Predictors and Consequences of Prescription Drug Misuse During Middle School

Joan S. Tucker, **Brett Ewing**, **Jeremy N. V. Miles**, **Regina A. Shih**, **Eric R. Pedersen**, and **Elizabeth J. D'Amico**

RAND Corporation, 1776 Main Street, PO Box 2138, Santa Monica, CA 90407

Abstract

Objectives—Non-medical prescription drug use (NMPDU) is a growing public health problem among adolescents. This is the first study to examine the correlates of early NMPDU initiation during middle school, and how early initiation is associated with four domains of functioning in high school (mental health, social, academic, and delinquency).

Methods—Students initially in 6th-8th grades from 16 middle schools completed in-school surveys between 2008 and 2011 (Waves 1-5), and a web-based survey in 2013-2014 (Wave 6). We used discrete time survival analysis to assess predictors of initiation from Waves 1-5 based on students who provided NMPDU information at any of these waves (*n*=12,904), and regression analysis to examine high school outcomes associated with initiation based on a sample that was followed into high school, Wave 6 (*n*=2,539).

Results—Low resistance self-efficacy, family substance use, low parental respect, and offers of other substances from peers were consistently associated with NMPDU initiation throughout middle school. Further, perceiving that more of one's peers engaged in other substance use was associated with initiation at Wave 1 only. By high school, those students who initiated NMPDU during middle school reported lower social functioning, and more suspensions and fighting, compared to students who did not initiate NMPDU during middle school.

Conclusion—NMPDU initiation during middle school is associated with poorer social functioning and greater delinquency in high school. It is important for middle school prevention programs to address NMPDU. Such programs should focus on both family and peer influences, as well as strengthening resistance self-efficacy.

1. Introduction

1.1 Prevalence of NMPDU

Nonmedical prescription drug use (NMPDU) has reached epidemic proportions in the United States (McHugh et al., 2015), and is a growing public health problem among adolescents (Ford and Watkins, 2012). NMPDU is typically defined as using prescription drugs without a medical doctor's prescription for personal use, in a way other than prescribed, or for the experience or feelings that it elicits. Steep increases occur from 8th-12th grade in past year non-medical use of prescription drugs such as Adderall, OxyContin, Ritalin, and Vicodin (Miech et al., 2015). This suggests that middle school students (i.e., 6th-8th graders) may be exposed to risks for future use or may be contemplating use in the near future. Studies are needed to identify risk and protective factors for NMPDU that can be targeted in prevention efforts for middle school students, as well as to understand the consequences of early NMPDU initiation on different domains of functioning during high school.

1.2 Risk and protective factors for NMPDU

Most of what is known about the risk and protective factors for drug use during adolescence comes from studies of substances other than prescription drugs. Studies examining the correlates of adolescent NMPDU have mostly been cross-sectional studies of high school students or samples combining middle and high school students (Young et al., 2012). Given developmental changes during adolescence, longitudinal studies of middle school students are needed to identify individual, peer and family factors relevant to NMPDU initiation in this younger age group. For example, adolescents who perceive themselves as popular tend to engage in more substance use (Allen et al., 2005; Ober et al., 2013; Tucker et al., 2013), perhaps as a way of maintaining their social status, as do those who feel less efficacious at resisting substances (Hiemstra et al., 2012; Ober et al., 2013). Although low resistance self-efficacy is likely relevant to NMPDU, popularity may be less of a risk factor for NMPDU than substances typically used in social settings such as alcohol. Both of these individual factors have been understudied in the context of NMPDU (Nargiso et al., 2015). Peer factors associated with adolescent NMPDU include exposure to drug use and pro-drug attitudes (Ford, 2008a; Ford and Hill, 2012). However, other peer factors largely overlooked in studies of NMPDU include receiving substance offers (Ellickson et al., 2004; Siegel et al., 2015) and overestimating peer use (D'Amico and McCarthy, 2006; Ober et al., 2013; Wu et al., 2015), although the prevalence of NMPDU overestimation has been documented (McCabe, 2008; Sanders et al., 2014). Family factors relevant to NMPDU include poor parental monitoring and involvement (Ford, 2009; Ford and McCutcheon, 2012). Exposure to family member substance use (Chan et al., 2013; Ober et al., 2013) and weaker family values (Shih et al., 2012; Soto et al., 2011; Unger et al., 2002) have also been identified as important risk factors for other forms of adolescent substance use and thus may be useful in understanding NMPDU initiation.

1.3 Outcomes associated with NMPDU

Cross-sectional studies indicate that adolescent NMPDU is associated with weaker academic orientation (Ford, 2009; Havens et al., 2011; McCabe et al., 2004), greater delinquency (Boyd et al., 2009; Ford, 2008b), and other substance use (Ford, 2009; Ford and McCutcheon, 2012; Havens et al., 2011; McCabe et al., 2007; McCabe et al., 2004). Few longitudinal studies have examined how NMPDU initiation is associated with later adolescent functioning. One study of 7th-11th grade students found that those who engaged in nonmedical use of prescription opioids were more likely to screen positive for substance abuse 12 months later than abstainers (McCabe et al., 2013), but another study of 14-17 year olds involved in the juvenile justice system did not find that NMPDU predicted greater engagement in various types of delinquency over the same period of time (Drazdowski et al., 2015). The extent to which early NMPDU initiation is a risk factor for academic and behavioral problems as adolescents transition into high school remains an important, yet largely unexplored question. In addition, beyond these outcomes, there has been no research examining whether NMPDU initiation is a risk factor for problems in other domains of functioning in high school, such as mental health and social functioning.

