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## Sources of Nonmedical Prescription Drug Misuse Among US High School Seniors: Differences in Motives and Substance Use Behaviors

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## Abstract

**Objective:** To examine whether sources of nonmedical use of prescription drugs (NMUPD) involving anxiolytics, opioids, and stimulants were associated with sociodemographic characteristics, NMUPD characteristics (eg, frequency) and other substance use.

**Method:** Nationally representative samples of U.S. high school seniors (N=18,549) were surveyed via self-administered questionnaires (2009-2016). Design-based latent class analysis and Rao-Scott chi-square tests were used to test the associations among sociodemographic characteristics, NMUPD characteristics, other substance use behaviors (eg, binge drinking, cigarette smoking, marijuana use), and NMUPD sources.

**Results:** Approximately 11.0% of high school seniors reported past-year NMUPD (n=1,917). A substantial proportion of nonmedical users obtained the prescription drugs from multiple sources (44.2%). Latent class analysis identified five subgroups of NMUPD sources (friend/relative sources, friend/purchased sources, own leftover prescription, multiple sources and other sources). Nonmedical users who obtain prescription drugs from friend/purchased sources were more likely to be male adolescents while those who used their own leftover prescriptions were more likely to be female adolescents. Nonmedical users who obtain prescription drugs from multiple sources were more substance-involved. In contrast, adolescent nonmedical users who used their own leftover prescriptions were less substance-involved.

**Conclusion:** Growing evidence indicates that different NMUPD sources are associated with different substance use behaviors. All NMUPD sources should be discouraged, because they place individuals, families and communities at risk. Patients and their families should receive education on how to manage and properly dispose controlled medications to avoid diversion into the community. Prescribers are encouraged to check prescription monitoring programs and screen adolescents for substance use/misuse when prescribing controlled medications.

## Keywords

prescription medications; diversion; epidemiology; substance abuse

## INTRODUCTION

More than one in every ten US high school seniors reports past-year nonmedical use of prescription drugs (NMUPD), or using prescription drugs on their own without medical supervision.<sup>1</sup> The number of U.S. emergency department visits involving prescription opioids has more than doubled over the past decade for those under 21 years of age, and this appears to be related to NMUPD.<sup>2</sup> Adolescents often assume more responsibility for their own prescription medication management, which may contribute to the increased prevalence of NMUPD during this developmental time period.<sup>1,3-6</sup> Cross-sectional and longitudinal research has shown that NMUPD during adolescence is significantly associated with substance-related consequences during adolescence and into adulthood.<sup>3,5</sup> A better understanding of the sources of NMUPD among adolescents could help guide prevention efforts to reduce NMUPD and related consequences.

While there is heterogeneity in the sources of NMUPD among adolescents, the leading NMUPD sources involve friends/peers.<sup>1,4,5</sup> However, this is difficult to establish from many national studies because these studies either fail to assess sources of NMUPD or combine peer and family NMUPD sources, obscuring differences in NMUPD sources and sociodemographic characteristics. For example, past work shows that NMUPD sources are significantly associated with sex of the recipient and substance use behaviors.<sup>5,7-9</sup> There is evidence suggesting that male adolescents are more likely than female adolescents to report NMUPD sources involving friends or purchasing from drug dealers. Conversely, female adolescents are more likely to report conventional NMUPD sources such as family members or using their own leftover prescription medications.<sup>5,9,10</sup>

To date, most studies have examined individual sources of NMUPD among adolescents. Because adolescents often obtain prescription drugs from multiple sources, identifying categories of individuals who endorse combinations of sources of NMUPD (i.e., a person-centered approach) offers a complementary approach to a more traditional variable-centered approach such as examining individual sources of NMUPD. Variable-centered approaches focus on the relationships between variables, whereas person-centered approaches focus on the relationships among persons. Person-centered approaches include latent class analysis (LCA), which can be used to group individuals into similar categories according to their sources of NMUPD.<sup>11</sup>

While prescription drug diversion among adolescents remains a major health concern, there is limited national information about whether adolescents' NMUPD sources differ as a function of motives of NMUPD and substance use behaviors. Previous regional work has found compelling evidence that recreational motives for NMUPD are significantly associated with substance-related consequences.<sup>5</sup> However, there remains a lacuna regarding whether adolescents engaging in NMUPD for recreational purposes are getting the medications from specific sources (e.g., purchased from friends) or multiple sources. Thus, it is imperative to improve our understanding regarding potential differences in the sources of NMUPD among U.S. adolescents; this will help us to understand why some nonmedical users are at increased risk for negative outcomes. Such information may also identify factors to inform prescribing practices and education/prevention efforts to reduce NMUPD. The main objective of this study was to examine sources of NMUPD involving anxiolytics, opioids, and stimulants based on motives for NMUPD and other substance use behaviors in a large national multi-cohort sample of U.S. high school seniors.

## METHOD

### 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 U.S., 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 80% to

85% between 2009 and 2016. 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 on Form 1, so this study focuses on the subsamples receiving Form 1 within each cohort year between 2009 and 2016. Details about the *MTF* design and methods are available elsewhere.<sup>1</sup> Institutional Review Board approval was granted for this study by the University of Michigan Institutional Review Board Health Sciences.

