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Is Nonmedical Prescription Opiate Use a Unique Form of Illicit Drug Use?

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Abstract

Nonmedical prescription opiate (NMPO) use is of great concern because of its high addiction potential, cognitive impairment effects, and other adverse consequences (e.g., hormonal and immune system effects, hyperalgesia and overdose). Due to the combination of drugs used by those who are NMPO users, it is difficult to isolate the negative effects of NMPO use from the effects of other legal and illicit drugs. Based on a stage model of substance use, this study tested whether NMPO use represents a unique form of illicit drug use among emerging adults and whether there are unique consequences of early NMPO use. We used longitudinal data from 912 emerging adults from the Raising Healthy Children study who were interviewed at least annually from the first or second grade through age 21. The findings indicated that almost all NMPO users have also used marijuana and a large majority has also used other drugs, such as cocaine and ecstasy. In addition, more frequent users of NMPOs are also more frequent users of other drugs. Except for violent behavior, NMPO use explained little unique variance in negative outcomes of use (e.g., drug use disorder, mood disorder, nonproductive behavior, poor health, and property crime) beyond that explained by other illicit drug use. Future studies examining the predictors or consequences of NMPO use and nonmedical use of other prescription drugs need to consider use within the context of other drug use.

Keywords

opiates; nonprescription drugs; nonmedical use; adolescents; emerging adults

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Contributors Catalano is PI on the NIDA grant which supported the collection of the data and he designed the original study. Haggerty ran the study including overseeing all data collection and data management. The paper was originally conceptualized by all four authors. Fleming conducted the analyses. White and Fleming did most of the writing. Catalano and Haggerty did most of the editing. All authors have approved the final manuscript.

Conflict of Interest

Richard F. Catalano is on the board of the Channing Bete Company, distributor of *Guiding Good Choices* ® and *Supporting School Success* ®. These programs were tested in the intervention described in this paper. None of the others authors have a competing interest to declare and no sponsors have read the manuscript prior to submission.

1. Introduction

In recent years there has been a large increase in prescriptions for pain medications in the United States. Between 1997 and 2006, sales of opioid analgesics (e.g., methadone, oxycodone, fentanyl base, hydromorphone, hydrocodone, morphine, meperidine, and codeine) increased by 347% and currently hydrocodone is the number one prescribed drug in the United States (Manchikanti & Singh, 2008). Coupled with this increase in prescription use of opiates, there has been a significant increase in nonmedical prescription opiate (NMPO) use, especially among adolescents and young adults (Johnston, O'Malley, Bachman, & Schulenberg, 2008a, 2008b; Manchikanti & Singh, 2008). In fact, among college students and young adults in the United States, NMPO use is the most common type of illicit drug use after marijuana use (McCabe, Teter, Boyd, Knight, & Wechsler, 2005b). The increase in NMPO use has been observed outside the United States as well (Haydon, Monga, Rehm, Adlaf, & Fischer, 2005). Nevertheless, Americans are currently consuming about 80% of the global opiate supply and 99% of the global hydrocodone supply (Manchikanti & Singh, 2008).

Use of opiates is of great concern due to their high addiction potential, cognitive impairment effects, and other adverse consequences (e.g., hormonal and immune system effects, hyperalgesia, and overdose) (Compton & Volkow, 2006; Gruber, Silveri, & Yurgelun-Todd, 2007; Haydon et al., 2005; Manchikanti & Singh, 2008). Nonmedical users of prescription opiates are also more likely to drink alcohol and use other drugs (Boyd, McCabe, & Teter, 2006; McCabe, Cranford, & Boyd, 2006; Sees, Di Marino, Ruediger, Sweeney, & Shiffman, 2005). Due to the combination of drugs used by those who are nonmedical opiate drug users, it is difficult to isolate the negative effects of NMPO use from the effects of other legal and illicit drugs. Nevertheless, researchers often ascribe consequences of NMPO use to opiates rather than to the combination of drugs used. In other words, researchers have failed to demonstrate whether NMPO use among youth represents a unique pattern of addictive drug use or whether it represents the newest illicit drug to join the variety of other drugs that are used by those whose drug use has gone beyond alcohol, cigarettes, and marijuana. The purpose of this study is to determine whether NMPO use represents a unique form of illicit drug use among emerging adults and whether unique consequences of early NMPO use might be discerned.

1.1. Previous Research on NMPO Use Among Adolescents and Emerging Adults

Most of the previous studies on predictors and consequences of NMPO use have been cross sectional (e.g., Boyd et al., 2006; McCabe et al., 2005b). For example, Boyd et al. (2006) administered a web survey to 5th- to 10th-grade students and found that 16% had ever used NMPOs and 11% used them in the last year. They divided the users of prescription opiates into those who were prescription users only, nonprescription users only, and mixed users. Nonprescription-only users, compared to nonusers, were 7 times more likely to smoke cigarettes, 5 times more likely to drink alcohol and smoke marijuana, almost 4 times more likely to binge drink, and 8 times more likely to have used other illicit drugs (p. 41). Thus, among adolescents, NMPO users are multiple substance users.

