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Nonmedical Use of Prescription Stimulants Among US High School Students to Help Study: Results From a National Survey

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Abstract

Objective—Mixed findings exist regarding extent and efficacy of nonmedical use of prescription stimulants (NMUPS) for study enhancement (SE). This national study of US high school seniors examined NMUPS for SE and addressed risk/benefit questions: To what extent are students reporting NMUPS specifically for SE, and do these individuals demonstrate fewer problem behaviors and superior academic performance?

Method—Total of 15 098 US students surveyed (2009–2015) and divided into 4 subgroups: (1) no past-year NMUPS (nonusers), (2) past-year NMUPS to help study (NMUPS-SE only), (3) past-year NMUPS for study/ nonstudy motives (NMUPS-SE+ other), and (4) past-year NMUPS for nonstudy motives (NMUPS-nonSE only). Student characteristics (eg, grade point average [GPA]) and substance-related problems (eg, binge drinking) compared between subgroups.

Results—Among students who reported past-year NMUPS (n = 781), 7.4% reported NMUPS-SE only, 40.9% NMUPS-SE+ other, and 51.7% NMUPS-nonSE only. Odds of binge drinking, cigarette smoking, marijuana, and opioid nonmedical use significantly higher among all NMUPS subgroups. GPAs significantly lower among subgroups reporting NMUPS nonstudy motives; did not differ between NMUPS-SE only and nonusers.

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Declaration of Conflicting Interests

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All authors made a substantial contribution to the concept and design, acquisition of data or analysis and interpretation of data; drafted the article or revised it critically for important intellectual content; approved the version to be published. We examined motives for non-medical use of prescription stimulants (NMUPS) *specifically for study enhancement* among a national sample of US high school seniors. NMUPS for *study enhancement only* was not common or frequent. Our findings indicate much higher rates of substance use among students who reported NMUPS (for any reason).

Conclusions—7% of US high school seniors engaged in NMUPS for SE only (0.4% total population). Findings indicate greater substance-related problems without superior academic performance among NMUPS-SE subgroups.

Keywords

prescription stimulant; nonmedical; students; study; enhancement

Motives associated with the nonmedical use of prescription stimulants (NMUPS) have garnered a great deal of attention in recent years among US high school and college students.[1–9] A common theme found throughout these studies is that students self-report NMUPS for purposes of increasing concentration, helping them to study and increasing alertness. It is difficult to determine whether certain motives for NMUPS (eg, increase alertness) pertain uniquely to cognitive enhancement, while most would agree that *studying* implies the intention of improving cognitive performance. This definition of NMUPS-study enhancement (SE; ie, "to study") will be used hereafter to describe our study findings.

Although students report NMUPS for motives consistent with academic performance enhancement, there appear to be *mixed* findings as to the extent and efficacy of prescription stimulants when used for this purpose. Three comprehensive reviews regarding pharmacologic cognitive enhancement have described equivocal efficacy findings and concluded the risks may outweigh the potential cognitive benefits.[10–12] Although these studies present the occasional positive finding for specific memory tasks and possible benefits in "specific cognitive domains," the real-world (ie, natural setting) significance of these relatively isolated laboratory-based findings cannot be determined at this time. For instance, there are no concrete findings that students engaging in NMUPS-SE demonstrate fewer problem behaviors and superior academic performance compared to their peers. This lack of real-world cognitive enhancement efficacy associated with NMUPS may be due to the fact that isolated laboratory findings that have demonstrated pharmacologic cognitive enhancement (eg, improved working memory and increased processing speed) reveal very small and modest effect sizes.[13,14]

An explanation for pharmacologic cognitive enhancement use among students that has been put forth is that prescription stimulants simply increase students' *interest* in study materials. Findings from a college student sample indicated that stimulants increased interest in academic work.[15] This finding has been supported using laboratory techniques; for example, methylphenidate (MPH) was associated with increased ratings of tasks being "interesting," "exciting," and "motivating," which correlated with dopaminergic increases in the central nervous system.[16] The authors postulated that MPH may increase saliency and motivation of a task, which could in turn result in improved ability; however, performance on tasks was not reported.[16] This explanation is certainly credible given that dopamine is essential to learning and motivation.[17] A related mechanism for engaging in NMUPS-SE might be explained by research that demonstrates subjective arousal with mere expectation of receiving MPH during cognitive batteries. Evidence for cognitive enhancement was not identified in this "placebo effect" study, although findings suggest the experience of subjective arousal could propagate NMUPS-SE, despite lack of proven efficacy.[18] Finally,

recent work by Arria et al demonstrates that students continue to perceive academic benefit from NMUPS,[1] despite the mixed findings described earlier.