## Sample

The sample included 18,549 high school seniors in the *MTF* cohorts from 2009 through 2016 who completed Form 1 during the spring of their senior year, including 1,917 past-year nonmedical users of prescription opioids, stimulants, or anxiolytics (the primary focus of the present study). This sample, appropriately weighted, represents a population that is estimated to be 51.5% female, 53.2% White, and have modal age 17-18 years. Table 1 provides more information on the characteristics of the target population and the subpopulation of past-year nonmedical prescription drug users.

## Measures

*Nonmedical use of prescription drugs (NMUPD)* was assessed by asking respondents on how many occasions (if any) in the past 12 months they used each prescription drug class [opioids, stimulants or anxiolytics] on their own—that is, without a doctor telling the respondent to take them. Extensive lists of examples were provided for each prescription medication class. The response scale for each item ranged from: 1) no occasions to 7) 40 or more occasions.

*Sources for NMUPD* were assessed by asking respondents where they obtained prescription drugs (i.e., opioids, stimulants, and anxiolytics) they used without a doctor's orders during the past 12 months (mark all that apply). The list of ten sources of NMUPD included: bought on the Internet, took from a friend without asking, took from a relative without asking, given for free by a friend, given for free by a relative, bought from a friend, bought from a relative, from one's own prior prescription, bought from drug dealer/stranger, and other method. Latent class analysis (LCA) was used to create classes of respondents based on these ten sources (see Data Analysis and Results sections for more details).

*Motives for NMUPD* were assessed by asking respondents the most important reasons they used prescription drugs without a doctor's orders (mark all that apply). Self-treatment NMUPD motives were defined as motives that were most consistent with the drug's pharmaceutical main indication, including prescription anxiolytics (i.e., to relax), prescription opioids (i.e., to relieve physical pain), and prescription stimulants (i.e., to help study). If respondents endorsed any recreational or other non-self-treatment motives, they were characterized as engaging in recreational/other motives. Recreational/other NMUPD motives that were common across all prescription drug classes included to get high, to experiment, to seek deeper insights, to have a good time with my friends, to fit in with a group I like, to get away from my problems, because of boredom, because of anger or

frustration, to get through the day, to increase the effects of some other drugs, to decrease the effects of some other drugs, and because I am “hooked.”

*Recent substance use* was assessed with standard measures including binge drinking, cigarette smoking, marijuana and other drug use.<sup>1</sup> *Binge drinking* was measured by asking respondents how often they had five or more drinks in a row during the past 2 weeks. The response scale ranged from 1) none to 6) 10 or more times. *Cigarette smoking* was measured by asking respondents how frequently they had smoked cigarettes during the past 30 days. The response scale ranged from 1) not at all to 7) two or more packs per day. *Marijuana and other drug use* included marijuana, LSD, other psychedelics, cocaine (crack or any other form), heroin, and nonmedical prescription drug use. These drug use behaviors were each measured by asking respondents on how many occasions they used [specified drug] during the past 30 days. The response scale for each of these items ranged from 1) no occasions to 7) 40 or more occasions. For purposes of analyses, each response scale was dichotomized (any use vs. no use and experimental/infrequent use on 1-9 occasions vs. more frequent use on 10 or more occasions) consistent with previous research.<sup>1,6,9</sup>

## Data Analysis

The analysis is divided into two major sections. First, descriptive statistics were used to examine bivariate associations between past-year NMUPD (across the three prescription drug classes) and respondents’ sociodemographic characteristics (i.e., sex, race, urbanicity, and parental education) and recent substance use (i.e., two-week binge drinking, past-month cigarette use, and past-month marijuana use). Second, latent class analysis (LCA) was used to create classes of respondents based on the ten sources of NMUPD. The exploratory LCA (with no covariates) was conducted using Mplus (version 8.0; code available upon request), and model fit was compared across different class solutions. Class membership was determined using a modal approach, which involved identifying the highest posterior predicted probability of class membership for each of the respondents based on the best-fitting model.<sup>11</sup> The resulting classes were then profiled. Descriptive statistics and Rao-Scott chi-square tests<sup>12</sup> were generated in Stata to examine bivariate associations between the classes and respondents’ sociodemographics, characteristics of NMUPD (i.e., frequency, motives), and recent substance use. Allowing for uncertainty in predicted class membership using three-step approaches in Mplus did not alter our conclusions.<sup>13</sup> All analyses incorporated the survey weights provided by the MTF study to account for differential probabilities of selection into the sample in estimation and variance estimation. Finally, given that we conducted multiple tests of association using several indicators and outcomes, all analyses employed a significance level of 0.005 based on growing evidence that a lower significance threshold is needed to improve reproducibility.<sup>14</sup>

## RESULTS

### Prevalence and correlates of nonmedical prescription drug use sources

The weighted prevalence of past-year NMUPD was 11.0% among U.S. high school seniors. Table 1 shows that the most prevalent sources among past-year nonmedical users of prescription stimulants, opioids and tranquilizers (n=1,917) were ‘given free by friends’

