It is illegal to post this copyrighted PDF on any website. Sources of Prescription Medication Misuse Among Young Adults in the United States: The Role of Educational Status

Sean Esteban McCabe, PhD^{a,*}; Christian J. Teter, PharmD^b; Carol J. Boyd, PhD^a; Timothy E. Wilens, MD^{c,d}; and Ty S. Schepis, PhD^e

ABSTRACT

Objective: This study examined prescription drug misuse (PDM), sources of PDM, and substance use disorder (SUD) symptoms as a function of educational status among US young adults based on a large nationally representative sample.

Methods: Data from the 2009–2014 National Survey on Drug Use and Health came from a sample of 106,845 young adults aged 18– 25 years. Respondents were categorized by educational status and PDM, sources of PDM, other substance use, and SUD symptoms, with analyses performed separately for prescription opioids, stimulants, and sedatives/tranquilizers.

Results: Prescription opioid (past-year: 11.9%) and sedative/ tranquilizer (past-year: 5.8%) misuse were most prevalent among young adults not attending college, especially among high school dropouts. In contrast, full-time college students and college graduates had the highest rates of prescription stimulant misuse (past-year: 4.3% and 3.9%, respectively). Obtaining prescription medications from friends/relatives for free was the most common source of PDM, especially among college students/graduates. Prescription drug misusers who obtained medications from theft/ fake prescriptions, purchases, or multiple sources were more likely to report past-year SUDs and had the most severe overall risk profile of concurrent substance use and SUD. More than 70% of pastmonth prescription drug misusers who reported multiple sources for PDM had at least 1 past-year SUD.

Conclusions: Sources of PDM vary by educational status among US young adults, and the college environment is associated with sharing prescription medications. Clinicians can help assess an individual's risk for SUD by determining whether the individual engaged in PDM and the source of prescription medication the individual is misusing.

J Clin Psychiatry 2018;79(2):17m11958

To cite: McCabe SE, Teter CJ, Boyd CJ, et al. Sources of prescription medication misuse among young adults in the United States: the role of educational status. *J Clin Psychiatry*. 2018;79(2):17m11958.

To share: https://doi.org/10.4088/JCP.17m11958 © Copyright 2018 Physicians Postgraduate Press, Inc.

^aCenter for the Study of Drugs, Alcohol, Smoking and Health, School of Nursing, and Institute for Research on Women and Gender, University of Michigan, Ann Arbor, Michigan

^bDepartment of Pharmacy Practice, College of Pharmacy, University of New England, Portland, Maine

^cPediatric and Adult Psychopharmacology Units, Massachusetts General Hospital, Boston, Massachusetts

^dDepartment of Psychiatry, School of Medicine, Harvard University, Boston, Massachusetts

^eDepartment of Psychology, Texas State University, San Marcos, Texas **Corresponding author:* Sean Esteban McCabe, PhD, Center for the Study of Drugs, Alcohol, Smoking and Health, School of Nursing, University of Michigan, 426 N. Ingalls St, Ann Arbor, MI 48109 (plius@umich.edu). Young adults aged 18–25 years have the highest rates of prescription drug misuse (PDM) in the United States.¹ For the present study, PDM is defined as using prescription opioids, stimulants, or sedatives/ tranquilizers that were not prescribed to the young adult or that were taken only for the experience or feeling they caused. More than 1 in every 7 young adults has misused prescription opioids, stimulants, or sedatives/tranquilizers in the past year.¹ While there is evidence that the medical and nonmedical use of prescription opioids has declined in recent years among adolescents and young adults, opioid-related adverse consequences such as emergency department visits and overdose deaths continue to rise.²⁻⁴

Prescription stimulant misuse is more prevalent among traditional-aged college students than among their noncollege peers.⁵⁻⁷ For instance, more than 1 in every 7 US college males (14.8%) reported nonmedical use of Adderall relative to 7.4% of same-age young adult males not attending college.⁶ In contrast, young adults not attending college have higher prevalence rates of opioid and sedative/ tranquilizer misuse than college students.⁶ Adult college graduates have lower rates of opioid use disorder and, in those with treated attention-deficit/hyperactivity disorder, lower prescription stimulant misuse rates.⁷⁻⁹ Despite differences in the prevalence of PDM between young adult student and non-student populations, the majority of research has focused on student samples.

Young adults often assume greater responsibility for their own medication management during the transition from adolescence to young adulthood, and this leads to greater availability of prescription drugs and diversion involving peers.^{6,10–12} Prescription medication diversion is most prevalent among young adults prescribed stimulant medications, followed by prescription opioids and prescription sedatives/tranquilizers.^{12–14} At least 1 collegebased study¹⁴ found that the majority of users of prescribed stimulant medications had been approached to share their medication, while another college-based study¹³ found that 62% of users of prescribed stimulant medications had shared their medications at least once in their lifetime.

A few studies have examined sources of PDM among young adults,^{10,13,15-17} and there is growing evidence that PDM differs by geographical region and educational attainment.^{5-7,16} Regional college-based studies have found that the most common source of PDM across all prescription drug classes was a friend or peer.^{10,15,17}



McCabe et al It is illegal to post this copyrighted PDF on any website. PDM was assessed by asking

- Prior research has not investigated whether sources of prescription drug misuse differ as a function of educational status among young adults.
- Clinicians can assess educational status when screening for prescription drug misuse and potential sources of prescription drug misuse.
- If a young adult patient presents with recent prescription drug misuse, clinicians should probe sources of prescription drugs and conduct a more comprehensive substance use disorder assessment, especially for those with multiple sources.

Moreover, no research has assessed whether sources of PDM differ by educational status among young adults. This lack of knowledge significantly limits the potential for targeted prevention and treatment program development, especially for those not currently in school.

On the basis of previous studies, we hypothesized the following: (1) prescription opioid and sedative/tranquilizer misuse would be most prevalent among young adults not in college, while prescription stimulant misuse would be most prevalent among young adults in college; (2) obtaining prescription medications from friends/relatives for free would be most prevalent among young adults in college; and (3) young adults who had multiple sources for PDM would have the most severe risk profile of concurrent substance use and substance use disorders.

METHODS

Design and Sample

This study examined data collected between 2009 and 2014 as part of the National Survey on Drug Use and Health (NSDUH). The NSDUH used an independent, multistage area probability sample for all states and Washington, DC, to produce nationally representative data. Interviews began with audio computer-assisted self-interviewing questions on sensitive variables such as PDM; audio computer-assisted self-interviewing was employed to ensure privacy and promote honest reporting and data completeness. The weighted screening and weighted full interview response rates for the NSDUH were both consistently above 80% and 70%, respectively. This study was deemed exempt by an institutional review board. Details regarding NSDUH methodology are available elsewhere.¹⁸

For 2009–2014, a total of 106,845 unweighted young adults completed the NSDUH. The weighted sample was 50.3% male, 50.3% White, 14.2% African-American, and 20.2% Hispanic/Latino.

Measures

Educational status. Educational status among young adults aged 18–25 years of age was categorized as follows: (1) still in high school, (2) in college (full-time or part-time), (3) college graduate, and (4) not in college (high school graduate or high school dropout).