In a 2001 cross-sectional, national mailed survey of college students, McCabe and colleagues (2005b) found that 12% of the students had ever used NMPOs, 7% had used in the last year, and 3% in the last month. Compared to nonusers of NMPOs, NMPO users were 4 times more likely to frequently binge drink in past 30 days, almost 5 times more likely to smoke cigarettes in the past 30 days, 8 times more likely to use marijuana in the past year, and over 13 times more likely to report cocaine use in the past year. NMPO users were also more likely to engage in other risky behaviors such as driving after drinking. Multivariate analyses indicated that use was higher among college students who were White, residents of fraternity/sorority houses and off-campus houses, had lower grade point averages (GPAs), and attended more competitive

colleges (p. 796). Because the researchers did not control for other drug use in their multivariate analyses, it is not clear whether the risk factors were unique to NMPO use or simply risk factors for substance use in general. In fact, the risk factors identified in this study are similar to those for binge drinking and marijuana use found in other studies (e.g., Bell, Wechsler, & Johnston, 1997; Cashin, Presley, & Meilman, 1998; Wechsler, Lee, Kuo, & Lee, 2000).

McCabe and colleagues (2005b) found no difference in NMPO use between students who were older than 24 years compared to 24 years and younger. They suggested that students may not mature out of NMPO use in the same manner that they mature out of other drugs, and that NMPO use, perhaps due to its addictive potential, may have unique consequences compared to other drugs that usually show some drop-off after age 24.

McCabe, Teter, and Boyd (2005a) administered a web survey to students at one Midwestern university. They found that men compared to women were only slightly more likely to report lifetime (17% vs. 16%, respectively) and past-year (10% vs. 9%, respectively) NMPO use. In the multivariate analyses, NMPO use was more likely among students who lived off campus, reported lower GPAs, and were prescribed pain medication previously (especially at a young age). GPA and living off campus have been associated with illicit drug use and heavier drinking in many previous studies (e.g., Baer, 2002; Harford, Wechsler, & Muthen, 2002) and thus may not be unique risk factors for NMPO use. However, given that few studies have examined the effects of prescription drug use on later illicit drug use, prescription drug use may be a unique predictor of NMPO use. McCabe et al. (2005a) found that rates of other illicit drug use depended on sources of prescription drugs. Those who used illicit opiates but got their prescription drugs from family members were not more likely to engage in other drug use, but those who got their prescription drugs from friends were.

In a follow-up analysis of these same data, McCabe, Boyd, and Teter (2009) identified several subtypes of users based on their motivations for use, route of administration, and use of opiates in conjunction with alcohol. Among NMPO users, 42% were classified as self-treaters (used only for pain relief), 24% as recreational users only, and 34% as mixed. The researchers found that recreational and mixed users were more likely to screen for alcohol and drug abuse, use illicit drugs, and binge drink compared to self-treaters. Opiate self-treaters did not differ from nonusers in terms of other substance use or abuse. On the other hand, self-treaters of other types of prescription drug use (e.g., sleeping, sedative/anxiety, and stimulant medications) reported higher rates of alcohol and drug use and abuse than nonusers of these prescription drugs, suggesting that for these classes of prescription drugs, self-treatment may indicate a different motivation than opiate self-treatment, which is generally used for pain relief. The overlap among opiate recreational drug use and recreational use of other prescription drugs was modest. For example, among recreational NMPO users, 22% had also used sedatives and anxiety drugs for recreational purposes and 15% had used stimulant drugs for recreational purposes.

Using cross-sectional data from the 2001–2002 National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), McCabe and colleagues (2006) examined the association between drinking behavior and NMPO use. They found that young adults (ages 18 – 24), compared to older adults (ages 25 and older), reported higher rates of binge drinking, alcohol use disorders (AUD), and NMPO use. Even with adjustments for age, gender, and race, those who binge drank and were diagnosed with AUD reported significantly higher rates of NMPO use than abstainers. For example, compared to abstainers, binge drinkers were 4 times more likely, alcohol abusers were 8 times more likely, and those diagnosed with alcohol dependence were 24 times more likely to report NMPO use in the last year. This strong association between alcohol abuse and NMPO use suggests that NMPO use may represent one form of drug use engaged in by those who are frequent substance users.

Sees and colleagues (2005) analyzed OxyContin use using data from the National Household Survey on Drug Abuse from 1999–2001. Overall, they found that OxyContin users were multiple substance users and the vast majority had used other prescription opiates. About 80% of the nonmedical users of OxyContin reported having used illicit drugs or engaging in nonmedical use of other prescription drugs before their first nonmedical use of prescription analgesics. These findings also support the hypothesis that nonprescription opiates may be one of several illicit drugs used by more frequent drug users and may not be a unique form of drug use for adolescents and emerging adults.

