent with previous work,[31,32] we defined "frequent users" as those with 100 days or more of nonmedical stimulant use in the past year. For persons reporting nonmedical prescription stimulant use in the past year, NSDUH collected the source of stimulants for the most recent nonmedical use, including given by a friend or a relative for free, prescribed by 1 or more physicians, stolen from a friend or a relative, bought from a friend or a relative, bought from a drug dealer, or stranger, bought from the internet, or other source. If respondents reported that they were given by friends or relatives for free, NSDUH asked them the source of their friends or relatives.

NSDUH estimated 12-month substance use disorder for each specific substance (dependence on or abuse of alcohol, marijuana, cocaine, hallucinogens, heroin, or inhalants or prescription pain relievers, sedatives, or stimulants) based on assessments of individual diagnostic criteria from the *DSM-IV*.[33] Nicotine dependence among cigarette smokers was assessed using the Nicotine Dependence Syndrome Scale.[34]

Sociodemographic characteristics from NSDUH data included age (12–17, 18–25, 26–34, or 35–64 years), sex, race/ethnicity (non-Hispanic white, non-Hispanic black, non-Hispanic other, or Hispanic), health insurance (private insurance only, uninsured, Medicaid, or other), annual family income (< $20,000, $20,000–$49,999, $50,000–$74,999, or ≥ $75,000), and college enrollment (only among persons aged 18–25 years).

Statistical Analyses

All analyses were conducted for persons aged 12–64 years. Between 2003 and 2014, we created 6 biennial periods to improve the precision of estimates. For each biennial period, descriptive analyses were conducted to estimate the average annual prevalence of nonmedical use of prescription stimulants, the average frequency of nonmedical use of prescription stimulants among past-year nonmedical users, the mean number of days of nonmedical use of prescription stimulants among past-year nonmedical users, the average annual prevalence of prescription stimulant use disorders among individuals and among nonmedical users, and the average annual US prescription stimulant sales in grams. In addition, among nonmedical prescription stimulant users, we examined trends in frequent nonmedical use and prescription stimulant use disorders during 2003–2014 by sex, age, and race/ethnicity.

For percentage estimates, bivariate logistic regression models were applied to assess the unadjusted annual prevalence, to test for differences between the 2003–2004 estimate and each biennial estimate during 2005–2014 (using PREDMARG and PRED_EFF statements in SUDAAN,[35,36] 2-sided t test with a significance level of .05), and to test P values of β coefficients of the year variable. For mean numbers of days of nonmedical use, linear regression models were applied to examine differences between the 2003–2004 estimate and each biennial estimate in 2005–2014 (using REFLEVEL statement in SUDAAN,[36] 2-sided t test with a significance level of .05) and to test P values of β coefficients of the year variable.

Bivariate and multivariable logistic regression modeling were applied to assess unadjusted and model-adjusted relative risk (using PREDMARG and PRED_EFF statements in SUDAAN[34,35]) for nonmedical use of prescription stimulants among individuals and for prescription stimulant

Table 1. Trends in Past-Year Prescription Stimulant Nonmedical Use and Use Disorders and Trends in Sales of Prescription Stimulants, United States, 2003–2014 (N = 783,400[a])[b,c]

	2003–2004	2005–2006	2007–2008	2009–2010	2011–2012	2013–2014	*P* Value for Trend
Past-year NMU among people, %[d]	1.5 (0.05)	1.6 (0.05)	1.3 (0.04)+	1.4 (0.05)	1.4 (0.05)+	1.6 (0.05)	< .0001
Past-year NMU frequency among users, %[e]							.237 (overall)
1–11 days	42.8 (1.50)	41.2 (1.53)	45.1 (1.64)	46.4 (1.74)	46.3 (1.89)	44.7 (1.56)	.166
12–49 days	23.3 (1.20)	23.7 (1.32)	24.2 (1.64)	22.8 (1.28)	24.5 (1.58)	22.5 (1.35)	.897
50–99 days	10.8 (0.91)	10.3 (0.94)	10.5 (1.03)	11.5 (1.04)	8.0 (0.97)+	11.0 (1.26)	.276
100 days or more	23.1 (1.41)	24.8 (1.46)	20.3 (1.46)	19.3 (1.46)	21.2 (1.66)	21.8 (1.50)	.110
Mean no. of days of NMU among users[e]	60.1 (3.09)	64.8 (3.22)	56.9 (3.22)	54.9 (3.40)	53.9 (3.18)	58.5 (3.20)	.181
Past-year stimulant use disorders among people, %[d]	0.2 (0.02)	0.2 (0.02)	0.2 (0.02)	0.2 (0.02)	0.2 (0.02)	0.2 (0.02)	.377
Past-year stimulant use disorders among users, %[e]	15.0 (1.02)	12.8 (1.00)	13.9 (1.24)	13.1 (1.13)	14.6 (1.38)	14.0 (1.24)	.122
Annual prescription stimulant sales, g/100,000 population	6.45	7.42+	9.16+	10.76+	12.50+	13.41+	< .0001

[a]Substance Abuse and Mental Health Services Administration requires that any description of overall sample size based on the restricted-use data files has to be rounded to the nearest 100 to minimize potential disclosure risk.
[b]Data source: the 2003–2014 National Surveys on Drug Use and Health and the 2003–2014 data from the Automated Reports and Consolidated Ordering System.
[c]Each estimate in parentheses is the standard error of the point estimate within each table cell.
[d]People: individuals aged 12–64.
[e]Users: individuals aged 12–64 who used prescription stimulants nonmedically in the past year.
Abbreviation: NMU = nonmedical use of prescription stimulants.
Symbol: + = difference between the estimate in which the footnote symbol appears and the 2003–2004 estimate (the reference year) is statistically significant at the .05 level.

use disorders among nonmedical users. Moreover, bivariate and multivariable zero-truncated negative binomial regression models were applied to examine factors associated with the number of days of nonmedical use of prescription stimulants among nonmedical users. To account for the complex sample design and sample weights of NSDUH, Stata[37,38] was used for a zero-truncated negative binomial regression function, and SUDAAN software[35] was used for the rest of the analyses. Multicollinearity (using variance inflation factors) and potential interaction effects between examined factors were assessed and were not identified in final multivariable models.

