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Leftover prescription opioids and nonmedical use among high school seniors: A multi-cohort national study

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Abstract

Purpose—The main objectives of this study were to (1) estimate the proportion of nonmedical users of prescription opioids (i.e., used prescription opioids in the past year without a doctor's orders) who used leftover medications from their own previous prescriptions, (2) assess substance use behaviors as a function of diversion source, and (3) identify the sources for these prescribed opioids.

Methods—Data were collected via self-administered questionnaires from nationally representative samples of high school seniors (modal age 18). The sample consisted of four cohorts (senior years of 2007–2010, n=8,888), including 647 high school seniors who reported past-year nonmedical use of prescription opioids (NMUPO), of which 53% were women.

Results—An estimated 36.9% of past-year nonmedical users of prescription opioids obtained these opioid medications from their own previous prescriptions. Logistic regression analyses indicated that nonmedical users who used leftover medications from their previous prescription were primarily motivated to relieve physical pain while nonmedical users who obtained from other sources had significantly higher odds of prescription opioid abuse and other substance use behaviors. Based on a sub-analysis of nonmedical users who obtained prescription opioids from their previous prescriptions in 2010 (n=51), approximately 27.1% obtained them from a dentist, 45.0% obtained them from an emergency room physician, and 38.3% obtained them from another physician.

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Implications and Contribution: The sources of prescription opioids were examined among high school seniors who reported nonmedical use in the past year. The findings indicate that leftover prescription opioids from a previous prescription represent a major source of nonmedical use and enhanced vigilance is needed when prescribing prescription opioids and monitoring their use among adolescents.

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Conclusions—Leftover prescription opioids from previous prescriptions represent a major source of NMUPO among high school seniors. These findings indicate enhanced vigilance is needed when prescribing and monitoring prescription opioids among adolescents to reduce leftover medications and nonmedical use.

Keywords

Epidemiology; Adolescents; Prescription opioids; Nonmedical use; Diversion; Adolescents; Medication; Substance use; High school

Introduction

Approximately 13.0% of high school seniors in the United States reported nonmedical use of prescription opioids (NMUPO, i.e., used prescription opioids without a doctor's orders) in their lifetimes and 8.7% of high school seniors reported NMUPO in the past 12 months according to the *2010 Monitoring the Future (MTF)* study [1]. These lifetime and annual prevalence rates of NMUPO have increased significantly over the past two decades among high school seniors [1]. The estimated number of emergency department visits involving NMUPO more than doubled between 2004 and 2008 for patients in the United States younger than 21 years of age [2].

Prescription opioids are highly efficacious when used appropriately for pain management; however, the prescribing rates of prescription opioids have nearly doubled among adolescents and young adults in the United States since 1994 [3]. Prescription opioids were often prescribed for common conditions, such as back pain, to adolescents aged 15 to 19 years of age (21.5%) and young adults aged 20 to 29 years of age (33.4%). One potential consequence of an increase in prescribing rates of prescription opioids is an increase in amount of leftover medication that could lead to NMUPO (due to greater availability). A recent study conducted in Utah found that 72% of adult respondents aged 18 and older who were prescribed an opioid had leftover medications, and 71% of those individuals kept the leftover medications [4]. Dentists, primary care physicians, and emergency medicine physicians serve as the leading prescribers of opioid analgesics among adolescents and young adults in the United States [5–7].

Among adolescent and young adult nonmedical users, the leading diversion sources of prescription opioids are their peers and leftover medications from previous prescriptions [1,8]. For the purposes of this investigation, *diversion* is defined as the exchange (i.e., selling, trading, loaning, giving away) of controlled medications that leads to their use by individuals other than those for whom they were prescribed. At least two studies have found that more than half of adolescent and young adult nonmedical users of prescription opioids were given these medications by a friend for free and between 33% and 40% obtain leftover prescription opioids from their own previous prescriptions [1,8]. A better understanding of the diversion of prescription opioids would likely help guide prevention and intervention efforts to reduce NMUPO and related adverse consequences among adolescents and young adults.