Prescription arug misuse. PDM was assessed by asking respondents a series of questions regarding misuse of prescription opioids, stimulants, and sedatives/tranquilizers in their lifetime that were not prescribed to the respondent (eg, nonmedical misuse) or that they took only for the experience or feeling it caused (eg, medical misuse). These questions were preceded by definitional information explaining to respondents that the study was not interested in their use of over-the-counter medications such as aspirin, Tylenol, or Advil that can be bought in drug stores or grocery stores without a doctor's prescription. To aid recall, individual drug names were used, and respondents were shown pill cards containing pictures of common medications. Respondents who reported lifetime PDM were asked a series of follow-up questions regarding past-year and past-month PDM.

Sources of PDM. Sources of PDM were assessed by asking respondents who endorsed PDM within the opioid, stimulant, and sedative/tranquilizer drug classes several follow-up questions regarding the most recent source for the medication they misused. Only those who endorsed past 30-day PDM were queried as to their most recent source of medication for PDM. The response options for most recent source for PDM were categorized as follows: (1) physician ("got from 1 doctor" or "got from more than 1 doctor"), (2) stole/used a fake prescription ("took from friend or relative without asking," "wrote fake prescription," or "stole from doctor's office, clinic, hospital, or pharmacy"), (3) free from friend or relative ("got from friend or relative for free"), (4) purchased ("bought from friend or relative," "bought from drug dealer or other stranger," or "bought on the internet"), and (5) other source ("got some other way").

Concurrent substance use. Concurrent substance use included past-month binge drinking (ie, 5 or more drinks on the same occasion at the same time or within a couple of hours of each other) and past-month marijuana use. The frequency of past-month binge drinking and marijuana use ranged from 0 days to 30 days.

Substance use disorder. Substance use disorder (SUD) was assessed using past-year *DSM-IV* symptoms for substance abuse and substance dependence for each of the prescription drug classes separately (prescription opioids, stimulants, and sedatives/tranquilizers) as well as each of the other substances separately (alcohol, cannabis, cocaine, methamphetamine, heroin, hallucinogens, and inhalants).^{19,20} For this study, "any SUD" was defined as meeting substance abuse or dependence criteria for at least 1 of the previously mentioned substances.

Data Analysis

The NSDUH data were weighted, clustered on primary sampling units, and stratified appropriately. The Taylor series approximation was used, with adjusted degrees of freedom, to create robust variance estimates. Also, all analyses occurred separately by medication class, with prescription sedatives and tranquilizers aggregated, per previous studies,^{21,22} due to low base rates of sedative PDM and shared pharmacologic agents between sedative and tranquilizer classes and to be

Clinical Points

It is illegal to post this copyrighted PDF on any website

Table 1. School and Non-School Differences in Prescription Drug Misuse and Substance Use Disorders Among Young Adults Aged 18–25 Years^a

	In High School	College Graduate	In College	No College	
	(a)	(b)	(c)	(d)	Pairwise
	% (95% Cl)	% (95% CI)	% (95% Cl)	% (95% CI)	Comparisons ^b
Prescription opioids					
Lifetime misuse	16.4 (15.4–17.5)	19.6 (18.3–20.9)	19.5 (18.9–20.0)	26.8 (26.2–27.4)	a, b, c < d
Past-year misuse	9.0 (8.1–9.9)	7.1 (6.3-8.0)	8.6 (8.3-8.9)	11.9 (11.5–12.3)	a, b, c < d
Prescription stimulants					
Lifetime misuse	4.7 (4.0-5.5)	12.7 (11.6–13.8)	9.2 (8.8–9.6)	9.3 (9.0-9.7)	a < b, c, d
Past-year misuse	2.6 (2.1-3.1)	3.9 (3.3–4.5)	4.3 (4.1–4.6)	2.9 (2.7-3.1)	a < b, c; d < c
Prescription sedatives/tranquilizers					
Lifetime misuse	7.4 (6.6-8.2)	12.9 (11.9–13.9)	11.1 (10.8–11.5)	16.3 (15.8–16.9)	a < c, d; b, c < d
Past-year misuse	3.5 (2.9-4.1)	4.6 (4.0-5.2)	4.5 (4.3-4.8)	5.8 (5.5-6.2)	a < c, d; b, c < d
Substance use disorder					
Past-year prescription opioid use disorder	1.4 (1.0–1.7)	0.5 (0.3-0.7)	1.0 (0.9–1.1)	2.5 (2.3-2.7)	b <a, c<d<="" td=""></a,>
Past-year prescription stimulant use disorder	0.4 (0.3-0.6)	0.3 (0.2-0.5)	0.3 (0.2-0.4)	0.5 (0.4-0.7)	c <d< td=""></d<>
Past-year prescription sedative/ tranquilizer use disorder	0.5 (0.3-0.7)	0.2 (0.1-0.3)	0.3 (0.2-0.4)	0.7 (0.6-0.8)	b, c < d
Past-year prescription drug use disorder ^c	1.8 (1.4–2.3)	0.8 (0.6-1.1)	1.4 (1.2–1.6)	3.1 (2.9–3.3)	b <a, c<d<="" td=""></a,>
Past-year any substance use disorder ^d	14.3 (13.2–15.4)	19.0 (18.0–20.1)	18.5 (18.0–19.2)	19.3 (18.9–19.8)	a < b, c, d
Past-year prescription drug dependence ^e	1.1 (0.8–1.4)	0.6 (0.4-0.8)	1.1 (0.9–1.2)	2.4 (2.2-2.7)	b <a, c<d<="" td=""></a,>
Past-year any substance dependence ^f	7.1 (6.3–8.0)	9.0 (8.3–9.7)	9.7 (9.3–10.2)	11.3 (10.9–11.7)	a < c, d; b, c < d

^aSource: National Survey on Drug Use and Health (NSDUH), 2009–2014 cohorts.

^bAll pairwise comparisons were Bonferroni corrected for multiple comparisons, with comparisons noted only when they differ at a *P* level of .05 or less. The post hoc comparisons were based on logistic models adjusted for age, sex, and race.

CPast-year prescription drug use disorder refers to individuals who self-reported symptoms consistent with DSM-IV substance abuse or dependence involving prescription opioids, stimulants, or sedatives/tranquilizers.

^dPast-year any substance use disorder refers to individuals who self-reported symptoms consistent with *DSM-IV* substance abuse or dependence involving alcohol, cannabis, heroin, cocaine, methamphetamine, hallucinogen, inhalant, prescription opioids, prescription stimulants, or prescription sedatives/ tranquilizers based on the NSDUH instrument.

^ePast-year prescription drug dependence refers to individuals who self-reported symptoms consistent with *DSM-IV* substance dependence involving prescription opioids, prescription stimulants, or prescription sedatives/tranquilizers based on the NSDUH instrument.

^fPast-year any substance dependence refers to individuals who self-reported symptoms consistent with *DSM-IV* substance dependence involving alcohol, cannabis, heroin, cocaine, methamphetamine, hallucinogen, inhalant, prescription opioids, prescription stimulants, or prescription sedatives/tranquilizers based on the NSDUH instrument.

consistent with the *DSM* classification.^{19,20} Initial analyses employed weighted cross-tabulations to estimate prevalence and 95% confidence intervals (CIs) of any lifetime and pastyear PDM (by class) and the sources of PDM variables of interest by educational status. Primary analyses used design-based Rao-Scott χ^2 tests of homogeneity to analyze differences by educational status characteristics in young adults.²³ When the initial χ^2 test was significant, post hoc pairwise comparisons using design-based logistic regression were employed adjusting for age, sex, and race, with *P* values Bonferroni corrected for multiple comparisons. Analyses were performed in Stata 15.0 (StataCorp, 2017; College Station, Texas).