RESULTS

Based on the ARCOS data, we found that the average annual US prescription stimulant sales increased from 6.45 g/100,000 population in 2003–2004 to 13.41 g/100,000 population in 2013–2014 (Table 1). Based on 783,400 sampled persons aged 12–64 from the 2003–2014 NSDUH, we found that the prevalence of nonmedical use of prescription stimulants changed from 1.5% in 2003–2004 to 1.3% in 2007–2008 and to 1.4% in 2011–2012, but it was similar between 2003–2004 and 2013–2014 (Table 1). In contrast, the frequency of nonmedical use of prescription stimulants and the mean number of days of nonmedical stimulant use remained unchanged between 2003 and 2014. Similarly, the prevalence of prescription stimulant use disorders among individuals and among nonmedical users also remained stable during this time period.

Among nonmedical prescription stimulant users, trends remained stable for frequent nonmedical use and prescription stimulant use disorders during 2003–2014 by sex, age, and race/ethnicity, except that the trends in frequent nonmedical use decreased from 19.7% in 2003–2004 to 13.0%–16.0% during 2007–2014 among nonmedical users aged 18–25 overall and decreased from 26.0% in 2003–2004 to 17.2%–20.2% during 2009–2014 among nonmedical users who were non–college students aged 18–25 (Table 2).

After controlling for covariates, compared to 2003–2004, individuals aged 12–64 were less likely to use prescription stimulants nonmedically in 2007–2008 (adjust relative risk [ARR] = 0.9; 95% confidence interval [CI], 0.83–0.98), but were more likely to use them nonmedically in 2013–2014 (ARR = 1.2; 95% CI, 1.17–1.33) (Table 3). Compared to each corresponding reference group, the prevalence of nonmedical use of prescription stimulants was higher among females, those aged 12–34, non-Hispanic whites, those with annual family income less than $20,000, and those with nicotine dependence, alcohol use disorders, and each specific examined drug use disorder.

After controlling for covariates, nonmedical prescription stimulant users had more number of days of nonmedical use in 2005–2006 compared to 2003–2004 (adjusted incidence rate ratios [IRRs] = 1.3; 95% CI, 1.13–1.54) (Table 3). Compared to each corresponding reference group, the frequency of nonmedical use of prescription stimulants was higher among female users, users aged 35–64, Hispanic users, uninsured users, and Medicaid users. Frequency of nonmedical use was also higher among users with nicotine dependence, cocaine use disorders, heroin use disorders, prescription opioid use disorders, and prescription sedative use disorders than users without the corresponding disorders. Moreover, frequency of nonmedical use of prescription stimulants was higher among users who got stimulants from 1 or more physicians, users who bought/stole stimulants from friends/relatives, and users who bought stimulants from drug dealers or strangers than users who got from friends/relatives for free.

Among nonmedical prescription stimulant users, after controlling for covariates, the prevalence of prescription

Table 2. Trends in Past-Year Frequent Nonmedical Use of Prescription Stimulants and Stimulant Use Disorders Among Nonmedical Prescription Stimulant Users Aged 12–64 Years, United States, 2003–2014 (N = 16,000[a])[b,c]