(53.7%), 'bought from a friend' (38.0%), and 'from their own prior prescription' (29.5%). A substantial proportion of adolescents engaged in NMUPD obtained the medications from multiple sources (44.2%). Adolescents reporting NMUPD were more likely to engage in recent binge drinking, cigarette use and marijuana use than those without NMUPD. Evidence of differences in NMUPD were found for several sociodemographic characteristics, including race/ethnicity (White adolescents were more likely to indicate NMUPD when compared to Non-White adolescents) and urbanicity (respondents who lived in suburban areas were more likely to indicate NMUPD when compared to adolescents who lived in urban and rural areas). Tables S1-S3, available online, provide additional bivariate analyses with respect to respondents who indicated past year NMUPD and those who did not; Tables S4-S6, available online, provide additional bivariate analyses with respect to the individual sources and respondents' sociodemographics, NMUPD characteristics, and recent substance use.

### Prevalence and correlates of nonmedical prescription drug source classes based on LCA

The results from the LCAs, where model fit was assessed using both the Bayesian Information Criterion (BIC) and entropy measures, indicated that a five-class solution for the ten aggregate source items was the best fitting model. We therefore tested associations of sociodemographic characteristics, NMUPD characteristics, and substance use behaviors with the five source classes (see Table 2 and Figure 1). The five-class solution had the lowest BIC value of all solutions considered (BIC=13601.38) and had an adequate entropy score (entropy=0.817) indicating good separation of the latent classes. Based on the probabilities of the ten source items within each estimated latent class, the five source classes were defined in the following manner:

1. *'Friend/relative sources'* (n=686, 40.6%) – the probability of receiving prescription drugs from a specific source was 0.5 or higher for one item ('given free by friend'=0.613) and the probability of receiving prescription drugs from a relative was notable (e.g., 'given free by relative'=0.203);
2. *'Friend/purchased sources'* (n=478, 28.3%) – the probability of receiving prescription drugs from a specific source was 0.5 or higher for two of the items ('bought from a friend'=1.00, 'given free by friend'=0.596);
3. *'Own leftover prescription'* (n=286, 16.9%) – the probability of receiving prescription drugs from a specific source was 0.5 or higher for one item ('From their own leftover prescription'=1.00);
4. *'Multiple sources'* (n=128, 7.6%) – the probability of receiving prescription drugs from a specific source was 0.5 or higher for five items ('stole from a relative'=0.565, 'given free by friend'=0.974, 'given free by relative'=0.611, 'bought from a friend'=0.936, 'bought from a dealer'=0.695); and
5. *'Other sources'* (n=111, 6.6%) – the probability of receiving prescription drugs from a specific source was 0.5 or higher for one item ('other source'=1.00).

Table 3 provides descriptive information from the analysis examining differences in sociodemographic characteristics between the predicted latent source classes. Adolescent



nonmedical users who obtained prescription drugs from ‘friend/purchased sources’ were more likely to be male adolescents, while adolescents who used their ‘own leftover prescriptions’ were more likely to be female adolescents. Nonmedical users who obtained prescription drugs from ‘friend/purchased sources’ were more likely to be White, while those who obtain prescription drugs from ‘other sources’ were more likely to be non-White. Finally, nonmedical users who obtain prescription drugs from ‘other sources’ were more likely to have no parents with a college degree. No differences were detected based on urbanicity (see Table S7, available online).

Table 4 shows differences between the predicted source classes in terms of NMUPD characteristics (e.g., frequency, motives). Adolescent nonmedical users who obtained prescription drugs from ‘multiple sources’ were more likely to report frequent NMUPD. In contrast, adolescents who used their ‘own leftover prescriptions’ or obtained prescription drugs from ‘friend/relative sources’ or ‘friend/purchased sources’ were more likely to report experimental/infrequent NMUPD. In addition, 13.8% of nonmedical users overall indicated self-treatment motives; however, approximately 27% of adolescents who used their ‘own leftover prescription’ indicated NMUPD for self-treatment motives (see Tables S8 and S9, available online, for more information regarding NMUPD motives, including psychometric details). Adolescents who obtained prescription drugs from ‘friend/relative sources,’ ‘own leftover prescriptions,’ and ‘other sources’ were more likely to report only one source for NMUPD. In contrast, adolescents who obtained prescription drugs from ‘friend/purchased sources’ and ‘multiple sources’ were more likely to indicate multiple sources. It should be noted that similar patterns emerged among users of multiple classes (e.g., stimulants and opioids) and single classes (e.g., stimulants only) of prescription drugs (see Table S7, available online).

The results assessing differences between the predicted source classes in terms of substance use behaviors are also presented in Table 4, and show several significant associations. Nonmedical users who obtained prescription drugs from ‘multiple sources’ or ‘friend/purchased sources’ were more likely to engage in substance use behaviors (e.g., cigarette smoking and marijuana use). In contrast, adolescents who used their ‘own leftover prescriptions’ or ‘other sources’ were less likely to engage in substance use behaviors.

