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Co-ingestion of Prescription Opioids and Other Drugs among High School Seniors: Results from a National Study

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Abstract

Background—The objective of this study was to determine the past-year prevalence rates and behavioral correlates of co-ingestion of prescription opioids and other drugs among high school seniors in the United States.

Methods—Nationally representative probability samples of high school seniors in the United States were surveyed as a part of the Monitoring the Future (MTF) study. Data were collected in schools via self-administered paper-and-pencil questionnaires during the spring of each cohort's senior year. The sample consisted of five cohorts (senior years of 2002–2006) made up of 12,441 high school seniors (modal age 18), of which 53% were women.

Results—The estimated prevalence of any past-year co-ingestion of prescription opioids and other drugs for these cohorts was 4.4%, and 69.8% among nonmedical users of prescription opioids. The substances most commonly co-ingested with prescription opioids included marijuana (58.5%), alcohol (52.1%), cocaine (10.6%), tranquilizers (10.3%), and amphetamines (9.5%). Nonmedical users who co-ingested prescription opioids with other drugs were more likely to report intranasal administration, recreational motives, oxycodone use, and greater subjective high when using prescription opioids than nonmedical users who did not co-ingest prescription opioids and other drugs.

Conclusions—Nearly 7 out of every 10 nonmedical users of prescription opioids reported co-ingestion of prescription opioids and other drugs in the past year. The findings indicate that the co-ingestion of prescription opioids and other drugs by high school seniors in the United States serves as a marker for substance abuse and represents a significant public health concern.

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Contributors

Drs. McCabe, West, Teter and Boyd designed the study and wrote the protocol. Dr. McCabe managed the literature searches and summaries of previous related work. Dr. West undertook the statistical analysis, and Dr. McCabe wrote the first draft of the manuscript. All authors contributed to and have approved the final manuscript.

Keywords

Prescription opioids; co-ingestion; simultaneous use; adolescents; polydrug use; epidemiology; nonmedical use

1. Introduction

Despite the efficacy of prescription opioids in treating pain-related medical conditions (Savage, 2003), there are growing public health concerns in the United States regarding the nonmedical use of prescription opioids (NMUPO) and the abuse potential of these medications (Zacny et al., 2003). The percentage of ambulatory and emergency medical care visits (e.g., physician practices, outpatient departments, and emergency departments) during which controlled opioid medications were prescribed rose from 3% in 1994–1995 to 6% in 2006–2007 among adolescents and from 4% in 1994–1995 to 10% in 2006–2007 among young adults (Fortuna et al., 2010). In the United States, past-year NMUPO and prescription opioid use disorders are most prevalent among adolescents and young adults, although they have increased across all age groups over the past two decades (Blanco et al., 2007; Johnston et al., 2007, 2011; McCabe et al., 2007; SAMHSA, 2010a). National, regional and case-report data document a wide range of adverse consequences that can occur as a result of co-ingestion of prescription opioids with other drugs (Cone et al., 2003, 2004; McCabe et al., 2006; SAMHSA, 2004, 2010b; Watson et al., 2004). Emergency department visits associated with NMUPO have recently increased and often involve the use of other substances (SAMHSA, 2004, 2010b). Data from the Drug Abuse Warning Network indicate that the number of emergency department visits involving NMUPO more than doubled between 2004 and 2008 (from 144,644 visits per year to 305,885 visits per year) for patients less than 21 years old (SAMHSA, 2010b) and often involved the use of another substance (SAMHSA, 2004).

There is evidence that prescription opioids are much more toxic when they are taken with other drugs that depress the central nervous system, such as alcohol, as compared to when prescription opioids are taken alone, based on a review of drug-induced fatalities (Cone et al., 2004). Furthermore, of the deaths attributed to oxycodone between August 1999 and January 2002 in 23 states in the United States, only 3.3% (n=30) reported oxycodone as the single causal agent; alcohol and benzodiazepines were the most prevalent drugs involved in oxycodone related deaths (Cone et al., 2003). There is also evidence that alcohol and other drugs can increase the abuse liability-related subjective effects of prescription opioids (e.g., drug liking, pleasant bodily sensations, and euphoria) which may explain why prescription opioids and other drugs are co-ingested (Martin, 1995; Zacny and Gutierrez, 2011; see Discussion section for more details regarding drug-drug interactions).