	2003–2004	2005–2006	2007–2008	2009–2010	2011–2012	2013–2014	*P* Value for Trend
Frequent nonmedical use (used 100 days or more nonmedically in the past year)							
Sex							
Male	24.8 (2.03)	25.1 (2.18)	18.6 (2.00)+	20.6 (2.13)	21.8 (2.52)	22.4 (2.13)	.929
Female	21.2 (1.82)	24.4 (2.03)	21.7 (2.05)	17.9 (2.00)	20.5 (1.98)	21.1 (2.05)	.238
Age							
12–17 y	17.1 (1.55)	17.3 (1.68)	15.1 (1.63)	14.0 (1.71)	18.2 (2.17)	15.3 (2.14)	.922
18–25 y	19.7 (1.26)	18.3 (1.29)	16.0 (1.31)+	13.0 (1.10)+	13.8 (1.18)+	14.6 (1.16)+	.0002
College students[d]	11.0 (1.39)	12.3 (1.75)	9.1 (1.44)	9.0 (1.34)	8.2 (1.20)	8.4 (1.28)	.275
Non–college students[d]	26.0 (1.77)	23.1 (1.88)	21.8 (1.97)	17.2 (1.80)+	19.6 (2.02)+	20.2 (1.83)+	.011
26–34 y	27.8 (4.35)	22.7 (3.68)	23.7 (3.43)	25.5 (3.84)	24.2 (3.84)	21.1 (3.12)	.372
35–64 y	30.6 (4.46)	40.0 (4.41)	27.9 (4.70)	27.3 (4.26)	32.8 (5.23)	37.0 (4.19)	.134
Race/ethnicity							
Non-Hispanic white	21.6 (1.53)	24.1 (1.70)	19.4 (1.56)	17.9 (1.58)	19.6 (1.84)	21.0 (1.59)	.286
Non-Hispanic black	20.9 (5.41)	21.2 (6.27)	28.8 (11.6)	22.2 (6.26)	37.6 (10.64)	30.7 (8.71)	.977
Non-Hispanic other	33.5 (7.01)	22.3 (5.05)	15.2 (4.35)+	25.6 (5.19)	16.8 (4.79)	27.8 (5.47)	.200
Hispanic	29.8 (4.57)	31.5 (4.70)	25.8 (4.21)	25.4 (5.32)	27.1 (4.77)	20.3 (4.49)	.797
Prescription stimulant use disorders							
Sex							
Male	14.5 (1.51)	11.4 (1.40)	11.5 (1.32)	13.9 (1.67)	14.9 (2.19)	14.8 (1.55)	.124
Female	15.5 (1.43)	14.2 (1.39)	16.1 (2.01)	12.2 (1.33)	14.3 (1.62)	13.0 (2.01)	.521
Age							
12–17 y	17.3 (1.49)	16.4 (1.74)	18.4 (2.07)	17.0 (1.85)	19.9 (2.19)	16.8 (2.21)	.713
18–25 y	13.3 (1.06)	12.5 (1.09)	11.0 (1.11)	11.9 (1.05)	11.1 (1.15)	11.8 (1.12)	.597
College students[d]	9.5 (1.32)	8.0 (1.33)	9.9 (1.51)	6.9 (1.01)	7.9 (1.28)	6.1 (1.07)	.265
Non–college students[d]	16.1 (1.50)	16.1 (1.64)	12.0 (1.57)	17.3 (1.85)	14.5 (1.88)	16.9 (1.82)	.313
26–34 y	15.0 (3.44)	9.2 (2.21)	11.4 (2.64)	13.3 (3.14)	20.4 (4.17)	16.6 (3.38)	.156
35–64 y	16.2 (3.00)	13.3 (2.79)	18.6 (4.09)	13.0 (2.86)	12.5 (3.45)	13.3 (2.73)	.483
Race/ethnicity							
Non-Hispanic white	15.2 (1.16)	12.8 (1.11)	13.7 (1.26)	13.2 (1.31)	14.0 (1.41)	13.3 (1.46)	.120
Non-Hispanic black	19.4 (5.05)	15.4 (5.29)	20.3 (11.77)	16.6 (5.88)	32.2 (13.81)	20.4 (7.05)	.589
Non-Hispanic other	14.5 (3.91)	9.8 (2.99)	10.7 (3.30)	15.5 (4.01)	16.5 (4.95)	25.1 (5.46)	.348
Hispanic	11.5 (2.53)	13.7 (3.08)	14.0 (3.41)	9.9 (2.35)	11.4 (3.31)	10.9 (2.41)	.583

[a]Substance Abuse and Mental Health Services Administration requires that any description of overall sample size based on the restricted-use data files has to be rounded to the nearest 100 to minimize potential disclosure risk.
[b]Data source: the 2003–2014 National Surveys on Drug Use and Health.
[c]Each estimate in parentheses is the standard error of the point estimate within each table cell.
[d]Those aged 18–25 years.
Symbol: + = difference between the estimate in which the footnote symbol appears and the 2003–2004 estimate (the reference year) is statistically significant at the .05 level.

stimulant use disorders was lower in 2005–2010 compared to 2003–2004 (ARRs = 0.7–0.8), but it was similar between 2011–2014 and 2003–2004 (Table 3). Compared to each corresponding reference group, the prevalence of prescription stimulant use disorders was higher among users aged 35–64, non-Hispanic white users, Medicaid users, and users with nicotine dependence, alcohol use disorders, marijuana use disorders, cocaine use disorders, hallucinogen use disorders, prescription opioid use disorders, and prescription sedative use disorders. The prevalence of prescription stimulant use disorders also was higher among users who got stimulants from 1 or more physicians, users who bought/stole stimulants from friends/relatives, and users who bought stimulants from drug dealers or strangers than users who got them from friends/relatives for free.

Consistent with these multivariable results, Figure 1 shows that the adjusted prevalence of nonmedical use of prescription stimulants among individuals aged 12–64 in 2003–2004 was 1.4% (annual average), which was higher than the 1.3% in 2007–2008, but was lower than the 1.8% in 2013–2014. Among prescription stimulant users aged 12–64, the adjusted prevalence of frequent nonmedical use (100 days or more) in 2003–2004 was 19.3%, which was lower than the 24.5% in 2005–2006. Also among prescription stimulant users, the adjusted prevalence of prescription stimulant use disorders in 2003–2004 was 17.0%, which was higher than the 11.8%–13.0% in 2005–2010.

Based on the 2013–2014 NSDUH data, Figure 2 shows that among past-year nonmedical prescription stimulant users, their most recent source of stimulants used nonmedically included free from relatives/friends (53.2%), buying/stealing from friends/relatives (26.8%), from 1 doctor (10.7), and buying from drug dealers or strangers (4.7%). Among users who responded that they got prescription stimulants for free from friends/relatives, most of them reported that their friend/relatives got them from 1 doctor (78.0%).

