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Motivational Subtypes of Nonmedical Use of Prescription Medications: Results From a National Study

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A B S T R A C T

Purpose: Very little research has examined the heterogeneity associated with the nonmedical use of prescription medications (NUPM) in nationally representative samples of adolescents. The main objectives of this study were to (1) identify motivational subtypes of past-year NUPM among high school seniors in the United States using a person-centered approach, and (2) examine the associations among motivational subtypes and characteristics of substance abuse (i.e., route of administration, co-ingestion, and subjective high).
Methods: Self-administered questionnaires as part of the Monitoring the Future study were completed by nationally representative samples of high school seniors (modal age, 18 years). The sample consisted of five cohorts (senior years of 2002–2006) made up of 12,431 high school seniors in total, of which 53% were women.
Results: Approximately 75% of past-year nonmedical users of prescription opioids, stimulants, and tranquilizers endorsed more than one motive. Latent class analysis indicated five motivational subtypes associated with nonmedical use of prescription opioids (experiment, relax, get high, pain relief, and affect regulation), four subtypes of prescription stimulants (weight loss/enhance energy, enhance energy/awake/high, experiment, and affect regulation), and five subtypes of prescription tranquilizers (experiment, get high, relax/sleep, relax, affect regulation). Recreational subtypes were positively associated with characteristics of substance abuse, whereas self-treatment subtypes were associated with medical use before nonmedical use.
Conclusions: Because multiple motives underlie NUPM, identifying subgroups of individuals who endorse combinations of motives, versus a single motive, will better inform intervention efforts to reduce nonmedical prescription medication use.

IMPLICATIONS AND CONTRIBUTION

High school seniors were grouped into similar categories according to their motivations for using prescription medications nonmedically, thereby allowing for a better understanding of why adolescents engage in such risky behavior. We identified individuals who were at higher risk for substance abuse, and such information can be used to guide intervention efforts.

Several studies have shown that the nonmedical use of prescription medications (NUPM) has significantly increased over the past 2 decades and is most prevalent among adolescents and young adults [1–6]. Despite these recent increases, very little research has examined the motivations for NUPM in nationally representative samples [7]. Many existing studies often fail to distinguish between individuals who nonmedically use someone else's prescription medications to self-treat a medical condition and those who use someone else's prescription medications recreationally [8]. The findings from at least two regional studies indicate that motivations for NUPM are varied and associated with different adverse consequences among adolescents and young adults [9,10]. These findings warrant additional investigations within national samples of adolescents, as there is a lack of epidemiologic research that accurately assesses the motivations

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and characteristics of those individuals at greatest risk for substance abuse [7,11,12].

At least four studies have examined individual motivations associated with nonmedical use of prescription opioids, stimulants, and tranquilizers among secondary students [9,13–15]. All these studies used variable-centered analytical approaches and focused on individual motivations. Because individuals are likely to have multiple motivations underlying their behavior, identifying categories of individuals who endorse combinations of motivations, versus a single motivation, offers a valuable complementary approach to variable-centered approaches. Muthén and Muthén (2000) elaborated the distinction between variable-centered and person-centered statistical methods [16]. Variable-centered approaches focus on the relationships between variables, whereas person-centered approaches focus on the relationships among persons. In contrast to variable-centered approaches, the goal of person-centered approaches "is to group individuals into categories, each one of which contains individuals who are similar to each other and different from individuals in other categories" [16]. Examples of person-centered approaches include cluster analysis and latent class analysis (LCA), both of which can be used to group individuals into similar categories according to their motives for nonmedical use (referred to as motivational classes or subtypes).

LCA has been previously used in the analysis of illicit drug use [17], alcohol use disorders [18,19], adolescent drinking [20], antisocial personality disorder symptoms among alcohol-dependent subjects [21], adolescent sedative/anxiolytic misuse [22], and the comorbidity of adolescent problem behaviors [23]. For example, an investigation examined the relationships between different patterns of drinking motivations and behaviors in a sample of U.S. 12th grade students using a person-centered approach [20]. The results of this study identified four motivational classes for alcohol use, including Experiment, Thrill-seek, Multi-reason, and Relax. The results also indicated that the riskiest drinking behaviors were related to membership in the Multi-reason class. Despite these recent advances in the alcohol literature, motivational subtypes of NUPM among adolescents have not been examined using person-centered approaches.