1.4 The present study

This is the first study to specifically focus on NMPDU initiation during middle school, identifying both correlates of initiation and high school outcomes associated with early initiation, addressing the critical need for longitudinal research in this area (Nargiso et al., 2015; Young et al., 2012). We followed a diverse cohort of middle school students over 4 years (6 waves of data) to address the following research questions: First, to what extent do time-varying individual factors (resistance self-efficacy, perceived popularity), family factors (family substance use, parental respect), and peer factors (offers, approval, and perceived prevalence of substance use) predict initiation of NMPDU during the middle school years? Second, does the strength of the association between these factors and NMPDU initiation change over time? Third, to what extent is NMPDU initiation during middle school associated with high school outcomes in four domains of functioning: mental health, social, academic, and delinquency?

2. Methods

2.1 Participants and procedures

Participants were part of the evaluation of CHOICE, a voluntary after-school substance use prevention program (see D'Amico et al., 2012a, 2012b for details). All 6th-8th grade students enrolled in 16 middle schools across three school districts in southern California were invited to participate. Schools were selected and matched to their nearest neighbor school based on the squared Euclidean distance measure, estimated using publicly available information on ethnic diversity, approximate size and standardized test scores. At wave 1, 8932 students enrolled in the study, and an additional 3982 students (e.g., those new to the school) were added to the cohort between Waves 2-4. Waves 1-5 involved in-school surveys during the evaluation (fall 2008, spring 2009, fall 2009, spring 2010, spring 2011), with follow-up rates ranging from 83% to 95%. Initiation models are based on 12,904 students with NMPDU data at any of these waves.

Youth transitioned from 16 middle schools to over 200 high schools nationally and internationally. The cohort was re-contacted and re-consented to complete an outside-of-school web-based survey (Wave 6) between May, 2013-April, 2014 when participants were in 9th-12th grades. Of the 4,366 youth who were eligible for Wave 6 (i.e., in 6th-7th grade at Wave 1, could be located, were re-consented), 2,653 (61%) of those completed the survey. Dropout was not associated with demographics or risk behaviors, such as alcohol and marijuana use. High school outcome models are based on 2,539 youth who completed Wave 6 and had usable data.

As shown in Table 1, the sample at baseline was 11.60 years old on average, 50.7% female, 54.1% Hispanic, 16.8% Asian or Pacific Islander, 15.3% non-Hispanic White, 10.4% Multiracial/Other, and 3.4% non-Hispanic Black. The percentage of students initiating NMPDU at each of Waves 1-5 ranged from 0.95% to 1.76%, with 6.62% of students initiating use at some point during middle school. A Certificate of Confidentiality was obtained, and all materials and procedures were approved by the school districts and the institution's review board.

2.2 Measures

2.2.1 Lifetime nonmedical use of prescription drugs—This was assessed with a single item: "During your life, how many times have you used or tried prescription medicines to get 'high,' like Ritalin, OxyContin, or Vicodin?" Responses options ranged from 0 times to 7 or more times. Students were classified as having initiated NMPDU by Wave 1 if they reported any lifetime use at Wave 1, and were classified as having initiated NMPDU at each of Waves 2-5 if they reported any lifetime use at that wave and no lifetime use at the previous wave.

2.2.2 Time-invariant background characteristics—The Wave 1 survey asked students about their age, race/ethnicity, gender, and mother's education. Students were classified as non-Hispanic White (reference group), non-Hispanic Black, Hispanic, Asian/Pacific Islander, or Multiracial/Other. Mother's education was rated from 1=*did not finish high school* to 4=*graduated from college*.

2.2.3 Individual time-varying covariates: resistance self-efficacy and perceived popularity—Resistance self-efficacy was assessed with separate items for marijuana, alcohol, and cigarettes asking students what they would do if they were offered substances in different situations (e.g., all your friends at a party are [using marijuana; alcohol; cigarettes]) and did not want to use (Ellickson et al., 2004). Items were rated from 1=*I would definitely use* to 4=*I would definitely not use* and averaged (α=.93 at Wave 1). Self-rated popularity was assessed with a 5-item scale based on a measure of social goals (Jarvinen and Nicholls, 1996; sample item: "When I'm with people my own age, everyone wants to be my friend"). Items were rated from 1=*strongly disagree* to 4=*strongly agree* and averaged (α=.89 at Wave 1).

2.2.4 Family time-varying covariates: substance use and parental respect—
Family substance use was assessed with four items asking whether they had an older sibling

who used marijuana and used alcohol sometimes (0=*no*, 1=*yes*; those without an older sibling were coded as 0) and how often the adult who is most important to them used marijuana and used alcohol (0=*never* to 3=*4-7 days per week*). This information was combined to create a three-level variable (0=*no substance use by important adult or sibling*, 1=*substance use by either important adult or sibling*, 2=*substance use by both important adult and sibling*). Parental respect was assessed with a 4-item scale developed by Unger et al. (2002) and updated by Soto et al. (2011). It asked about the importance of honoring, respecting, and caring for one's parent(s), as well as striving to be a good person. Items were rated from 1=*strongly disagree* to 4=*strongly agree* and averaged (α=92 at Wave 1).