DISCUSSION

With a more than doubling of the sales of prescription stimulant medications in the United States during 2003–2014, we found that after adjusting for covariates, the national prevalence of nonmedical use of prescription stimulants among the population aged 12–64 also increased

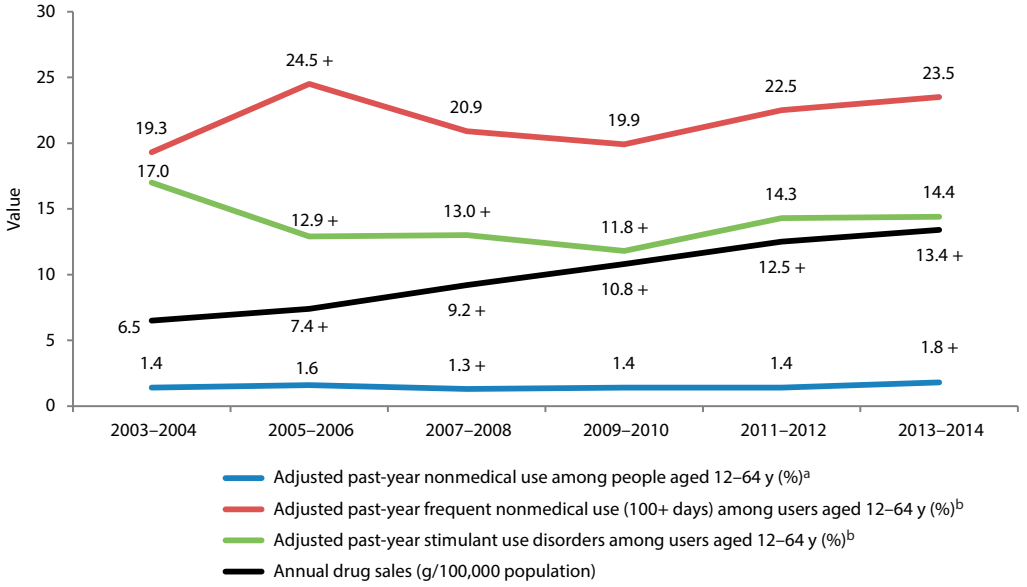
Table 3. Multivariable Results From Regression Models Examining Characteristics Associated With Frequent Nonmedical Use of Prescription Stimulants and Stimulant Use Disorders, United States, 2003–2014[a]

Characteristic	Among People Aged 12–64 y (N = 783,400[b]) Nonmedical Use Adjusted Relative Risk (95% CI)[c]	Among Nonmedical Prescription Stimulant Users Aged 12–64 y (n = 16,000[b])	
		Frequency of Nonmedical Use Adjusted Incidence Rate Ratio (95% CI)[c]	Stimulant Use Disorder Adjusted Relative Risk (95% CI)[c]
Year			
2003–2004 (ref)	1.0	1.0	1.0
2005–2006	1.1 (1.00–1.19)	**1.3 (1.13–1.54)**	**0.8 (0.61–0.94)**
2007–2008	**0.9 (0.83–0.98)**	1.1 (0.96–1.32)	**0.8 (0.61–0.96)**
2009–2010	1.0 (0.88–1.05)	1.0 (0.90–1.26)	**0.7 (0.55–0.88)**
2011–2012	1.0 (0.91–1.08)	1.1 (0.92–1.29)	0.8 (0.66–1.07)
2013–2014	**1.2 (1.17–1.33)**	1.2 (1.00–1.38)	0.8 (0.68–1.05)
Sex			
Male	**0.9 (0.86–0.95)**	**0.9 (0.80–0.95)**	0.9 (0.79–1.00)
Female (ref)	1.0	1.0	1.0
Age			
12–17 y	**2.3 (2.12–2.52)**	**0.6 (0.49–0.66)**	1.0 (0.81–1.19)
18–25 y	**3.3 (3.03–3.53)**	**0.6 (0.51–0.66)**	**0.8 (0.70–0.98)**
26–34 y	**2.2 (1.96–2.38)**	**0.8 (0.66–0.92)**	1.0 (0.79–1.20)
35–64 y (ref)	1.0	1.0	1.0
Race/ethnicity			
Non-Hispanic white (ref)	1.0	1.0	1.0
Non-Hispanic black	**0.3 (0.26–0.35)**	1.1 (0.93–1.35)	1.2 (0.86–1.55)
Non-Hispanic other	**0.5 (0.49–0.58)**	1.0 (0.89–1.23)	**0.8 (0.66–0.99)**
Hispanic	**0.6 (0.56–0.71)**	**1.2 (1.07–1.42)**	1.1 (0.84–1.38)
Insurance type			
Private insurance only (ref)	1.0	1.0	1.0
Uninsured	**1.2 (1.09–1.26)**	**1.4 (1.25–1.55)**	1.2 (1.00–1.39)
Medicaid	1.0 (0.95–1.14)	**1.4 (1.25–1.60)**	**1.2 (1.02–1.45)**
Other insurance	1.09 (0.84–1.07)	1.2 (0.93–1.33)	1.0 (0.79–1.36)
Annual family income			
Less than $20,000 (ref)	**1.5 (1.37–1.62)**	1.0 (0.88–1.13)	1.0 (0.88–1.20)
$20,000-$49,999	1.1 (1.00–1.16)	1.1 (0.95–1.23)	1.1 (0.92–1.28)
$50,000-$74,999	1.0 (0.92–1.09)	1.0 (0.84–1.12)	1.1 (0.88–1.30)
$75,000 or more	1.0	1.0	1.0
Substance use disorders[d]			
Nicotine dependence	**1.9 (1.80–2.04)**	**1.6 (1.44–1.71)**	**1.3 (1.12–1.45)**
Alcohol use disorders	**3.0 (2.78–3.17)**	1.0 (0.95–1.13)	**1.3 (1.11–1.43)**
Marijuana use disorders	**2.7 (2.49–2.90)**	1.0 (0.92–1.10)	**1.2 (1.05–1.36)**
Cocaine use disorders	**3.0 (2.55–3.42)**	**1.2 (1.07–1.38)**	**1.4 (1.17–1.71)**
Inhalant use disorders	**3.1 (2.38–3.98)**	1.2 (0.97–1.42)	1.4 (0.96–1.99)
Hallucinogen use disorders	**2.0 (1.64–2.48)**	1.2 (0.98–1.35)	**1.6 (1.30–1.95)**
Heroin use disorders	**2.5 (1.88–3.22)**	**1.3 (1.04–1.60)**	0.9 (0.70–1.22)
Prescription opioid use disorders	**3.3 (2.94–3.79)**	**1.3 (1.16–1.45)**	**2.4 (1.99–2.85)**
Prescription sedative use disorders	**2.5 (2.03–3.12)**	**1.3 (1.13–1.53)**	**2.6 (2.08–3.14)**
Source of prescription stimulants			
Free from a friend or relative (ref)		1.0	1.0
Prescribed by 1 or more physicians		**2.9 (2.48–3.43)**	**2.8 (2.23–3.45)**
Stolen from a friend or relative		**1.2 (1.01–1.51)**	**1.7 (1.24–2.35)**
Bought from a friend or relative		**1.4 (1.21–1.62)**	**1.6 (1.28–1.95)**
Bought from a drug dealer of stranger		**1.9 (1.56–2.28)**	**1.9 (1.45–2.43)**