RESULTS

As shown in Table 1, PDM and SUD among young adults differed as a function of educational status and varied by prescription drug class. For prescription opioids and prescription sedatives/tranquilizers, misuse was most prevalent among young adults not in high school or college. Similarly, past-year prescription opioid use disorder and sedative/tranquilizer use disorder were most prevalent in those not in college, with significant differences as compared to either college graduates or those in college full-time after controlling for age, sex, and race/ethnicity.

For prescription stimulants, college graduates and full-time college students had the highest rates of lifetime and past-year prescription stimulant misuse, respectively. However, past-year prescription stimulant use disorder was significantly more prevalent in those not in college, after controlling for age, sex, and race/ethnicity. For *any* past-year prescription drug use disorder, college graduates reported the lowest rates, while high school dropouts or non-college students reported the highest rates. Similarly, young adults in neither high school nor college reported the highest rates of any SUD, prescription drug dependence, and any substance dependence.

We conducted additional analyses and found that pastmonth prescription drug misusers were significantly more likely to report any past-year SUD than those who did not report past-month PDM (PDM = 59.6% [95% CI, 57.8%– 61.3%] vs non-PDM = 16.4% [95% CI, 16.1%–16.7%], P < .0001). Additional analyses revealed that high school dropouts reported the highest rates for any past-year SUD, while young adults attending high school reported the lowest rates.

As illustrated in Table 2, the most prevalent individual mutually exclusive source of PDM was friends or relatives who gave them for free, followed by purchased. There were some important differences in sources of PDM as a function of educational status. Most notably, prescription drug misusers in college were generally more likely than those not in college to obtain medications for free from friends/relatives, and college graduates and young adults in high school were less likely to make purchases than those not in college. We conducted additional analyses examining non–mutually exclusive sources across 6 categories of young

Table 2. School and Non-School Differences in Diversion Sources Among Young Adult Prescription Drug Misusers^a

	In High School	College Graduate	In College	No College	
	(a)	(b)	(c)	(d)	Post Hoc
Diversion Source ^b	% (95% CI)	% (95% Cl)	% (95% CI)	% (95% CI)	Comparison ^c
Prescription opioids					
Physician only	18.8 (11.2–29.8)	15.4 (9.7–23.6)	10.2 (8.1–12.9)	11.2 (9.7–12.9)	No differences
Theft/fake prescription only	4.9 (2.3–10.3)	0.5 (0.1-3.5)	3.7 (2.5-5.5)	2.8 (1.9-4.2)	No differences
Free from friend/relative only	38.0 (30.0-46.7)	40.6 (31.3-50.6)	37.7 (34.2–41.3)	31.5 (29.2–34.0)	d < b, c
Purchased only	7.9 (4.6–13.5)	10.8 (6.1–18.5)	11.8 (9.7–14.4)	17.2 (14.9–19.7)	a, b, c < d
Other source only	4.5 (2.0–10.0)	3.0 (1.1–7.7)	3.6 (2.5–5.1)	6.0 (4.7–7.6)	No differences
Multiple sources	25.8 (19.3–33.7)	29.7 (21.1–40.1)	33.0 (29.6–36.5)	31.3 (28.9–33.8)	No differences
Prescription stimulants					
Physician only	18.1 (8.2–35.3)	10.2 (4.5–21.4)	7.2 (5.0–10.4)	12.6 (8.1–19.2)	No differences
Theft/fake prescription only	3.1 (0.4–18.7)	0.6 (0.1-3.9)	2.3 (1.1–4.8)	3.3 (1.5–7.2)	No differences
Free from friend/relative only	40.4 (21.3–63.0)	49.3 (33.3–65.4)	37.0 (32.2–42.1)	30.5 (24.8–36.8)	d, c < b
Purchased only	17.7 (8.2–34.0)	23.5 (12.4–40.1)	28.6 (24.4–33.2)	31.7 (25.5–38.6)	a <c< td=""></c<>
Other source only	2.9 (0.7–11.1)	7.1 (1.7–25.5)	2.5 (1.2–5.0)	5.9 (3.7–9.3)	No differences
Multiple sources	17.9 (8.4–34.2)	9.3 (3.3–23.5)	22.4 (17.4–28.4)	16.0 (11.4–22.1)	No differences
Prescription sedatives/tranquilizers					
Physician only	6.3 (2.4–15.5)	13.4 (6.2–26.5)	9.7 (7.1–13.2)	9.9 (7.5–13.0)	No differences
Theft/fake prescription only	6.7 (2.7–15.6)	7.1 (2.9–16.5)	4.1 (2.5-6.9)	5.8 (3.6–9.4)	No differences
Free from friend/relative only	46.8 (32.3–61.8)	56.0 (43.6–67.6)	45.0 (40.0-50.1)	38.1 (33.8–42.7)	No differences
Purchased only	25.7 (15.5–39.5)	8.0 (3.5–17.6)	23.7 (19.1–29.0)	29.5 (25.7–33.7)	b <d< td=""></d<>
Other source only	2.7 (0.5–13.8)	3.4 (0.8–13.3)	3.5 (1.7–6.8)	4.6 (2.9–7.1)	No differences
Multiple sources	11.9 (5.5–23.8)	12.1 (5.5–24.7)	14.0 (10.8–17.9)	12.1 (9.5–15.3)	No differences

^aSource: National Survey on Drug Use and Health (NSDUH), 2009–2014 cohorts.

^bDiversion sources are mutually exclusive from one another.

^cAll pairwise comparisons were Bonferroni corrected for multiple comparisons, with comparisons noted only when they differ at a *P* level of .05 or less. The post hoc comparisons were based on logistic models adjusted for age, sex, and race.

adults and also found the most prevalent source of PDM was friends or relatives who gave them for free, while the sources with the lowest prevalence (1% or less) were purchased on the internet and obtained via a fake prescription (see Supplementary eTable 1).

As illustrated in Table 3, prescription drug misusers who obtained medications from multiple sources, purchased them, or used theft/fake prescriptions had the highest prevalence rates of substance-specific SUDs, any SUDs, and any substance dependence. In addition, prescription drug misusers who only obtained medications from a friend/ relative for free tended to have the lowest prevalence rates of substance-specific SUDs, any SUDs, and any substance dependence. Notably, more than 70% of past-month prescription drug misusers who reported multiple sources for PDM had a past-year SUD.