Using national data from four surveys from 1993 – 2001, McCabe, West, and Wechsler (2007) examined historical trends in NMPO use among college students. Over this time, lifetime prevalence increased from 8% to almost 13%, whereas annual prevalence increased from 3% to 7%. The researchers distinguished between nonmedical use of prescription drugs and use of other illicit drugs (e.g., marijuana, cocaine, psychedelics). They found that the 1993 level of illicit drug use at each college was significantly related to nonmedical use of prescription drugs across all four surveys, providing further evidence to suggest that nonmedical prescription drug use, including NMPO use, may simply be another indicator of heavy substance use.

1.2. A Stage Model of Substance Use

A number of studies in the United States and abroad have replicated a similar sequence of drug use progression which, for the majority of individuals, starts with alcohol or cigarettes and proceeds to marijuana and then to other illicit drugs (Kandel & Yamaguchi, 1999; Kandel, Yamaguchi, & Chen, 1992). From a theoretical perspective, the stage model of substance use assumes that individuals progress from a lower stage drug to the next higher stage drug in a sequence. A person is unlikely to proceed to a higher stage drug without having first tried a lower stage drug. However, most individuals are likely to stop at an early stage without progressing through the whole sequence. This model implies that the sequence of drug use onset is universal and that the most important individual differences are differences in the end stage that is reached by different persons. Several studies, however, have refuted the generalizability of this sequence (e.g., Golub & Johnson, 2002; Peele & Brodsky, 1997; White, Jarrett, Valencia, Loeber, & Wei, 2007).

Labouvie and White (2002) found that sequence of onset is not a useful concept unless one also takes into account subsequent escalation, persistence, and decreases in use. Rather, they suggested that a modified stage model of substance use is a more useful concept (see also Kandel, 2002). According to their stage model, stage of use is the “most severe” substance an individual has used irrespective of sequence of onset (e.g., alcohol/cigarettes versus marijuana versus hard drugs). Labouvie and White (2002) found that individuals who were in the highest or most severe stage (i.e., hard drug users), irrespective of sequence of onset, compared to those who were at a lower or less severe stage, were more likely to develop problems with hard drugs, as well as with alcohol and marijuana. Their definition of hard drug use included illicit drugs, such as cocaine and psychedelics, as well as nonmedical use of prescription drugs (e.g., sedatives, opiates, and amphetamines). Based on their theoretical framework, we suggest that NMPO use may simply represent one type of “hard drug” use, and be a more severe stage of illicit drug use than using only marijuana. Noting the overlap of NMPOs with the use of other "hard drugs" and with abuse of alcohol, it may not be possible to differentiate the consequences of NMPO use from the consequences of other hard drug use. Therefore, there may be nothing unique about NMPO use, and NMPO use may have the same consequences as use of illicit drugs other than marijuana.

1.3. Present Study

This review identified several limitations of previous research on nonprescription opiate use. First, although some studies have shown overlap of use of NMPOs and other substances, few have characterized this pattern in detail, and none of these studies followed the same individuals over time to examine patterns of use of NMPOs in relation to other substances. Thus, previous studies have not addressed the frequency, escalation, and persistence of NMPO use from adolescence into emerging adulthood within the same individuals. Second, although previous studies have examined risk factors for and consequences of NMPO use, they have not accounted for other drug use to examine whether there are unique consequences related to NMPO use as opposed to use of other hard drugs.

The present study attempts to overcome these limitations by examining NMPO use within the context of other drug use in a sample of emerging adults who were interviewed at least annually from the first or second grade through age 21. We test a stage model of substance use to determine whether there are unique consequences of NMPO use in emerging adulthood once other drug use is controlled. Specifically, we examine (a) patterns of NMPO use over time and whether these patterns differ for males and females, (b) the extent of other drug use among NMPO users during adolescence and emerging adulthood, and (c) whether NMPO use from Grade 10 to age 20 predicts negative consequences including drug use disorder, mood disorder, nonproductive behavior, poor physical health, violence, and property crime at age 21 once other drug use is controlled. In accord with the stage model of substance use, we hypothesize that there will be a unique effect of NMPO use on outcomes when other “hard” drugs (i.e., cocaine, heroin, sedatives, amphetamines, ecstasy, and psychedelics) are not included in the model because, based on this framework, NMPO use represents a more “severe” stage of substance use than alcohol, tobacco, and marijuana. However, we also hypothesize that once other “hard” drug use is controlled, there will not be a unique effect of NMPO use. We do not attempt an historical analysis to understand why levels of NMPO use are currently elevated. Rather we determine whether NMPO use has unique consequences compared to other hard drugs.