[a]Data source: the 2003–2014 National Surveys on Drug Use and Health.
[b]Substance Abuse and Mental Health Services Administration requires that any description of overall sample size based on the restricted-use data files has to be rounded to the nearest 100 to minimize potential disclosure risk.
[c]Adjusted incidence rate ratios and adjusted relative risks in bold: each is significantly different ($P < .05$) from the corresponding reference group.
[d]Reference group is having no corresponding use disorder in the past year.
Abbreviations: CI = confidence interval, ref = reference group.

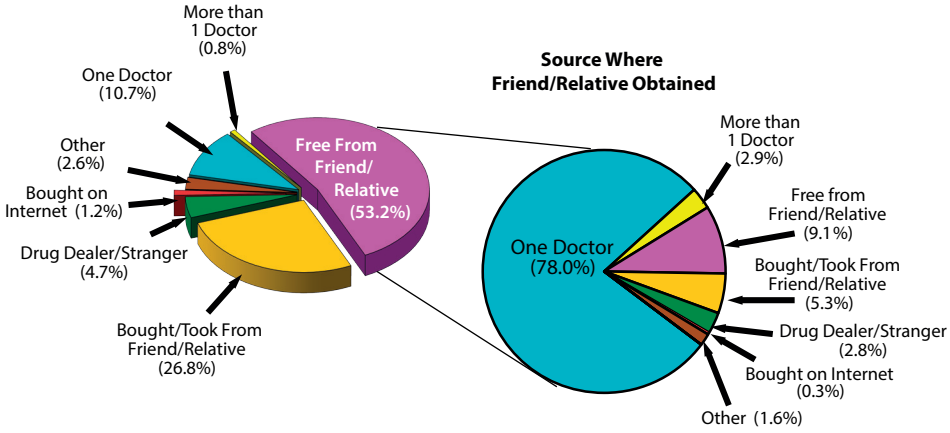
during this study period. Furthermore, our multivariable results show that the frequency of nonmedical use of prescription stimulants and stimulant use disorders did not differ between 2003–2004 and 2013–2014 among those who used prescription stimulants nonmedically. Interestingly, these results do not follow the same patterns seen with opioid analgesics where increases in prescribing have been associated with increases in prescription opioid nonmedical use frequency and use disorders.[27,39,40] Unlike prescription opioids that are often prescribed for acute conditions, stimulants are usually prescribed for chronic conditions requiring long-term use by patients, so there may be fewer

Figure 1. Adjusted Prescription Stimulant Nonmedical Use and Use Disorders and Sales of Prescription Stimulants, United States, 2003–2014



[a]Each adjusted prevalence was estimated after controlling for age, sex, race/ethnicity, insurance status, annual family income, nicotine dependence, and substance use disorder for each specific substance (alcohol, marijuana, cocaine, hallucinogens, heroin, inhalants, prescription pain relievers, and prescription sedatives).
[b]Each adjusted prevalence was estimated after controlling for the variables listed in the above footnote and source of prescription stimulants.
Symbol: + = difference between the estimate in which the footnote symbol appears and the 2003–2004 estimate (the reference year) is statistically significant at the .05 level.

Figure 2. Source of Prescription Stimulants Obtained for Most Recent Nonmedical Use Among US Prescription Stimulant Nonmedical Users Aged 12–64 Years, 2013–2014 (N = 2,000)[a]



[a]Source: Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration, 2013 and 2014 National Surveys on Drug Use and Health.

prescription stimulants to share or divert. Also, stimulants may have been prescribed to more people with lower overall psychopathology, who tend to be at lower risk for high frequency of nonmedical use and use disorders.