2.2.5 Peer time-varying covariates: offers, approval, and perceived prevalence —Offers were assessed by asking how often in the past 30 days they had been offered alcohol, marijuana and cigarettes (1=*never* to 7=*20 or more times;* Ellickson et al., 2004). Each response was then dichotomized (0=*never,* 1=*1 or more times)* and the three items were averaged (α=79 at Wave 1). Approval was assessed by asking how their friends would feel if they found out the adolescent sometimes drank alcohol, used marijuana, and smoked cigarettes (1=*they would disapprove and stop being my friends*, 2=*they would disapprove but still be my friends*, 3=*they would approve/wouldn't care*; Ellickson et al., 2004) and responses to these three items were averaged (α=94 at Wave 1). Perceived prevalence of peer use was a continuous variable that asked students to think about a group of 100 students in their grade and estimate how many had smoked cigarettes at least once a month, drank alcohol at least once a month, or ever tried marijuana (WestEd, 2008). Responses were recorded on a scale from 1= *no students out of 100* to 11=*100 students out of 100* and these three ratings were averaged (α=90 at Wave 1).

2.2.6 High school functioning (Wave 6)—Mental health was assessed using the MHI-5, a subscale of the SF-36 (Ware and Sherborne, 1992; α=75). Five items rated mood in the past 30 days (1=*none of the time* to 6=*all of the time*). Items were reversed coded as applicable such that higher scores indicated better mental health functioning, summed, and then transformed to a possible range of 0 to 100. Social functioning was assessed with seven items from the PROMIS Peer Relationships Short Form item bank (DeWalt et al., 2013), which were rated on a 5-point scale (0=*never* to 4=*always*) and transformed to a t-score (α=92) such that higher scores indicated better social functioning. Sample items include: "I was able to count on my friends", "I felt accepted by other kids my age", and "Other kids wanted to talk to me." Academic functioning was based on three items: self-reported grades in past year (1=*mostly F's* to 8=*mostly A 's*), the highest level of school they plan to finish (1=*I may not finish high school* to 6=*I plan to go to graduate school or professional school*; D'Amico et al., 2008), and how much they agree with the statement "Getting good grades is important to you" (1=*strongly disagree* to 5=*strongly agree*; Ingels et al., 2011). The items were summed (α=0.57), with higher scores indicating stronger academic orientation. Finally, we examined five distinct delinquent behaviors: suspended from school in the past year, involved in fights in the past year, stolen from a store in the past year, damaged others' property on purpose in the past year, and used any illegal drug or pill to get high in the past 30 days (0=*no*, 1=*yes*).

2.3 Analytic approach

We used discrete time survival analysis to assess the predictors of initiating NMPDU across five time points. Time-invariant covariates (age at wave 1, gender, race/ethnicity, mother's education), assessed at the first wave (or at later waves if the data were not collected at wave 1), predict the overall risk of initiation such that the change in risk associated with a time-invariant covariate is assume to be constant over time (Watson, 2005). Time-varying covariates (all remaining variables), assessed at all five waves, predict initiation at each wave.

We controlled for age at Wave 1, gender, race/ethnicity, and mother's education. CHOICE focused on alcohol and marijuana use and did not focus on NMPDU. There were no intervention effects on marijuana use, and initial intervention effects on alcohol use were no longer significant after Wave 3 of the study; however, we controlled for CHOICE participation in the present analyses. We used full information maximum likelihood estimation, which provides unbiased and consistent parameter estimates in the presence of data that are missing at random or missing completely at random, to control for any attrition effects (Arbuckle, 1996).

To examine predictors of NMPDU initiation during middle school, we first conducted three types of tests for each of the time-varying covariates. In the first test, we assessed the effects of time-varying covariates separately for each of Waves 1-5. Second, we tested the interaction between time and the time-varying covariate. In the third test, we constrained the effects across time to change in a linear manner. This tested whether the effect of resistance self-efficacy, for example, changed over time in a consistent fashion. Next, we tested three multivariable block models, one for each domain of time-varying covariates: individual factors, family factors, and peer factors. Finally, we tested a full multivariable model that contained the time-invariant covariates as well as each of the three domains of time-varying covariates.

To examine high school outcomes associated with NMPDU initiation during middle school, we conducted multivariable regression models focused on mental health, social, academic, and delinquency. Similar to the discrete time survival models we controlled for age at Wave 1, gender, race/ethnicity, mother's education and school. Additionally we controlled for the time-varying covariates used in the discrete time survival models from the most recent wave in which they were measured for the respondent.

3. Results

3.1 Psychosocial predictors of initiation during middle school

Results from both the separate block models and the full multivariable model are shown in Table 2. In terms of the time-varying covariates, lower resistance self-efficacy, greater exposure to family substance use, lower parental respect, and more substance use offers from peers were significant risk factors for NMPDU initiation. In addition, perceiving that more of one's peers engaged in substance use at Wave 1 was associated with NMPDU initiation in the full model; this differed somewhat from the block model, which found that perceived prevalence of use was consistently associated with NMPDU initiation across

waves. In the case of demographic characteristics, the full model showed that the likelihood of NMPDU initiation was significantly higher among students who reported greater maternal education, opposite of what was found in the block model and thus indicating a suppressor effect. In addition, race/ethnicity was a significant risk factor for initiation in the full model only, with the Hispanic, Asian and Multiracial/Other groups (but not non-Hispanic Blacks) having a higher odds of initiation compared to the non-Hispanic White group. Neither age nor gender was significantly associated with NMPDU initiation in the full model, consistent with results from the block model

3.2 NMPDU initiation during middle school as a predictor of high school outcomes

We examined four domains of functioning in high school. Table 3 shows results from multivariable regression models examining the association of NMPDU initiation during middle school with mental health, social, and academic functioning, and Table 4 shows results for delinquent behaviors. Students who initiated NMPDU during middle school reported significantly lower social functioning in high school compared to NMPDU non-initiates. For delinquency, students who initiated NMPDU during middle school were nearly twice as likely as non-initiates to have been involved in a fight in the past year, and three times as likely to have been suspended during this period. However, those who had initiated NMPDU during middle school were not significantly more likely to report stealing, property damage, or illicit drug use in high school (Table 4). There were no significant differences for mental health or academic functioning.