As shown in Table 4, we examined binge drinking, marijuana use, drug-specific SUD, any SUD, and any substance dependence as a function of source of PDM. Prescription drug misusers who purchased medications had significantly elevated odds of past-month binge drinking across medication classes, and those who purchased opioids or sedative/tranquilizers also had elevated odds of pastmonth marijuana use and a past-year substance dependence diagnosis, relative to those who obtained from a physician. Finally, opioid purchasers were more likely than those using physician sources to have a past-year opioid use disorder or any SUD. In addition, prescription opioid misusers who *only* obtained from a friend/relative for free or who had multiple sources had significantly greater odds of binge drinking and marijuana use relative to those who obtained from a physician. Users of multiple sedative/tranquilizer sources also had higher odds of any SUD or substance dependence than those who only obtained from a physician. Finally, prescription opioid and sedative/tranquilizer misusers who obtained medications from any nonphysician sources had significantly greater odds of recent marijuana use. Across medication classes, misusers who *only* obtained medications from a friend/relative for free had significantly *lower* odds of the medication class-related SUD as compared to those who obtained only from a physician.

DISCUSSION

The present study indicated that prescription stimulant misuse was more prevalent among full-time college students and college graduates, while prescription opioid and sedative/tranquilizer misuse was more prevalent among young adults not in college, especially high school dropouts. The prevalence rate of prescription opioid misuse among US college students in the present study is higher than in other national studies such as the Monitoring the Future (MTF) study, while rate of prescription stimulant misuse was higher among college students in the MTF study.⁶ Such differences are due in part to important measurement and methodological differences between the NSDUH and other national studies such as the MTF study.^{6,16} Nevertheless, national studies have found similar differences in PDM among college versus non-college young adults.^{6,7,16} It is plausible that motivations could play an important role in these differences because at least 1 prior college study¹⁵ found that over 70% of young adult prescription stimulant misusers

S IIIeoal to post this copyrighted PLJF on any webs

Diversion Source ^b	Past-Year Substance-Specific Use Disorder, ^c % (95% CI) ^f	Past-Year Any Substance Use Disorder, ^d % (95% Cl) ^f	Past-Year Any Substance Dependence, ^e % (95% Cl) ^f
Prescription opioids			
Physician only	20.0 (15.3–25.7)	46 3 (40 6-52 2)	31 8 (27 1–37 0)
Theft/fake prescription only	20.6 (12.7–31.7)	64.3 (51.4–75.4)	41.6 (30.7–53.5)
Free from friend/relative only	9.5 (7.5–12.0)	49.6 (45.7–53.6)	30.3 (26.7–34.1)
Purchased only	40.5 (35.3–46.0)	70.4 (65.4–75.0)	57.5 (52.5–62.4)
Other source only	17.3 (12.3–23.9)	60.3 (51.1–68.9)	38.0 (29.2–47.7)
Multiple sources	43.2 (39.4–47.1)	75.6 (72.3–78.7)	61.7 (57.9–65.3)
	Free < Other, Physician,	Free, Physician < Purchased,	Free, Physician,
	Theft < Purchased,	Multiple sources;	Other < Purchased, Multiple
Pairwise comparisons ^f	Multiple sources	Other < Multiple sources	sources; Theft < Multiple sources
Prescription stimulants			
Physician only	35.5 (22.2–51.5)	63.4 (48.1–76.3)	51.8 (36.8–66.5)
Theft/fake prescription only	35.0 (16.5–59.6)	82.2 (61.6–93.1)	63.7 (39.3–82.7)
Free from friend/relative only	9.3 (5.9–14.3)	56.4 (49.1–63.4)	35.5 (29.7–41.7)
Purchased only	19.0 (14.3–24.7)	71.8 (63.6–78.7)	57.2 (50.6–63.6)
Other source only	25.0 (11.1–47.1)	64.2 (42.3-81.4)	49.7 (27.2–72.3)
Multiple sources	25.5 (18.1–34.7)	71.3 (60.1–80.3)	46.9 (36.7–57.4)
Pairwise comparisons ^f	Free < Physician, Multiple sources	No differences	Free < Purchased
Prescription sedatives/tranguilizers			
Physician only	25.8 (18.2–35.3)	64.9 (54.8–73.9)	45.6 (36.3–55.2)
Theft/fake prescription only	31.7 (17.6–50.2)	77.8 (65.1-86.8)	59.8 (45.7–72.5)
Free from friend/relative only	5.2 (3.2–8.4)	56.1 (51.0-61.1)	39.8 (34.9-44.9)
Purchased only	18.0 (13.9–23.0)	74.7 (68.2–80.2)	62.9 (56.3–69.0)
Other source only	11.2 (4.3–26.3)	69.6 (52.2-82.8)	59.0 (43.3–73.2)
Multiple sources	26.9 (19.7–35.4)	81.0 (73.2-86.9)	67.5 (58.2–75.7)
Pairwise comparisons ^f	Free < Physician, Theft,	Free < Theft, Purchased,	Physician < Multiple sources;
	Purchased, Multiple sources	wulliple sources	Multiple sources
			multiple sources

^aSource: National Survey on Drug Use and Health (NSDUH), 2009–2014 cohorts.

^bDiversion sources are mutually exclusive from one another.

^cPast-year substance-specific use disorder refers to individuals who self-reported symptoms consistent with *DSM-IV* substance abuse or dependence for each prescription drug class based on the NSDUH instrument (eg, 20.0% of prescription opioid misusers who endorsed "physician only" had prescription opioid abuse or dependence).

^dPast-year any substance use disorder refers to individuals who self-reported symptoms consistent with *DSM-IV* substance abuse or dependence involving alcohol, cannabis, heroin, cocaine, methamphetamine, hallucinogen, inhalant, prescription opioids, prescription stimulants, or prescription sedatives/tranquilizers based on the NSDUH instrument.

^ePast-year any substance dependence refers to individuals who self-reported symptoms consistent with DSM-IV substance dependence involving alcohol, cannabis, heroin, cocaine, methamphetamine, hallucinogen, inhalant, prescription opioids, prescription stimulants, or prescription sedatives/tranquilizers based on the NSDUH instrument.

^fAll pairwise comparisons were Bonferroni corrected for multiple comparisons, with comparisons noted only when they differ at a *P* level of .05 or less. The post hoc comparisons were based on logistic models adjusted for age, sex, and race.

reported study/productivity-related motives. More research is needed to investigate the potential causes for higher rates of prescription opioid and sedative/tranquilizer misuse among young adults not in college, including motives for PDM.

The findings of this study provide new evidence that sources of PDM differ among US young adults based on educational status. The findings reinforce that developmental changes during the transition from adolescence to young adulthood place individuals in social contexts such as colleges that directly impact sources of PDM. Prescription drug misusers enrolled full-time in college and recent college graduates were more likely to obtain medications for free from friends/relatives than those not in college across all 3 medication classes. These findings lend support to the notion that greater responsibility of one's own medication management during young adulthood could lead to increased availability and willingness to share with peers, especially among college students and college graduates.^{6,10-12} Previous studies indicate that the influence of educational status on PDM appears to extend beyond adolescence and young adulthood into adulthood with lower PDM prevalence in college graduates^{7–9} and lower rates of opioid overdose in those who at least completed high school.²⁴

Regional and national studies have demonstrated PDM involving each drug class is associated with short-term and long-term consequences, including neuropsychological functioning, depressed mood, sleep problems, and higher rates of SUD symptoms in adulthood.^{25–29} Clinicians can easily assess educational status when screening for PDM among young adults and make their patients aware of the growing evidence for adverse consequences associated with PDM.