Some have proposed that "responsible" pharmacologic cognitive enhancement is possible given an appropriate risk–benefit analysis.[19] Given the abovementioned mixed and modest results regarding pharmacologic cognitive enhancement efficacy, in addition to negative health behaviors and consequences associated with NMUPS among secondary and college students,[5,20–25] the risk–benefit analysis regarding NMUPS specifically for pharmacologic cognitive enhancement appears to be weighted toward neutral or unfavorable outcomes.[11,26] In fact, researchers have posited what they consider as the "myth" of pharmacologic cognitive enhancement among healthy students and supported their assertions with the following outcomes that commonly occur among college students reporting NMUPS: lower grade point averages (GPA), greater and more severe alcohol and other drug use, skipped classes, and nonstudy motives for use (eg, "partying").[26]

Although previous studies have contributed to our understanding of college students who report NMUPS for enhancing academic performance,[5,27] these studies were conducted at a small number of college campuses, their operational definition for enhancing academic performance included motives beyond "to help me study," and generalizability may be limited. Furthermore, experts have called for more research regarding stimulant misuse for cognitive enhancement and more research utilizing the Monitoring the Future (MTF) data set.[28] We now present findings from the MTF study,[29] which is the first nationally representative, probability-based sample of US high school students to assess characteristics specifically associated with NMUPS-SE, in addition to numerous other student characteristics and behaviors. The MTF study instrument contained a rich supply of items covering NMUPS, including an extensive list of motives for NMUPS. Our study objective was to analyze MTF's large, nationally representative sample and examine the following risk/benefit questions related to NMUPS: To what extent are students reporting NMUPS specifically for SE, and do these individuals demonstrate fewer substance-related problem behaviors and superior academic performance than their peers?

Study Methods

Data were collected via self-administered questionnaires that were distributed to a nationally representative probability sample of US high school seniors during the MTF study.[29] For purposes of this study, our sample consisted of 15 098 individuals in 7 MTF cohorts (2009–2015) with valid data on the outcome variables of interest. As illustrated in Figure 1, we divided the total sample into 4 mutually exclusive subgroups for comparison: (1) students reporting no past-year NMUPS (*nonusers*), (2) students reporting past-year NMUPS to help them study only (*NMUPS-SE only*), (3) students reporting NMUPS for study and nonstudy motives (*NMUPS-SE + other motives*), and (4) students reporting past-year NMUPS for non-study reasons only (*NMUPS-nonSE only*). The motive "to help me study" was the single decision point for assigning subgroups into NMUPS-SE versus NMUPS-nonSE. Although additional motives could possibly be construed as "academic performance enhancement" (eg, "to stay awake"), we cannot definitively confirm that these motives were intended for enhancing cognition solely for academic achievement.

Measures

Data were gathered on student demographic characteristics (eg, race/ethnicity), alcohol and other drug use, student perceptions (eg, views on cheating), and self-reported GPAs, which were taken from questionnaire form 1 (parts B–C) of the MTF study.[29] Below, we discuss our independent variables followed by a description of dependent variables most relevant to our study aims. Our dependent variables were chosen a priori based upon characteristics found among secondary school and college students endorsing NMUPS, which included: (1) lower GPAs,[2,24,30] (2) elevated rates of binge drinking and drug use,[30,31] (3) view that NMUPS is not cheating or is acceptable when applied to academic performance enhancement,[32,33] and (4) higher rates of truancy.[34] In the following paragraphs, we provide details for selected variables (to serve as examples); further information for our study variables can be found within the MTF documentation.[29]

Past-year NMUPS was assessed using a series of questions covering students' behaviors with regard to stimulant use.[29] Prior to individual questions, a brief explanatory introduction was provided in the survey to clarify the intent of the amphetamine questions. For example, the MTF instrument states that "The next questions are about amphetamines and other stimulant drugs, which are sometimes prescribed by doctors for people who have trouble paying attention, are hyperactive, have ADHD . . . ." Examples of amphetamines are provided and include, among others, "Dexedrine," "Ritalin," "Adderall," "Concerta," and "Vyvanse." The primary past-year NMUPS question provided to students was "On how many occasions (if any) have you taken amphetamines on your own—that is, without a doctor telling you to take them?" Responses ranged from "0 occasions" to "40 or more occasions." For the purposes of this study, past-year NMUPS was determined based upon endorsement of one or more occasions "during the last 12 months"; additionally, we examined frequency of NMUPS among subgroups of past-year nonmedical stimulant users. The MTF survey mentions both stimulants available by prescription (eg, mixed amphetamines, MPH) and nonprescription ("crystal meth") stimulants in the same broad category of "Amphetamines." Therefore, we used an additional NMUPS question from the MTF survey relating to specific stimulant use. A follow-up question asked respondents to choose "What amphetamines have you taken during the last year without a doctor's orders? (*mark all that apply*)." Responses included, among others, stimulant medications such as "Ritalin (MPH)," "Concerta (MPH)," "Dexedrine," "Adderall," and "Vyvanse." Using this follow-up item, we were able to extract 13 students from the 7 cohorts who responded only with "crystal meth," thereby helping to eliminate the use of nonprescription stimulants from the NMUPS sample.