2. Method

2.1. Design and Sample

Raising Healthy Children (RHC) project data are used to address these questions. RHC is a longitudinal study of social development with an experimental trial of a preventive intervention to reduce drug use and other problem behaviors nested within it (Brown, Catalano, Fleming, Haggerty, & Abbott, 2005; Haggerty, Fleming, Catalano, Harachi, & Abbott, 2006). Experimental condition did not have a statistically significant association with any of the primary variables in this study (i.e., gender and all the measures of drug use), and tests of interaction terms in the analysis models did not show evidence that the associations among study variables differed by intervention condition. We, therefore, combined data from participants in both the intervention and control groups for the current study.

In 1993 and 1994, 1,040 students and their parents (76% of those eligible) from 10 suburban public elementary schools in a Pacific Northwest school district consented to participate. At recruitment, 52% were in first grade and 48% were in second grade. Prior to baseline data collection, parents provided written consent for their children’s participation. After age 18, youth participants provided written consent for subsequent data collection. All procedures were approved by a University of Washington Institutional Review Board.

Surveys were completed annually every spring. Data for the current study were organized by the grade level of participants. We refer to time points as if participants progressed normally

through high school, even though 18% of the sample had dropped out of school as of the 12th-grade time point. Most of the survey data was collected via in-person interviews and questionnaires, although at the age 20 and 21 time points about half the surveys were completed over the Internet.[1] In addition to the regular spring survey at age 21, participants who met screening criteria were administered the Composite International Diagnostic Interview (CIDI--Kessler, Berglund, Demler, Jin, & Walters, 2005). The CIDI is a structured interview used to determine whether participants meet criteria for substance use and other mental health disorders. Half of the participants were administered the CIDI in person and half over the telephone.

In order to be included in the current study, participants had to have reported on whether they used NMPOs in the past year on at least one of five spring time points between Grade 10 and age 20 and had to have completed the age 21 spring survey from which the outcome measures were derived. These criteria excluded 128 participants, leaving an analysis sample of 912. There were no statistically significant ($p < .05$) differences between the excluded and included participants with respect to gender, ethnicity, or low-income status of their family at the beginning of the project. Of the 912 participants included in the study, between 91% and 95% had data at any given time point. The sample was 53% male. The ethnic/racial composition was 82% White, 5% Hispanic, 7% Asian or Pacific Islander, 5% Black, and 3% Native American. Thirty percent of participants received free/reduced-price lunch in the first 2 years of the study. During the spring of the 10th-grade time point, the average age was 16.19 years (*s.d.* = 0.33).

2.2. Measures

Substance use was assessed from Grade 10 through age 20 based on self-reports of use in the prior year. Participants reported on their frequency of use of NMPOs, marijuana, alcohol, psychedelics (e.g., LSD or hallucinogenic mushrooms), ecstasy, cocaine/crack, sedatives, amphetamines, and heroin, using a 7-point response option ranging from 1 = *never* to 7 = *>40 times*. Frequency was recoded to a count of the number of times used by recoding each category to its midpoint and recoding the last category to 40 times. For these analyses, prescription drugs (NMPOs, sedatives, and amphetamines) were included only if they were used at least sometimes without a medical prescription. For some analyses, psychedelics, ecstasy, cocaine/crack, sedatives, amphetamines, and heroin were collapsed into an "other drugs" category; frequency of other drug use was based on the drug reported as being used most frequently each year. For cigarette smoking, respondents were asked if they smoked in the prior year and, if so, they reported their quantity in the prior month, generating a 7-category variable ranging from 1 = *never* to 7 = about *2 packs a day or more*.

A variety of outcomes were measured at age 21. Variables derived from the CIDI included a measure of *drug use disorder* (whether participants met criteria for drug abuse or dependence in the prior year) and *mood disorder* (whether participants met criteria for major depression, generalized anxiety disorder, or posttraumatic stress disorder in the prior year). Other outcomes included whether or not participants: (a) were *not employed or in school*, (b) reported general *health that was "poor" or "fair"* (as opposed to "good" or "excellent"), (c) engaged in *violent behavior* (started fights, hit someone to hurt them, threw object at cars/people, beat someone so that they needed a doctor, used a weapon/force to get things, threatened someone with a

[1]During the early years of high school, interview questions were read aloud by an interviewer while the respondents marked their answers on an answer sheet. Subsequent spring surveys were administered one-on-one using laptop computers. For sensitive questions (e.g., substance use), participants completed questions in a self-administered mode. In the post-high school period, some interviews were completed over the internet. For example, over half completed via web at the age 21 time point. Analyses of those randomly assigned to either an in-person interview or a web-based survey (at the fall survey at age 19) indicated few statistically significant differences in responses to sensitive questions between modes of administration (McMorris et al., 2009). At all time points, less than 4% completed surveys by phone or mail.

weapon), and (d) had committed *property offenses* (took something worth >$200, broke into a building, stole a motor vehicle, took something <$200). At age 21, 5.7% reported a current drug use disorder, 9.8% reported a mood disorder, 18.9% were not in school or working, 24.3% reported poor or fair health, 30.6% reported at least one incident of violence, and 12.8% reported at least one property offense.