To date, the majority of research focusing on PDM has focused on college students, and the current study indicates that young adults not in college are at heightened risk for PDM-related SUD and substance dependence. Despite lower rates of past-year prescription stimulant misuse, the present study found that non-college young adults had

McCabe et al

Table 4. Trescription Drug Mis	suse sources and s	ubstance-helateu	conclates		
			Past-Year	Past-Year Any	Past-Year Any
	Past-Month	Past-Month	Substance-Specific	Substance Use	Substance
	Binge Drinking,	Marijuana Use,	Use Disorder, ^d	Disorder, ^e	Dependence, ^f
Prescription Drug Misuse Source ^b	AOR (95% CI) ^c	AOR (95% CI) ^c	AOR (95% CI) ^c	AOR (95% CI) ^c	AOR (95% CI) ^c
Prescription opioids					
Physician only	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Theft/fake prescription only	1.25 (0.67–2.33)	2.36 (1.32-4.23)**	1.02 (0.52-2.01)	2.17 (1.27–3.73)**	1.52 (0.94–2.47)
Free from friend/relative only	1.73 (1.30–2.30)***	1.86 (1.38–2.49)***	0.41 (0.27-0.63)***	1.19 (0.91–1.55)	0.93 (0.72-1.20)
Purchased only	1.72 (1.22–2.45)**	3.68 (2.51–5.40)***	2.54 (1.70-3.80)***	2.52 (1.79–3.55)***	2.70 (1.96-3.72)***
Other source only	1.16 (0.74–1.82)	1.67 (1.11–2.49)*	0.76 (0.46-1.27)	1.65 (1.11–2.47)*	1.24 (0.82–1.89)
Multiple sources	2.43 (1.78-3.32)***	2.96 (2.07-4.23)***	2.96 (2.04-4.29)***	3.70 (2.79–4.90)***	3.39 (2.69-4.28)***
Prescription stimulants					
Physician only	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Theft/fake prescription only	0.78 (0.19-3.26)	0.99 (0.26-3.75)	0.95 (0.29-3.17)	2.75 (0.74–10.25)	1.61 (0.50-5.20)
Free from friend/relative only	2.08 (0.96-4.53)	1.39 (0.69–2.80)	0.19 (0.09–0.43)***	0.76 (0.38–1.52)	0.53 (0.27-1.02)
Purchased only	2.33 (1.06–5.14)*	1.84 (0.85–3.98)	0.42 (0.21–0.86)*	1.48 (0.73–3.02)	1.23 (0.65–2.35)
Other source only	0.51 (0.17–1.58)	1.14 (0.41–3.20)	0.57 (0.15–2.11)	1.03 (0.36–2.97)	0.88 (0.29-2.66)
Multiple sources	2.06 (1.03–4.11)*	1.10 (0.50–2.39)	0.63 (0.30–1.33)	1.51 (0.62–3.63)	0.84 (0.42-1.68)
Prescription sedatives/tranquilizers					
Physician only	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Theft/fake prescription only	0.76 (0.35-1.66)	3.76 (1.69–8.34)***	1.33 (0.55–3.56)	1.91 (0.86–4.25)	1.79 (0.89–3.60)
Free from friend/relative only	1.62 (0.95–2.76)	2.29 (1.43–3.67)***	0.16 (0.08–0.32)***	0.73 (0.45–1.16)	0.81 (0.52-1.28)
Purchased only	2.02 (1.22–3.33)**	5.57 (3.40–9.13)***	0.61 (0.34-1.08)	1.53 (0.91–2.58)	1.97 (1.23–3.15)**
Other source only	2.52 (1.06-6.00)*	6.76 (2.78–16.44)***	0.35 (0.11–1.16)	1.19 (0.51–2.78)	1.68 (0.81–3.49)
Multiple sources	1.51 (0.83–2.74)	3.40 (1.97–5.88)***	1.08 (0.58–2.03)	2.37 (1.25–4.51)**	2.52 (1.47-4.32)***

^aSource: National Survey on Drug Use and Health (NSDUH), 2009–2014 cohorts.

^bDiversion sources are mutually exclusive from one another.

^cAORs controlled for age, sex, and educational status; all categories, except for the multiple sources group, include individuals who used only that source in the past 30 days.

^dPast-year substance-specific use disorder refers to individuals who self-reported symptoms consistent with *DSM-IV* substance abuse or dependence for each prescription drug class based on the NSDUH instrument.

^ePast-year any substance use disorder refers to individuals who self-reported symptoms consistent with DSM-IV substance abuse or dependence involving alcohol, cannabis, heroin, cocaine, methamphetamine, hallucinogen, inhalant, prescription opioids, prescription stimulants, or prescription sedatives/tranquilizers based on the NSDUH instrument.

^fPast-year any substance dependence refers to individuals who self-reported symptoms consistent with *DSM-IV* substance dependence involving alcohol, cannabis, heroin, cocaine, methamphetamine, hallucinogen, inhalant, prescription opioids, prescription stimulants, or prescription sedatives/tranquilizers based on the NSDUH instrument.

* $P \le .05$: significantly different from physician source group.

**P≤.01: significantly different from physician source group.

*** $P \le .001$: significantly different from physician source group.

Abbreviations: AOR = adjusted odds ratio, Ref = reference group.

increased rates of prescription stimulant use disorder and prescription drug use disorders relative to their same-age peers in college. While clinicians treating college students/ graduates may want to screen for prescription stimulant misuse, it is important that clinicians be aware that young adults not in college/school have increased rates of SUDs involving prescription drugs and substance dependence.

The findings of the present study indicate that the most prevalent source of PDM among young adults was friends or relatives given for free in most instances. However, the assessment of sources of PDM in the NSDUH does not distinguish between friend/peer versus family/relative sources, and prior studies indicate important differences between friend/peer and family/relative PDM sources among adolescents and young adults.^{10,17,30} For instance, previous studies found (1) notable gender differences between family/ relative and friend/peer sources (eg, women were more likely to report family/relative sources), (2) family/relative sources were associated with self-treatment motives for nonmedical use of prescription drugs (eg, prescription opioids for physical pain relief) while friend/peer sources were associated with recreational motives (eg, prescription opioids to get high), and (3) friend/peer sources were associated with significantly

higher rates of SUD symptoms as compared to family/ relative sources.^{10,17,30} Therefore, the limitation of combining these sources in the NSDUH is that the increased risk for SUD associated with friend/peer sources is diminished by the influence of family/relative sources.

The findings of the present study indicate that more than 7 in every 10 past-month prescription drug misusers who reported multiple sources for PDM had a past-year SUD, the majority involving substance dependence. To place these findings in context, less than 1 in every 5 young adults in the overall sample had a past-year SUD. Individuals with substance dependence are more likely to expend effort and time to obtain drugs than occasional or experimental substance users.^{19,20} Seeking multiple PDM sources aligns with these findings and suggests that clinicians should conduct comprehensive SUD assessments with young adults who report multiple sources for prescription opioid or sedative/tranquilizer misuse because these individuals are more likely to have severe SUDs. Consistent with prior studies, there were other sources of PDM associated with lower (eg, free from friends/relatives) or greater (eg, purchased) risk for SUD and substance dependence.³¹⁻³⁴ PDM source can predict treatment outcome among those

Sources of Prescription Medication Misuse

It is illegal to post ³¹ Taken together, with prescription opioid dependence.³¹ Taken together, these findings indicate the importance of screening for PDM and, if the result is positive, ascertaining if multiple PDM sources are involved and conducting a more comprehensive SUD assessment to identify young adults who are at the greatest risk for developing substance-related consequences.