Motives for past-year NMUPS were attained using the following question: "What have been the most important reasons for your taking amphetamines without a doctor's orders? (*mark all that apply*)"; over 15 possible responses were provided in the original instrument,[29] including our target motive "To help me study." Examples of other motives for NMUPS included "To feel good or get high," "To have a good time with my friends," and "To help me lose weight."

Sources for past-year NMUPS were attained using the following question: "Where did you get the amphetamines you used without a doctor's orders during the last year?"[29] Responses

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 a prescription I had,” “Bought from a drug dealer/stranger,” and “Other method.”

Grade Point Average (GPA) was measured using the following item: “Which of the following best describes your average grade so far in high school?”[29] Response scale ranged from 1 to 9 (eg, 1 being “D or below,” 4 being “C+,” and 9 being “A”). Responses were collapsed into 2 groups: C+ or below (responses 1–4) and B– to A (responses 5–9). We also considered the full range of responses (1–9) and examined mean GPA estimates based on these responses.

Binge Drinking (past 2 weeks) was assessed using the following standard self-report item, which has been utilized by the MTF for many years and allows direct comparisons to earlier findings: “During the last 2 weeks how many times (if any) have you had 5 or more drinks in a row?”[29] Drinks were defined as a 12-ounce can or bottle of beer, a 4-ounce glass of wine, a 12-ounce can or bottle of wine cooler, a mixed drink, and a shot glass of liquor or the equivalent. Responses were collapsed into 2 groups: no binge drinking versus one or more episodes of binge drinking.

Cigarette Smoking (past 30 days) was assessed with the following item: “How frequently have you smoked cigarettes during the past 30 days?”[29] The response options ranged from (1) none to (7) 2 packs or more per day. Responses were collapsed into 2 groups: no cigarette smoking and one or more episodes of cigarette smoking.

Marijuana Use (past 12 months) was assessed with the following item: “On how many occasions (if any) have you used marijuana in the last 12 months.”[29] The response scale ranged from (1) no occasions to (7) 40 or more occasions. Responses were collapsed into 2 groups: no marijuana use versus one or more episodes of marijuana use.

Past-year prescription opioid nonmedical use was assessed with the following question, which was preceded by explanatory language similar to the NMUPS variable above and included examples, such as OxyContin and Vicodin: “On how many occasions (if any) have you taken narcotics other than heroin on your own—that is, without a doctor telling you to take them during the last 12 months?”[29] The response scale ranged from (1) no occasions to (7) 40 or more occasions. Responses were collapsed into 2 groups: no prescription opioid nonmedical use versus 1 or more episodes of prescription opioid nonmedical use.

Data Analyses

All analyses of the MTF data conducted for this study were design based in that the population estimates incorporated the final MTF survey weights. Variance estimates were computed using Taylor Series Linearization,[35] and test statistics incorporated the survey weights as well. The first set of analyses focused on estimating the distributions of selected demographic characteristics for each of the 4 study groups, and using appropriate design-based methods to test associations between each demographic characteristic and the 4-category study group variable. The second set of analyses focused on estimating the

prevalence of selected attitudes and behaviors for each of the 4 study groups and testing associations between each attitude/behavior and the 4-category study group variable. Finally, design-based logistic regression models were used to model the prevalence of selected attitudes and behaviors as a function of the 4-category NMUPS group variable while controlling for race/ethnicity and parental education, due to differences between the 4 subgroups in the distribution of these variables. Stata code used for the analyses is available upon request.

Results

Weighted estimates of distributions of selected sociodemographic characteristics for each of the 4 NMUPS groups are presented in Table 1. There were notable parental education and racial/ethnic differences with respect to the 4-category NMUPS variable. For example, respondents who endorsed NMUPS-SE only also endorsed a higher percentage of “at least some college education” regarding their parents. Distributions on all other demographic variables were similar among the 4 subgroups. Finally, we did not find evidence of a significant statistical trend across the study years ($P = .120$, based on a Rao-Scott test of the association between year and study motives) in the prevalence of NMUPS for SE overall; the highest estimated prevalence was 3.3% in 2011.

An estimated 5.2% of high school students engaged in past-year NMUPS during this time period. Further analyses provided weighted estimates for NMUPS motives (see Figure 1): Based on those respondents in the sample endorsing NMUPS (n = 781), an estimated 7.4% only indicated “to help me study,” 40.9% indicated NMUPS-SE + other nonstudy motives, and 51.7% indicated only nonstudy motives. It should be noted that among the entire sample of high school seniors, less than one-half percent (unweighted) endorsed NMUPS for study motives only (n = 58). Furthermore, there was a statistically significant relationship between NMUPS motives and NMUPS frequency. For example, an estimated one-half (50.0%) of the NMUPS-SE only group reported infrequent NMUPS on 1 to 2 occasions, compared to 25.1% and 44.3% infrequent use for the NMUPS-SE + other and NMUPS-nonSE groups, respectively. The most commonly reported sources for NMUPS were “given for free by a friend” (56.22%; n = 335) and “bought from a friend” (43.63%; n = 358).