2.3. Analysis

Preliminary analyses consisted of examining prevalence of NMPO use and using contingency tables to assess the overlap between NMPO use and other types of substance use. These analyses were done using cases with no missing data. For the within-year analyses, this resulted in 5% to 9% missing cases. For analyses involving multiple-year measures, requiring complete data resulted in a loss of approximately 17% of cases.

For all other analyses, multiple imputation was used so that data on all 912 cases in the sample could be used (Schafer & Graham, 2002). Using NORM version 2.03 (Schafer, 2000), 40 datasets were imputed that contained values for outcomes and substance use variables at each time point. Measures that summarized substance use across time points were computed for each dataset after imputation. The 40 datasets were subsequently used to run 40 sets of analyses, with results averaged based on Rubin's (1987) rules.

3. Results

3.1. Prevalence and Frequency of NMPO Use

As shown in Table 1, a little over a third of both males and females reported at least some NMPO use over the 5-year span. Annual prevalence of NMPO use increased from Grade 10 to Grade 12, peaked in the 12^{th} grade at 20.3% for females and 18.2% for males, and decreased back to Grade 10 levels by age 20. There was no linear trend observed over time in frequency among users, although the mean number of times used was highest at age 20. There were few differences in prevalence or number of times used by gender, although males who used in Grade 11 reported more frequent use than females. By age 20, lifetime prevalence rates for alcohol (88.3%), tobacco (58.3%), and marijuana (61.9%) use were higher than for NMPOs; however, NMPO prevalence was higher than cocaine (20.1%), psychedelics (21.6%), ecstasy (21.1%), sedatives (10.3%), amphetamines (15.6%), and heroin (3.2%) (not shown). Among all users, the average age of initiation was 17 years, which would have been senior year for most of these youth. The mean number of years used for all NMPO users was 2 years.

To understand continuity and persistence in NMPO use between high school and emerging adulthood (up to age 20) we conducted crosstabulations of those who used in high school by those who used after high school and limited the analyses to only those who reported information at all assessments (n = 754). These results are presented in Table 2. More than one fourth (Columns 3 and 4: 28.2%) of the sample used NMPOs in high school and 49.3% of high school users continued to use in emerging adulthood (age 19 and/or 20). One fifth (Columns 2 and 4: 20.0%) of the sample used NMPOs after high school. Most (69.5%) youth using at ages 19 or 20 persisted in their use from high school. Thus, use of NMPOs was more common in high school than at ages 19 and 20, and only 6.1% of the total sample began using after high school. At age 20, although mean frequency of NMPO use was higher for those who began in high school than after (7.8 v 4.5, respectively), there was no significant difference between the two groups ($t = 1.73$, $df = 149$, $p > .05$) (not shown).

In contrast to the findings for NMPO users, half (50.6%) of the participants used marijuana in high school and three fourths (79.3%) of those high school users were still using in emerging adulthood. Thus, continuity rates were greater for marijuana than NMPOs. About half (51.4%)

of the youth had used marijuana after high school, and 78.0% of those users persisted in use from high school. In terms of other hard drug use (not NMPOs), one fourth (25.6%) had used in high school and 71.0% of them were continuing to use in emerging adulthood. Continuity was also higher for other drugs than NMPOs. One fourth (25.8%) of the youth were using other hard drugs after high school and most of them (70.6%) persisted in use from high school.

3.2. Overlap of NMPO Use with Use of Other Substances

Table 3 shows the prevalence of use of other substances by level of NMPO use. Level of NMPO use was split into no use, light use (less than 10 times in a year), and heavy use (more than 10 times in a year). Because the frequency variable was categorical, we split the light and heavy categories at the 10 – 19 times category, which approximates monthly use. Of those who ever used opiates more than 10 times in any year between Grade 10 and age 20, almost all had also used alcohol, tobacco, and marijuana; almost three fourths had use cocaine or crack; about two thirds had also used psychedelics, ecstasy, and amphetamines; less than half had used sedatives; and less than 1 in 5 had used heroin. Even among light users, most had used alcohol, tobacco, and marijuana and between one fifth and one half had used all other drugs except heroin. In fact, 96.4% of the NMPO lifetime heavy users and 94.9% of the lifetime light users had also used one other illicit drug, and 85.7% and 68.6%, respectively, had used an illicit drug besides marijuana. Similar degrees of overlap were seen at each age separately. Furthermore, lifetime heavy NMPO users had used an average of four other illicit drugs and lifetime light users had used an average of three other illicit drugs. Thus, there was substantial overlap between NMPO use and use of alcohol, tobacco, marijuana, and other illicit drugs.

3.3 Consequences of NMPO Use

The unadjusted associations between ever use of NMPOs and the six negative outcomes at age 21 were positive and statistically significant ($p < .05$). Ever use of NMPOs was associated with a 7.9 greater odds of having a current drug use disorder, 2.1 greater odds of a mood disorder, 1.6 greater odds of being unemployed and not enrolled in school, 1.4 greater odds of poor/fair health, 2.6 greater odds of being violent, and 2.8 greater odds of committing a property offense (not shown).