The findings from the current study should be interpreted within context of some notable limitations. First, the cross-sectional study design precludes any causal determinations regarding the relationships between sources of PDM and educational status. Second, all measures were based on self-reports, and while prior work has found that self-report measures are reliable and valid, studies suggest that misclassification and underreporting of sensitive behaviors such as substance use can occur.^{16,35,36} Finally, the present study was constrained by the NSDUH measures such as PDM that did not differentiate between prescription drugs that were not prescribed for the individual (ie, nonmedical misuse) or that were taken only for the experience or feeling they caused (ie, medical use or misuse).

ighted PDF on any website. Despite these limitations, the findings of this study offer some notable clinical implications. First, greater attention is needed to address PDM among young adults not in college/ school based on the higher rates of PDM and SUDs in this vulnerable population, especially high school dropouts. Second, the majority of PDM did not originate directly from physicians/prescribers, and the findings indicate greater sharing of prescription medications among full-time college students and recent college graduates. Prescribers can help young adults understand potential health and legal consequences associated with PDM and diversion of controlled medications, including breaking the treatment contract and potentially losing their preferred clinician. Finally, the findings of this study indicate the importance of assessing PDM and educational status among young adults when devising treatment plans for young adult patients. Among those who report PDM, a more comprehensive SUD diagnostic assessment is recommended especially for misusers with multiple sources for PDM based on the increased risk of SUDs in these young adults.

Submitted: October 4, 2017; accepted February 13, 2018.

Published online: March 20, 2018.

Author contributions: Study concept and design: Dr McCabe. Interpretation of data: Drs Boyd, McCabe, Schepis, Teter, and Wilens. Statistical analysis: Dr Schepis. Drafting of the manuscript for important intellectual content: Drs Boyd, McCabe, Schepis, Teter, and Wilens.

Potential conflicts of interest: Dr Wilens is or has been a consultant for Alcobra, Neurovance/ Otsuka, and Ironshore; receives grant funding from the National Institutes of Health (National Institute on Drug Abuse); has published the book Straight Talk About Psychiatric Medications for Kids (Guilford Press) and co/edited the books ADHD in Adults and Children (Cambridge University Press), Massachusetts General Hospital Comprehensive Clinical Psychiatry (Elsevier), and Massachusetts General Hospital Psychopharmacology and Neurotherapeutics (Elsevier); is co/owner of a copyrighted diagnostic questionnaire (Before School Functioning [BFSQ] Questionnaire); has a licensing agreement with Ironshore (BSFQ Questionnaire); is Chief, Division of Child and Adolescent Psychiatry, and (Co) Director, Center for Addiction Medicine, at Massachusetts General Hospital: and serves as a clinical consultant to the US National Football League (ERM Associates). US Minor/Major League Baseball, Phoenix/Gavin House, and Bay Cove Human Services. Drs McCabe, Teter, Boyd, and Schepis report no financial or other relationships relevant to the subject of this article.

Funding/support: This research was supported by research grants R01DA031160, R01DA036541, and R01DA04691 from the National Institute on Drug Abuse, National Institutes of Health.

Role of the sponsor: The sponsors had no role in the design, analysis, interpretation, preparation, review, or publication of this manuscript. There was no editorial direction or censorship from the sponsors.

Disclaimer: The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute on Drug Abuse or the National Institutes of Health.

Additional information: The original data set for the National Survey on Drug Use and Health (NSDUH) is available from the Inter-university

Consortium for Political and Social Research (https://www.icpsr.umich.edu/icpsrweb/ICPSR/ series/64).

Supplementary material: Available at PSYCHIATRIST.COM

REFERENCES

- Hughes A, Williams MR, Lipari RN, et al. Prescription Drug Use and Misuse in the United States: Results from the 2015 National Survey on Drug Use and Health. NSDUH Data Review. SAMHSA website. http://www.samhsa.gov/ data/. 2016.
- Dart RC, Severtson SG, Bucher-Bartelson B. Trends in opioid analgesic abuse and mortality in the United States. N Engl J Med. 2015;372(16):1573–1574.
- 3. Guy GP Jr, Zhang K, Bohm MK, et al. Vital signs: changes in opioid prescribing in the United States, 2006–2015. *MMWR Morb Mortal Wkly Rep.* 2017;66(26):697–704.
- Rudd RA, Seth P, David F, et al. Increases in drug and opioid-involved overdose deaths—United States, 2010–2015. MMWR Morb Mortal Wkly Rep. 2016;65(5051):1445–1452.
- Ford JA, Pomykacz C. Non-medical use of prescription stimulants: a comparison of college students and their same-age peers who do not attend college. *J Psychoactive Drugs.* 2016;48(4):253–260.
- Johnston LD, O'Malley PM, Bachman JG, et al. Monitoring the Future National Survey Results on Drug Use, 1975–2014: Volume 2, College Students and Adults Ages 19–55. Ann Arbor, MI: University of Michigan; 2015.
- Martins SS, Kim JH, Chen LY, et al. Nonmedical prescription drug use among US young adults by educational attainment. *Soc Psychiatry Psychiatr Epidemiol*. 2015;50(5):713–724.
- Chen LY, Crum RM, Martins SS, et al. Patterns of concurrent substance use among nonmedical ADHD stimulant users: results from the National Survey on Drug Use and Health. Drug Alcohol Depend. 2014;142:86–90.
- Han B, Compton WM, Jones CM, 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.

- McCabe SE, Boyd CJ. Sources of prescription drugs for illicit use. *Addict Behav*. 2005;30(7):1342–1350.
- Upadhyaya HP, Rose K, Wang W, et al. Attention-deficit/hyperactivity disorder, medication treatment, and substance use patterns among adolescents and young adults. J Child Adolesc Psychopharmacol. 2005;15(5):799–809.
- Wilens TE, Adler LA, Adams J, et al. Misuse and diversion of stimulants prescribed for ADHD: systematic review of the literature. J Am Acad Child Adolesc Psychiatry. 2008;47(1):21–31.
- Garnier LM, Arria AM, Caldiera KM, et al. Sharing and selling of prescription medication in a college student sample. *J Clin Psychiatry*. 2010;71(03):262–269.
- McCabe SE, Teter CJ, Boyd CJ. Medical use, illicit use and diversion of abusable prescription drugs. J Am Coll Health. 2006;54(5):269–278.
- Arria AM, Caldeira KM, O'Grady KE, et al. Nonmedical use of prescription stimulants among college students: associations with attention-deficit-hyperactivity disorder and poly drug use. *Pharmacotherapy*. 2008;28(2):156–169.
- Center for Behavioral Health Statistics and Quality. 2016 National Survey on Drug Use and Health: Detailed Tables. Rockville, MD: Substance Abuse and Mental Health Services Administration; 2017.
- McCabe SE, Cranford JA, Boyd CJ, et al. Motives, diversion and routes of administration associated with nonmedical use of prescription opioids. *Addict Behav.* 2007;32(3):562–575.
- Center for Behavioral Health Statistics and Quality. 2014 National Survey on Drug Use and Health: Methodological Summary and Definitions. Rockville, MD: Substance Abuse and Mental Health Services Administration; 2015.
- American Psychiatric Association. Diagnostic and Statistical Manual for Mental Disorders.
 Fourth Edition, Text Revision. Washington, DC: American Psychiatric Association; 2000..
- 20. American Psychiatric Association. *Diagnostic* and Statistical Manual for Mental Disorders. Fifth Edition. Washington, DC: American Psychiatric