As shown in Table 2, the highest percentages of students reporting a C+ or lower grade, favorable perceived peer views of academic cheating, binge drinking, cigarette smoking, marijuana use, opioid nonmedical use, and skipped classes were found in the 3 NMUPS groups compared to nonusers, and these associations were all significant ($P < .001$). In addition, there were significantly ($P < .001$) lower mean GPAs identified among the NMUPS-SE + other (mean [M] = 5.99, standard error [SE] = 0.15) and NMUPS-nonSE (M = 6.02, SE = 0.13) groups when compared to the nonuser group (M = 6.64, SE = 0.02). The mean GPA in the NMUPS-SE only subgroup (M = 6.26, SE = 0.31) was not significantly different from the mean GPA in the nonuser group.

The estimated odds of reporting a GPA of C+ or lower and endorsing a favorable perceived peer view of academic cheating were significantly higher among the 2 subgroups of students reporting NMUPS for any nonstudy motives (with or without additional study motives; see

Table 3) relative to nonusers. However, the odds of reporting a C+ or lower and a favorable perceived peer view of academic cheating did not statistically differ between the NMUPS-SE–only subgroup and nonusers.

Notably, the estimated odds of binge drinking in the last 2 weeks were between 5 and 7 times greater among students reporting NMUPS (*regardless of study motives*) relative to nonusers. For example, the odds of binge drinking were over 6 times greater among the NMUPS-SE–only subgroup relative to nonusers (adjusted odds ratio; AOR = 6.05, 95% confidence interval [CI] = 3.24–11.31). Similarly, the estimated odds of cigarette smoking, marijuana, and prescription opioid nonmedical use were significantly greater among students reporting NMUPS (*regardless of study motives*) relative to nonusers. For example, the odds of marijuana use were over 7 times greater among the NMUPS-SE only subgroup relative to nonusers (AOR = 7.94, 95% CI = 3.30–19.08). In addition, the estimated odds of skipping class were about 2 to 3 times greater among students reporting NMUPS nonSE only and NMUPS-SE + other, relative to nonusers.

The estimated odds of getting moderately or very high when using prescription stimulants were over 16 times higher among students reporting NMUPS-SE + other (AOR = 16.69, 95% CI = 4.84–57.56) and NMUPS-nonSE only (AOR = 17.07, 95% CI = 5.00–58.26), relative to NMUPS-SE only. Finally, we identified no significant differences in self-reported nonoral routes of stimulant administration or expected future NMUPS as a function of NMUPS motives.

Discussion

Our study is the first to report NMUPS motives that relate specifically to SE *compared* to other motives (eg, recreational use) among a national sample of US high school seniors. There are unique aspects of this study that deserve mention. First, we chose the most conservative definition of NMUPS-SE that we could utilize from the MTF instrument (ie, a single motive “to help me study”). Prior studies of college students have applied broader definitions, including other motives not necessarily inclusive of study purposes. For example, Arria et al included “improve focus/study/ work” in their definition of NMUPS for studying.[27] Other research that has assessed academic motives for NMUPS has focused primarily on symptoms of ADHD[5] versus pharmacologic cognitive enhancement among the general student population. Second, our findings were derived from a gold standard US epidemiologic study of substance use among high school seniors over 7 cohorts from 2009 to 2015. Although providing valuable knowledge on NMUPS and academic performance, previous research has been conducted primarily among a small number of college institutions,[5,27] and these studies require replication among nationally representative samples of students in high school and college. Thus, the current study is the first to examine a nationally representative sample of US high school seniors endorsing NMUPS specifically for SE purposes.

Our estimated prevalence rate of NMUPS associated specifically with academic SE motives among US high school seniors (2.5%) is on the lower end of the range reported in the literature among college students[36]; however, our national high school student sample was

younger, and our definition of NMUPS-SE was narrower compared to other studies. Furthermore, in our preliminary comparison of the current MTF findings to the 2015 National Survey on Drug Use and Health (NSDUH; which are described in further detail below), the prevalence rates of NMUPS that included SE purposes among high school seniors were very low in both studies (ie, 2.5% according the MTF compared to less than 2% in the NSDUH). Taken together, we identified very few students in either nationally representative study who reported NMUPS-SE only, and over half of this small number of students reported the behavior infrequently (ie, on 1 or 2 occasions) according to the MTF findings. Thus, *NMUPS-SE only* does not appear to be a prevalent or frequent substance use behavior. Finally, our work is very consistent with prior studies in that "friends" continue to be the most common source for students to obtain prescription stimulants for nonmedical use.[37]