Our study identified sociodemographic factors associated with prescription stimulant nonmedical use. After adjusting for covariates, our study found that compared to male counterparts, females aged 12–64 were more likely to use prescription stimulants nonmedically; female nonmedical users aged 12–64 had a higher frequency of nonmedical prescription stimulant use and had similar prevalence of prescription stimulant use disorders. An earlier study reported similar findings among individuals aged 12–34.[41] One recent study reported that more adult women are

prescribed stimulants than adult men.[3] Another recent study found that the use of prescription stimulants was greater in boys than girls among those under age 20, did not differ by sex among those aged 20–34, and was greater in women than men among those aged 35–64.[2] In contrast, among youth aged 10–18 from 10 cities, one recent study did not find sex differences in nonmedical use after controlling for covariates.[11] Among college students of local samples, one study did not find sex difference in nonmedical use of prescription stimulants,[20] while another study found that men were more likely to use prescription stimulants nonmedically than women.[17] The inconsistency in these findings may be because of differences in the age and sampling coverages of these study populations.

Unlike prior studies examining only youth or young adults,[8–26] our study reveals detailed age differences in prescription stimulant nonmedical use, use frequency, and use disorders. Although total prescription stimulant sales to adults have surpassed those for youth,[3] our multivariable results suggest that individuals aged 12–34 were 2.2–3.4 times more likely to use prescription stimulants nonmedically than individuals aged 35–64. However, among those who used prescription stimulants nonmedically, the frequency of nonmedical use was lower among those aged 12–34 than among those aged 35–64, and the prevalence of prescription stimulant use disorders among those aged 35–64 did not differ from that among those aged 12–17 and among those aged 26–34, but was higher than that among those aged 18–25. Our results suggest that nonmedical use in older individuals tends to be more frequent than in youth or young adults, and it is important for clinicians to ensure appropriate management and identify problematic nonmedical use.

Among middle and high school students, one study found that whites were more likely to use prescription stimulants nonmedically than blacks.[42] Among college students, another study reported that whites and Hispanics were over 3.1–3.8 times more likely to have nonmedical use of prescription stimulants than blacks.[43] Our study generally confirms these results,[42–44] showing that among individuals aged 12–64, non-Hispanic whites were more likely to use prescription stimulants nonmedically than racial/ethnic minorities. However, among those who used prescription stimulants nonmedically, the frequency of nonmedical use and stimulant use disorder did not follow these same patterns. We found that among prescription stimulant nonmedical users aged 12–64, Hispanics used prescription stimulants more frequent than non-Hispanic whites, and non-Hispanic others were less likely to have prescription stimulant use disorders than non-Hispanic whites. These results may inform clinicians about complex racial/ethnic differences in prescription stimulant nonmedical use, use frequency, and use disorders.

Among children aged 5–17 during 2006–2008, one study reported that prescription stimulant use did not vary by income and health insurance.[1] We found that lower income and lack of insurance were associated with nonmedical use. Moreover, among nonmedical prescription stimulant users, the frequency of nonmedical use was higher among those uninsured and among those with Medicaid compared to those with private insurance only, and the prevalence of prescription stimulant use disorders was higher among those with Medicaid than among those with private insurance only. These results help clinicians identify those with increased risk for prescription stimulant nonmedical use, use frequency, and use disorders. However, low income and lack of insurance may also make needed treatment harder to obtain.

Consistent with the findings from recent studies,[45,46] our study found that among nonmedical prescription stimulant users in 2013–2014, 53.2% reported that their source of most recently nonmedically used stimulant was from relatives/friends for free. Among users who responded that they obtained prescription stimulants for free from friends/relatives, the vast majority reported that their friends/relatives obtained the stimulant from 1 doctor. Furthermore, our results showed that those with high frequency nonmedical use of prescription stimulants and those with prescription stimulant use disorders were more likely to get their stimulants from physicians or to buy from drug dealers/strangers than get them free from friends/relatives. These results are consistent with sources of prescription opioids used nonmedically.[27] Our results support the idea that physicians should take greater responsibility in the prevention of nonmedical use of prescription stimulants and diversion by implementing evidence-based prevention practices. Yet many physicians do not regularly implement practices that may prevent prescription stimulant nonmedical use.[47,48] Such practices could include following prescribing guidelines to minimize environmental availability of stimulants due to excessively large numbers of leftover medications and checking state prescription drug monitoring programs to identify problematic use of controlled prescription drugs.

Consistent with findings of other existing studies,[11,12,16,41,44] our results showed that among individuals aged 12–64, nonmedical use of prescription stimulants was associated with all examined specific substance use disorders. Moreover, among nonmedical users, nonmedical use and stimulant use disorders were more prevalent among those with many other substance use disorders. Thus, co-occurrence with other substance use disorders is common among those reporting nonmedical use of prescription stimulants. Clinicians should screen for other substance use disorders once nonmedical use of prescription stimulants is identified and for nonmedical stimulant use when other substance use disorders are found.

This study has several limitations. NSDUH did not cover homeless persons not living in shelters, active-duty military, or those residing in institutions (eg, incarcerated individuals). Our national prevalence of prescription stimulant nonmedical use and use disorders may be underestimated because homeless people not living in shelters and people in the criminal justice system usually have higher prevalence of substance use and use disorders compared to general civilian, noninstitutionalized individuals.[49,50] Moreover, because of the cross-sectional nature of NSDUH, this study could not

establish temporal or causal relationships. Furthermore, the 2002–2014 NSDUH did not collect data on motivations for nonmedical use of prescription stimulants and adverse reactions related to nonmedical use. Finally, NSDUH data are subject to recall and social-desirability biases.