4. Discussion

There has been little longitudinal research to date on NMPDU among middle school students, yet our results suggest that a greater focus on these younger adolescents is warranted. In our sample of nearly 13,000 students from 16 middle schools in Southern California, 1 in every 15 students reported at some point between 6th- 8th grade that they had used or tried prescription medicines such as Ritalin, OxyContin, or Vicodin to get 'high.' Although national data indicate some decline in NMPDU among young people in recent years (Miech et al., 2015), rates of misuse of these drugs remains a significant public health concern. It is important to identify risk factors for early initiation to inform prevention programs to continue this downward trend, as well as to better understand the potential adverse consequences of early initiation as these adolescents transition to high school.

Our findings indicate the important role of family in the initiation of NMPDU during middle school. Initiation was less likely among adolescents who reported higher parental respect, a pattern similar to other research focusing on the initiation of alcohol and inhalant use (Ober et al., 2013; Shih et al., 2012; Soto et al., 2011; Unger et al., 2002). This may be due to these adolescents being more concerned about their parents' negative reaction if they found out or having a stronger inclination to follow their parents' rules about substance use. Adolescents were more likely to initiate NMPDU, however, if an older sibling or the adult most important to them was using alcohol or marijuana. Family use of these substances may create an atmosphere of perceived tolerance in the home that not only increases the adolescent's inclination to experiment with that same substance (Komro et al., 2007; White et al., 2000), but with other types of drugs as well. These adolescents may also have greater

access to prescription drugs in the home. Adults who drink and use illicit drugs are more likely to engage in prescription drug misuse (McCabe et al., 2006; Sweeney et al., 2013), and there is some evidence from a study of pain medication that family members may be a key source of prescription drugs for adolescents who misuse them (Boyd et al., 2006). Thus, it is crucial to address family issues in efforts to curb NMPDU initiation.

In addition to family influences, results from this study suggest that middle school students who receive more alcohol and marijuana offers from peers, and perceive that more of their peers use these substances, are at higher risk for NMPDU initiation. These adolescents may be embedded in higher risk peer networks that afford them access to other types of substances, including prescription drugs. At the same time, low resistance self-efficacy makes adolescents vulnerable to NMPDU offers, as it does for other types of substances (Hiemstra et al., 2012; Ober et al., 2013). It is interesting to note that perceived prevalence of substance use was associated with initiation only at the first wave of data collection, similar to results from the same data set on the initiation of inhalant use (Ober et al., 2013), suggesting that peer influence may wane as adolescents get older. Perceived popularity and peer approval of substance use, despite their relevance to other forms of substance use, were not found to be robust risk factors for NMPDU initiation. Together, these findings suggest that NMPDU prevention programs for middle school students should include a strong focus on peers, both in terms of deterring the sharing of prescription drugs within peer groups and providing normative feedback on peer substance use to address the overestimation of peer use that is often found among adolescents (Page et al., 2002). At the same time, it is important to help adolescents develop the skills and confidence they need to resist these offers when they occur.

We also found that initiating NMPDU during middle school was associated with an increased risk for problems in certain areas of functioning as adolescents transitioned to high school. Initiation was associated with an increased likelihood of future problems related to fighting and school suspension, but not stealing, property damage, or illicit drug use. Thus, early NMPDU initiation may be primarily a risk factor for interpersonal problems during high school. This is consistent with our finding that NMPDU initiation during middle school is associated with poorer social functioning, such as feeling a lack of peer support or acceptance, but not necessarily with poorer mental health or a weaker academic orientation in high school. Impulsivity (Milner et al., 2014) and risk taking (Schepis and Krishnan-Sarin, 2008) have been associated with NMPDU among adolescents, and perhaps are particular concerns for students who initiate NMPDU during middle school. Further, nonmedical use of certain prescription drugs such as stimulants may increase adolescents' impulsive behaviors. If so, these may be important contributing factors to the interpersonal problems experienced by these students as they transition to high school.

Some limitations should be noted. First, results are based on a majority Hispanic sample from southern California and thus may not generalize to adolescents in other geographic areas or with different sociodemographic profiles. Second, the single-item NMPDU measure is limited in several respects and future work is needed to assess its validity. It could not distinguish between medical misuse and non-medical use of prescription drugs, nor between different prescription drug classes. There was potential for underreporting use if youth only

considered the few prescription drugs included as examples (none of which were benzodiazepines) or were misusing prescription drugs for reasons other than "to get high". In addition, we did not measure the quantity of use and thus cannot draw conclusions about the correlates of heavier use; it may be that the risk factors and outcomes that were not found to be significantly associated with NMPDU initiation in this study, such as illicit drug use in high school, are related to the quantity of NMPDU during middle school. Third, a clear picture of how NMPDU initiation may differ by maternal education and race/ethnicity did not emerge from this study, with some inconsistent results across the block and full models; as such, these results should be interpreted with caution.

To date, a few interventions for middle school students have been evaluated for their effects in deterring NMPDU. Programs that help parents of middle school students reduce the availability of prescription drugs in the home have shown promise (Collins et al., 2012), as has a computer-based program developed for young girls and their mothers (Schinke et al., 2009). In addition, there is some evidence that universal preventive interventions conducted during middle school students can have a long-term effect on NMPDU during later adolescence and young adulthood (Spoth et al., 2013). Results from this study identify a number of important risk and protective factors that should be targeted in future prevention efforts for this age group, as well as highlight the importance of this work for preventing early NMPDU initiation and associated problems in functioning during the high school years.