Despite the notable risks associated with co-ingestion of prescription opioids and other drugs, there is surprisingly little epidemiological research directed at the prevalence and characteristics associated with the co-ingestion of NMUPO and other drugs (Collins et al., 1998; Compton and Volkow, 2006a, 2006b). At least two epidemiological, college-based studies have shown that the majority of nonmedical users of prescription opioids have co-ingested prescription opioids and alcohol (Garnier et al., 2009; McCabe et al., 2006). These two epidemiological studies of undergraduate students found that co-ingestion of prescription opioids and alcohol was more prevalent among those who were male and White. The past-year prevalence of co-ingestion involving NMUPO and alcohol was approximately 4% (McCabe et al., 2006). Among those who reported co-ingestion of NMUPO and alcohol in the past year, the mean (SD) number of days of co-ingestion was 3.2 days (range 0–40 days). Nonmedical users who co-ingested prescription opioids and

alcohol also experienced more substance use related problems than other nonmedical users. To date, there have been no national epidemiological studies that examine co-ingestion of NMUPO and other drugs and no epidemiological studies that focus on co-ingestion of NMUPO and drugs other than alcohol. Based on these gaps in the existing literature, the main objectives of this study were to identify the prevalence and behavioral correlates of past-year co-ingestion of NMUPO and other drugs in a national sample of high school seniors in the United States.

2. Methods

2.1 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 (Johnston et al., 2011). 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 class size); and in stage 3, students within schools are selected. The student response rates for high school seniors ranged from 82% to 83% between 2002 and 2006. 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 data collected from seniors receiving Form 1 from 2002 to 2006 were used in this study because these MTF surveys contained questions regarding co-ingestion of prescription opioids and other drugs. Additional details about the MTF design and methods are available elsewhere (Johnston et al., 2011). Approval was granted for this study by the University of Michigan Institutional Review Board Health Sciences.

2.2 Sample

There were 12,441 individuals who completed Form 1 in the five cohorts between 2002 and 2006 during the spring of their senior year, and these respondents comprise the study sample. The full sample represented a population of high school seniors that was 53% women, 49% white, 13% African-American, and 38% from other racial groups or not specifying their race. Table 1 shows that the socio-demographic features of the subpopulation of past-year nonmedical users of prescription opioids represented by the sample were mostly similar to those of the full population, with the exceptions of race/ethnicity (more white nonmedical users and fewer African-American nonmedical users) and college aspirations (more nonmedical users saying that they probably or would not attend a four-year college). The modal age of the individuals in the sample was 18 years of age.

2.3 Measures

The MTF study assesses demographic characteristics such as sex, race and geographical region as well as standard measures of substance use behaviors such as binge drinking, cigarette use, nonmedical use of prescription drugs, marijuana use, and other drug use.

Nonmedical use of prescription opioids (NMUPO) was assessed with a series of items asking respondents on how many occasions (if any) they used prescription opioids on their own, without a doctor's orders (e.g., acetaminophen and hydrocodone, oxycodone, oxycodone with aspirin, acetaminaphin and aspirin, meperidine, hydromorphone, morphine, methadone, opium, codeine). Respondents were asked about NMUPO in their lifetimes and the past 12 months. The response scale ranged from (1) no occasions to (7) 40 or more occasions.

Co-ingestion of NMUPO and other drugs was measured with 10 items focused on the number of times prescription opioids were used nonmedically at the same time as other drugs so that the effects overlapped: alcohol, marijuana, LSD, hallucinogens other than LSD, amphetamines, sedatives, barbiturates, tranquilizers, cocaine, and heroin. The response scale ranged from (1) not at all to (5) every time for each of the 10 items.

Routes of administration for NMUPO were assessed with five items that asked which methods respondents who reported NMUPO used for taking prescription opioids (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 to indicate the most important reasons for NMUPO (mark all that apply). The list of binary items included but was not limited to the following: (1) to experiment; (2) to feel good or get high; and (3) to relieve physical pain.