Past work shows that diversion sources, routes of administration and motives of NMUPO are significantly associated with substance use and abuse [8,9]. For instance, approximately seven in every ten individuals who report lifetime NMUPO and administered the opioids intranasally screened positive for past-year drug abuse, while only 8% of those who report lifetime NMUPO for pain relief or who obtained opioid medication from family sources screened positive for past-year drug abuse [9]. To date, there is a lack of studies that examine the sources of leftover prescription opioids from previous prescriptions and

whether nonmedical users who use leftover medications differ from other nonmedical users who obtain prescription opioids from other sources in terms of substance use behaviors. As a result, it is important to distinguish between diversion sources in terms of associated substance use behaviors. Such information can be useful for developing interventions and identifying those who may need appropriate pain management and/or have an increased risk of substance abuse.

The present study, which draws on national cross-sectional data from the *MTF* study, includes four cohorts of nationally representative samples of high school seniors in the United States and examines three research questions: What proportion of past-year nonmedical users of prescription opioids obtained leftover medications from their own previous prescription? Do substance use behaviors differ between nonmedical users who use leftover medications and those who obtain from other sources? What are the original sources of leftover prescription opioids that lead to subsequent NMUPO?

Methods

Participants and procedures

The *MTF* study annually surveys a cross-sectional, nationally representative sample of high school seniors in approximately 135 public and private schools in the coterminous United States, using self-administered paper-pencil questionnaires in classrooms. The *MTF* study uses a multi-stage sampling procedure. In stage 1, geographic areas or primary sampling units are selected; in stage 2, schools within primary sampling units are selected (with probability proportionate to school size); and in stage 3, students within schools are selected. The student response rates for high school seniors ranged from 79% to 85% between 2007 and 2010. Because so many questions are included in the *MTF* study, much of the questionnaire content is divided into six different questionnaire forms which are randomly distributed. This approach results in six virtually identical subsamples. The measures most relevant for this study were introduced on Form 1 in 2007, so this study focuses on the subsamples receiving Form 1 within each year cohort between 2007 and 2010. Details about the *MTF* design and methods are available elsewhere [1]. Institutional Review Board approval was granted for this study by the University of Michigan Institutional Review Board Health Sciences.

The sample included 8,888 individuals in the *MTF* cohorts from 2007 through 2010 who completed Form 1 during the spring of their senior year, including 647 individuals who reported past-year NMUPO. The sample represents a population that is estimated to be 53% female, 70% White, 13% African-American, and 17% Hispanic students. The modal age of the individuals in the sample was 18 years of age.

Measures

The *MTF* study assesses demographic characteristics and standard measures of substance use behaviors such as nonmedical use of prescription medications, and use of marijuana and other drugs [1].

Nonmedical use of prescription opioids (NMUPO) was assessed by asking respondents on how many occasions (if any) in their lifetime (and past 12 months) they used prescription opioids on their own—that is, without a doctor telling you to take them (e.g., Vicodin®, OxyContin®, Percodan®, Percocet®, Demerol®, Dilaudid®, Ultram®, morphine, opium, codeine). The response scale ranged from: 1) no occasions to 7) 40 or more occasions. For purposes of this investigation, responses were dichotomized into no use versus any use.

Diversion sources for NMUPO were assessed by asking respondents where they obtained the prescription opioids they used without a doctor's order during the past 12 months (mark all that apply). The list of diversion sources included: 1) bought on the Internet, 2) took from friend or relative without asking, 3) given for free by friend or relative, 4) bought from friend or relative, 5) from a prescription I had, 6) bought from drug dealer/stranger, and 7) other method. In 2010, respondents who used prescription opioids without a doctor's orders during the past 12 months and used medication from a previous prescription in their name were also asked from whom they got this prescription. The list of sources included: 1) A dentist, 2) An emergency room doctor, and 3) another doctor.

Past-year drunkenness was measured using the following item: "On how many occasions (if any) have you been drunk or very high from drinking alcoholic beverages during the last 12 months?" The response scale and coding were the same as for NMUPO.