McCabe et al It is illegal to post this copyrighted PDF on any website Association, 2013 Barbaro Bar

- Grant BF, Saha TD, Ruan WJ, et al. Epidemiology of *DSM-5* drug use disorder: results from the National Epidemiologic Survey on Alcohol and Related Conditions-III. *JAMA Psychiatry*. 2016;73(1):39–47.
- Schepis TS, Hakes JK. Dose-related effects for the precipitation of psychopathology by opioid or tranquilizer/sedative nonmedical prescription use: results from the National Epidemiologic Survey on Alcohol and Related Conditions. J Addict Med. 2013;7(1):39–44.
- Rao JNK, Scott AJ. On chi-squared tests for multi-way tables with cell proportions estimated from survey data. Ann Stat. 1984;12(1):46–60.
- Lanier WA, Johnson EM, Rolfs RT, et al. Risk factors for prescription opioid-related death, Utah, 2008–2009. *Pain Med*. 2012;13(12):1580–1589.
- McCabe SE, Veliz P, Schulenberg JE. Adolescent context of exposure to prescription opioids and substance use disorder symptoms at age 35: a national longitudinal study. *Pain*. 2016;157(10):2173–2178.

Adolescents' prescription stimulant use and adult functional outcomes: a national prospective study. J Am Acad Child Adolesc Psychiatry. 2017;56(3):226–233.e4.

- Rabiner DL, Anastopoulos AD, Costello EJ, et al. Motives and perceived consequences of nonmedical ADHD medication use by college students: are students treating themselves for attention problems? J Atten Disord. 2009;13(3):259–270.
- Teter CJ, Falone AE, Cranford JA, et al. Nonmedical use of prescription stimulants and depressed mood among college students: frequency and routes of administration. J Subst Abuse Treat. 2010;38(3):292–298.
- Wilens TE, Carrellas NW, Martelon M, et al. Neuropsychological functioning in college students who misuse prescription stimulants. *Am J Addict*. 2017;26(4):379–387.
- Boyd CJ, McCabe SE, Cranford JA, et al. Prescription drug abuse and diversion among adolescents in a southeast Michigan school district. Arch Pediatr Adolesc Med. 2007;161(3):276–281.
- 31. Worley MJ, Shoptaw SJ, Bickel WK, et al. Using

during prescription opioid dependence treatment. *Drug Alcohol Depend*. 2015;148:62–68.

- Ford JA, Lacerenza C. The relationship between source of diversion and prescription drug misuse, abuse, and dependence. Subst Use Misuse. 2011;46(6):819–827.
- 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(8):828–836.
- Daniulaityte R, Falck R, Carlson RG. Sources of pharmaceutical opioids for non-medical use among young adults. J Psychoactive Drugs. 2014;46(3):198–207.
- Miech RA, Johnston LD, O'Malley PM, et al. Secondary School Students. Monitoring the Future National Survey Results on Drug Use: 1975–2015. vol I. Ann Arbor, MI: Institute for Social Research, The University of Michigan; 2016.
- Morral AR, McCaffrey DF, Chien S. Measurement of adolescent drug use. J Psychoactive Drugs. 2003;35(3):301–309.

See supplementary material for this article at PSYCHIATRISTCOM.



THE OFFICIAL JOURNAL OF THE AMERICAN SOCIETY OF CLINICAL PSYCHOPHARMACOLOGY

Supplementary Material

- Article Title: Sources of Prescription Medication Misuse Among Young Adults in the United States: The Role of Educational Status
- Author(s): Sean Esteban McCabe, PhD; Christian J. Teter, PharmD; Carol J. Boyd, PhD; Timothy E. Wilens, MD; and Ty S. Schepis, PhD
- **DOI Number:** 10.4088/JCP.17m11958

List of Supplementary Material for the article

1. <u>eTable 1</u> School and Non-School Differences in Sources of Prescription Drug Misuse Among Young Adults (Non-Mutually Exclusive)

Disclaimer

This Supplementary Material has been provided by the author(s) as an enhancement to the published article. It has been approved by peer review; however, it has undergone neither editing nor formatting by in-house editorial staff. The material is presented in the manner supplied by the author.