2.4 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 past-year prevalence rates of co-ingestion involving NMUPO and other drugs - across subgroups defined by demographic characteristics and substance use behaviors - were computed using weighted cross-tabulations. Rao-Scott Chi-square tests of homogeneity (Rao and Scott, 1984) and design-based logistic regression analyses (Heeringa et al., 2010) were conducted to determine whether co-ingestion involving NMUPO and other drugs was significantly associated with other substance use behaviors. The following three mutually exclusive groups were compared in terms of other substance use behaviors in the analyses: 1) no past-year NMUPO, 2) past-year NMUPO without co-ingestion, and 3) past-year NMUPO with co-ingestion. The logistic regression models included cohort year, school geographical region and frequency of NMUPO (where frequency was a covariate in models for nonmedical users only) as covariates based on their significant associations with dependent variables used in the present study, NMUPO, and/or co-ingestion of prescription opioids and other drugs in previous research (McCabe et al., 2005, 2006).

The complex multistage sampling design used in the MTF study resulted in the need to account for effects of cluster sampling on variance estimates. Estimated (linearized) variances of weighted estimates were multiplied by an average MTF design effect factor corrected for design effects due to the cluster sampling prior to the construction of confidence intervals, and weighted Pearson chi-square statistics were divided by this same design effect factor (Rao and Scott, 1984) per the recommendation of Johnston and colleagues (Johnston et al., 2011). 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).

3. Results

3.1 Prevalence of co-ingestion of prescription opioids and other drugs

The estimated prevalence of lifetime NMUPO among high school seniors in the United States between the years of 2002 and 2006 was 12.3%, while the past-year prevalence of NMUPO was 8.0%. Based on the 900 sampled high school seniors between 2002 and 2006 who reported past-year NMUPO, an estimated 38.2% used on 1 to 2 occasions, 21.7% used on 3 to 5 occasions, 15.8% used on 6 to 9 occasions and 24.2% used on 10 or more occasions. The majority of past-year nonmedical users of prescription opioids co-ingested at

least one other drug while using prescription opioids. Among past-year nonmedical users, the past-year prevalence of any co-ingestion of prescription opioids and other drugs was estimated to be 69.8%. Also among past-year nonmedical users, the prevalence of co-ingestion did not differ by race, but co-ingestion was more prevalent among males than females (73.1% vs. 63.3%, $p < 0.05$).

The most prevalent forms of co-ingestion of prescription opioids and other drugs included marijuana (58.5%), alcohol (52.1%), cocaine (10.6%), tranquilizers (10.3%), and amphetamines (9.5%). Among those past-year nonmedical users who co-ingested prescription opioids with other drugs, an estimated 34.2% reported co-ingestion of one other substance, 38.7% reported co-ingestion of two other substances, and 27.0% reported co-ingestion with three or more substances. Co-ingestion was more prevalent among frequent nonmedical users of prescription opioids (10 or more occasions) than nonmedical users who used less frequently (less than 10 occasions) (88.3% vs. 63.3%, $\chi^2 = 22.0$ [df = 1]; $p < 0.001$).

We examined the estimated frequency of co-ingestion of prescription opioids and other drugs among nonmedical users of prescription opioids (see Table 2). In general, we found that nonmedical users who co-ingested prescription opioids with other drugs were more likely to report “a few times” or “sometimes” as compared to “most times” or “every time.” For example, approximately 37% co-ingested prescription opioids with alcohol “a few times” or “sometimes” while about 15% of nonmedical users co-ingested prescription opioids and alcohol “most times” or “every time.”

3.2 Co-ingestion and other substance use behaviors

Design-adjusted Rao-Scott chi-square analyses and logistic regression analyses were used to examine the associations among past-year co-ingestion of prescription opioids and other drugs with other substance use behaviors, including lifetime drunkenness, binge drinking in the past two weeks, lifetime marijuana use, lifetime illicit drug use other than marijuana use, and lifetime nonmedical use of other prescription medications such as stimulants, sedatives and tranquilizers. The chi-square analyses revealed significant associations between co-ingestion of prescription opioids and other drugs and each substance use behavior ($p < .001$). As illustrated in Table 3, multivariate logistic regression results reinforced the bivariate findings; after adjusting for cohort year and school geographical region, the odds of reporting substance use behaviors were considerably higher among individuals who reported past-year NMUPO (both with and without co-ingestion) compared to those who did not engage in past-year NMUPO ($p < .001$).