CONCLUSIONS

Between 2003–2004 and 2013–2014, with a more than doubling of the sales of prescription stimulant medications in the United States, the adjusted national prevalence of nonmedical use of prescription stimulants among this population also increased. Our study identified correlates of prescription stimulant nonmedical use, use frequency, and use disorders. Co-occurring substance use disorders are common among those with prescription stimulant use problems. Our results can be informative for clinicians to identify inappropriate drug-seeking behaviors and to intervene with patients who have prescription stimulant use problems.

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REFERENCES

1. Zuvekas SH, Vitiello B. Stimulant medication use in children: a 12-year perspective. *Am J Psychiatry*. 2012;169(2):160–166.
2. Burcu M, Zito JM, Metcalfe L, et al. Trends in stimulant medication use in commercially insured youths and adults, 2010–2014. *JAMA Psychiatry*. 2016;73(9):992–993.
3. Safer DJ. Recent trends in stimulant usage. *J Atten Disord*. 2016;20(6):471–477.
4. Weyandt LL, Oster DR, Marraccini ME, et al. Prescription stimulant medication misuse: where are we and where do we go from here? *Exp Clin Psychopharmacol*. 2016;24(5):400–414.
5. Kroutil LA, Van Brunt DL, Herman-Stahl MA, et al. Nonmedical use of prescription stimulants in the United States. *Drug Alcohol Depend*. 2006;84(2):135–143.
6. Wilens TE, Adler LA, Adams J, et al. Misuse and diversion of stimulants prescribed for ADHD: a systematic review of the literature. *J Am Acad Child Adolesc Psychiatry*. 2008;47(1):21–31.
7. Gerlach KK, Dasgupta N, Schnoll SH, et al. Epidemiology of stimulant misuse and abuse: implications for future epidemiologic and neuropharmacologic research. *Neuropharmacology*. 2014;87:91–96.
8. Cruz S, Sumstine S, Mendez J, et al. Health-compromising practices of undergraduate college students: examining racial/ethnic and gender differences in characteristics of prescription stimulant misuse. *Addict Behav*. 2017;68:59–65.
9. Silvestri MM, Correia CJ. Normative influences on the nonmedical use of prescription stimulants among college students. *Psychol Addict Behav*. 2016;30(4):516–521.
10. Zullig KJ, Divin AL, Weiler RM, et al. Adolescent nonmedical use of prescription pain relievers, stimulants, and depressants, and suicide risk. *Subst Use Misuse*. 2015;50(13):1678–1689.
11. Wang Y, Cottler LB, Striley CW. Differentiating patterns of prescription stimulant medical and nonmedical use among youth 10–18 years of age. *Drug Alcohol Depend*. 2015;157:83–89.
12. Benson K, Flory K, Humphreys KL, et al. Misuse of stimulant medication among college students: a comprehensive review and meta-analysis. *Clin Child Fam Psychol Rev*. 2015;18(1):50–76.
13. Giordano AL, Prosek EA, Reader EA, et al. Collegiate misuse of prescription stimulants: examining differences in self-worth. *Subst Use Misuse*. 2015;50(3):358–365.
14. Donaldson CD, Siegel JT, Crano WD. Nonmedical use of prescription stimulants in college students: attitudes, intentions, and vested interest. *Addict Behav*. 2016;53:101–107.
15. Vrecko S. Everyday drug diversions: a qualitative study of the illicit exchange and non-medical use of prescription stimulants on a university campus. *Soc Sci Med*. 2015;131:297–304.
16. Messina BG, Silvestri MM, Diulio AR, et al. Alcohol use, impulsivity, and the non-medical use of prescription stimulants among college students. *Addict Behav*. 2014;39(12):1798–1803.
17. McCabe SE, West BT, Teter CJ, et al. Trends in medical use, diversion, and nonmedical use of prescription medications among college students from 2003 to 2013: connecting the dots. *Addict Behav*. 2014;39(7):1176–1182.
18. Bavarian N, Flay BR, Ketcham PL, et al. The illicit use of prescription stimulants on college campuses: a theory-guided systematic review. *Health Educ Behav*. 2015;42(6):719–729.
19. Whiteside LK, Cunningham RM, Bonar EE, et al. Nonmedical prescription stimulant use among youth in the emergency department: prevalence, severity and correlates. *J Subst Abuse Treat*. 2015;48(1):21–27.
20. Bavarian N, Flay BR, Ketcham PL, et al. Illicit use of prescription stimulants in a college student sample: a theory-guided analysis. *Drug Alcohol Depend*. 2013;132(3):665–673.
21. Cottler LB, Striley CW, Lasopa SO. Assessing prescription stimulant use, misuse, and diversion among youth 10–18 years of age. *Curr Opin Psychiatry*. 2013;26(5):511–519.
22. Wong CF, Silva K, Kecojevic A, et al. Coping and emotion regulation profiles as predictors of nonmedical prescription drug and illicit drug use among high-risk young adults. *Drug Alcohol Depend*. 2013;132(1–2):165–171.
23. Zosel A, Bartelson BB, Bailey E, et al. Characterization of adolescent prescription drug abuse and misuse using the Researched Abuse Diversion and Addiction-related Surveillance (RADARS()) System. *J Am Acad Child Adolesc Psychiatry*. 2013;52(2):196–204.e2.
24. Garnier-Dykstra LM, Caldeira KM, Vincent KB, et al. Nonmedical use of prescription stimulants during college: four-year trends in exposure opportunity, use, motives, and sources. *J Am Coll Health*. 2012;60(3):226–234.
25. Arria AM, DuPont RL. Nonmedical prescription stimulant use among college students: why we need to do something and what we need to do. *J Addict Dis*. 2010;29(4):417–426.
26. Rabiner DL, Anastopoulos AD, Costello EJ, et al. The misuse and diversion of prescribed ADHD medications by college students. *J Atten Disord*. 2009;13(2):144–153.
27. Han B, Compton WM, Jones C, et al. Nonmedical prescription opioid use and use disorders among adults aged 18 through 64 years in the United States, 2003–2013. *JAMA*. 2015;314(14):1468–1478.
28. Substance Abuse and Mental Health Services Administration. National Survey on Drug Use and Health. SAMHSA website. http://www.samhsa.gov/data/population-data-nsduh/reports. Accessed April 23, 2017.
29. American Association for Public Opinion Research. *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates For Surveys*. 8th ed. Lenexa, KS: AAPOR; 2015:52–53.
30. US Department of Justice. Drug Enforcement Administration. Automation of Reports and Consolidated Orders System (ARCOS). https://www.deadiversion.usdoj.gov/arcos/. Accessed April 23, 2017.
31. Jones CM, Paulozzi LJ, Mack KA. Sources of prescription opioid pain relievers by frequency of past-year nonmedical use United States, 2008–2011. *JAMA Intern Med*. 2014;174(5):802–803.
32. Jones CM. Heroin use and heroin use risk behaviors among nonmedical users of prescription opioid pain relievers—United States, 2002–2004 and 2008–2010. *Drug Alcohol Depend*. 2013;132(1–2):95–100.
33. American Psychiatry Association. *Diagnostic and Statistical Manual of Mental Disorders*. Fourth Edition. Washington, DC: American Psychiatric Association; 1994.
34. Shiffman S, Waters A, Hickcox M. The Nicotine Dependence Syndrome Scale: a multidimensional measure of nicotine dependence. *Nicotine Tob Res*. 2004;6(2):327–348.
35. Research Triangle Institute. *SUDAAN Release 11.0.1*. Research Triangle Park, NC: RTI International; 2015.
36. Bieler GS, Brown GG, Williams RL, et al. Estimating model-adjusted risks, risk differences, and risk ratio from complex survey data. *Am J Epidemiol*. 2010;171(5):618–623.
37. StataCorp. *STATA Statistical Software: Release 13*. College Station, TX: StataCorp LP; 2014.
38. Hilbe JM. *Negative Binomial Regression*. Cambridge, UK: Cambridge University Press; 2007.
39. Centers for Disease Control and Prevention (CDC). Vital signs: overdoses of prescription opioid pain relievers—United States, 1999–2008. *MMWR Morb Mortal Wkly Rep*. 2011;60(43):1487–1492.