## DISCUSSION

The present study found that more than one in every ten U.S. high school seniors has engaged in NMUPD in the past year. There was a great deal of heterogeneity associated with NMUPD sources, and a substantial proportion of adolescents engaged in past-year NMUPD obtained the medications from multiple sources (44.2%). Most importantly, the current study identified distinct subtypes of adolescent NMUPD that were associated with substance use behaviors. In particular, adolescent nonmedical users who obtained prescription drugs from multiple sources and those who obtained/purchased from friends were more substance-involved. In contrast, adolescent nonmedical users who obtained prescription drugs from their own prior leftover prescriptions were less substance-involved. Taken together, these findings are consistent with prior studies that found nonmedical users of prescription drugs who take a more active role in obtaining prescription drugs (e.g., multiple sources or

purchasing) have an increased risk of substance-related consequences.<sup>5,7,9,15</sup> Furthermore, NMUPD during adolescence has been shown to be significantly associated with substance use disorder symptoms in adulthood.<sup>3</sup> Notably, other factors may underlie the tendency for NMUPD and other substance use to co-occur in the same individuals, such as many other types of vulnerabilities that predate both behaviors (e.g., impulsivity, attitudinal vulnerabilities, and family history of substance-related problems). Regardless, the current findings suggest the need for clinicians to screen adolescents for NMUPD, and if NMUPD is detected, to carefully examine other NMUPD characteristics including sources and motives. Moreover, prescribers are also strongly encouraged to screen adolescents for substance-related problems when prescribing controlled medications and refer individuals who may require a more comprehensive substance use assessment. Screening and assessment appears especially important for adolescents who obtained prescription drugs from multiple sources and those who purchased the medications from friends.

The present study indicated that the vast majority of past-year nonmedical users of prescription drugs obtained these drugs from their friends, and these findings align with previous qualitative and quantitative studies.<sup>5,15</sup> While friends were the most prevalent source for NMUPD among adolescents, the majority of national studies either do not assess NMUPD sources or do not differentiate whether nonmedical users obtained prescription drugs from a friend or relative. The present study offers evidence for the importance of differentiating NMUPD sources. For instance, we found important sex differences in NMUPD sources, with female adolescents more likely to use their own leftover medications and male adolescents more likely to purchase these medications from friends (i.e., friend/purchased sources). In addition, there was heterogeneity associated with friend sources with one subgroup (i.e., friend/purchased sources) associated with higher rates of substance use behaviors (e.g., binge drinking, cigarette use, and marijuana use) and a second subgroup (i.e., friend/relative sources) associated with no differences in substance use behaviors.

The sex differences observed in this study are consistent with existing evidence that females adolescents are more likely to obtain prescription drugs for nonmedical use from their own leftover medications from prior prescriptions, suggesting an important role of the home/family environment in detecting and addressing NMUPD among young women.<sup>10</sup> In contrast, we found that male adolescents were more likely to purchase from friends as a source for obtaining prescription drugs, which is consistent with a proclivity of deviance involving peers.<sup>5,9</sup> These findings clearly identify friends/peers as an important area of study for NMUPD. A number of studies document peer attitudes and behaviors as significant correlates of substance use and NMUPD among adolescents, which is consistent with the well-established tendency for substance users to affiliate with deviance-prone peers.<sup>16-24</sup> Adolescents are often unaware of preexisting medical conditions or drug interactions when sharing medications or using their own leftover medications. Such information can be useful for prescribers educating patients and their families to avoid using leftover medications or sharing medications to self-treat new symptoms. Notably, the perceived risk associated with NMUPD among U.S. secondary school students is at an all-time low.<sup>1</sup> Taken together, these findings suggest adolescent friends/peers are likely to underestimate the risks of NMUPD.



The present study had several strengths that should be taken into account when weighing the implications of the findings. Most notably, this study featured a large multi-cohort nationally representative sample of U.S. high school seniors that allowed for subgroups to be defined based on NMUPD sources. In terms of limitations, the cross-sectional design precluded any conclusions about the causal relationships between NMUPD sources and substance use behaviors. Additional prospective research to examine the causal order associated with multiple sources and substance use behaviors is warranted. There are also some important subgroups of the US youth population missing from the MTF data collected each year, such as students who were home-schooled, have dropped out of school, or were absent on the day of data collection. Youth who are home-schooled are less likely to engage in substance use behaviors, while those who drop out or often absent from school are more likely to engage in substance use behaviors.<sup>1,6,25</sup> All MTF measures were based on self-reports, and while prior work has found that these self-report measures have been found to be reliable and valid, studies on youth suggest that misclassification and under-reporting of sensitive behaviors such as substance use can occur.<sup>1,6</sup> In the MTF study, no adjustments are made to correct for any missing data or under-reporting; thus, results from the present study may be conservative and underreport the actual prevalence of sensitive behaviors. We conducted multiple imputation analyses to examine the sensitivity of our inferences to possible biases introduced by missing data, and we did not find any major substantive differences. Finally, the MTF survey form used for the present study did not include mental health measures and future research is needed to examine associations between NMUPD sources, sex-specific binge drinking measures, and mental health symptomology as well as validate NMUPD sources and motives sub-scales.