3.3 Co-ingestion and specific behaviors related to prescription opioids

The associations among co-ingestion of NMUPO and other drugs and specific behaviors related to the use of prescription opioids, such as route of administration, subjective high, recreational motives and oxycodone use, were also examined using design-adjusted chi-square analyses, revealing several significant associations ($p < .001$). As illustrated in Table 4, multiple logistic regression results supported the bivariate findings; the odds of intranasal administration of prescription opioids, getting moderately or very high when using prescription opioids, recreational motives, and oxycodone use were significantly greater among those nonmedical users who co-ingested prescription opioids with other drugs as compared to those nonmedical users who did not report co-ingestion, after adjusting for frequency of NMUPO, cohort year and school geographical region ($p < .001$). Notably, the odds of using prescription opioids to get high or experiment were more than six times greater among those nonmedical users who co-ingested prescription opioids with other drugs as compared to those nonmedical users who did not report co-ingestion (86.4% vs. 49.3%,

AOR = 6.5, 95% CI = 3.7, 11.5, p < .001). In contrast, the odds of using prescription opioids to relieve physical pain were significantly lower among those nonmedical users who co-ingested prescription opioids with other drugs as compared to those who did not report co-ingestion (AOR = 0.1, 95% CI = <0.1, 0.2, p < .001).

We also examined the associations between the number of substances co-ingested with prescription opioids and specific behaviors related to the use of prescription opioids, using design-adjusted Rao-Scott chi-square analyses and logistic regression analyses. We found that the odds of intranasal administration, subjective high, recreational motives, and oxycodone use increased as a function of the number of drugs co-ingested with prescription opioids (see Table 5). For example, the odds of intranasal administration were nearly ten times greater among those nonmedical users who co-ingested prescription opioids with three or more drugs as compared to those nonmedical users who did not report co-ingestion (AOR = 9.9, 95% CI = 4.3, 23.1, p < .001), after adjusting for frequency of NMUPO, cohort year and school geographical region.

4. Discussion

This study represents the first national examination of co-ingestion involving prescription opioids and other drugs among high school seniors in the United States. The results of this study suggest that one out of every eight high school seniors reports lifetime NMUPO, and seven out of 10 nonmedical users report the co-ingestion of prescription opioids and other drugs in the previous year. A prior investigation of college students attending a Midwestern university in the United States found that 56% of past-year nonmedical users of prescription opioids reported co-ingestion of prescription opioids and alcohol in the past year (McCabe et al., 2006), which is comparable to the past-year prevalence of the same behavior found in this study (52%). The findings of this study provide compelling evidence, based on a national sample of high school seniors, that the majority of past-year nonmedical users of prescription opioids co-ingest at least one other drug while using prescription opioids.

We found a relatively high co-ingestion rate of prescription opioids and marijuana (58.5%). The high rates of co-ingestion involving prescription opioids and marijuana among high school seniors could be partially related to the high prevalence of marijuana use in general. An estimated 35% of high school seniors have used marijuana in the past 12 months (Johnston et al., 2011). Cannabinoids and opioids share several pharmacological properties, such as analgesia and drug reward, suggesting additive or possibly synergistic effects of these substances (see Abrams et al., 2011; Serranoa and Parsons, 2011 for reviews). Nonetheless, we also recognize that the mechanistic interactions between cannabinoids and opioids have primarily been explored in preclinical animal studies, and this research is far from conclusive. Regarding the possibility of increased drug abuse liability from opioid and cannabinoid co-ingestion, it has been known for some time there are multiple pharmacological mechanisms by which this might occur (Martin, 1995). More specifically, it is known that opioid neurons synapse on dopaminergic neurons in the nucleus accumbens (i.e., terminal end of the “reward pathway” in the CNS). Furthermore, cannabinoids appear to interact allosterically with the opioid system, and this may occur either presynaptically on the opioid neurons or with the opioid system directly on the dopaminergic neuron; in either case, to enhance reinforcing drug effects. Lastly, cannabinoid and opioid receptors may share a similar localization pattern in the CNS, suggesting that these systems may interact (Martin, 1995). More recent reviews of this topic support very similar conclusions (e.g., cannabinoid and opioid receptors being similarly expressed in CNS areas associated with reward), although most of the data continues to be derived from animal models (Serrano and Parsons, 2011).