US high school seniors who reported lower GPAs were significantly more likely to report NMUPS for any nonstudy motives (with and without additional study motives present). Earlier work with college student samples has provided consistent evidence of lower GPAs among students who report NMUPS.[5,30,38] Notably, the odds of reporting lower GPAs did not differ between students who endorsed NMUPS-SE only when compared to nonusers in the present study. This lack of notable GPA differences between NMUPS-SE *only* and nonusers is congruent with the human laboratory data that has shown very mixed findings regarding the efficacy of pharmacologic cognitive enhancement among healthy individuals.[10–12]

As shown previously among secondary school and college students,[2,5,30,31,39,40] the current study demonstrated that NMUPS was significantly associated with substance-related problem behaviors among US high school seniors. Specifically, binge drinking, cigarette smoking, marijuana use, and prescription opioid nonmedical use were all associated with both study and nonstudy-related NMUPS. More research is needed to examine this association between NMUPS and other substance use among high school students, given the high rates of coin-gestion and adverse consequences found among those who report NMUPS.[40] For example, it is possible there is a shared causal mechanism to explain this strong relationship between NMUPS and other substance use (eg, reward deficiency syndrome, self-medication hypothesis).[41]

A large percentage of high school seniors in all of the subgroups included in this study appeared to view academic cheating either with indifference (eg, "would not care") or favorably (eg, "like it"). This is consistent with findings among college students, who viewed "illegal stimulant" use to be *acceptable* given the alleged academic purposes.[15,32] Another study identified this questionable academic performance enhancement behavior as more acceptable than sports performance enhancement.[33] It appears from the current study that the belief cheating is acceptable (eg, peers "would not care") and endorsing NMUPS for both study and nonstudy purposes are 2 student characteristics that are particularly related. The issue as to whether stimulant use for academic performance enhancement is viewed as cheating[42] is an important area for additional research into this highly debatable topic.

The higher estimated odds of reporting stronger ratings of stimulant-induced subjective high in both NMUPS groups that contained nonstudy motives (ie, NMUPS-SE + other and NMUPS-nonSE) compared to NMUPS-SE only fits with a pharmacokinetic and pharmacodynamic model of substance misuse. For example, this finding suggests that perhaps the small number NMUPS-SE *only* users are taking these medications (infrequently, as identified in this study) in a manner more consistent with their prescribed use (eg, low to moderate oral doses); however, we cannot confirm this speculation given the lack of medication dose-specific related questions in the MTF survey.

Finally, we briefly provide results from a preliminary comparison between our current findings using the MTF data set with a similar approach we applied using data from the NSDUH, which also collects self-reported stimulant use motives among the general population aged 12 years and older.[43] We examined prescription stimulant use motives among 12-grade students who participated in the 2015 NSDUH[44] to serve as a preliminary comparison (ie, provide context) to our current findings using the MTF study data set. All analyses of NSDUH data occurred in Stata 15.0, using similar methodology as that noted earlier. This preliminary comparison of MTF findings to NSDUH findings, in regard to NMUPS motives, demonstrated very consistent results between the 2 studies. For example, from a total sample of 1880 12th-grade students in the 2015 NSDUH, there were 4 (weighted estimate 0.2%) who endorsed only “to study” as their reason for the last time they engaged in NMUPS. There were an additional 23 (1.2%) and 51 (2.7%) who endorsed either “to study + other motives” or “nonstudy motives,” respectively. The remaining 95.9% of the respondents (n = 1802) did not self-report NMUPS. This is very consistent with our MTF findings in that approximately one-half of the NMUPS groups reported “to study” (with or without other motives) and the remaining one-half reported only “non-study” motives. In both the MTF and NSDUH studies, the number of respondents who self-endorsed NMUPS for “study” only purposes were *extremely* small (less than 0.4% of the overall sample).

Limitations

As noted earlier, we were unable to evaluate the doses of stimulants being used by students. Understanding the dose-related effect of NMUPS is essential to disentangling the important issues raised in this study (eg, subjective high findings noted above) and the broader literature. Additionally, the term “Amphetamines” used in the MTF survey is not the broadest pharmacological term and is encompassed within the “psychostimulant” category. However, specific stimulant examples were provided in the MTF survey and included MPH, dextroamphetamine, and medication brand names (eg, Concerta). In addition, the MTF survey added the phrase “amphetamines or other stimulant drugs” in 2014 and we found similar results to prior cohorts. Therefore, the use of “Amphetamines” terminology is not expected to significantly impact our findings.