Acknowledgments

References

Allen JP, Porter MR, McFarland FC, Marsh P, McElhaney KB. The two faces of adolescents' success with peers: adolescent popularity, social adaptation, and deviant behavior. Child Dev. 2005; 76:747–760. [PubMed: 15892790]

Arbuckle, J. Full information estimation in the presence of incomplete data. In: Marcoulides, GA.; Schumacker, RE., editors. Advanced Structural Equation Modeling: Issues And Techniques. Erlbaum; Mahwah, NJ: 1996.

Boyd CJ, Esteban S, Teter CJ. Medical and nonmedical use of prescription pain medication by youth in a Detroit-area public school district. Drug Alcohol Depend. 2006; 81:37–45. [PubMed: 16040201]

Boyd CJ, Young A, Grey M, McCabe SE. Adolescents' nonmedical use of prescription medications and other problem behaviors. J Adolesc Health. 2009; 45:543–550. [PubMed: 19931825]

Centers for Disease Control and Prevention. [Accessed on August 5, 2015] Youth Risk Behavior Survey. 2015. Available at: www.cdc.gov/yrbs(http://www.cdc.gov/healthyyouth/data/yrbs/index.htm)

Chan GCK, Kelly AB, Toumbourou JW, Hemphill SA, Young RM, Haynes MA, Catalano RF. Predicting steep escalations in alcohol use over the teenage years: age-related variations in key social influences. Addiction. 2013; 108:1924–1932. [PubMed: 23834266]

Collins DA, Johnson KW, Shamblen SR. Examining a home environmental strategy to reduce availability of legal products that can be misused by youth. Subst Use Misuse. 2012; 47:1339–1348. [PubMed: 22943304]

D'Amico EJ, Green HD Jr, Miles JNV, Zhou A, Tucker JS, Shih RA. Voluntary after school alcohol and drug programs: if you build it *right*, they will come. J Res Adolesc. 2012; 22:571–582. [PubMed: 23264722]

D'Amico EJ, McCarthy DM. Escalation and initiation of younger adolescents' substance use: the impact of perceived peer use. J Adolesc Health. 2006; 39:481–487. [PubMed: 16982381]

D'Amico EJ, Miles JNV, Stern SA, Meredith LS. Brief motivational interviewing for teens at risk of substance use consequences: a randomized pilot study in a primary care clinic. J Subst Abuse Treat. 2008; 35:53–61. [PubMed: 18037603]

D'Amico EJ, Tucker JS, Miles JN, Zhou AJ, Shih RA, Green HD Jr. Preventing alcohol use with a voluntary after-school program for middle school students: results from a cluster randomized controlled trial of CHOICE. Prev Sci. 2012; 13:415–425. [PubMed: 22311178]

DeWalt DA, Thissen D, Stucky BD, et al. PROMIS pediatric peer relationships scale: development of a peer relationships item bank as part of social health measurement. Health Psychol. 2013; 32:1093–1103. [PubMed: 23772887]

Drazdowski TK, Jäggi L, Borre A, Kliewer WL. Use of prescription drugs and future delinquency among adolescent offenders. J Subst Abuse Treat. 2015; 48:28–36. [PubMed: 25135798]

Ellickson PL, Tucker JS, Klein DJ, Saner H. Antecedents and outcomes of marijuana use initiation during adolescence. Prev Med. 2004; 39:976–984. [PubMed: 15475032]

Ford JA. Social learning theory and nonmedical prescription drug use among adolescents. Sociol Spectrum. 2008a; 28:299–316.

Ford JA. Nonmedical prescription drug use and delinquency: an analysis with a national sample. J Drug Issues. 2008b; 38:493–516.

Ford JA. Nonmedical prescription drug use among adolescents: the influence of bonds to family and school. Youth Soc. 2009; 40:336–352.

Ford JA, Hill TD. Religiosity and adolescent substance use: evidence from the National Survey on Drug Use and Health. Subst Use Misuse. 2012; 47:787–798. [PubMed: 22443107]

Ford JA, McCutcheon J. The misuse of Ambien among adolescents: prevalence and correlates in a national sample. Addict Behav. 2012; 37:1389–1394. [PubMed: 22795592]

Ford JA, Watkins WC. Adolescent nonmedical prescription drug use. Prev Res. 2012; 19:3–6.

Havens JR, Young AM, Havens CE. Nonmedical prescription drug use in a nationally representative sample of adolescents: Evidence of greater use among rural adolescents. Arch Pediatr Adolesc Med. 2011; 165:250–255. [PubMed: 21041587]

Hiemstra M, Otten R, Engels RCME. Smoking onset and the time-varying effects of self-efficacy, environmental smoking, and smoking-specific parenting by using discrete-time survival analysis. J Behav Med. 2012; 35:240–251. [PubMed: 21643802]

Ingels, SJ.; Pratt, DJ.; Herget, DR.; Burns, LJ.; Dever, JA.; Ottem, R.; Rogers, JE.; Jin, Y.; Leinwand, S. Base-Year Data File Documentation (NCES 2011-328). U.S. Department of Education. National Center for Education Statistics; Washington, DC: 2011. High School Longitudinal Study of 2009 (HSLS:09). Retrieved May 27, 2015 from http://nces.ed.gov/pubsearch

Jarvinen DW, Nicholls JG. Adolescent's social goals, beliefs about the causes of socio success, and satisfaction in peer relations. Dev Psychol. 1996; 32:435–441.