The objectives of this study were to (1) identify the motivational subtypes of NUPM within U.S. high school seniors using a person-centered approach, and (2) examine variations in these motivational subtypes of NUPM by characteristics of substance abuse (i.e., route of administration, co-ingestion, and subjective high).

Methods

Participants and procedures

The *Monitoring the Future* study (MTF) annually surveys a cross-sectional, nationally representative sample of high school seniors in approximately 135 public and private schools in the coterminous United States. MTF 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 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, 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 relevant for this study were asked on Form 1; therefore, this study focuses on the subsamples receiving Form 1 within each cohort (for more information on the procedures see [3]).

The total sample size was 12,431 high school seniors. Sample sizes for each year were as follows: 2,256 for 2002, 2,556 for 2003, 2,563 for 2004, 2,581 for 2005, and 2,475 for 2006. The sample included 53% women, 62% white, 10% black, and 28% were from other racial groups or did not specify their race. The modal age of the individuals in the sample was 18 years. Subsamples for the current study are described in detail in the following text.

Measures

NUPM was assessed with a series of items asking respondents on how many occasions (if any) in the past 12 months they used prescription medications on their own, without a doctor's orders. There were separate questions for each prescription medication class:

(a) Prescription opioids (e.g., Vicodin, OxyContin, Percodan, Percocet, Demerol, Dilaudid, methadone, morphine, codeine);
(b) Prescription tranquilizers (e.g., Librium, Valium, Xanax);
(c) Prescription stimulants (e.g., Ritalin, Dexedrine).

The response scale ranged from 1 (no occasions) to 7 (40 or more occasions).

Motives for NUPM were assessed by asking respondents who reported past-year NUPM to indicate the most important reasons for NUPM from a check-all-that-apply list of binary items.

Subjective high of NUPM was measured with three items that asked past-year nonmedical users how high they usually get when they use each prescription medication class. The response scale for these items ranged from 1 (not at all high) to 4 (very high).

Co-ingestion of NUPM and other drugs was measured with nine items focused on the number of times each prescription medication class was used nonmedically at the same time as other drugs such that the effects overlapped (e.g., alcohol, marijuana, LSD, hallucinogens other than lysergic acid diethylamide, prescription opioids, stimulants, tranquilizers, cocaine, heroin) in the past 12 months. The response scale ranged from 1 (not at all) to 7 (every time).

Routes of administration of NUPM were assessed with five items that asked which methods respondents used for past-year NUPM. The binary items included: (1) intranasal (snorting or sniffing), (2) smoking, (3) injection, (4) orally (by mouth), and (5) other.

Medical use of prescription medications was assessed by asking respondents whether they had ever taken each prescription medication class because a doctor told them to use them. Respondents were informed that prescription medications are sometimes prescribed by doctors, and that drugstores are not supposed to sell them without a prescription. The response scale included: (1) no medical use, (2) medical use before NUPM, and (3) NUPM before medical use.

Data analysis

Questions about motives for NUPM were asked only of those who reported nonmedical use in the past year. Accordingly,

analyses focused on participants who reported past-year nonmedical use of opioids (N = 768), stimulants (N = 782), and/or tranquilizers (N = 541) for the years 2002–2006. We used the SAS PROC LCA program (The Methodology Center, University Park, PA) [24] to conduct a LCA of the 11 most prevalent motivation items for past-year NUPM of each class, using data from the years 2002 through 2006 (six items with base rates of <10% were excluded from prescription opioids, five items with base rates of <12% were excluded from prescription stimulants, and four items with base rates of <10% were excluded from prescription tranquilizers). Beginning with a baseline LCA model, we added classes sequentially and used the likelihood ratio G^2 statistic, Akaike's Information Criterion (AIC) [25], the Bayesian Information Criterion (BIC) [26], model interpretability, and parsimony to assess model fit at each step [16,24,27]. Item parameters (i.e., conditional item probabilities that indicate the probability that a given individual in a given latent class endorsed that item) and class probability parameters (i.e., the relative prevalence of each latent class) were estimated [24,28,29]. All LCAs were exploratory, that is, no a priori constraints were imposed on any of the parameter estimates [28]. After baseline models of motives for each class of prescription medications were identified, we used an LCA with covariates framework to test predictors of latent class membership [24,27].