Past-year marijuana use was measured using the following item: "On how many occasions (if any) have you used marijuana during the last 12 months?" The response scale and coding were the same as for NMUPO.

*Past-year other illicit drug use--including LSD, psychedelics other than LSD, heroin, cocaine, and crack--*was measured with the following item for each drug: "On how many occasions (if any) have you used [SPECIFIED DRUG CLASS]...during the last 12 months?" The response scale and coding for each substance was the same as for NMUPO.

*Past-year nonmedical use of other prescription medications--including stimulants, tranquilizers and sedatives--*was measured with the following item for each medication: "On how many occasions (if any) have you used [SPECIFIED DRUG CLASS]...during the last 12 months?" The response scale for each substance was the same as for NMUPO.

Routes of administration for NMUPO were assessed with five items that asked which methods respondents used for taking prescription opioids not prescribed to them (mark all that apply). The binary items included: 1) intranasal (snorting or sniffing); 2) smoking; 3) injection; 4) orally (by mouth); and 5) other.

Motives for NMUPO were assessed by asking respondents who reported NMUPO in the past 12 month to indicate the most important reasons for using prescription opioids on their own without a doctor's orders (mark all that apply). The list of 17 binary items included but was not limited to the following motives: "to relieve physical pain," "to experiment," and "to feel good or get high."

Data Analysis

The *MTF* study provides survey weights for responding cases in each of its public-use data files, and these weights were used in all analyses to ensure that estimates of population features were unbiased. The estimated prevalence rates of diversion sources associated with NMUPO - across subgroups defined by demographic characteristics and substance use behaviors - were computed using weighted cross-tabulations. Rao-Scott Chi-square tests of homogeneity [10] and design-based logistic regression analyses [11] were conducted to determine whether diversion sources were significantly associated with substance use behaviors. The following four mutually exclusive groups were compared in the analyses: 1) NMUPO from a previous prescription only, 2) NMUPO from a previous prescription + other source(s), 3) NMUPO from other source(s), and 4) non-users. The logistic regression models included sex, cohort year, and school geographical region as covariates based on their significant associations with NMUPO identified in previous research [12]. The complex multistage sampling design used in the *MTF* study resulted in the need to account for effects

of stratified cluster sampling on variance estimates. Estimated (linearized) variances of weighted estimates were adjusted using average design effects provided by MTF study staff [1] per the method outlined by West and McCabe [13], prior to the construction of confidence intervals. Weighted Pearson chi-square statistics were divided by an average design effect factor of 2.0, per the recommendation of Johnston and colleagues [1]. All statistical analyses were performed using commands for the analysis of complex sample survey data in the Stata 11.2 software (StataCorp, College Station, TX, 2011).

Results

Prevalence of Diversion Sources associated with NMUPO

An estimated 36.9% of past-year nonmedical users of prescription opioids obtained these opioid medications from their own leftover medication. The estimated prevalence of other diversion sources included: bought on the internet (1.4%), took from friend or relative without asking (22.2%), given for free from friend or relative (55.0%), bought from a friend or relative (37.9%), bought from a drug dealer (19.4%), and other method (9.5%). Among past-year nonmedical users of prescription opioids, approximately 14.4% indicated they used opioids from their previous prescription only, 22.5% reported they used opioids from their previous prescription along with other source(s), and 63.2% obtained from only other source(s). As illustrated in Table 1, the prevalence of diversion sources of NMUPO varied significantly by sex. The proportion of past-year nonmedical users of prescription opioids who obtained these opioid medications from their leftover medications was higher among females while obtaining prescription opioids from other sources was more prevalent among males.

A sub-analysis of the 2010 data was conducted to determine the original source of leftover prescription opioids that was associated with subsequent NMUPO. Among past-year nonmedical users who obtained prescription opioids from their own previous prescription (n=51), an estimated 27.1% received the opioids from a dentist, 45.0% received them from an emergency room doctor, and 38.3% received them from another doctor. A more detailed breakdown indicates that among nonmedical users who obtained prescription opioids from their previous prescription, the original source of these medications used nonmedically were 11.4% from a dentist only, 7.3% from an emergency room doctor only, 23.1% from another doctor only, and 24.9% reported multiple doctor/dentist sources.