We are just beginning to acquire data from human studies regarding cannabinoid-opioid interactions, as they relate to antinociception (i.e., pain relief). For example, a recent study demonstrated that inhaled cannabis augmented the pain relief response among individuals receiving stable doses of opioids (Abrams et al., 2011). The authors speculate that the mechanism for this response is likely pharmacodynamic (e.g., similar intracellular signaling mechanisms for both drug classes); however, the exact mechanism of action remains unknown. Although we cannot draw firm conclusions at this point in time, there appear to be cannabinoid-opioid mechanistic interactions that may help explain the high rates of co-ingestion of prescription opioids and marijuana identified in our study. It is certainly plausible that this drug combination leads to perceived benefits by users, such as increased drug reward or enhanced pain relief. This remains an important area for further study.

We found that the majority of nonmedical users co-ingested prescription opioids and alcohol. Similar to marijuana, the high rates of co-ingestion involving prescription opioids and alcohol among high school seniors in the United States could be related to the high prevalence of alcohol use in general. An estimated 65% of high school seniors have used alcohol in the past 12 months (Johnston et al., 2011). At least one psychopharmacological investigation has shown that ethanol increases the abuse liability-related subjective effects (e.g., drug liking, pleasant bodily sensations, and euphoria) of prescription opioids, which may partially explain why prescription opioids and alcohol are often co-ingested (Zacny and Gutierrez, 2011). A 21-year old college student described her co-ingestion of alcohol and acetaminophen and hydrocodone in a qualitative study: “Well, recreationally, I would take acetaminophen and hydrocodone and I would take half of one to drink. When I get drunk I get kind of loud, and so when I take half of one I can still be functional, but be a little mellower and my body just feels looser and relaxed…” (Quintero, 2009, p.23). Zacny and Gutierrez (2011) found that several abuse liability-related subjective effects differed significantly from placebo when ethanol and oxycodone were combined by fourteen participants in a randomized crossover trial, but these same abuse liability-related subjective effects did not differ significantly from placebo by the same doses of ethanol or oxycodone alone (Zacny and Gutierrez, 2011). Undeniably, additional psychopharmacological studies are needed to examine the extent to which other drugs increase the abuse liability-related effects of prescription opioids.

Previous research has shown a wide array of acute and long-term adverse consequences associated with the co-ingestion of prescription opioids and other drugs among adolescents and young adults (Cone et al., 2003, 2004; McCabe et al., 2006; SAMHSA, 2004, 2010b; Watson et al., 2004). This study highlights that substance use behaviors and health risks are more prevalent among nonmedical users who co-ingest prescription opioids and other drugs relative to other nonmedical users of prescription opioids and non-users. We found that nonmedical users who co-ingested prescription opioids with other drugs were significantly more likely than other nonmedical users and non-users to engage in problematic substance use behaviors, even after statistically controlling for relevant covariates such as frequency of nonmedical prescription opioid use.

The present study extended existing knowledge by identifying several behavioral correlates associated with co-ingestion of prescription opioids and other drugs, such as recreational motives, subjective high, and intranasal administration. This study found that only 1% of high school seniors who co-ingested prescription opioids and other drugs reported using prescription opioids to relieve physical pain only, while nearly 90% of those who co-ingested were motivated to get high or experiment; these results suggest that motives for co-ingestion are primarily recreational in nature. In addition, approximately two-thirds of nonmedical users who co-ingested prescription opioids and other drugs reported getting moderately to very high when using prescription opioids, relative to about one-fourth of

nonmedical users who did not co-ingest. Taken together, these behavioral correlates can potentially serve as important signals to include in screening efforts to detect nonmedical users of prescription opioids at the highest risk for developing substance use disorders.