The results of hierarchical multivariate logistic regression models regressing the six negative outcomes on frequency of substance use are shown in Table 4. For each outcome, we controlled for gender and tested five models representing various stages of substance use. Model 1 assessed the effects of alcohol/cigarette use on the outcomes; Model 2 assessed alcohol/cigarettes plus marijuana on the outcomes; Model 3 examined alcohol/cigarettes, marijuana, and other drugs (not NMPOs); Model 4 examined alcohol/cigarette, marijuana, and NMPO use only (no other drugs); and Model 5 assessed alcohol/cigarettes, marijuana, other drugs, and NMPOs. Based on the variance inflation factor (VIF) and tolerance indicators, multicollinearity was a not a problem in any of the models.

As seen in Model 1, the first stage of substance use, alcohol and/or cigarette use, significantly predicted all of the negative outcomes except mood disorder. Only cigarettes predicted negative health outcomes. Less frequent alcohol use and more frequent cigarette smoking were associated with nonproductive behavior. When marijuana was added to Model 1, it predicted drug use disorder but alcohol and cigarettes no longer did. For every unit increase in the frequency of marijuana use, there was a 1.68 times higher risk of a drug use disorder. Marijuana use also predicted not being in school or working (odds ratio [OR] = 1.16), and alcohol and cigarette use remained significant predictors in the same direction as in Model 1. When other drug use was added to Model 2, other drugs predicted all negative outcomes except poor health and violence. When NMPO use was added to Model 2, like other drugs, NMPO use predicted drug use disorder, mood disorder, and property offending. For every unit increase in the

frequency of NMPO use, there was a 1.19 greater risk of drug use disorder, 1.19 greater risk of a mood disorder, and 1.17 greater risk of property offending. Unlike other drugs, NMPO use predicted violence (OR = 1.22) but did not predict nonproductive behavior. Marijuana was a strong predictor of drug use disorder (OR = 1.62) in this model. In Model 5 with both NMPO and other illicit drug use included, NMPO use had a significant effect only on violence (OR=1.21), as did alcohol and cigarette use. Other drugs had a unique effect on drug use disorder (OR = 1.27) and nonproductive behavior (OR = 1.14), along with cigarettes and alcohol; cigarettes still had an influence on health; and marijuana use was still a strong predictor of drug use disorder (OR = 1.49). Effects on mood disorder, property crime, and no school or work, which were significant when entered separately for NMPOs or other hard drugs, were not significant when both were in the same model.

4. Discussion

This study examined the use of NMPOs within the context of other drug use from adolescence into young adulthood. We found, as other studies have found (e.g., Johnston et al., 2008a, 2008b), that currently NMPO use is the most prevalent form of illicit drug use beyond marijuana. In this sample, annual prevalence peaked in high school rather than later. Furthermore, more than half of high school users did not continue use after high school and few youth first initiated NMPO use after high school. One explanation for this drop may have to do with living situations in emerging adulthood. That is, high school students usually live at home with their parents and some parents may keep NMPOs in the medicine cabinet, providing easier access to these drugs compared to access for youth who move away from home. However, almost one half of those who began using in high school continued in their use after high school. Therefore, given the high addiction potential of NMPOs, these youths may be at risk for developing dependence and other negative consequences in the future.

We also found very little gender differences in NMPO use for prevalence, frequency, and duration of use. The lack of a gender difference is in contrast to other drugs such as marijuana, which males tend to use more often (Johnston et al., 2008a).

Overall, we found a large degree of overlap between NMPO use and use of other licit and illicit drugs. There were almost no NMPO users who did not also use alcohol, cigarettes, and/or marijuana. Furthermore, most of the heavy NMPO users and a large minority of the light users also used other hard drugs. Because of this overlap, as suggested by the stage framework, there were few unique negative outcomes of NMPO use. In fact, violent behavior was the only unique outcome that was attributable to NMPO use when other drug use was included in the model. The reason for the unique association with violence is difficult to explain. Pharmacologically one would not expect that opiate use would increase the risks of violent behavior (Miczek et al., 1994). Perhaps aggressive individuals are drawn to opiates as a form of self-medication (Khantzian, 1985). Further, individuals exposed to stressful life events (e.g., victimization) may also self-medicate with drugs and may often find themselves in violent situations (White & Widom, 2008). Perhaps some of the NMPO users may have learned about or experienced the ability of opiates to relieve pain and thus consider it a more effective and/or safer drug than the other “hard drugs” included in this study for reducing pain caused by internalizing and/or externalizing disorders. More research on motivations for use is needed. Due to the addictive nature of opiates, it may be that NMPO use will not decline as young adults progress through their 20s and more unique longer term consequences may become evident. These data make it clear that studies examining the consequences of NMPO use must not attribute these consequences to NMPO use alone, and must consider these consequences within the context of other drug use.