Komro KA, Maldonado-Molina MM, Tobler AL, Bonds JR, Muller KE. Effects of home access and availability of alcohol on young adolescents' alcohol use. Addiction. 2007; 102:1597–1608. [PubMed: 17854336]

McCabe SE. Misperceptions of nonmedical prescription drug use: a web survey of college students. Addict Behav. 2008; 33:713–724. [PubMed: 18242002]

McCabe SE, Boyd CJ, Young A. Medical and nonmedical use of prescription drugs among secondary school students. J Adolesc Health. 2007; 40:76–83. [PubMed: 17185209]

McCabe SE, Cranford JA, Boyd CJ. The relationship between past-year drinking behaviors and nonmedical use of prescription drugs: prevalence of co-occurrence in a national sample. Drug Alcohol Depend. 2006; 84:281–288. [PubMed: 16621337]

McCabe SE, Teter CJ, Boyd CJ. The use, misuse and diversion of prescription stimulants among middle and high school students. Subst Use Misuse. 2004; 39:1095–1116. [PubMed: 15387205]

McCabe SE, West BT, Boyd CJ. Medical use, medical misuse, and nonmedical use of prescription opioids: results from a longitudinal study. Pain. 2013; 154:708–713. [PubMed: 23433943]

McHugh RK, Nielsen S, Weiss RD. Prescription drug abuse: from epidemiology to public policy. J Subst Abuse Treat. 2015; 48:1–7. [PubMed: 25239857]

Miech, RA.; Johnston, LD.; O'Malley, PM.; Bachman, JG.; Schulenberg, JE. Monitoring The Future National Survey Results On Drug Use, 1975–2014: Volume I, Secondary School Students. Institute for Social Research, The University of Michigan; Ann Arbor: 2015. Available at http://monitoringthefuture.org/pubs.html#monographs

Milner LA, Ham LS, Zambuanga BL. Adolescents misusing prescription drugs: who's the riskiest users of them all? J Subst Use. 2014; 19:68–74.

Nargiso JE, Ballard EL, Skeer MR. A systematic review of risk and protective factors associated with nonmedical use of prescription drugs among youth in the United States: a social ecological perspective. J Stud Alcohol. 2015; 76:5–20.

Ober AJ, Miles JNV, Ewing B, Tucker JS, D'Amico EJ. Risk for inhalant initiation among middle school students: understanding individual, family, and peer risk and protective factors. J Stud Alcohol. 2013; 74:835–840.

Page RM, Hammermeister J, Roland M. Are high school students accurate or clueless in estimating substance abuse among peers? Adolescence. 2002; 37:567–574. [PubMed: 12458693]

Sanders A, Stogner J, Seibert J, Miller BL. Misperceptions of peer pill-popping: the prevalence, correlates, and effects of inaccurate assumptions about peer pharmaceutical misuse. Subst Use Misuse. 2014; 49:813–823. [PubMed: 24502373]

Schepis TS, Krishnan-Sarin S. Characterizing adolescent prescription misusers: a population-based study. J Am Acad Child Psychol. 2008; 47:745–754.

Schepis TS, Krishnan-Sarin S. Sources of prescriptions for misuse by adolescents: differences in sex, ethnicity, and severity of misuse in a population-based sample. J Am Acad Child Psychol. 2009; 48:828–836.

Schinke SP, Fang L, Cole KC. Preventing substance use among adolescent girls: 1-year outcomes of a computerized, mother-daughter program. Addict Behav. 2009; 34:1060–1064. [PubMed: 19632053]

Shih RA, Miles JNV, Tucker JS, Zhou AJ, D'Amico EJ. Racial/ethnic differences in the influence of cultural values, alcohol resistance self-efficacy, and alcohol expectancies on risk for alcohol initiation. Psychol Addict Behav. 2012; 26:460–470. [PubMed: 22867294]

Siegel JT, Tan CN, Navarro MA, Alvaro EM, Crano WD. The power of the proposition: frequency of marijuana offers, parental knowledge, and adolescent marijuana use. Drug Alcohol Depend. 2015; 148:34–39. [PubMed: 25620730]

Soto C, Unger JB, Ritt-Olson A, Soto DW, Black DS, Baezconde-Garbanati L. Cultural values associated with substance use among Hispanic adolescents in southern California. Subst Use Misuse. 2011; 46:1223–1233. [PubMed: 21491991]

Spoth R, Trudeau L, Shin C, Ralston E, Redmond C, Greenberg M, Feinberg M. Longitudinal effects of universal preventive intervention on prescription drug misuse: three randomized controlled trials with late adolescents and young adults. Am J Public Health. 2013; 103:665–672. [PubMed: 23409883]

Sweeney CT, Sembower MA, Ertischek MD, Shiffman S, Schnoll SH. Nonmedical use of prescription ADHD stimulants and preexisting patterns of drug abuse. J Addict Dis. 2013; 32:1–10. [PubMed: 23480243]

Tucker JS, Miles JNV, D'Amico EJ, Zhou A, Green HD Jr, Shih RA. Temporal associations of popularity with alcohol use among middle school students. J Adolesc Health. 2013; 52:108–115. [PubMed: 23260843]

Unger JB, Ritt-Olson A, Teran L, Huang T, Hoffman BR, Palmer P. Cultural values and substance use in a multiethnic sample of California adolescents. Addict Res Theory. 2002; 10:257–279.

Ware JE Jr, Sherbourne CD. The MOS 36-Item Short-Form Health Survey (SF-36): I. Conceptual framework and item selection. Med Care. 1992; 30:473–483. [PubMed: 1593914]

Watson, P. Survival analysis. In: Miles, J.; Gilber, P., editors. A Handbook Of Research Methods For Clinical And Health Psychology. Oxford University Press; Oxford; 2005.

