

Medical and Nonmedical Use of Prescription Opioids Among High School Seniors in the United States

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Objectives: To determine the prevalence of medical and nonmedical use of prescription opioids among high school seniors in the United States and to assess substance use behaviors based on medical and nonmedical use of prescription opioids.

Design: Nationally representative samples of high school seniors (modal age 18 years) were surveyed during the spring of their senior year via self-administered questionnaires.

Setting: Data were collected in public and private high schools.

Participants: The sample consisted of 7374 students from 3 independent cohorts (2007, 2008, and 2009).

Outcome Measures: Self-reports of medical and nonmedical use of prescription opioids and other substance use.

Results: An estimated 17.6% of high school seniors reported lifetime medical use of prescription opioids, while 12.9% reported nonmedical use of prescription opioids.

Sex differences in the medical and nonmedical use were minimal, while racial/ethnic differences were extensive. More than 37% of nonmedical users reported intranasal administration of prescription opioids. An estimated 80% of nonmedical users with an earlier history of medical use had obtained prescription opioids from a prescription they had previously. The odds of substance use behaviors were greater among individuals who reported any history of nonmedical use of prescription opioids relative to those who reported medical use only.

Conclusions: Nearly 1 in every 4 high school seniors in the United States has ever had some exposure to prescription opioids either medically or nonmedically. The quantity of prescription opioids and number of refills prescribed to adolescents should be carefully considered and closely monitored to reduce subsequent nonmedical use of leftover medication.

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PRESCRIPTION OPIOIDS ARE highly efficacious when used properly for the treatment of acute and chronic pain-related conditions.¹ The prescribing of prescription opioids has increased among adolescents and young adults in the United States.²⁻⁴ Indeed, the prescribing rates for prescription opioids have nearly doubled since 1994 among adolescents and young adults.² One possible consequence of an increase in prescribing rates is an increase in nonmedical use of prescription opioids (NMUPO) and related consequences due to greater availability.⁴⁻⁷ For example, the estimated number of emergency department visits involving the NMUPO more than doubled between 2004 and 2008 for patients younger than 21 years.⁷

The leading sources of prescription opioids among adolescent nonmedical users are from their peers and from their own

previous prescription opioids,⁸⁻¹⁰ indicating that NMUPO should be considered within the larger context of medical availability. The association between medical availability and NMUPO among adolescents has received relatively scant attention and little research exists that assesses

*For editorial comment
see page 865*

See also page 880

this relationship. At least 2 studies of adolescents found that the majority of lifetime medical users of prescription opioids reported no lifetime history of NMUPO.^{11,12} However, most lifetime nonmedical users of prescription opioids reported a lifetime history of medical use of prescription opioids.^{11,12} Despite find-

ings from these 2 studies conducted in the Detroit, Michigan, metropolitan area, there remains a lack of research assessing the associations between medical use of prescription opioids and NMUPO in national samples of adolescents.¹³ Such studies could provide assurance to health professionals who prescribe opioid medications to adolescents that they can effectively treat patients with these medications and provide insights about how to reduce NMUPO.

Adolescence represents an important time to understand medical use of prescription opioids and NMUPO because older adolescents often become responsible for their own medication management and adolescents serve as the leading diversion source of NMUPO for their peers.⁸⁻¹² Adolescents who initiate NMUPO before 18 years of age are more likely to develop prescription opioid use disorders than those who initiate NMUPO later in life.¹⁴ To date, there are no known national studies of medical use of prescription opioids among high school students. The objectives of the present study are to (1) assess the lifetime prevalence of medical use of prescription opioids and NMUPO in a national sample of high school seniors and (2) assess the associations between the history of lifetime medical use of prescription opioids and NMUPO and substance use behaviors.

METHODS

STUDY DESIGN

The Monitoring the Future (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-and-pencil questionnaires in classrooms. The sample for this study consisted of high school seniors from 3 independent cohorts (senior years 2007-2009) and the MTF study uses a multistage 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 82% between 2007 and 2009. Because so many questions are included in the MTF study, much of the questionnaire content is divided into 6 different questionnaire forms that are randomly distributed. This approach results in 6 virtually identical subsamples. The measures most relevant for this study were asked on Form 1, so this study focuses on the cross-sectional subsamples receiving Form 1 within each year cohort. Details about the MTF study design and methods are available elsewhere.⁸ Institutional review board approval was granted for this study by the University of Michigan Institutional Review Board Health Sciences.

SAMPLE

The sample included 7374 individuals who completed questionnaires during the spring of their senior year between 2007 and 2009, and these respondents compose the study sample. After applying sampling weights, the sample represented a population that was 48% female, 69% white, 13% African American, and 18% Hispanic. The modal age of the individuals in the sample was 18 years.