Sources of NMUPO and other substance use behaviors

As illustrated in Table 2, bivariate analyses were used to examine the associations among diversion sources of past-year NMUPO and substance use behaviors. The substance use behaviors included past-year drunkenness, marijuana use, illicit drug use other than marijuana use, and nonmedical use of other prescription medications. Rao-Scott Chi-square analyses revealed significant associations between diversion sources of past-year NMUPO and each substance use measure ($p < .001$). Multiple logistic regression results reinforced the bivariate findings. After adjusting for sex, cohort year and school geographical region, the odds of substance use behaviors were considerably higher among past-year nonmedical users who obtained prescription opioids from sources besides their previous leftover prescriptions than nonmedical users who only used leftover prescription opioids from previous prescriptions ($p < .01$). In contrast, the odds of substance use behaviors were generally lower among past-year non-users relative to nonmedical users who only used leftover prescription opioids from previous prescriptions.

As illustrated in Table 3, the associations among diversion sources of past-year NMUPO and specific behaviors related to NMUPO, such as route of administration, subjective high,

and motives, were also examined for nonmedical users of prescription opioids using design-adjusted chi-square analyses, revealing several significant associations ($p < .001$). Multiple logistic regression results supported the bivariate findings; the odds of intranasal administration of prescription opioids and getting moderately or very high when using prescription opioids were significantly greater among those nonmedical users who obtained prescription opioids from sources besides their own previous prescriptions as compared to those nonmedical users who only obtained leftover prescription opioids from previous prescriptions after adjusting for sex, cohort year and school geographical region ($p < .001$). For example, the odds of using prescription opioids intranasally were more than six times greater among nonmedical users who obtained prescription opioids from sources besides their own previous prescriptions as compared to nonmedical users who only obtained leftover prescription opioids from their own previous prescriptions. In contrast, the odds of using prescription opioids to relieve physical pain were significantly lower among nonmedical users who only obtained prescription opioids from sources besides their own previous prescriptions as compared to those nonmedical users who only obtained leftover prescription opioids from their own previous prescriptions (AOR = 0.2, 95% CI = 0.1, 0.5, $p < .001$). The prevalence of using prescription opioids nonmedically to relieve physical pain among past-year nonmedical users who only obtained prescription opioids from sources besides their own previous prescriptions was 39.6% as compared to more than 71.3% of nonmedical users who only obtained leftover prescription opioids from their own previous prescriptions.

Discussion

The present study found that leftover prescription opioids from previous prescriptions account for a substantial source of nonmedical use of prescription opioids (NMUPO) among high school seniors in the United States. We found that more than a third of past-year nonmedical users of prescription opioids obtained these medications from their own previous prescription(s). The findings of the present study are consistent with previous work among adolescents which has shown that using one's previous prescription serves as a major source of NMUPO [1,8]. It has been estimated that 5% to 23% of all prescription opioid doses dispensed are used nonmedically and the findings from the present study and previous work indicate that leftover medication, peers, and family members play a role in the diversion and NMUPO among adolescents [1,8,14].

There were notable sex differences in the prevalence of nonmedical use with leftover prescription opioids among high school seniors in the United States. The higher rates of nonmedical use with leftover prescription opioids among females could be partially explained by higher rates of prescribing and medical use of opioid analgesics among female high school students [15,16]. For example, one study of secondary school students found that 53.1% of females and 35.0% of males reported lifetime medical use of prescription opioids [16]. These sex differences in nonmedical use with leftover prescription opioids deserve more attention in future research and may provide useful information for developing prevention efforts.

We found that nonmedical users of prescription opioids who obtained these medications from diversion sources other than their previous prescriptions had significantly higher odds of intranasal administration of prescription opioids and other substance use behaviors. In contrast, nonmedical users of prescription opioids who obtained these medications from diversion sources other than their previous prescriptions had significantly lower odds of using prescription opioids nonmedically to relieve physical pain. These findings suggest that individuals who use leftover prescription opioid medication nonmedically are most likely attempting to self-treat physical pain and could benefit from appropriate pain management.