WestEd. California Healthy Kids Survey. 2008. Available at: www.wested.org/hks

White HR, Johnson V, Buyske S. Parental modeling and parenting behavior effects on offspring alcohol and cigarette use: a growth curve analysis. J Subst Abuse. 2000; 12:287–310. [PubMed: 11367605]

Wu L, Swartz MS, Brady KT, Hoyle RH. NIDA AAPI Workgroup. Perceived cannabis use norms and cannabis use among adolescents in the United States. J Psychiatr Res. 2015; 64:79–87. [PubMed: 25795093]

Young AM, Glover N, Havens JR. Nonmedical use of prescription medications among adolescents in the United States: a systematic review. J Adolesc Health. 2012; 51:6–17. [PubMed: 22727071]

Highlights

- 6.6% of youth initiated nonmedical prescription drug use (NMPDU) in middle school.

- Early NMPDU initiation was predicted by individual, family and peer factors.

- NMPDU use in middle school was a risk factor for poorer outcomes in high school.

Table 1

Descriptive Statistics for Study Variables

Variable	Wave 1 Mean/%	(SD)	Wave 2 Mean/%	(SD)	Wave 3 Mean/%	(SD)	Wave 4 Mean/%	(SD)	Wave 5 Mean/%	(SD)
NMPDU initiation	1.40		1.76		0.95		1.05		1.46	
Time invariant covariates										
Age	11.60	(1.23)								
Race										
Hispanic	54.12									
Asian	16.80									
White	15.30									
Multiracial/Other	10.39									
Black	3.39									
Female	50.74									
Mother's education										
<HS	17.65									
HS	20.77									
Some College	13.65									
College	47.93									
Individual time-varying covariates										
Resistance self-efficacy	3.70	(0.59)	3.63	(0.65)	3.74	(0.58)	3.68	(0.63)	3.64	(0.65)
Perceived popularity	2.23	(0.84)	2.25	(0.85)	2.21	(0.88)	2.30	(0.86)	2.31	(0.86)
Family time-variant covariates										
Substance use	0.25	(0.49)	0.30	(0.53)	0.20	(0.45)	0.25	(0.49)	0.26	(0.50)
Respect	3.80	(0.54)	3.74	(0.59)	3.78	(0.60)	3.74	(0.62)	3.74	(0.61)
Peer time-variant covariates										
Offers	0.12	(0.27)	0.16	(0.31)	0.09	(0.24)	0.13	(0.28)	0.14	(0.30)
Approval	1.70	(0.70)	1.80	(0.70)	1.68	(0.71)	1.74	(0.72)	1.81	(0.72)
Perceived prevalence	1.75	(1.43)	2.26	(1.87)	1.64	(1.34)	2.06	(1.73)	2.11	(1.77)

Table 2

Block and Full Discrete Time Hazards Models Predicting NMPDU Initiation

Variable	Block models OR	(95% CI)	Full model OR	(95% CI)
Time invariant covariates				
Age	1.04	(0.94, 1.95)	1.01	(0.97, 1.05)
Race (reference = White)				
Hispanic	1.17	(0.86, 1.57)	**1.40**	**(1.04, 1.89)**
Asian	0.69	(0.46, 1.02)	**1.56**	**(1.05, 2.31)**
Multiracial/Other	1.35	(0.94, 1.95)	**2.75**	**(1.90, 3.97)**
Black	0.52	(0.24, 1.12)	0.84	(0.42, 1.67)
Female	1.20	(0.98, 1.47)	1.15	(0.94, 1.41)
Mother's education	**0.90**	**(0.82, 0.995)**	**1.12**	**(1.02, 1.23)**
Individual time-variant covariates				
Resistance self-efficacy	**0.23**	**(0.20, 0.25)**	**0.33**	**(0.28, 0.38)**
Perceived popularity	**1.54**	**(1.37, 1.72)**	1.04	(0.90, 1.21)
Family time-variant covariates				
Substance use	**3.51**	**(3.03, 4.07)**	**1.52**	**(1.26, 1.84)**
Respect	**0.47**	**(0.41, 0.52)**	**0.60**	**(0.51, 0.71)**
Peer time-variant covariates				
Offers	**23.60**	**(18.23, 30.39)**	**5.65**	**(3.90, 8.18)**
Approval	**3.17**	**(2.71, 3.72)**	1.10	(0.89, 1.36)
Perceived prevalence				
W1	**1.54**	**(1.42, 1.67)**	**1.12**	**(1.01, 1.25)**
W2	**1.41**	**(1.30, 1.52)**	1.06	(0.96, 1.17)
W3	**1.44**	**(1.31, 1.58)**	1.01	(0.89, 1.16)
W4	**1.43**	**(1.30, 1.57)**	1.02	(0.91, 1.15)
W5	**1.29**	**(1.19, 1.40)**	0.97	(0.86, 1.11)

Note. Boldface indicates statistical significance at $p < .05$.