This study had several strengths. It was based on a large community sample of young men and women who were followed from adolescence into young adulthood. Thus, we were able to prospectively observe patterns of use over time. Furthermore, we were able to examine concurrent and longitudinal patterns of other drug use when examining patterns and outcomes of NMPO use. Nevertheless, there were some limitations to this study that need to be acknowledged. First, we did not have any measures of sources of use or reasons for use. Thus, some of these youth may have used NMPOs to treat pain rather than for "recreational" purposes (see McCabe et al., 2005a). In addition, the sample had insufficient numbers from Nonwhite groups to examine racial differences and all came from one suburban community; thus, the results may not generalize to other samples.

Consistent with a stage model of substance use, the findings from this study suggest that NMPO use may not indicate a unique pattern of substance use. Instead, those using NMPOs may simply be adding them to a variety of other illicit drugs. From these data it is clear that NMPO users are using alcohol, marijuana, and tobacco, as well as a number of other drugs, and thus are frequent substance users. Previous studies may have inaccurately attributed correlates and consequences to NMPO use because they failed to consider the multiple substance use patterns among NMPO users. Nevertheless, given the high addiction potential of opiates (Compton & Volkow, 2006), we must not dismiss the potential seriousness of NMPO use among adolescents and emerging adults. Although we found few unique negative consequences at age 21, those youth who continue to use NMPOs may increase their use over time and develop a drug use disorder, as well as other negative consequences in the future. As McCabe and colleagues (2005b) suggested, because of their addiction potential, youth may not mature out of NMPO use in the same way that they mature out of other drugs. Therefore, future research should continue to follow these early-onset NMPO users into adulthood.

Bullet points

1. A third reported nonmedical opiate use by age 20 and most users began in high school.
2. Almost all nonmedical opiate (NMPO) users used other illicit drugs.
3. Except for violence, NMPO use did not explain unique variance in negative outcomes.

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Table 1

Patterns of NMPO use from adolescence into emerging adulthood.

	Females %	Males %	Total %
Used Grade 10 (n = 846)[a]	13.1	11.6	12.3
Used Grade 11 (n = 839)	17.9	16.3	17.0
Used Grade 12 (n = 838)	20.3	18.2	19.2
Used age 19 (n = 859)	15.7	15.5	15.6
Used age 20 (n = 870)	13.6	11.8	12.6
Used in high school (n = 754)	28.8	27.8	28.2
Used at age 19 and/or 20 (n = 754)	20.8	19.4	20.0
Ever used (n = 754)	33.6	35.0	34.4
Maximum frequency[b] of use	11.25 (11.98)	11.49 (11.98)	11.38 (11.98)
Mean frequency Grade 10	9.46 (11.73)	8.10 (10.03)	8.78 (10.88)
Mean frequency Grade 11	7.39 (9.05)	11.08 (12.27)*	9.27 (10.94)
Mean frequency Grade 12	8.21 (9.00)	8.90 (8.98)	8.55 (8.97)
Mean frequency age 19	7.06 (7.56)	10.07 (11.41)	8.66 (9.87)
Mean frequency age 20	10.21 (11.62)	13.23 (12.98)	11.69 (12.34)
Average age of first use between Grade 10 and age 20 among those who ever used	17.11 (1.13)	17.33 (1.21)	17.23 (1.18)
Number of years used among those who ever used	2.31 (1.23)	2.04 (1.22)	2.17 (1.22)

[a] Percentages for yearly data are based on cases with nonmissing data.

[b] Frequency was recoded as: '1 – 2 times' = 1.5, '3 – 5 times' = 4, '6 – 9 times' = 7.5, '10 – 19 times' = 14.5, '20 – 39 times' = 29.5, '40+ times' = 40.

* Significantly different at the .05-level in a two-tailed test.

Table 2

NMPO use in high school (HS) and emerging adulthood (EA; ages 19 and 20).

	No use	No use in HS/ use in EA	Use in HS/ no use in EA	Use in HS and use in EA
NMPO				
% of total	65.6	6.1	14.3	13.9
% of users		17.8	41.7	40.5
% of HS users			50.7	49.3
% of EA users		30.5		69.5
Marijuana				
% of total	38.1	11.3	10.5	40.1
% of users		18.2	17.0	64.8
% of HS users			20.7	79.3
% of EA users		22.0		78.0
Other drugs				
% of total	66.8	7.6	7.4	18.2
% of users		22.8	22.4	54.8
% of HS users			29.0	71.0
% of EA users		29.4		70.6

Note: Based on data from 754 participants with nonmissing data at all five time points.

Table 3

Percent of NMPO users using other drugs at each age and ever.