MEASURES

The MTF study assesses a wide range of behaviors, attitudes, and values. We have selected specific measures from a larger set of questions for the present study including demographic characteristics and standard measures of substance use behaviors such as binge drinking, cigarette use, nonmedical use of prescription medications, and marijuana and other drug use.⁸

Medical use of prescription opioids was assessed by asking respondents whether they had ever taken prescription opioids because a doctor told them to use the medication. Respondents were informed that prescription opioids are sometimes prescribed by doctors and drugstores are not supposed to sell them without a prescription. These included Vicodin, OxyContin, Percodan, Percocet, Demerol, Dilaudid, morphine, opium, and codeine. The response options included (1) no; (2) yes, but I had already tried them on my own; and (3) yes, and it was the first time I took any.

Nonmedical use of prescription opioids was assessed by asking respondents on how many occasions (if any) in their lifetime they used prescription opioids on their own, that is, without a doctor telling you to take them. The response scale ranged from (1) no occasions to (7) 40 or more occasions.

Routes of administration for NMUPO were assessed by asking which methods respondents used for taking NMUPO. The routes included (1) intranasal (snorting); (2) smoking; (3) injection; (4) orally (by mouth); and (5) other.

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 year. The diversion sources included (1) bought on the Internet, (2) took from a friend or relative without asking, (3) given for free by a friend or relative, (4) bought from a friend or relative, (5) from a prescription I had, (6) bought from a drug dealer/stranger, and (7) other method. Motives for NMUPO were assessed by asking respondents who reported NMUPO 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 binary items included to relieve physical pain and to feel good or get high.

STATISTICAL ANALYSES

The estimated prevalence rates for medical use of prescription opioids and NMUPO, across subgroups defined by demographic characteristics and substance use behaviors, were computed using cross-tabulations incorporating the MTF study sampling weights. Rao-Scott χ^2 tests of homogeneity¹⁵ and design-based logistic regression analyses, or logistic regression analyses incorporating the complex sample design features of the MTF study (including the sampling weights) and the effects of these features on variance estimates,¹⁶ were conducted to determine whether medical and nonmedical use history of prescription opioids was significantly associated with substance use behaviors. The following 5 mutually exclusive groups were compared in the analyses: (1) no lifetime medical use of prescription opioids or NMUPO, (2) lifetime medical use of prescription opioids only, (3) lifetime medical use of prescription opioids prior to NMUPO, (4) lifetime NMUPO prior to medical use, and (5) lifetime NMUPO only. Estimated (linearized) variances of weighted estimates were multiplied by an average MTF study design effect factor prior to the construction of confidence intervals, and weighted Pearson χ^2 statistics were divided by this same design effect factor¹⁵ per the recommendation of Johnston and colleagues.⁸ All statistical analyses were performed using commands for the analysis of complex sample survey data in the Stata software (version 11.2; StataCorp).

Table 1. Lifetime Medical and Nonmedical Use of Prescription Opioids Among US High School Seniors by Race/Ethnicity, 2007 to 2009^a

History of Lifetime Medical and Nonmedical Use	%				Racial/Ethnic Differences P Value
	Overall (n=6673)	White (n=4015)	African American (n=713)	Hispanic (n=993)	
No medical or nonmedical use	77.7	71.4	92.4	90.2	<.001
Medical use only	9.3	12.3	3.6	3.9	<.001
Medical use prior to nonmedical use	4.3	5.6	1.9	1.6	<.001
Nonmedical use prior to medical use	3.9	5.0	1.4	1.2	<.001
Nonmedical use only	4.7	5.8	0.7	3.1	<.001

^aSample sizes do not sum to full sample size because of 1368 missing values on race/ethnicity for these 3 cohorts.

RESULTS

PREVALENCE OF MEDICAL USE OF PRESCRIPTION OPIOIDS AND NMUPO

The estimated prevalence of lifetime medical use of prescription opioids among US high school seniors was 17.6% while the estimated prevalence of lifetime NMUPO was 12.9%. Based on these 3 cohorts, we estimate that 22.3% of US high school seniors had some lifetime exposure to prescription opioids either medically or nonmedically. The prevalence of lifetime NMUPO held steady at 13% over the 3 years between 2007 and 2009, while the prevalence of lifetime medical use of prescription opioids increased slightly from 16.9% in 2007 to 18.7% in 2009. None of these changes in prevalence were significant. There were minimal sex differences with respect to the history of medical use of prescription opioids and NMUPO. The lifetime prevalence of any medical use of prescription opioids was 18.3% among girls and 16.8% among boys while the lifetime prevalence of NMUPO was 11.8% among girls and 13.8% among boys. The percentage of students who ever received a prescription for opioids and never used nonmedically in their lifetime was 9.3%.