40. Sheridan DC, Laurie A, Hendrickson RG, et al. Association of overall opioid prescriptions on adolescent opioid abuse. *J Emerg Med*. 2016;51(5):485–490.
41. Wu LT, Swartz MS, Brady KT, et al; NIDA AAPI Workgroup. Nonmedical stimulant use among young Asian-Americans, Native Hawaiians/Pacific Islanders, and mixed-race individuals aged 12–34 years in the United States. *J Psychiatr Res*. 2014;59:189–199.
42. McCabe SE, Teter CJ, Boyd CJ. The use, misuse and diversion of prescription stimulants among middle and high school students. *Subst Use Misuse*. 2004;39(7):1095–1116.
43. Teter CJ, McCabe SE, LaGrange K, et al. Illicit use of specific prescription stimulants among college students: prevalence, motives, and routes of administration. *Pharmacotherapy*. 2006;26(10):1501–1510.
44. Kaye S, Darke S. The diversion and misuse of pharmaceutical stimulants: what do we know and why should we care? *Addiction*. 2012;107(3):467–477.
45. Sweeney CT, Sembower MA, Ertischek MD, et al. Nonmedical use of prescription ADHD stimulants and preexisting patterns of drug abuse. *J Addict Dis*. 2013;32(1):1–10.
46. Chen LY, Crum RM, Strain EC, et al. Prescriptions, nonmedical use, and emergency department visits involving prescription stimulants. *J Clin Psychiatry*. 2016;77(3):e297–e304.
47. Chen LY, Strain EC, Crum RM, et al. Sources of nonmedically used prescription stimulants: differences in onset, recency and severity of misuse in a population-based study. *Drug Alcohol Depend*. 2014;145:106–112.
48. Colaneri N, Keim S, Adesman A. Physician practices to prevent ADHD stimulant diversion and misuse. *J Subst Abuse Treat*. 2017;74:26–34.
49. Ferguson KM, Bender K, Thompson SJ. Gender, coping strategies, homelessness stressors, and income generation among homeless young adults in three cities. *Soc Sci Med*. 2015;135:47–55.
50. Compton WM, Dawson D, Duffy SQ, et al. The effect of inmate populations on estimates of *DSM-IV* alcohol and drug use disorders in the United States. *Am J Psychiatry*. 2010;167(4):473–474.