Although GPA and substance use behaviors assessed via self-report are subject to recall bias, the validity of these self-reported measures has been supported in previous work.[45–47] For example, a meta-analysis of 17 studies totaling 44 176 high school students was able to determine the correlation of self-reported and actual GPA to be 0.82. Furthermore, high school GPA was correctly reported 82.4% of the time, with minimal over- and underreported

GPA (12% and 3%, respectively).[45] Finally, this study is cross-sectional and cannot establish causation between our independent and dependent variables. For example, students reporting NMUPS-SE may have had lower GPA's previously and benefitted from stimulant use in specific academic situations (eg, completing a writing assignment) but still demonstrated a similar or lower self-reported GPA as compared to nonusers. Further studies need to be conducted using a prospective, longitudinal design in large, representative samples of US high school and college students to fully disentangle these issues.

Summary

Returning to our original study aims, we identified a very small sample of US high school seniors who reported NMUPS-SE *only* and found that their overall academic performance was comparable to nonusers. Therefore, we propose that NMUPS-SE *only* is a relatively rare substance use behavior and that NMUPS (*more generally across all stimulant subgroups*) is associated with substance-related problem behaviors (eg, binge drinking, cigarette smoking, marijuana use, and prescription opioid nonmedical use) and possibly students attempting to salvage their academic performance via pharmacologic cognitive enhancement, given their dissonant attitudes and behaviors.

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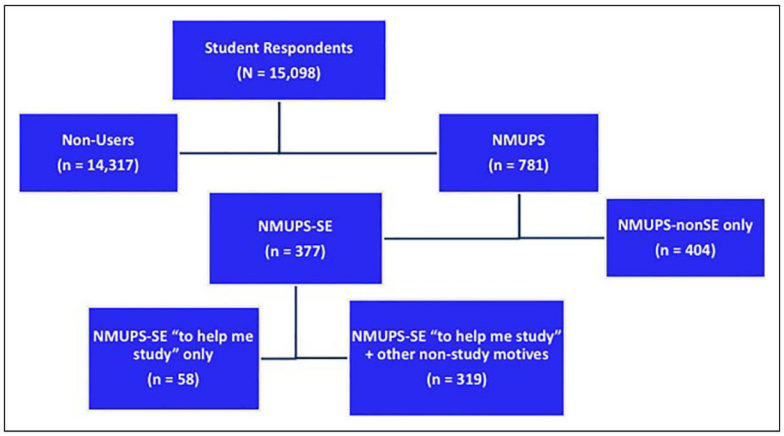

Figure 1.

NMUPS-SE (n = 377) category consisted of 2 subcategories: (1) "To help me study" as the sole motive and (2) "To help me study" plus other motives. The NMUPS-nonSE-only (n = 404) category is a mutually exclusive group containing students who only endorsed motives other than "to help me study." NMUPS indicates past-year nonmedical use of prescription stimulants; NMUPS-SE, past-year nonmedical use of prescription stimulants for study enhancement only; NMUPS-nonSE only, past-year nonmedical use of prescription stimulants for nonstudy purposes only.

Table 1

Weighted Estimates of Demographic Characteristics Associated With NMUPS Among High School Seniors (2009–2015 MTF[a]).

Distributions of DemographicCharacteristics	No Past-Year NMUPS (N = 14 317[b]; %)	Past-Year NMUPS-SE only (n = 58; %)	Past-Year NMUPS-SE and non-SE (n = 319; %)	Past-Year NMUPS-non-SE only (n = 404; %)	Test of Association (Design-Adjusted F-statistic)[c]
Sex					
Male	48.2	63.2	49.8	48.7	$F_{3,\ 42\ 878.0} = 1.22$; $P = .30$
Female	51.8	36.8	50.3	51.3	
Parental education (highest level)					
High school or less	25.3	14.8	16.6	26.1	$F_{5.55,\ 83\ 822.91} = 3.43$[d]
At least some college	66.6	83.4	75.2	63.3	
Don’t know/Missing	8.1	0.8	8.2	10.6	
Race/ethnicity					
White	56.1	61.5	74.9	62.6	$F_{7.49,\ 113\ 040} = 5.33$[e]
Black	11.6	10.8	4.1	6.2	
Hispanic	15.2	16.3	5.2	11.6	
Not reported/missing	17.1	11.5	15.8	19.6	
Geographical region					
South	35.9	35.0	35.3	35.2	$F_{8.89,\ 134\ 194} = 0.91$; $P = .51$
Northeast	17.6	20.4	20.3	16.7	
Midwest	23.3	26.9	27.8	24.2	
West	23.1	17.7	16.6	23.9	
Urbanicity					
Farm/country	17.3	14.1	13.2	20.1	$F_{2.73,\ 36\ 062} = 0.94$; $P = .41$
Small city or larger	82.7	85.9	86.9	79.9	
Senior year cohort					
2009	14.7	5.3	10.5	18.0	$F_{16.75,\ 252\ 823} = 1.47$; $P = .10$
2010	15.3	7.9	14.0	15.0	
2011	14.9	19.0	20.2	18.0	
2012	14.5	19.3	15.2	13.7	
2013	13.6	12.2	14.4	12.1	