Results

Sample representativeness

A binary variable distinguished between participants who reported past-year nonmedical use of at least one prescription medication (n = 1,399, 11.3% of the sample) and those who did not (n = 11,032, 88.7% of the sample). Past-year NUPM did not vary by sex (female = 11.3%, male = 11.2%), age (<18 years = 11.0%, ≥18 years = 11.4%), or mother's or father's education. However, prevalence of past-year NUPM was higher among whites (14.6%) compared with blacks (2.8%), $\chi^2_{(1)} = 128.1$, $p < .05$; also, nonmedical users were significantly more likely to report low-to-average high school grades, $\chi^2(8)=103.31$, $p < .05$.

Prevalence of motives for NUPM

We estimated the prevalence of NUPM and motives of three prescription medication classes among U.S. high school seniors. The past-year prevalence of NUPM was 8.0% for prescription opioids, 7.2% for stimulants, and 5.3% for tranquilizers. The motives for nonmedical use were different for each prescription medication class (Table 1). Notably, approximately 75% of nonmedical users for each prescription medication class endorsed more than one motive.

Table 1
Prevalence of motives for nonmedical use of three prescription medication classes among high school seniors

Motives for nonmedical use	Opioids (n = 768)	Stimulants (n = 782)	Tranquilizers (n = 541)
To relax or relieve tension	56.1%	27.2%	66.0%
To get more energy	NA	56.8	NA
To experiment	53.5	54.6	49.5
To feel good or get high	54.6	47.4	52.3
To stay awake	NA	47.7	NA
To relieve physical pain	45.5	NA	NA
To help me lose weight	NA	35.5	NA
To get to sleep	27.7	NA	38.9
To have a good time with my friends	31.2	32.4	30.9
Because of boredom	21.7	21.3	22.2
To get away from my problems or troubles	18.2	18.2	24.0
To get through the day	11.7	24.1	13.3
To increase the effects of some other drug(s)	16.4	12.0	16.9
Because of anger or frustration	12.3	11.5	18.8
To seek deeper insights and understanding	7.9	12.2	8.2
To fit in with a group I like	2.6	4.3	4.9
Because I am "hooked"	2.5	5.9	2.4
To decrease the effects of some other drug(s)	1.6	2.5	5.2
Substitute for heroin	3.3	NA	NA
More than one motive	77.2	76.7	73.8

Latent classes based on motives for NUPM

Results from LCA of motives for past-year nonmedical use of prescription opioids indicated that, compared with the baseline model (G^2 = 2,018.2, AIC = 2,040.2, BIC = 2,091.3), a 5-class solution provided the best fit to the data (G^2 = 894.1, AIC = 1,012.1, BIC = 1,286.1) and yielded interpretable classes. Item-response probabilities and latent class membership probabilities for motives of nonmedical use of prescription opioids are presented in Table 2. The most prevalent class was composed of individuals who had a higher probability of endorsing "to experiment" relative to the other motives, and thus class 1 was considered the "Experiment" (41.2%) class. Individuals in class 2, the "Relax" (25.6%) class, were distinguished by relatively high probabilities of endorsing the "to relax" motive combined with low probabilities of endorsing motives related to negative affect reduction. Individuals in class 3, the "Get High" (14.4%) class, had a relatively high probability of endorsing "to experiment," but, unlike class 1, the motives "to feel good or get high" and "to have a good time with friends" also had high probabilities. Class 4, the "Pain Relief" (11.4%) class, was characterized by relatively high probabilities of endorsing "pain relief," combined with low-to-moderate probabilities for the other motives. Finally, individuals in class 5, the "Affect Regulation" (7.4%) class, were distinguished by relatively high probabilities of endorsing motives related to regulation of positive and negative emotions.