The estimated lifetime prevalence of any medical use of prescription opioids was 22.8% among white students, 6.9% among African American students, and 6.7% among Hispanic students ($P < .001$) while the lifetime prevalence of NMUPO was 16.4% among white students, 4.0% among African American students, and 5.9% among Hispanic students ($P < .001$). As illustrated in **Table 1**, there were notable racial/ethnic differences with respect to the history of medical use of prescription opioids and NMUPO: white students had significantly higher rates of both medical use of prescription opioids and NMUPO compared with African American and Hispanic students and, correspondingly, significantly lower rates of nonuse.

MEDICAL USE OF PRESCRIPTION OPIOIDS AND NMUPO AND OTHER SUBSTANCE USE BEHAVIORS

Bivariate analyses were used to initially examine the associations among lifetime medical use of prescription opioids and NMUPO and substance use behaviors. Rao-Scott χ^2 tests revealed significant associations between

lifetime history of prescription opioid use and each measure of substance use ($P < .001$). Multivariate logistic regression results reinforced the bivariate findings; the odds of reporting substance use were considerably higher among individuals who reported lifetime NMUPO after adjusting for relevant covariates (**Table 2**). Substance use behaviors among individuals who reported NMUPO prior to medical use of prescription opioids were similar to individuals who reported only lifetime NMUPO. In contrast, individuals who reported only lifetime medical use of prescription opioids reported similar odds of substance use behaviors as individuals who reported no lifetime medical use of prescription opioids or NMUPO. Finally, some of the odds of individuals who reported medical use of prescription opioids prior to NMUPO were significantly higher than those who reported no lifetime medical use of prescription opioids or NMUPO but considerably lower than those who reported only lifetime NMUPO or those who reported NMUPO prior to medical use of prescription opioids.

The associations among lifetime medical use of prescription opioids and NMUPO and specific behaviors related to the use of prescription opioids, such as route of administration, diversion sources, and motives, were also examined using χ^2 tests and revealed significant associations ($P < .001$). Overall, we found that more than 37% of nonmedical users reported intranasal administration of prescription opioids and less than 1.5% of nonmedical users reported buying prescription opioids on the Internet. Multiple logistic regression results supported the bivariate findings; the odds of intranasal administration of prescription opioids, buying prescription opioids from any source, having a friend or relative give prescription opioids for free, and NMUPO to feel good or get high were significantly greater among those who reported NMUPO prior to medical use of prescription opioids and those who reported NMUPO only as compared with those who reported medical use of prescription opioids prior to NMUPO after adjusting for relevant covariates (**Table 3**). Of those who reported medical use of prescription opioids prior to NMUPO, an estimated 79.5% reported NMUPO with the prescription opioids they had been previously prescribed.

We found that individuals who reported only lifetime NMUPO had 70% lower expected odds of NMUPO "to relieve physical pain" relative to those who reported medical use of prescription opioids prior to NMUPO when

Table 2. Substance Use Behaviors as a Function of Medical and Nonmedical Use of Prescription Opioids, 2007 to 2009^a

History of Lifetime Medical and Nonmedical Use	Any Cigarette Smoking in the Past 30 d (n=5571)		Any Binge Drinking in the Past 2 wk ^b (n=5507)		Any Marijuana Use in Lifetime (n=5644)		Any Illicit Drug Use Other Than Marijuana in Lifetime ^c (n=5442)		Any Nonmedical Use of Other Prescription Medications in Lifetime ^d (n=5584)	
	%	AOR (95% CI)	%	AOR (95% CI)	%	AOR (95% CI)	%	AOR (95% CI)	%	AOR (95% CI)
No medical or nonmedical use	16.0	1 [Reference]	15.7	1 [Reference]	5.4	1 [Reference]	5.6	1 [Reference]	6.9	1 [Reference]
Medical use only	16.7	0.9 (0.6-1.3)	18.6	1.0 (0.7-1.4)	3.5	0.6 (0.3-1.2)	6.5	1.2 (0.7-2.0)	6.7	0.9 (0.5-1.4)
Medical use prior to nonmedical use	26.0	1.6 (1.0-2.5)	28.3	1.8 (1.2-2.8)	13.7	2.2 (1.2-3.9)	17.8	3.3 (2.0-5.7)	26.4	4.2 (2.7-6.6)
Nonmedical use prior to medical use	61.2	8.2 (5.4-12.5)	58.0	7.7 (5.0-11.9)	41.9	12.3 (8.0-19.1)	59.7	26.6 (16.9-41.9)	70.6	27.6 (17.7-43.0)
Nonmedical use only	63.3	8.6 (5.9-12.6)	49.9	4.5 (3.1-6.6)	48.8	16.0 (10.8-23.9)	57.9	22.2 (14.8-33.5)	67.5	25.5 (17.0-38.3)

Abbreviation: AOR, adjusted odds ratio.