There are several important implications of this work for clinical practice and future research. The findings suggest that researchers should make an effort to identify categories of adolescents who endorse combinations of sources of NMUPD (i.e., a person-centered approach) because a substantial proportion of adolescents endorse more than one source of NMUPD. The present study also found some evidence for considering friend and relative sources of NMUPD separately because they appear to be associated with different substance use behaviors. Based on the high prevalence of past-year NMUPD, peer-to-peer prescription drug diversion and leftover medications, health professionals should consider changes in prescribing practices to reduce excess medications (e.g., prescribe appropriate medication amount/doses, and check prescription monitoring programs). Many states require prescribers to check their state prescription monitoring programs prior to prescribing a controlled substance. As a result, prescribers now have the capacity to easily assess recent medication history, including whether someone has recently received similar medication from another prescriber. Furthermore, adolescent females were more likely to report NMUPD from their own leftover medications which suggests the importance of prescribing appropriate amounts and educating adolescents and their parents/guardians regarding responsible medication management practices (e.g., careful monitoring/counting, responsible usage/storage, and proper disposal). Parents and relatives should refer such individuals to health professionals rather than using leftover medications to self-treat their own symptoms. Additionally, adolescents and their parents/guardians should receive education not to use leftover controlled medications and how to properly dispose of medication via practical FDA-

approved methods. Indeed, more research is needed to identify the most effective interventions for health professionals prescribing medications to adolescents to reduce subsequent diversion and NMUPD. Based on the findings from the present study and prior work, health professionals should screen adolescents for NMUPD and substance-related problems when prescribing controlled medications.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## Acknowledgments

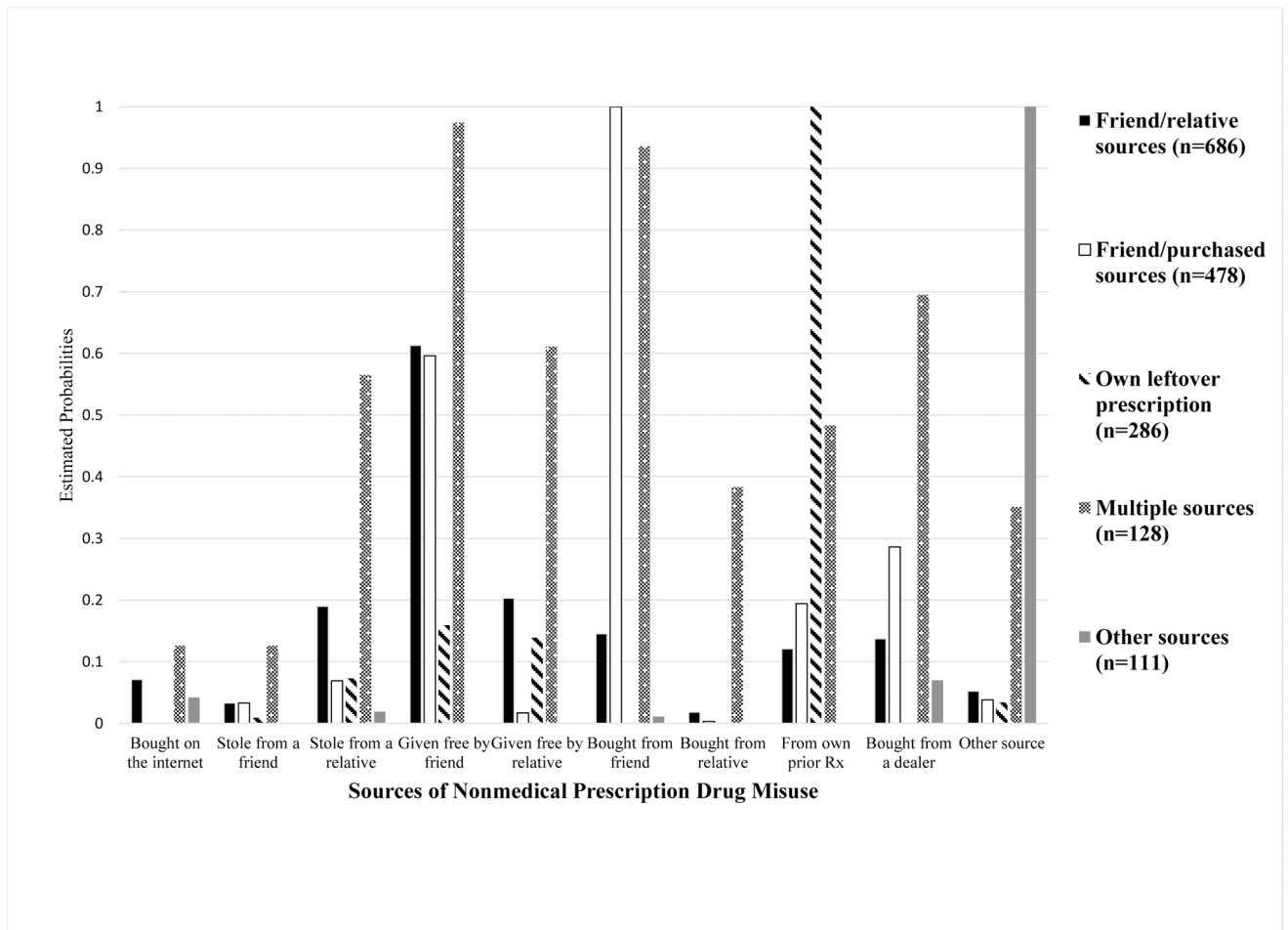
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**Figure 1.**  
 Estimated Latent Class Analysis Probabilities and Prevalence of Sources Based on Five Latent Classes (n=1691)