Prescribers such as dentists can play a key role in minimizing leftover medication and help reduce nonmedical use and abuse of prescription opioids through careful assessment, appropriate prescribing with concomitant education, vigilant monitoring, and referral for substance abuse treatment when indicated [17]. Indeed, an evidence-based protocol for assessment and education among prescribers is needed: one aimed at preventing nonmedical use, ensuring safe/secure storage and dictating safe disposal [18]. Patient and prescriber interventions must take place across a range of health care settings, and materials should consider the possibility of nonmedical use and diversion.

Among nonmedical users who obtained prescription opioids from their previous prescriptions based on a sub-sample of the 2010 data, the leading sources included emergency room physicians, dentists, and other physicians. Based on prescription data from a national database in the United States, dentists were found to be the leading prescriber of prescription opioids among patients 10 to 19 years of age [7]. Dentists' prescribing practices after performing third-molar extractions were examined based on a survey of 563 practicing oral and maxillofacial surgeons from a sample from the American Dental Association Survey Center [5,6]. Approximately 85.1% of U.S. surgeons usually prescribed opioid analgesics following third-molar extractions; the medication of choice was a hydrocodone and acetaminophen formulation [6]. The median number of pills prescribed by dentists for all opioid formulations was 20 (range 8–40) and labeling instructions for opioid analgesics were “as needed” or “as needed for pain” in 96% of the cases [6]. There are potential problems associated with the “PRN” or “as needed” designation that licensed clinicians use when prescribing opioid analgesics; this designation may allow for greater liberties than the prescriber intends. Based on the findings of the present study, there is a need for more research to examine the sources of leftover medications and how prescribing practices may contribute to leftover controlled medications.

This study has noteworthy limitations that should be considered when weighing its practical implications. First, since the present study represented secondary analyses, the survey items in the *MTF* limited the variables that could be examined. Survey items did not assess the diagnosis or type of medication prescribed, specify on how many occasions respondents had used each diversion source, or indicate the reasons why respondents had leftover opioid medication. Second, the results cannot be generalized to all adolescents because this sample only included high school seniors (modal age 18 years) and did not include individuals who had dropped out of school or were not present in school on the day of survey administration. Third, the data are subject to potential bias introduced when assessing sensitive behaviors via self-report surveys administered in a school setting. The present study attempted to minimize these biases by informing potential respondents that participation was voluntary and assuring potential respondents that data would remain confidential [19,20]. Fourth, the cross-sectional nature of the study presented some limitations in terms of making causal inferences. Finally, the sample size for the sub-analysis of the sources of previous prescriptions in 2010 was small (n=51), and future research in this area is needed with larger samples.

In conclusion, we found that more than a third of high school seniors in the United States who reported past-year NMUPO had obtained leftover prescription opioids for nonmedical use from their previous prescriptions. Nonmedical users of prescription opioids who used leftover medications from their previous prescription were primarily motivated to relieve physical pain, while nonmedical users who obtained from other sources had significantly higher odds of prescription opioid abuse and other substance use behaviors. The leading sources of these leftover opioid medications included emergency room doctors, dentists, and other doctors. Taken together, these findings indicate that enhanced vigilance is needed

when prescribing prescription opioids and monitoring their use among adolescents to reduce leftover medications and nonmedical use.