^aSample sizes for the regression models ranged from 5442 (any illicit drug use other than marijuana in lifetime) to 5644 (any marijuana use in lifetime) because of missing data. Multivariate logistic regression adjusting for race/ethnicity, cohort year, school geographical region, and metropolitan statistical area.

^bBinge drinking in the past 2 weeks was defined as consuming 5 or more drinks in a row.

^cAny illicit drug use other than marijuana included LSD, other psychedelics, crack cocaine, other cocaine, and heroin.

^dAny nonmedical use of other prescription medications included stimulants, sedatives, and tranquilizers.

Table 3. Route of Administration, Diversion, and Motive as a Function of Medical and Nonmedical Use of Prescription Opioids, 2007 to 2009^a

History of Lifetime Medical and Nonmedical Use	Intranasal Administration of Prescription Opioids (Snorted) (n=426)		Given Prescription Opioids for Free From a Friend or Relative (n=432)		Bought Prescription Opioids From a Friend, Relative, Drug Dealer, or Stranger (n=432)		Nonmedical Use to Relieve Physical Pain (n=425)		Nonmedical Use to Feel Good or Get High (n=425)	
	%	AOR (95% CI)	%	AOR (95% CI)	%	AOR (95% CI)	%	AOR (95% CI)	%	AOR (95% CI)
Medical use prior to nonmedical use	9.4	1 [Reference]	21.5	1 [Reference]	18.2	1 [Reference]	63.7	1 [Reference]	31.4	1 [Reference]
Nonmedical use prior to medical use	41.7	6.7 (2.0-21.9)	62.9	6.9 (2.9-16.8)	51.6	5.0 (2.1-12.1)	59.9	0.7 (0.3-1.6)	61.7	4.1 (1.8-9.2)
Nonmedical use only	46.5	8.9 (2.8-28.1)	56.5	6.5 (2.7-15.4)	50.9	4.4 (1.9-10.5)	33.6	0.3 (0.1-0.6)	58.9	3.8 (1.8-8.4)

Abbreviation: AOR, adjusted odds ratio.

^aSample sizes for the regression models ranged from 425 (nonmedical use to relieve physical pain and nonmedical use to feel good or get high) to 432 (given prescription opioids for free from a friend or relative and bought prescription opioids from a friend, relative, drug dealer, or stranger) because of missing data. Multivariate logistic regression adjusting for race/ethnicity, cohort year, school geographical region, and metropolitan statistical area.

adjusting for relevant covariates. Individuals who reported NMUPO prior to medical use of prescription opioids had an estimated percentage indicating NMUPO to relieve physical pain that was similar to the estimate for those with medical use of prescription opioids prior to NMUPO, and these groups did not differ in the odds of reporting NMUPO to relieve physical pain when adjusting for relevant covariates. On the other hand, individuals who reported NMUPO only and those reporting NMUPO prior to medical use of prescription opioids each had expected odds of NMUPO “to feel good or get high” that were approximately 4 times higher than the odds for those who reported medical use of prescription opioids prior to NMUPO.

COMMENT

This study found that approximately 17.6% of US high school seniors report medical use of prescription opioids at least once in their lifetime, while 12.9% of high school seniors report NMUPO. Nearly 1 in every 4 US

high school seniors has had some lifetime exposure to prescription opioids either medically or nonmedically. These prevalence rates are lower than smaller regional-based studies of secondary school students and national studies of adolescents.^{11,12,17} For example, a study conducted in the Detroit metropolitan area found that 48.9% of high school students reported lifetime medical use of prescription opioids while 20.9% reported lifetime NMUPO.¹² Recent evidence indicates that the prevalence of medical and nonmedical use of controlled medications can vary according to geographical location.^{2,11,12,17} Based on the differences in findings between regional and national studies, it remains critical to monitor medical use of prescription opioids and NMUPO at the local, regional, and national levels. These findings serve as a reminder that individual communities should not rely solely on national findings to inform best practices for their local youth. Instead, health professionals and researchers should be encouraged to collect data to learn more about drug use behaviors of local youth and use national findings to benchmark results.