Results from LCA of motives for past-year nonmedical use of prescription stimulants showed that, compared with the baseline model (G^2 = 2536.3, AIC = 2558.3, BIC = 2609.5), a 4-class solution provided the best fit to the data (G^2 = 1133.0, AIC = 1227.0, BIC = 1446.1) and yielded interpretable classes. As shown in Table 2, the most prevalent class was composed of individuals who had moderate probabilities of endorsing "to lose weight" and "to get more energy," along with relatively low item-response probabilities for other motives, so we labeled class 1 the "Weight Loss/Enhance Energy" (38.0%) class. Individuals in class 2, the "Experiment" (25.3%) class, showed a moderate probability of endorsing the "to experiment" motive relative to the other motives. Individuals in class 3, the "Energy/Awake/High" (24.3%) class, had relatively high probabilities of endorsing "to get high," "to have a good time with friends," "to experiment," "to get more energy," and "to stay awake." Finally, individuals in class 4, the "Affect Regulation" (12.4%) class, had relatively high

Table 2
Item-response probabilities for latent class membership for nonmedical prescription medication motives

Item	Latent class solution for opioid motives (n = 768)				
	Experiment (41.2%)	Relax (25.6%)	Get high (14.4%)	Pain relief (11.4%)	Affect regulation (7.4%)
To experiment	.69	.30	.77	.01	.66
To relax or relieve tension	.29	.84	.90	.23	.94
To feel good or get high	.52	.42	.99	.01	.92
To have a good time with friends	.25	.07	.81	.00	.80
To get away from problems	.02	.27	.03	.00	.97
Because of boredom	.10	.12	.06	.00	.58
Because of anger or frustration	.01	.18	.01	.00	.85
To get through the day	.01	.18	.02	.01	.56
To increase effects/other drugs	.10	.05	.03	.00	.53
To get to sleep	.02	.43	.02	.36	.62
To relieve physical pain	.12	.58	.07	.99	.70

Item	Latent class solution for stimulant motives (n = 782)			
	Lose weight/energy (38.0%)	Experiment/get high (25.3%)	Energy/awake (24.3%)	Affect regulation (12.4%)
To experiment	.23	.63	.76	.78
To relax or relieve tension	.07	.26	.27	.82
To feel good or get high	.05	.54	.79	.92
To have a good time with friends	.01	.30	.66	.65
To get away from problems	.08	.05	.07	.93
Because of boredom	.02	.14	.33	.58
Because of anger or frustration	.04	.01	.02	.66
To get through the day	.22	.01	.35	.59
To stay awake	.43	.01	.84	.72
To get more energy	.54	.09	.94	.80
To help me lose weight	.50	.03	.36	.60

Item	Latent class solution for tranquilizer motives (n = 541)				
	Experiment (30.0%)	Get high (23.5%)	Relax (22.1%)	Relax/sleep (16.6%)	Affect regulation (8.2%)
To experiment	.65	.66	.01	.42	.63
To relax or relieve tension	.32	.78	.60	.92	.99
To feel good or get high	.41	.92	.10	.48	.98
To have a good time with friends	.18	.59	.04	.11	.99
To get away from problems	.01	.10	.08	.68	.97
Because of boredom	.04	.39	.10	.16	.96
Because of anger or frustration	.01	.07	.01	.57	.87
To get through the day	.01	.07	.03	.31	.60
To increase effects/other drugs	.06	.35	.01	.06	.60
To get to sleep	.10	.39	.38	.69	.82
To relieve physical pain	.07	.42	.50	.50	.72

probabilities of endorsing most of the 11 motives; however, this class was distinguished from the other classes by relatively high probabilities of selecting motives related to affect regulation.

Results from LCA of motives for past-year nonmedical use of prescription tranquilizers indicated that, compared with the baseline model (G^2 = 1691.5, AIC = 1713.5, BIC = 1760.7), a 5-class solution provided the best fit to the data (G^2 = 806.1, AIC = 924.1, BIC = 11177.4) and yielded interpretable classes (see Table 2). The most prevalent class was composed of individuals who had a moderate probability of reporting "to experiment" relative to other motives, and we labeled class 1 the "Experiment" (30.0%) class. The "Get High" class (23.5%) was characterized by high item-response probabilities for motives to "get high" and moderate item-response probabilities for "relax/relieve tension" and "experiment." By contrast, the "Relax" class (22.1%) was characterized by moderate item-response probabilities for "relax/relieve tension" and "relieve physical pain," along with low item-response probabilities for all other motives. The next most prevalent class was composed of individuals who had a relatively high probability of endorsing "to relax/relieve tension" and a moderate item-response probability for "to help sleep," and we labeled class 4 the "Relax/Sleep" (16.6%) class. Finally, individuals in class 5, the "Affect Regulation" (8.2%) class, had moderate-to-high probabilities of endorsing all 11 motives, especially the affect regulation motives.