The present study features several notable strengths, such as the inclusion of a large national sample of high school seniors. This study is the first attempt to assess co-ingestion involving prescription opioids and other drugs among high school seniors in the United States. Despite the strengths, there were also several limitations that should be noted when considering the implications of the findings. First, 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. Second, the data are subject to the potential response 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 (Harrison and Hughes, 1997; Johnston and O'Malley, 1985). Third, since the present study represented secondary analyses, the survey items in the MTF limited what variables could be examined. Survey items did not specify the quantity of prescription opioids and other drugs used on each occasion. Finally, the cross-sectional nature of the study presented some limitations in terms of making causal inferences; longitudinal studies are needed to examine adverse outcomes caused by co-ingestion of prescription opioids and other drugs.

In summary, this study found that approximately 70% of past-year nonmedical users of prescription opioids co-ingest prescription opioids and other drugs, and that the majority of these individuals co-ingest prescription opioids with more than one drug. Nonmedical users who co-ingest prescription opioids and other drugs are significantly more likely than other nonmedical users and non-users to engage in problematic substance use behaviors, indicating that co-ingestion of prescription opioids and other drugs may serve as a marker for substance abuse. The co-ingestion of prescription opioids and other substances represents a significant public health concern among adolescents in the United States, and the findings of this study indicate that prevention and intervention efforts directed toward youth need to address this behavior.

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Table 1

Weighted estimates of distributions of demographic characteristics among high school seniors in the United States: Past-year nonmedical users of prescription opioids vs. overall population (Source: MTF 2002–2006)

Demographic characteristics	Overall population of high school seniors %	Past-year nonmedical users of prescription opioids %
Sex	(n = 11,274)	(n = 843)
Male	47.3	49.9
Female	52.7	50.1
Race	(n = 9,353)	(n = 753)
White	48.5	56.4
Black	13.2	3.0
Other/Not specified/Missing	38.3	40.6
Geographical region	(n = 12,431)	(n = 900)
West	20.3	22.8
North Central/Midwest	24.8	24.8
South	34.8	32.5
Northeast	20.1	19.9
Urbanicity	(n = 11,155)	(n = 788)
Town/city	82.1	81.1
Country/farm	17.9	18.9
College plans	(n = 11,157)	(n = 790)
Probably/definitely won't	19.0	23.3
Probably/definitely will	81.0	76.7

Table 2

Past-year frequency of co-ingestion of prescription opioids and other drugs among nonmedical users of prescription opioids (Source: MTF 2002–2006)

Substances co-ingested with prescription opioids	Not at all %	A few times %	Sometimes %	Most times %	Every time %
Marijuana (n = 768)	41.5	20.6	13.8	8.7	15.3
Alcohol (n = 775)	47.9	22.1	14.8	8.2	7.1
Cocaine (n = 750)	89.4	5.3	3.1	1.1	1.1
Tranquilizers (n = 754)	89.7	4.8	4.1	0.8	0.6
Amphetamines (n = 749)	90.5	4.8	3.1	1.0	0.7
Hallucinogens other than LSD (n = 759)	93.6	3.3	2.1	0.6	0.3
Barbiturates (n = 748)	94.8	2.2	2.5	0.4	0.1
LSD (n = 751)	95.9	1.3	2.0	0.5	0.3
Sedatives (n = 752)	96.7	1.1	1.4	0.6	0.2
Heroin (n = 746)	96.7	1.2	1.7	0.1	0.4

Table 3

Substance use behaviors as a function of past-year nonmedical use of prescription opioids (NMUPO) and co-ingestion (Source: MTF 2002–2006)