Distributions of DemographicCharacteristics	No Past-Year NMUPS (N = 14 317[b]; %)	Past-Year NMUPS-SE only (n = 58; %)	Past-Year NMUPS-SE and non-SE (n = 319; %)	Past-Year NMUPS-non-SE only (n = 404; %)	Test of Association (Design-Adjusted F-statistic)[c]
2014	13.0	21.7	12.0	14.7	
2015	14.1	14.7	13.6	8.6	

Abbreviations: NMUPS, nonmedical use of prescription stimulants; NMUPS-SE *only*, nonmedical use of prescription stimulants for study enhancement only; NMUPS-SE and non-SE, nonmedical use of prescription stimulant for both study enhancement and nonstudy purposes; NMUPS-nonSE only, nonmedical use of prescription stimulants for nonstudy enhancement purposes only during the past year.

[a] Source: 2009 to 2015 Monitoring The Future (MTF); weighted estimates.

[b] Sample sizes in each column may not sum to overall total in each column header due to missing data on some of the demographic variables (eg, gender) in the MTF data set.

[c] Design-based *F*-statistic, computed based on Rao-Scott χ^2 statistic with second-order design correction.

[d] $P < .01$.

[e] $P < .001$.

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Table 2

Estimated Prevalence of Attitudes and Behaviors Associated With NMUPS Among High School Seniors (2009–2015 MTF[a]).

Attitudes and Behaviors	No Past-Year NMUPS (n = 14 317[b]; %)	Past-Year NMUPS-SE only (n = 58; %)	Past-Year NMUPS-SE and non-SE (n = 319; %)	Past-Year NMUPS-non-SE only (n = 404; %)	Statistical Analyses (Design-Adjusted *F*-statistic)
Academic achievement					
Which of the following best describes your *average grade* so far in high school?					
A, A-, B+, B, B- (80–100)	84.9	82.4	76.5	75.2	$F_{2.94,\ 41\ 139.87} = 9.81^{c}$
C+, C, C-, D (79 or below)	15.1	17.6	23.5	24.8	
Academic cheating					
How do you think most students in your classes would feel if you *cheated* on a test?					
They would like it very much, they would like it, or they would not care	82.9	89.0	94.4	89.1	$F_{2.80,\ 37\ 001.43} = 7.60^{c}$
They would dislike it or they would dislike it very much	17.1	11.0	5.6	10.9	
Binge drinking					
During the last 2 weeks, how many times have you had 5 *or more drinks* in a row?					
No binge drinking	84.6	45.6	40.3	47.5	$F_{2.99,\ 41\ 362.92} = 200.14^{d}$
Yes, binge drinking	15.4	54.4	59.7	52.5	
Cigarette smoking					
Have you smoked cigarettes during the past 30 days?					
No cigarette smoking	85.1	63.9	41.5	41.8	$F_{2.99,\ 43\ 761.07} = 233.25^{d}$
Yes, cigarette smoking	14.9	36.1	58.5	58.2	
Marijuana use					
Have you used marijuana during the last 12 months?					
No marijuana use	69.2	22.3	10.1	15.8	$F_{2.91,\ 43\ 160.71} = 205.53^{d}$
Yes, marijuana use	30.8	77.7	89.9	84.2	
Opioid nonmedical use (past 12 months)					
No, opioid nonmedical use	95.3	79.1	44.0	51.8	$F_{3,\ 43\ 609.1} = 538.54^{c}$
Yes, opioid nonmedical use (past-year)	4.7	20.9	56.0	48.2	

Attitudes and Behaviors	No Past-Year NMUPS (n = 14 317[b]; %)	Past-Year NMUPS-SE only (n = 58; %)	Past-Year NMUPS-SE and non-SE (n = 319; %)	Past-Year NMUPS-non-SE only (n = 404; %)	Statistical Analyses (Design-Adjusted *F*-statistic)
Skipped class					
During last 4 weeks, how many whole days of school have you missed because you *skipped*				or "cut"?	
Did not skip any days	71.6	62.3	41.6	52.6	$F_{3.00,\ 40\,913.56} = 43.41$[d]
Skipped one or more days	28.4	37.7	58.4	47.4	
Route of administration					
Oral administration only	NA	86.7	77.0	73.5	$F_{1.79,\ 1365.53} = 1.08$; $P = .33$
Nonoral routes of administration		13.3	23.0	26.5	
Subjective high					
Not at all/a little/not	NA	95.3	55.2	54.2	$F_{1.92,\ 1468.32} = 15.03$[c]
Moderately/very high		4.7	44.8	45.8	
Expected future use					
Probably/definitely will not	NA	75.1	68.4	78.0	$F_{1.94,\ 1479.00} = 2.64$; $P = .07$
Definitely/probably will		24.9	31.6	22.0	

Abbreviations: NMUPS, nonmedical use of prescription stimulants; NMUPS-SE only, nonmedical use of prescription stimulants for study enhancement only; NMUPS-SE and non-SE, nonmedical use of prescription stimulant for both study enhancement and nonstudy purposes; NMUPS non-SE only, nonmedical use of prescription stimulants for nonstudy enhancement purposes only; NA, Not Applicable.