Correlates of latent class membership

Having identified adequate baseline models for motives for past-year NUPM, we then used a latent class with covariates framework [24,27] to examine correlates of latent class membership (Tables 3, 4, and 5). We focused on the following covariates: sex, subjective high, co-ingestion, route of administration, and history of medical use of each prescription medication. Given the exploratory nature of this research, analyses were limited to testing bivariate associations between each correlate and latent class membership. That is, each correlate was tested individually in separate models. Because all baseline models included more than two latent classes, these analyses took the form of bivariate multinomial regression analyses with latent class membership as the dependent variable. For comparison purposes, the "experiment" class was treated as the reference group across all three medication classes.

Table 3
Correlates of latent class (n = 768)

	Latent class				
	Experiment (41.2%)	Relax (25.6%)	Get high (14.4%)	Pain relief (11.4%)	Affect regulation (7.4%)
Sex					
Male	—	—	—	—	—
Female	—	3.8* (2.0–7.4)	.9 (.5–1.7)	2.2* (1.4–3.6)	1.8 (.9–3.8)
Subjective high					
Not at all/little	—	—	—	—	—
Moderate/very	—	1.0 (.3–3.2)	2.9* (1.5–5.5)	.3* (.2–.6)	2.3 (.9–5.8)
Co-ingestion					
No	31.2%	25.4%	5.4%	36.2%	1.8%
Yes	48.1%	20.5%	17.9%	4.2%	9.3%
Route of administration					
Oral only	—	—	—	—	—
Non-oral	—	.4* (.2–.7)	2.1* (1.1–4.0)	.02* (.01–.3)	.4* (.2–.7)
Medical use history					
No medical use	—	—	—	—	—
Medical use before nonmedical use	—	1.9 (.9–4.0)	1.1 (.4–3.3)	13.7* (6.4–29.5)	.6 (.2–1.9)
Nonmedical use before medical use	—	2.4* (1.4–4.1)	4.0* (1.9–8.3)	2.8* (1.8–6.5)	1.9* (1.1–3.4)

For co-ingestion, only n = 4 cases in the "affect regulation" cell. Multinomial regression model cannot be estimated.
CI = confidence interval; OR = odds ratio from bivariate multinomial regression analyses; – = reference group.
χ^2 (4) = 159.1, $p < .05$.
* $p < .05$.

Sex

Results indicated that being female was associated with higher odds of membership in (a) the "relax" and "pain relief" classes for opioid motives; (b) the "energy/awake/high," "affect regulation," and "lose weight" motive classes for stimulant motives; and (c) the "relax" and "relax" classes for tranquilizer motives, relative to the "experiment" classes. Sex did not predict membership in the "get high" motive classes for any of the medications.

Subjective high

Subjective high was associated with higher odds of membership in (a) the "get high" class for opioid motives, (b) the "energy/awake/high" and "affect regulation" motive classes for stimulant motives, and (c) the "get high" and "affect regulation" classes for tranquilizer motives, relative to the "experiment" classes. By contrast, subjective high was associated with lower odds of membership in (a) the "pain relief" class for opioid motives, (b) the "lose weight/energy" motive class for stimulant motives, and (c) the "relax/sleep" and "relax" classes for tranquilizer.

Co-ingestion

Co-ingestion was associated with (a) lower odds of membership in the "lose weight/energy" motive class for stimulant motives, (b) higher odds of membership in the "get high" and "affect regulation" classes for tranquilizer motives, and (c) lower odds of membership in the "relax/sleep" and "relax" classes for tranquilizer motives, relative to the "experiment" classes. Small cell sizes made it impossible to estimate models of co-ingestion as a predictor of class membership for opioid motives.