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Drs. Sean Esteban McCabe and Brady T. West had full access to all the data reported in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

References

1. Johnston, LD.; O'Malley, PM.; Bachman, JG.; Schulenberg, JE. Secondary School Students. Vol. I. Ann Arbor, MI: University of Michigan Institute for Social Research; 2011. Monitoring the Future National Survey Results on Drug Use, 1975–2010.
2. Substance Abuse and Mental Health Services Administration. The DAWN Report: Trends in Emergency Department Visits Involving Nonmedical Use of Narcotic Pain Relievers. Rockville, MD: Office of Applied Studies; 2010. Available at: <http://oas.samhsa.gov/2k10/dawn016/opioided.htm>
3. Fortuna RJ, Robbins BW, Caiola E, Joynt M, Halterman JS. Prescribing of controlled medications to adolescents and young adults in the United States. *Pediatrics*. 2010; 126:1108–1116. [PubMed: 21115581]
4. Centers for Disease Control and Prevention. Adult use of prescription opioid pain medications: Utah, 2008. *MMWR Morb Mortal Wkly Rep*. 2010; 59:153–157. [PubMed: 20168293]
5. Moore PA, Nahouraii HS, Zovko JG, Wisniewski SR. Dental therapeutic practice patterns in the U.S. I: anesthesia and sedation. *Gen Dent*. 2006; 54:92–98. [PubMed: 16689062]
6. Moore PA, Nahouraii HS, Zovko JG, Wisniewski SR. Dental therapeutic practice patterns in the U.S. II: analgesics, corticosteroids, and antibiotics. *Gen Dent*. 2006; 54:201–207. [PubMed: 16776415]
7. Volkow ND, McLellan TA, Cotto JH, Karithanom M, Weiss SR. Characteristics of opioid prescriptions in 2009. *JAMA*. 2011; 305:1299–1301. [PubMed: 21467282]
8. McCabe SE, Boyd CJ. Sources of prescription drug for illicit use. *Addict Behav*. 2005; 30:1342–1350. [PubMed: 16022931]
9. McCabe SE, Cranford JA, Boyd CJ, Teter CJ. Motives, diversion and routes of administration associated with prescription opioids. *Addict Behav*. 2007; 32:562–575. [PubMed: 16843611]
10. Rao JNK, Scott AJ. On chi-squared tests for multi-way tables with cell proportions estimated from survey data. *Ann Stat*. 1984; 12:46–60.
11. Heeringa, SG.; West, BT.; Berglund, PA. *Applied Survey Data Analysis*. London: Chapman and Hall; 2010.
12. McCabe SE, Boyd CJ, Teter CJ. Illicit use of opioid analgesics by high school seniors. *J Subst Abuse Treat*. 2005; 28:224–229.
13. West BT, McCabe SE. Incorporating complex sample design effects when only final survey weights are available. *Stata*. 2012 in press.
14. Katz NP, Birnbaum HG, Castor A. Volume of prescription opioids used nonmedically in the United States. *J Pain Palliat Care Pharmacother*. 2010; 24:141–144. [PubMed: 20504136]
15. Boyd CJ, McCabe SE, Teter CJ. Medical and nonmedical use of prescription pain medication by youth in a Detroit-area public school district. *Drug Alcohol Depend*. 2006; 81:37–45. [PubMed: 16040201]
16. McCabe SE, Boyd CJ, Young A. Medical and nonmedical use of prescription drugs among secondary school students. *J Adolesc Health*. 2007; 40:76–83. [PubMed: 17185209]

17. Denisco RC, Kenna GA, O'Neil MG, et al. Prevention of prescription opioid abuse: The role of the dentist. *J Am Dent Assoc.* 2011; 142:800–810. [PubMed: 21719802]
18. Boyd CJ, Anderson KG, Rieckman T. ABC's of controlled medications: What patients need to know about their prescription pain medicine. *J Addict Nurs.* 2011; 22:1–3.
19. Harrison, L.; Hughes, A. NIH Publication 97–4147, NIDA Research Monograph No 167. Washington: Government Printing Office; 1997. The validity of self-reported drug use: Improving the accuracy of survey estimates.
20. Johnston LD, O'Malley PM. Issues of validity and population coverage in student surveys of drug use. *NIDA Res Monogr.* 1985; 57:31–54. [PubMed: 3929114]

Table 1
 Diversion sources of nonmedical prescription opioids among high school seniors nationally, overall and by sex, 2007–2010

Diversion Source	Overall nonmedical users		Male nonmedical users		Female nonmedical users		Sex differences
	n (%)	n (%)	n (%)	n (%)	Chi-square (DF), p-value		
Previous prescription only	104 (14.4%)	40 (11.5%)	59 (17.2%)	29.04 (1), $p < 0.001$			
Previous prescription + other sources	147 (22.5%)	68 (20.8%)	74 (25.1%)	11.54 (1), $p < 0.001$			
Other sources	396 (63.2%)	202 (67.7%)	170 (57.7%)	47.07 (1), $p < 0.001$			

Note: Sample sizes for sex vary from overall sample sizes due to missing data on the sex variable in the MTF data set.