[a] Source: 2009 to 2015 Monitoring the Future (MTF); weighted estimates.

[b] Sample sizes in each column may not sum to overall total in each column header due to missing data on some of the outcome variables (eg, academic achievement) in the MTF data set.

[c] P < .001.

[d] P < .0001.

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Table 3

Weighted Estimates of Adjusted Odds Ratios (AORs) in Logistic Regression Models Examining Differences in Selected Student Attitudes and Behaviors as Function of NMUPS Among Subgroups of High School Seniors (2009–2015 MTF[a]).

Attitudes and Behaviors	Non-Users (Sample Size)[b,c,d]	Past-Year NMUPS-SE only, AOR (95% CI)	Past-Year NMUPS-SE and non-SE, AOR (95% CI)	Past-Year NMUPS-non-SE only, AOR (95% CI)
Academic achievement				
Which of the following best describes your *average grade* so far in high school?				
C+, C, C-, D (79 or below)	Reference (13 975)	1.26 (0.58–2.74)	2.02 (1.42–2.87)[e]	1.96 (1.47–2.63)[e]
Academic cheating				
How do you think most students in your classes would feel if you *cheated* on a test?				
They would like it very much, They would like it, or They would not care	Reference (13 232)	1.69 (0.48–5.91)	3.56 (2.08–6.10)[e]	1.70 (1.12–2.59)[f]
Binge drinking				
During the last 2 weeks, how many times have you had 5 *or more drinks* in a row?				
Yes, binge drinking	Reference (13 841)	6.05 (3.24–11.31)[e]	7.56 (5.72–9.99)[e]	5.93 (4.63–7.60)[e]
Cigarette smoking				
Have you smoked cigarettes during the past 30 days?				
Yes, cigarette smoking	Reference (14 658)	2.97 (1.64–5.40)[e]	7.74 (5.89–10.16)[e]	7.59 (5.99–9.62)[e]
Marijuana use				
Have you used marijuana during the last 12 months?				
Yes, marijuana use	Reference (14 809)	7.94 (3.30–19.08)[e]	19.79 (12.93–30.29)[e]	11.90 (8.49–16.67)[e]
Opioid PDM (past 12 months)				
Yes, opioid nonmedical use (during the past-year)	Reference (14 358)	5.45 (2.52–11.77)[e]	24.14 (18.19–32.02)[e]	18.48 (14.29–23.88)[e]
Skipped class				
During the last 4 weeks, how many whole days of school have you missed because you *skipped* or “cut”?				
Skipped one or more days	Reference (13 661)	1.56 (0.86–2.83)	3.62 (2.71–4.83)[e]	2.26 (1.76–2.90)[e]
Route of administration				
Nonoral routes of administration	(766)	Reference	1.87 (0.46–7.52)	2.32 (0.57–9.38)
Subjective high				

Attitudes and Behaviors	Non-Users (Sample Size)[b,c,d]	Past-Year NMUPS-SE only, AOR (95% CI)	Past-Year NMUPS-SE and non-SE, AOR (95% CI)	Past-Year NMUPS-non-SE only, AOR (95% CI)
Moderately/very high	(764)	Reference	16.69 (4.84–57.56)[e]	17.07 (5.00–58.26)[e]
Expected future use				
I definitely/probably will	(762)	Reference	1.38 (0.60–3.20)	0.86 (0.37–1.99)

Abbreviations: NMUPS, nonmedical use of prescription stimulants; NMUPS-SE only, nonmedical use of prescription stimulants for study enhancement only; NMUPS-SE and non-SE, nonmedical use of prescription stimulants for both study enhancement and nonstudy enhancement purposes; NMUPS non-SE only, NMUPS for nonstudy enhancement purposes only; 95% CI, 95% confidence interval; Monitoring the Future (MTF) Study; PDM, Prescription Drug Misuse.

[a] Source: 2009 to 2015 MTF; weighted estimates.

[b] Sample sizes for the regression models ranged from 13 232 (student feelings about cheating) to 14 809 (past-year marijuana use) due to missing data.

[c] Reference = Reference group for each multivariate logistic regression model.

[d] Race/ethnicity and highest parental education were used as covariates in our regression analyses due to their significant associations with the 4-category NMUPS variable (see Table 1).

[e] $P < .001$.

[f] $P < .05$.