An important contribution of this study was the racial/ethnic differences found with respect to medical use of prescription opioids and NMUPO. Although the results of this study indicated that white students were significantly more likely than African American and Hispanic students to report medical use of prescription opioids and NMUPO, previous studies found no such racial/ethnic differences.^{11,12,17} In this national study, racial/ethnic differences found in NMUPO may be influenced by the racial/ethnic differences in medical availability, especially since between 33% and 40% of high school seniors who reported NMUPO in the past 12 months obtained these medications from their own previous prescription for opioids.⁸ Furthermore, peers serve as the leading source of diversion for NMUPO among adolescents, which could have contributed to the racial/ethnic differences found in this study.^{8,10,11} Previous work has documented barriers for receiving prescription opioids among racial minority patients.¹⁸⁻²⁰ For example, pharmacies in minority zip codes (at least 70% minority residents) were 52 times less likely to carry sufficient opioid analgesics than pharmacies in white zip codes (at least 70% white residents), regardless of income.¹⁸ Thus, the racial/ethnic differences in medical use of prescription opioids and NMUPO observed in this study could be related to the lack of adequate treatment, insufficient availability, diversion, overprescribing among white populations, and/or underprescribing among nonwhite populations.

Although the results of this study found no sex differences in medical use of prescription opioids and NMUPO, previous regionally based studies have found that female youth were significantly more likely than male youth to report lifetime medical use of prescription opioids and NMUPO.^{11,12} At least 1 other national study found no significant sex differences in lifetime NMUPO among individuals 12 to 17 years of age in 2009; 10.0% of girls and 9.3% of boys reported lifetime NMUPO.¹⁷ The differences found between national and regional-based studies could be partially attributed to a multitude of variation between studies including differences in age of respondents, geographical location, school type (eg, size and public vs private), mode of data collection, questionnaire wording, response rate, and consent process.

Another important contribution of this study was that substance use behaviors were more prevalent among individuals who reported any history of NMUPO while those who reported medical use of prescription opioids only were not at increased risk for substance use compared with nonusers. These findings, along with results from 3 earlier smaller studies, should provide some reassurance to clinicians that prescription opioids can be safely prescribed to adolescents.^{11,12,21} A novel finding of this study was that individuals who have a history of NMUPO before they initiate medical use of prescription opioids have elevated rates of substance use behaviors and prescription opioid abuse. There was also compelling evidence that different prescription opioid use histories are associated with different motives for NMUPO. Clearly, prescribers are encouraged to screen patients for potential substance abuse problems, including NMUPO, using a brief screening instrument when assessing the risk for abusing and diverting controlled medications such as pre-

scription opioids. Notably, we found that 80% of non-medical users with an earlier history of medical use had used prescription opioids from a prescription they had previously. This finding suggests that the quantity of prescription opioids and/or limiting refills should be carefully considered by prescribers and closely monitored to reduce subsequent NMUPO of leftover opioid medication. Prescribers need to be aware that approximately 1 in 8 high school seniors reported NMUPO at least once in their lifetime. Individuals with a legitimate need for opioid analgesics who have a history of NMUPO should not be denied the medication. Instead, careful prescribing, close monitoring, and consultation with an addictionologist should be considered for such individuals.

This study has noteworthy strengths, including a large national sample of high school seniors. Further, this study represents the first attempt, to our knowledge, to assess the medical use of prescription opioids and NMUPO nationally among adolescents. Despite these strengths, there were also limitations. First, since the present study consists of secondary analyses, the survey items in the MTF study limited what variables could be examined. Furthermore, the MTF study design and measurement differ from other studies and these differences could explain the lower rates of medical use of prescription opioids and NMUPO in the MTF study relative to other studies.^{11,12,17} Second, the results cannot be generalized to all adolescents because this sample only included high school seniors 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. Finally, the cross-sectional nature of the study presented some limitations; longitudinal studies are needed to examine patterns of medical use of prescription opioids and NMUPO.

In conclusion, we found that nearly 1 in every 4 high school seniors in the United States had some lifetime exposure to prescription opioids either medically or non-medically. Based on the increased risk of substance abuse associated with NMUPO, it appears critical to assess a patient's history of prescription opioid use. One of our findings should be treated very seriously by prescribers of opioids; we found that 80% of nonmedical users with an earlier opioid prescription admitted to using their prescribed opioids nonmedically, presumably because there were pills left over. Indeed, this study indicates that the quantity of prescription opioids and number of refills prescribed to adolescents should be carefully considered and closely monitored to reduce subsequent nonmedical use of leftover medication.

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