Table 4
Correlates of latent class membership for stimulant motives (n = 782)

	Latent class			
	Experiment (25.3%)	Energy/awake/high (24.3%)	Affect regulation (12.4%)	Lose weight/energy (38.0%)
Sex				
Male	—	—	—	—
Female	—	1.8* (1.1–3.0)	5.5* (2.9–10.6)	4.3* (2.6–7.1)
Subjective high				
Not at all/little	—	—	—	—
Moderate/very	—	2.2* (1.2–3.8)	2.4* (1.3–4.7)	.3* (.2–.6)
Co-ingestion				
No	—	—	—	—
Yes	—	1.0 (.5–1.9)	1.2 (.5–2.7)	.12* (.1–.2)
Route of administration				
Oral only	—	—	—	—
Non-oral	—	1.4 (.9–2.3)	1.3 (.8–2.3)	.2* (.1–.3)
Medical use history				
No medical use	—	—	—	—
Medical use before nonmedical use	—	.2* (.1–.6)	.6 (.3–1.5)	.5* (.3–.9)
Nonmedical use before medical use	—	1.6 (.3–1.1)	.8 (.4–1.6)	.3* (.1–.6)

CI = confidence interval; OR = odds ratio from bivariate multinomial regression analyses; – = reference group.
* $p < .05$.

Table 5
Correlates of latent class membership for tranquilizer motives (n = 541)

	Latent class				
	Experiment (30.0%)	Get high (23.5%)	Relax/sleep (16.6%)	Relax (22.1%)	Affect regulation (8.2%)
Sex					
Male	—	—	—	—	—
Female	—	.8 (.4–1.64)	6.2* (2.7–14.1)	5.2* (2.3–11.7)	1.2 (.5–2.6)
Subjective high					
Not at all/little	—	—	—	—	—
Moderate/very	—	2.4* (1.1–5.3)	.9 (.4–1.9)	.2* (.1–.8)	4.8* (1.5–14.9)
Co-ingestion					
No		—	—	—	—
Yes		6.2* (1.2–32.4)	.4* (.2–.7)	.1* (.02–.2)	6.2* (1.1–34.4)
Medical use history					
No medical use	—	—	—	—	—
Medical use before nonmedical use	—	2.3 (.5–9.1)	4.4* (1.3–15.3)	12.2* (3.7–40.2)	1.9 (.2–7.0)
Nonmedical use before medical use	—	3.5* (1.5–8.1)	3.5* (1.5–8.0)	3.1* (1.2–8.2)	1.2 (.4–3.6)

Questions about route of administration were not asked for nonmedical use of tranquilizers.
CI = confidence interval; OR = odds ratio from bivariate multinomial regression analyses; – = reference group.
* $p < .05$.

Route of administration

Non-oral route of administration was associated with higher odds of membership in the "get high" class for opioid motives. By contrast, non-oral route of administration was associated with lower odds of membership in (a) the "relax," "pain relief," and "affect regulation" motive classes for opioid motives; and (b) the "lose weight/energy" class for stimulant motives, relative to the "experiment" classes.

History of medical use

Results for history of medical use were most consistent for opioid motives. Specifically, reporting nonmedical use before medical use of prescription opioids (relative to those who reported no lifetime medical use) was associated with higher odds of membership in all opioid motive classes, relative to the "experiment" class. By contrast, reporting medical use first was associated with higher odds of membership in only the "pain relief" class. Similarly, reporting nonmedical use before medical use of tranquilizers was associated with higher odds of membership in all but one of the tranquilizer motive classes, relative to the "experiment" class. By contrast, reporting medical use first was associated with higher odds of membership in the "relax/sleep" and "relax" classes. A very different pattern of results was observed for the stimulant motive classes. Specifically, regardless of order, reporting nonmedical and medical use of stimulants was associated with lower odds of membership in the "lose weight/energy" class. By contrast, reporting medical use first was associated with lower odds of membership in the "energy/awake/high" class.