Table 3

Multivariable regression models predicting high school mental, social and academic functioning from middle school NMPDU initiation, controlling for middle school individual, peer and family factors

Variable	Mental Health		Social		Academic	
	b	*(95% CI)*	*b*	*(95% CI)*	*b*	*(95% CI)*
NMPDU initiation	-2.60	(-6.51, 1.31)	**-2.54**	(-3.98, -1.09)	0.03	(-0.43, 0.49)
Age	0.81	(-0.28, 1.90)	-0.22	(-0.62, 0.18)	-0.05	(-.18, 0.08)
Race (ref = white)						
Hispanic	-0.71	(-3.11, 1.69)	-0.30	(-1.18, 0.59)	**-0.63**	(-0.91, -0.34)
Asian	**-4.13**	(-6.65, -1.61)	-0.71	(-1.64, 0.22)	0.15	(-0.14, 0.45)
Multiracial/Other	-2.79	(-5.64, 0.07)	-0.53	(-1.58, 0.52)	**-0.37**	(-0.70, -0.03)
Black	-1.28	(-6.63, 4.08)	-0.56	(-2.54, 1.42)	**-1.38**	(-2.01, -0.75)
Female	**-3.88**	(-5.51, -2.24)	**1.25**	(0.65, 1.86)	**0.88**	(0.69, 1.08)
Mother's education	0.31	(-0.52, 1.14)	0.20	(-0.10, 0.51)	**0.28**	(0.19, 0.38)
Substance use RSE	0.04	(-1.32, 1.40)	0.07	(-0.43, 0.57)	**0.31**	(0.15, 0.47)
Perceived popularity	**1.98**	(1.02, 2.94)	**1.19**	(0.84, 1.54)	**0.23**	(0.11, 0.34)
Family substance use	-0.47	(-2.10, 1.17)	-0.32	(-0.92, 0.29)	-0.08	(-0.27, 0.11)
Parental respect	**3.13**	(1.74, 4.53)	**1.18**	(0.67, 1.70)	**0.57**	(0.41, 0.73)
Peer offers	**-3.44**	(-6.22, -0.65)	0.72	(-0.31, 1.75)	-0.24	(-0.56, 0.09)
Peer approval	-0.86	(-2.17, 0.45)	-0.05	(-0.53, 0.44)	**-0.16**	(-0.31, 0.00)
Peer prevalence	-0.15	(-0.56, 0.26)	0.05	(-0.10, 0.20)	**0.07**	(0.02, 0.11)

Note. Boldface indicates statistical significance at $p < .05$. RSE = resistance self-efficacy

Table 4

Multivariable regression models predicting high school delinquent behaviors from middle school NMPDU initiation, controlling for middle school individual, peer and family factors

Variable	Suspended		Fights		Stealing		Property damage		Any illicit drug use	
	AOR	(95% CI)	AOR	(95% CI)	AOR	(95% CI)	AOR	(95% CI)	AOR	(95% CI)
NMPDU initiation	**3.15**	**(1.65, 5.99)**	**1.72**	**(1.01, 2.92)**	0.88	(0.49, 1.60)	1.56	(0.85, 2.84)	1.25	(0.74, 2.13)
Age	0.96	(0.72, 1.27)	0.86	(0.70, 1.05)	1.02	(0.83, 1.24)	1.02	(0.81, 1.28)	1.16	(0.96, 1.41)
Race (ref = white)										
Hispanic	1.14	(0.61, 2.11)	1.29	(0.86, 1.94)	0.71	(0.47, 1.08)	0.94	(0.60, 1.49)	0.87	(0.59, 1.29)
Asian	0.54	(0.23, 1.29)	0.61	(0.37, 1.01)	0.80	(0.49, 1.30)	0.85	(0.50, 1.44)	**0.51**	**(0.31, 0.85)**
Multiracial/Other	0.97	(0.45, 2.12)	1.22	(0.75, 1.97)	0.86	(0.52, 1.43)	1.36	(0.81, 2.28)	0.91	(0.57, 1.44)
Black	2.87	(0.98, 8.43)	1.93	(0.83, 4.51)	1.31	(0.55, 3.15)	1.09	(0.37, 3.26)	1.21	(0.52, 2.83)
Female	**0.43**	**(0.28, 0.67)**	**0.51**	**(0.37, 0.68)**	0.76	(0.56, 1.02)	**0.45**	**(0.32, 0.63)**	0.78	(0.58, 1.05)
Mother's education	**0.74**	**(0.60, 0.91)**	1.04	(0.90, 1.21)	0.90	(0.78, 1.04)	0.97	(0.82, 1.15)	1.10	(0.95, 1.27)
Substance use RSE	**0.65**	**(0.49, 0.86)**	**0.79**	**(0.64, 0.97)**	**0.65**	**(0.53, 0.79)**	0.81	(0.64, 1.02)	**0.63**	**(0.52, 0.76)**
Perceived popularity	1.01	(0.78, 1.30)	1.09	(0.92, 1.29)	1.00	(0.84, 1.19)	**0.80**	**(0.65, 0.97)**	1.02	(0.86, 1.20)
Family substance use	1.06	(0.71, 1.58)	1.10	(0.84, 1.44)	**1.55**	**(1.20, 2.00)**	1.49	(1.12, 1.99)	**1.30**	**(1.01, 1.66)**
Parental respect	0.84	(0.63, 1.12)	0.83	(0.67, 1.03)	**0.77**	**(0.62, 0.95)**	**0.78**	**(0.62, 0.97)**	0.93	(0.75, 1.15)
Peer offers	1.82	(0.96, 3.43)	**3.10**	**(2.02, 4.75)**	**2.04**	**(1.31, 3.15)**	1.59	(0.96, 2.64)	**3.10**	**(2.10, 4.59)**
Peer approval	0.96	(0.68, 1.36)	1.24	(0.98, 1.57)	1.02	(0.80, 1.31)	1.22	(0.93, 1.59)	**1.67**	**(1.32, 2.13)**
Peer prevalence	1.00	(0.91, 1.11)	1.01	(0.94, 1.08)	1.01	(0.95, 1.09)	1.04	(0.96, 1.12)	**1.07**	**(1.01, 1.14)**

Note. Boldface indicates statistical significance at $p < .05$. RSE = resistance self-efficacy. Each model controls for all of the middle school variables shown in this table.