				0 0			/
	In HS	College	Full-time	Part-time	Not in college,	Not in college,	Post-hoc
Young Adult Sources	(a)	graduate (b)	college (c)	college (d)	HS	less than HS (f)	comparison
(non-mutually exclusive)					graduate (e)		
	% (95% CI)						
Prescription Opioids							
Physician	23.6 (16.5-32.5)	27.8 (20.2-36.9)	25.2 (21.6-29.3)	17.3 (12.3-23.8)	20.5 (18.0-23.1)	19.0 (15.6-22.8)	
One	20.7 (14.3-28.9)	24.6 (17.2-33.7)	22.9 (19.0-27.2)	14.8 (10.3-20.8)	18.3 (15.9-20.9)	16.1 (12.9-20.0)	
More than one	2.9 (0.8-10.5)	3.7 (1.5-9.0)	4.5 (2.8-7.2)	3.5 (1.7-6.9)	3.4 (2.4-5.0)	3.8 (2.3-6.1)	
Theft/fake prescription	13.6 (8.7-20.8)	7.3 (3.5-14.5)	14.8 (11.9-18.3)	10.2 (5.9-17.0)	11.6 (10.0-13.6)	7.8 (5.6-10.6)	f < c
Stole from friend/relative	13.1 (8.2-20.2)	7.3 (3.5-14.5)	14.6 (11.7-18.1)	10.2 (5.9-17.0)	10.7 (9.0-12.6)	7.4 (5.3-10.2)	f < c
Stole from medical source	1.3 (0.3-5.7)	no cases	0.9 (0.4-2.1)	no cases	0.9 (0.5-1.7)	no cases	
Fake prescription	0.2 (0.03-1.7)	0.1 (0.01-0.7)	0.4 (0.1-1.0)	no cases	0.1 (0.03-0.3)	0.4 (0.08-1.5)	
Free from friend/relative	54.5 (44.5-64.1)	67.3 (58.9-74.6)	62.9 (58.6-67.0)	61.9 (53.1-69.9)	53.8 (50.3-57.2)	50.3 (44.9-55.6)	e, f < b, c
Purchased	24.7 (19.3-31.1)	27.0 (19.2-36.6)	33.8 (30.3-37.5)	31.7 (25.7-38.4)	40.2 (36.9-43.5)	42.0 (37.3-46.8)	a < e, f
From friend/relative	19.1 (14.0-25.5)	21.1 (14.6-29.5)	27.6 (24.3-31.3)	28.0 (21.8-35.2)	31.3 (28.5-34.1)	32.9 (28.5-37.6)	a < e, f
From drug dealer/stranger	13.7 (9.4-19.6)	9.9 (5.2-18.2)	15.5 (12.4-19.2)	11.0 (7.5-15.9)	20.3 (18.3-22.5)	23.2 (19.4-27.3)	d < e, f
From Internet	1.3 (0.2-8.6)	0.6 (0.1-2.5)	0.8 (0.3-2.0)	1.0 (0.2-6.9)	0.5 (0.2-1.2)	0.04 (0.01-0.3)	
Other source	7.7 (4.2-13.6)	7.4 (3.5-15.3)	8.6 (6.2-11.8)	7.7 (4.3-13.3)	8.6 (7.0-10.4)	12.1 (9.5-15.3)	
Multiple sources	25.8 (19.3-33.7)	29.7 (21.1-40.1)	33.8 (29.7-38.2)	30.3 (23.9-37.5)	31.8 (28.9-34.9)	30.0 (25.9-34.4)	
Prescription Stimulants							
Physician	20.0 (10.3-35.2)	12.4 (6.1-23.5)	8.5 (5.9-12.1)	8.5 (4.1-16.7)	14.4 (9.4-21.3)	8.4 (5.0-13.8)	
One	19.5 (9.9-34.6)	12.4 (6.1-23.5)	7.8 (5.3-11.3)	8.5 (4.1-16.7)	11.2 (7.3-16.8)	8.1 (4.8-13.3)	
More than one	3.6 (0.6-18.5)	no cases	1.0 (0.4-2.4)	1.5 (0.2-9.9)	3.5 (1.1-10.9)	0.4 (0.07-1.8)	
Theft/fake prescription	5.7 (1.9-15.9)	5.5 (1.3-19.9)	7.7 (5.0-11.9)	8.4 (3.6-18.4)	6.7 (3.8-11.4)	0.8 (0.2-3.2)	
Stole from friend/relative	3.5 (0.8-13.8)	4.9 (1.0-20.4)	7.6 (4.9-11.7)	8.4 (3.6-18.4)	5.7 (3.0-10.7)	0.3 (0.04-2.3)	
Stole from medical source	0.4 (0.05-2.7)	0.6 (0.08-3.9)	0.1 (0.03-0.5)	no cases	0.9 (0.3-2.9)	0.5 (0.06-3.2)	
Fake prescription	1.8 (0.2-12.3)	no cases	no cases	no cases	0.3 (0.05-1.5)	no cases	
Free from friend/relative	41.5 (25.7-59.2)	56.9 (40.9-71.6)	54.7 (49.5-59.8)	48.7 (38.1-59.3)	33.1 (27.0-39.7)	30.9 (21.3-42.5)	e, f < c
Purchased	23.9 (13.2-39.2)	25.1 (14.0-40.8)	45.2 (39.4-51.2)	40.8 (31.1-51.2)	35.6 (28.9-42.8)	26.0 (18.0-36.1)	f < c
From friend/relative	19.3 (9.8-34.5)	21.6 (11.9-36.0)	39.1 (33.7-44.8)	33.2 (24.4-43.3)	27.0 (20.6-34.5)	17.3 (9.9-28.5)	f < c
From drug dealer/stranger	2.5 (0.7-7.9)	5.1 (1.8-14.0)	8.7 (5.8-12.8)	11.2 (5.4-22.0)	10.9 (7.9-14.8)	14.5 (7.8-25.3)	
From Internet	3.0 (0.4-19.2)	no cases	1.5 (0.7-3.5)	no cases	1.9 (0.6-5.9)	no cases	
Other source	6.4 (2.0-18.4)	6.9 (1.6-24.8)	3.2 (1.6-6.2)	1.9 (0.4-8.7)	6.5 (4.4-9.4)	6.1 (2.7-13.5)	
Multiple sources	17.9 (8.4-34.2)	9.3 (3.3-23.5)	23.2 (17.7-29.9)	17.6 (11.3-26.4)	17.6 (11.9-25.2)	10.3 (4.3-22.3)	
Prescription							
Sedatives/Tranquilizers							
Physician	6.7 (2.8-15.1)	16.7 (9.0-28.6)	16.2 (11.9-21.7)	6.2 (2.7-13.8)	10.4 (7.9-13.5)	12.8 (8.9-18.1)	
One	6.7 (2.8-15.1)	16.7 (9.0-28.6)	14.5 (10.5-19.6)	5.8 (2.4-13.5)	9.5 (7.1-12.7)	11.0 (7.6-15.7)	

Supplementary eTable 1. School and non-school differences in sources of prescription drug misuse among young adults (non-mutually exclusive)

More than one	no cases	no cases	1.7 (0.6-4.9)	0.5 (0.1-1.9)	1.0 (0.5-2.2)	2.2 (0.7-7.0)	
Theft/fake prescription	10.2 (5.2-18.8)	10.2 (5.2-19.1)	7.0 (4.6-10.6)	6.8 (3.0-14.5)	7.5 (4.8-11.5)	6.7 (3.4-12.4)	
Stole from friend/relative	7.8 (3.7-15.5)	8.1 (4.0-15.7)	6.4 (4.1-9.8)	6.8 (3.0-14.5)	6.6 (4.1-10.6)	6.6 (3.4-12.4)	
Stole from medical source	3.1 (0.8-11.6)	2.1 (0.3-13.4)	0.2 (0.02-1.5)	no cases	0.7 (0.2-2.5)	0.01 (<0.01-	
						0.1)	
Fake prescription	0.9 (0.1-6.3)	no cases	0.4 (0.1-1.6)	no cases	0.1 (0.02-0.7)	no cases	
Free from friend/relative	47.8 (33.9-62.0)	61.6 (48.8-73.0)	51.6 (45.3-57.8)	54.7 (42.6-66.2)	44.3 (39.4-49.3)	37.8 (31.1-45.1)	f < b
Purchased	31.0 (20.7-43.7)	16.8 (8.9-29.5)	32.5 (27.7-37.6)	36.8 (26.5-48.5)	37.1 (32.0-42.4)	34.9 (27.9-42.6)	
From friend/relative	17.8 (9.4-31.2)	9.9 (4.7-19.8)	25.7 (21.4-30.4)	25.9 (17.2-37.0)	27.1 (22.5-32.1)	22.6 (16.5-30.2)	
From drug dealer/stranger	17.9 (10.4-29.2)	6.8 (1.9-20.9)	10.6 (7.5-14.6)	12.1 (6.2-22.4)	13.3 (10.4-17.0)	18.2 (13.5-23.9)	
From Internet	no cases	0.1 (0.01-0.7)	0.9 (0.2-4.2)	no cases	no cases	no cases	
Other source	2.4 (0.4-12.4)	7.3 (2.1-22.5)	3.6 (1.9-6.7)	7.7 (2.8-19.2)	4.2 (2.6-6.7)	6.6 (3.2-13.0)	
Multiple sources	11.9 (5.5-23.8)	12.1 (5.5-24.7)	15.0 (11.1-19.9)	10.5 (5.6-18.8)	11.8 (8.6-15.9)	13.0 (8.6-19.1)	

Source: NSDUH, 2009-2014 cohorts.

Notes: All pairwise comparisons were Bonferroni-corrected for multiple comparisons, with comparisons only noted when they differ at a *p*-level of 0.05 or less. The post-hoc comparisons were based on logistic models adjusted for age, sex and race.