Discussion

The findings of this study revealed a great deal of heterogeneity associated with NUPM in a nationally representative sample of adolescents. The present study found that approximately 75% of past-year nonmedical users of prescription stimulants, tranquilizers, and opioids endorsed more than one motive for NUPM. These findings indicate that most adolescents have multiple motivations underlying their past-year NUPM and suggest that the structure of motives may more closely approximate a categorical versus a dimensional distribution. In this study, we identified four or more motivational subtypes associated with past-year NUPM of each class. Although person- and variable-centered approaches are complementary, the results of this person-centered approach identified a greater range of subtypes of nonmedical users than previous studies based on variable-centered analytical approaches [9,10,14,15].

Information regarding motivations can be useful for understanding the consequences associated with NUPM and for designing appropriate prevention and intervention programs [7,10]. Just as research on motives has added to the understanding of consequences associated with drinking behaviors [20,30–32], cocaine use [33], and marijuana use [34–36], an improved understanding of motives for NUPM will help identify individuals at greatest risk for adverse consequences [9–12,37]. The findings of the present study provide evidence that motivational subtypes of nonmedical use of prescription stimulants, opioids, and tranquilizers were significantly associated with substance abuse. In particular, we found that the recreational subtypes (e.g., "get high" and "experiment") had significantly greater odds of feeling moderately or very high when using prescription medications, co-ingesting prescription medications and other drugs, and using non-oral routes of administration.

There were notable sex differences in the subtypes associated with NUPM. In particular, female subjects had greater odds of self-treatment subtypes than male subjects (e.g., "pain relief" and "relax"). These results reinforce the importance of examining differences in subtypes and suggest high school girls could be undertreated for some health conditions and disorders, such as pain, which could contribute to higher prevalence rates of NUPM due to self-treatment. The results of the present study can be used for screening efforts to identify adolescents who may need additional medical attention, and the motivational subtypes could be used to match patients to the appropriate intervention. For example, individuals falling into the "weight loss/energy" class for prescription stimulants, "relax" class for prescription tranquilizers, and "pain relief" class for prescription opioids would benefit from a professional assessment by a trained clinician to determine an appropriate diagnosis and treatment. Meanwhile, adolescents in the "affect regulation," "experiment," and "get high" classes could also benefit from a professional

assessment and treatment including more comprehensive substance abuse assessment.

We found that medical use before NUPM was significantly greater among self-treatment subtypes for prescription opioids and tranquilizers. Previous work has shown that many nonmedical users obtain prescription medications from a prescription they had previously [3]. For example, 40% of high school seniors who reported nonmedical use of prescription opioids in the past 12 months obtained these medications from their own previous prescription. Taken together, these findings suggest that medically prescribed prescription opioids and tranquilizers should be carefully prescribed and closely monitored to reduce subsequent NUPM of leftover medication.

The present study features several notable strengths, such as the inclusion of a large national sample. To date, no large-scale nationally representative studies have examined motivational subtypes for NUPM. There were limitations in the present study that need to be taken into account while considering the implications of the findings. First, the results may not be generalized to other adolescent populations because our sample was drawn from high school seniors and did not include individuals who had dropped out or who were absent from school on the day of survey administration. Also, our results suggested that our sample of past-year nonmedical users were more likely to be white students with poor academic performance. Second, nonresponse may have introduced potential bias in the present study, and the data are subject to the potential bias introduced when collecting information on substance use behaviors through self-report surveys. The present study attempted to minimize potential biases by implementing conditions that previous research has shown minimizes biases [38,39]. It is worth noting that the prevalence rates of NUPM in the present study were comparable with rates reported from other national studies of adolescents [6]. Finally, the prescription stimulant category contained examples that could be perceived as street drugs and was missing commonly misused prescription stimulants, such as Adderall, from the list of examples [40].

Despite these limitations, the findings of the present study indicate a wide range of motivational subtypes across the three classes of prescription medications and provide strong support for a great deal of heterogeneity associated with NUPM. Future work is needed to further validate motivational subtypes identified in this study, examine motivational subtypes over time, and incorporate additional characteristics associated with NUPM, such as frequency, route of administration, and co-ingestion with other substances. Targeted interventions that tailor program content to the distinct motivational subtypes may prove useful for reducing NUPM among adolescents.

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