Source: 2007–2010 MTF; weighted estimates with average design effect correction of 2.0 applied to chi-square statistics.

Table 2

Substance use behaviors as a function of diversion source of nonmedical prescription opioids, 2007–2010

Diversion Source	Past-year drunkenness		Past-year marijuana use		Past-year illicit drug use other than marijuana		Past-year nonmedical use of other prescription medications	
	%	Adjusted OR (95% CI)	%	Adjusted OR (95% CI)	%	Adjusted OR (95% CI)	%	Adjusted OR (95% CI)
Previous prescription only	68.1	--	7.7	--	10.7	--	23.8	--
Previous prescription + other sources	92.1	4.9 (1.6–15.0)**	35.8	6.1 (1.8–20.7)**	44.1	6.1 (2.1–18.0)***	75.1	10.5 (4.2–26.6)***
Other sources	88.8	3.2 (1.4–7.1)**	33.5	5.6 (1.8–17.4)**	52.4	8.3 (3.0–22.6)***	66.6	6.4 (2.9–14.0)***
Non-user	40.3	0.3 (0.1–0.6)***	4.0	0.4 (0.1–1.3)	3.9	0.3 (0.1–0.8)*	4.4	0.1 (<0.1–0.3)***
Chi-square (DF), p-value	237.8 (3), P < 0.001		423.2 (3), P < 0.001		855.7 (3), P < 0.001		1280.4 (3), P < 0.001	

--The reference group is "Previous prescription only."

Sample sizes for the regression models ranged from 7,857 (Past-year Drunkenness) to 8,442 (Past-year Marijuana Use) due to missing data.

Multivariate logistic regression adjusting for sex, cohort year, and school geographical region.

* p < 0.05,

** p < 0.01,

*** p < 0.001 based on logistic regression results.

Any past-year illicit drug use other than marijuana included LSD, psychedelics other than LSD, heroin, crack, and cocaine.

Any past-year nonmedical use of other prescription medications included stimulants, tranquilizers and sedatives.

Source: 2007–2010 MTF; weighted estimates with average design effect correction of 2.0 applied to chi-square statistics.

Table 3
 Nonmedical prescription opioid use behaviors as a function of diversion source, 2007–2010

Diversion Source	Snorted when using prescription opioids		Moderately or very high when using prescription opioids		Used prescription opioids to relieve physical pain	
	%	Adjusted OR (95% CI)	%	Adjusted OR (95% CI)	%	Adjusted OR (95% CI)
Previous prescription only	9.4	--	26.1	--	71.3	--
Previous prescription + other sources	35.4	6.7 (2.0–22.2)**	51.8	3.3 (1.4–7.5)**	72.8	1.0 (0.4–2.4)
Other sources	44.9	9.0 (2.9–28.0)***	60.0	4.3 (2.0–9.1)***	39.6	0.2 (0.1–0.5)***
Chi-square (DF), p-value	278.4 (2), p < 0.001		243.0 (2), p < 0.001		439.2 (2), p < 0.001	

--The reference group is “from a prescription I had only.”

Sample sizes for the regression models ranged from 605 (Relieve Pain) to 609 (Moderate or Very High) due to missing data.

Multivariate logistic regression models adjust for sex, cohort year, and school geographical region.

* p < 0.05,

** p < 0.01,

*** p < 0.001 based on logistic regression results.

Source: 2007–2010 MTF; weighted estimates with average design effect correction of 2.0 applied to chi-square statistics.