	Drunk 10 or more times in lifetime[a]		Binge drinking in the past 2 weeks[b]		Marijuana use in lifetime		Any illicit drug use other than marijuana in lifetime[c]		Any nonmedical use of other prescription medications in lifetime[d]	
NMUPO and co-ingestion status	**%**	**AOR (95% CI)**	**%**	**AOR (95% CI)**	**%**	**AOR (95% CI)**	**%**	**AOR (95% CI)**	**%**	**AOR (95% CI)**
No past-year NMUPO	20.0	Reference	20.8	Reference	7.1	Reference	8.6	Reference	10.6	Reference
NMUPO without co-ingestion	43.9	3.6 (2.3, 5.6)	35.8	2.3 (1.5, 3.6)	17.9	2.9 (1.7, 5.0)	26.8	4.1 (2.6, 6.5)	47.1	8.0 (5.3, 12.2)
NMUPO use with co-ingestion	81.6	18.9 (13.0, 27.7)	65.3	7.7 (5.7, 10.4)	56.7	18.8 (14.0, 25.3)	77.2	31.8 (22.7, 44.4)	78.4	31.8 (22.7, 44.7)

[a] Drunk 10 or more times in lifetime refers to being drunk or very high from drinking alcoholic beverages.

[b] Binge drinking in the past 2 weeks refers to any occasions of having five or more drinks in a row.

[c] Any illicit drug use other than marijuana in lifetime included: LSD, other psychedelics, crack cocaine, other cocaine, and heroin.

[d] Any nonmedical use of other prescription medications in lifetime included: stimulants, sedatives, and tranquilizers.

Odds ratios are adjusted for cohort year and school geographical region.

Table 4

Route of administration, subjective high and motives for nonmedical use as a function of past-year co-ingestion of nonmedical use of prescription opioids and other drugs (Source: MTF 2002–2006)

	Intranasal administration of prescription opioids		Moderately or very high when used prescription opioids		Used prescription opioids to feel good or get high		Used prescription opioids to relieve physical pain only		Used oxycodone in the past 12 months	
Co-ingestion status	**%**	**AOR (95% CI)**	**%**	**AOR (95% CI)**	**%**	**AOR (95% CI)**	**%**	**AOR (95% CI)**		**AOR (95% CI)**
Nonmedical use without co-ingestion	10.7	Reference	28.2	Reference	31.8	Reference	16.2	Reference	19.3	Reference
Nonmedical use with co-ingestion	43.3	4.3 (2.2, 8.5)	67.0	4.0 (2.4, 6.7)	65.1	3.4 (2.0, 5.6)	1.2	0.1 (<0.1, 0.2)	43.7	2.9 (1.6, 5.2)

Odds ratios are adjusted for past-year frequency of nonmedical use of prescription opioids, cohort year and school geographical region.

Table 5

Route of administration, subjective high and motives for nonmedical use as a function of the number of drugs co-ingested with prescription opioids (Source: MTF 2002–2006)

	Intranasal administration of prescription opioids		Moderately or very high when used prescription opioids		Used prescription opioids to get high		Used prescription opioids to relieve physical pain only		Used oxycodone in the past 12 months	
Number of drugs co-ingested	**%**	**AOR (95% CI)**	**%**	**AOR (95% CI)**	**%**	**AOR (95% CI)**	**%**	**AOR (95% CI)**		**AOR (95% CI)**
Nonmedical use without co-ingestion	10.7	Reference	28.2	Reference	31.8	Reference	16.2	Reference	19.3	Reference
Co-ingestion with one drug	27.5	2.6 (1.2, 5.6)	55.1	2.9 (1.6, 5.4)	54.7	2.4 (1.3, 4.5)	2.9	0.1 (<0.1, 0.4)	32.9	2.0 (1.0, 4.1)
Co-ingestion of two drugs	41.0	4.3 (2.1, 9.0)	70.4	5.1 (2.8, 9.7)	70.0	4.5 (2.4, 8.2)	0.0	N/A	42.4	2.8 (1.4, 5.5)
Co-ingestion with 3 or more drugs	67.4	9.9 (4.3, 23.1)	77.3	4.7 (2.2, 10.0)	71.9	3.8 (1.8, 8.1)	0.1	<0.1 (<0.1, 0.5)	58.9	5.6 (2.6, 12.0)

Odds ratios are adjusted for past-year frequency of nonmedical use of prescription opioids, cohort year and school geographical region.