**Table 1.**

Sociodemographic Characteristics, Substance Use, and Sources of Nonmedical Use of Prescription Drugs, Overall and by Nonmedical Use of Prescription Drugs (Weighted Estimates)

	<b>Full Population</b> N=18,549	<b>No Past-Year</b> <b>Nonmedical Use</b> n=15,432	<b>Past-Year</b> <b>Nonmedical Use</b> n=1,917	<b>% missing (total)</b>
	<b>%, (n)<sup>a</sup></b>	<b>%, (n)<sup>a</sup></b>	<b>%, (n)<sup>a</sup></b>	<b>p<sup>b</sup></b>
<b>Sex</b>				
Male	48.5% (8120)	48.3% (7074)	47.8% (840)	p = .728
Female	51.5% (8609)	51.7% (7564)	52.2% (917)	
<b>Race</b>				
White	53.2% (9866)	55.1% (8507)	63.6% (1219)	p < .001
Non-White	46.8% (8683)	44.9% (6926)	36.4% (697)	
Black	11.2% (2074)	12.2% (1873)	6.2% (118)	
Hispanic	14.3% (2657)	15.4% (2378)	11.2% (215)	
Other Race	21.3% (3952)	17.3% (2675)	19.0% (365)	
<b>Parental Education</b>				
Both parents have less than a college degree	50.1% (8422)	50.1% (7367)	47.9% (844)	p = .129
At least one parent has a college degree	49.9% (8391)	49.9% (7328)	52.1% (920)	
<b>Urbanicity</b>				
Urban	19.9% (3694)	20.9% (3225)	17.1% (328)	p < .001
Suburban	49.2% (9129)	48.9% (7549)	54.5% (1044)	
Rural	30.9% (5726)	30.2% (4659)	28.4% (545)	
<b>Substance Use</b>				
Past-Year nonmedical Rx drug use (total)	11.0% (1917)	0% (0)	100% (1917)	--
Past-Year nonmedical stimulant use	5.7% (968)	0% (0)	51.7% (968)	--
Past-Year nonmedical opioid use	6.8% (1133)	0% (0)	62.7% (1133)	--
Past-Year nonmedical tranquilizer use	4.3% (716)	0% (0)	38.8% (716)	--
Past-Year nonmedical Rx drug use (multiple class)	3.9% (685)	0% (0)	35.7% (685)	--
Binge drinking (past two-weeks)	16.7% (2895)	12.9% (1923)	43.3% (802)	p < .001
Cigarette use (past-month)	16.5% (2925)	12.3% (1843)	45.8% (846)	p < .001
Marijuana use (past-month)	22.4% (3900)	17.1% (2566)	58.2% (1085)	p < .001

Sources of Nonmedical Prescription Drug Use	Full Population N=18,549		No Past-Year Nonmedical Use n=15,432		Past-Year Nonmedical Use n=1,917		<i>p</i>	% missing (total) % missing (Past-Year NMUPD)
	%, (n) <sup>a</sup>	%, (n) <sup>a</sup>	%, (n) <sup>a</sup>	%, (n) <sup>a</sup>				
Bought on the internet	0.4% (79)	--	4.4% (79)	--				
Stole from a friend	0.5% (90)	--	5.3% (90)	--				
Stole from a relative	1.6% (277)	--	16.5% (277)	--				
Given free by friend	5.2% (895)	--	53.7% (895)	--				
Given free by relative	1.7% (288)	--	17.2% (288)	--				
Bought from a friend	3.7% (636)	--	38.0% (636)	--				
Bought from a relative	.4% (67)	--	3.9% (67)	11.8% (226)				
From their own prior Rx	2.8% (490)	--	29.5% (490)	--				
Bought from a dealer	1.9% (323)	--	19.3% (323)	--				
Other source	1.2% (216)	--	12.1% (216)	--				
Multiple sources	4.3% (739)	--	44.2% (739)	--				

Note: Data source was Monitoring the Future study, 2009-2016 cohorts. NMUPD = nonmedical use of prescription drugs

<sup>a</sup>Some cases had missing data on the sociodemographic variables and substance use variables; hence the varying sample sizes per sociodemographic and substance use variables. All estimated percentages provided use the Monitoring the Future weights; sample sizes are unweighted.

<sup>b</sup>*p* values are from Rao-Scott chi-square tests,<sup>12</sup> examining differences between respondents who did not engage in nonmedical use of prescription drugs in the past-year versus respondents who did engage in nonmedical use of prescription drugs during the past-year. The significant results (*p* < 0.001) for Race was in relation to the white versus Non-white association.



**Table 2.** Estimated Latent Class Analysis Probabilities and Prevalence of Sources Based on Five Latent Classes (n=1691)<sup>a</sup>

Estimated Latent Class Analysis probabilities (Mplus Results)	Bought on the internet	Stole from a friend	Stole from a relative	Given free by friend	Given free by relative	Bought from friend	Bought from relative	From own prior Rx	Bought from a dealer	Other source
Friend/relative sources (n = 686)	0.071	0.033	0.190	0.613	0.203	0.145	0.018	0.121	0.137	0.052
Friend/purchased sources (n = 478)	0.000	0.033	0.069	0.596	0.017	1.000	0.003	0.194	0.286	0.038
Own leftover prescription (n = 286)	0.000	0.009	0.073	0.159	0.139	0.000	0.000	1.000	0.000	0.034
Multiple sources (n = 128)	0.126	0.126	0.565	0.974	0.611	0.936	0.383	0.483	0.695	0.351
Other sources (n = 111)	0.042	0.000	0.019	0.000	0.000	0.011	0.000	0.000	0.070	1.000
Classes	Entropy	BIC	AIC	VLMR	Sig.	LRT	Sig.			
1	--	14540.014	14517.464	--	--	--	--			
2	0.897	14034.998	13987.642	551.822	p<.001	545.153	p<.001			
3	0.692	13836.328	13764.167	245.475	p<.001	242.509	p<.001			
4	0.704	13769.564	13672.598	105.876	p=.009	104.596	p=.009			
<b>5<sup>b</sup></b>	<b>0.817</b>	<b>13601.388</b>	<b>13479.617</b>	<b>116.191</b>	<b>p=.757</b>	<b>114.787</b>	<b>p=.757</b>			
6	0.737	13619.302	13472.725	50.613	p=.760	50.001	p=.760			
<b>Prevalence of sources based on the five latent classes (observed results)</b>										
Friend/relative sources (n = 686)	8.6%	3.5%	20.7%	<b>63.8%</b>	24.3%	5.1%	2.2%	7.4%	13.8%	4.4%
Friend/purchased sources (n = 478)	0.0%	3.1%	8.6%	<b>59.8%</b>	.2%	<b>100%</b>	0.0%	18.2%	26.8%	4.2%
Own leftover prescription (n = 286)	0.0%	0.7%	5.9%	16.1%	12.2%	0.0%	0.0%	<b>100%</b>	0.0%	2.8%
Multiple sources (n = 128)	12.5%	37.8%	<b>57.0%</b>	<b>98.4%</b>	<b>66.9%</b>	<b>95.3%</b>	40.9%	<b>51.6%</b>	<b>71.9%</b>	36.7%
Other sources (n = 111)	3.6%	0.0%	2.7%	0.0%	0.0%	0.0%	0.0%	0.0%	7.2%	<b>100%</b>

Note: Data source was Monitoring the Future study, 2009-2016 cohorts. AIC = Akaike information criterion; BIC = Bayesian information criterion; LRT = Lo-Mendell-Rubin Adjusted LRT Test; Sig = significance (ie, p value); VLMR = Vuong-Lo-Mendell-Rubin Likelihood Ratio Test.

<sup>a</sup> Respondents could select any diversion sources within the past 12 months, so the row percentages exceed 100% (all estimates provided use weights).

<sup>b</sup> The five class solution was chosen due to the following: The five-class solution had the lowest BIC value of all solutions considered (BIC=13601.38) and had an adequate entropy score (entropy=0.817) indicating good separation of the latent classes. While the VLMR LRT tests indicate that a four class solution would be adequate, the five class solution achieved a better entropy score and provided a theoretically important group that was not indicated in the four class solution (ie, Own leftover prescription).

**Table 3.** Examining Distributions of Source Class Membership as a Function of Selected Sociodemographic Characteristics

	Male adolescents %, (n) <sup>a</sup>	Female adolescents %, (n) <sup>a</sup>	<i>b</i> <i>p</i>	White %, (n) <sup>a</sup>	Non-White %, (n) <sup>a</sup>	<i>b</i> <i>p</i>	Both parents have less than a college degree %, (n) <sup>a</sup>	At least one parent has a college degree %, (n) <sup>a</sup>	<i>b</i> <i>p</i>
<b>Latent Classes of Sources</b>	n=1544			n=1691			n=1550		
Friend/relative source (n=686)	47.7% (297)	52.3% (326)	<i>p</i> = .701	62.8% (431)	37.2% (255)	<i>p</i> = .759	46.8% (294)	53.2% (334)	<i>p</i> = .585
Friend/purchased sources (n=478)	<b>57.9% (254)</b>	<b>42.1% (185)</b>	<i>p</i> < . <b>001</b>	<b>69.7% (333)</b>	<b>30.3% (145)</b>	<i>p</i> = <b>.003</b>	44.0% (191)	56.0% (243)	<i>p</i> = .106
Own leftover prescription (n=286)	<b>37.2% (100)</b>	<b>62.8% (169)</b>	<i>p</i> < . <b>001</b>	61.9% (177)	38.1% (109)	<i>p</i> = .618	48.0% (132)	52.0% (143)	<i>p</i> = .916
Multiple sources (n=128)	44.6% (50)	55.4% (62)	<i>p</i> = .524	59.1% (75)	40.9% (52)	<i>p</i> = 381	49.5% (55)	50.5% (56)	<i>p</i> = .760
Other sources (n=111)	45.5% (45)	54.5% (54)	<i>p</i> = .625	<b>47.7% (53)</b>	<b>52.3% (58)</b>	<i>p</i> = <b>.003</b>	<b>67.0% (69)</b>	<b>33.0% (34)</b>	<i>p</i> < <b>.001</b>

Note: Data source was Monitoring the Future study, 2009-2016 cohorts.

<sup>a</sup> Respondents can only be assigned to one class based on the latent class analysis. Comparisons are assessing differences between subgroups in the probability of belonging to each class separately (columns will add to approximately 100%; all estimates provided use weights).

<sup>b</sup> *p* values are from Rao-Scott 2 x 2 chi-square tests<sup>12</sup> comparing the row percentages (df = 1). Bold type indicates significant differences.

**Table 4.** Distributions of Source Class Membership as a Function of Frequency, Motive, and Number of Sources of Nonmedical Use of Prescription Drugs

	Experimental/ infrequent NMUPD (1-9 times) %, (n) <sup>a</sup>	Frequent NMUPD (10+ times) %, (n) <sup>a</sup>	Recreational/ other motives (NMUPD) %, (n) <sup>a</sup>	Self-treatment motives only (NMUPD) %, (n) <sup>a</sup>	One diversion source (NMUPD) %, (n) <sup>a</sup>	Multiple diversion sources (NMUPD) %, (n) <sup>a</sup>	<i>b</i> <i>p</i>
<b>Latent Classes of Sources</b> n=1652							
Friend/relative sources (n=686)	<b>77.7% (522)</b>	<b>22.3% (150)</b>	87.9% (594)	12.1% (82)	<b>74.0% (507)</b>	<b>26.0% (179)</b>	<i>p</i> < .001
Friend/purchased sources (n=478)	<b>62.6% (296)</b>	<b>37.4% (177)</b>	90.3% (429)	9.7% (46)	<b>29.5% (139)</b>	<b>70.5% (339)</b>	<i>p</i> < .001
Own leftover prescription (n=286)	<b>83.7% (237)</b>	<b>16.3% (46)</b>	<b>73.3% (195)</b>	<b>26.7% (71)</b>	<b>70.8% (201)</b>	<b>29.2% (85)</b>	<i>p</i> < .001
Multiple sources (n=128)	<b>37.3% (47)</b>	<b>62.7% (79)</b>	93.7% (118)	6.3% (8)	<b>0.0% (0)</b>	<b>100% (128)</b>	<i>p</i> < .001
Other sources (n=111)	74.5% (73)	25.5% (25)	90.1% (91)	9.9% (10)	<b>92.9% (103)</b>	<b>7.1% (8)</b>	<i>p</i> < .001
<b>Latent Classes of Sources</b> n=1632							
Friend/relative sources (n=686)	53.3% (348)	46.7% (305)	53.6% (356)	46.4% (308)	38.5% (253)	61.5% (404)	<i>p</i> = .845
Friend/purchased sources (n=478)	<b>45.0% (211)</b>	<b>55.0% (258)</b>	<b>40.4% (187)</b>	<b>59.6% (276)</b>	<b>26.8% (126)</b>	<b>73.2% (344)</b>	<i>p</i> < .001
Own leftover prescription (n=286)	<b>69.4% (195)</b>	<b>30.6% (86)</b>	<b>68.1% (190)</b>	<b>31.9% (89)</b>	<b>62.0% (173)</b>	<b>38.0% (106)</b>	<i>p</i> < .001
Multiple sources (n=128)	42.1% (51)	57.9% (70)	<b>27.7% (33)</b>	<b>72.3% (86)</b>	<b>18.4% (23)</b>	<b>81.6% (102)</b>	<i>p</i> < .001
Other sources (n=111)	<b>74.2% (72)</b>	<b>25.8% (25)</b>	58.9% (63)	41.1% (44)	<b>57.3% (59)</b>	<b>42.7% (44)</b>	<i>p</i> < .001

Note: Data source was Monitoring the Future study, 2009-2016 cohorts.

<sup>a</sup> Respondents can only be assigned to one class based on the latent class analysis. Comparisons are assessing differences between subgroups in the probability of belonging to each class separately (columns will add to approximately 100%).

<sup>b</sup> *p* values are from Rao-Scott 2 X 2 chi-square tests<sup>12</sup> comparing the row percentages (df = 1). Bold type indicates significant differences.