	Grade 10 (n = 846)			Grade 11 (n = 839)			Grade 12 (n = 838)			Age 19 (n = 859)			Age 20 (n = 870)			Ever (n = 754)		
	N	L[a]	H[a]	N	L	H	N	L	H	N	L	H	N	L	H	N	L	H
	(n=742)	(n=82)	(n=22)	(n=696)	(n=106)	(n=37)	(n=677)	(n=122)	(n=39)	(n=725)	(n=102)	(n=32)	(n=760)	(n=75)	(n=35)	(n=495)	(n=175)	(n=84)
Alcohol	46.9	87.8	86.4	55.0	93.4	100.0	63.4	94.3	94.9	71.7	98.0	96.9	76.4	100.0	97.1	82.6	98.9	100. 0
Tobacco	23.6	73.2	86.4	26.6	73.6	86.5	32.4	76.2	82.1	39.3	78.4	87.5	41.0	85.3	82.9	42.2	88.6	91.7
Marijuana	25.3	80.5	90.9	29.7	82.1	94.6	33.1	82.6	84.6	36.5	88.2	93.8	35.5	94.7	91.4	45.1	92.6	96.4
Cocaine or crack	1.8	20.7	59.1	1.9	28.3	43.2	2.8	35.2	46.2	4.3	49.0	62.5	5.3	41.3	80.0	4.6	38.3	72.6
Psychedelics	1.8	35.4	72.7	3.7	25.5	56.8	3.5	39.3	38.5	4.3	36.3	43.8	4.9	36.0	28.6	6.1	45.1	64.3
Ecstasy	2.4	35.4	54.5	2.3	22.6	32.4	3.1	23.8	38.5	4.8	31.4	53.1	5.8	42.7	60.0	6.5	41.1	64.3
Amphetamines	1.8	24.4	59.1	2.6	25.5	40.5	2.7	23.8	43.6	3.4	22.5	34.4	2.2	21.3	51.4	3.4	26.9	63.1
Sedatives	.8	8.6	27.3	.9	12.3	37.8	1.0	18.0	25.6	.6	17.6	40.6	.4	18.7	31.4	0.8	20.6	45.2
Heroin	.3	6.1	4.5		3.8	5.4		3.3	17.9	.1	7.8	9.4	.4	2.7	20.0	0.2	4.6	17.9
Any illicit drug[b]	25.9	82.9	90.9	30.3	84.9	94.6	34.4	86.9	89.7	37.7	89.2	96.9	37.4	94.7	97.1	45.7	94.9	96.4
Any illicit drug excluding marijuana	5.0	56.1	86.4	7.0	52.8	78.4	8.3	62.3	66.7	10.1	67.6	87.5	11.7	68.0	88.6	11.7	68.6	85.7
Mean number of illicit drugs including marijuana	.34	2.11	3.68	.41	2.00	3.11	.46	2.54	2.95	.54	2.53	3.38	.54	2.57	3.63	0.67	2.69	4.23

N = did not use; L = light use (less than 10 times per year); H = heavy use (10+ times per year)

[a] Light or heavy use was determined by the maximum times used in any year

[b] Illicit drugs represent drugs included in this study other than alcohol, tobacco, and NMPOs

Table 4

Models testing the effects of maximum frequency of drug use (Grade 10 through age 20) on negative outcomes at age 21.

	Drug disorder		Mood disorder		No school/work		Poor/fair health		Violence		Property crime	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Model 1												
Gender	1.15	0.64–2.07	0.31**	0.19–0.50	1.06	0.75–1.51	0.65**	0.48–0.89	1.01	0.75–1.36	1.70*	1.13–2.56
Alcohol	1.31*	1.04–1.66	1.05	0.92–1.21	0.87**	0.79–0.96	0.95	0.88–1.03	1.23**	1.14–1.33	1.16*	1.03–1.31
Cigarettes	1.46**	1.20–1.78	1.15	0.98–1.35	1.46**	1.30–1.64	1.25**	1.11–1.40	1.20**	1.09–1.32	1.28**	1.12–1.47
LLR[a]	*−177.10 (4)*		*−273.68 (4)*		*−421.83 (4)*		*−494.24 (4)*		*−529.05 (4)*		*−328.21 (4)*	
Model 2												
Gender	0.97	0.53–1.78	0.30**	0.18–0.49	1.01	0.71–1.44	0.64**	0.47–0.88	1.01	0.75–1.36	1.65*	1.09–2.49
Alcohol	1.03	0.80–1.33	1.01	0.86–1.18	0.80**	0.71–0.90	0.94	0.85–1.04	1.22**	1.11–1.35	1.11	0.96–1.27
Cigarettes	1.13	0.91–1.40	1.07	0.88–1.30	1.32**	1.15–1.52	1.23**	1.08–1.42	1.20**	1.06–1.35	1.20*	1.02–1.40
Marijuana	1.68**	1.33–2.13	1.09	0.95–1.26	1.16**	1.05–1.28	1.02	0.92–1.13	1.01	0.93–1.09	1.11	0.98–1.24
LLR[a]	*−163.38 (5)*		*−272.69 (5)*		*−417.38 (5)*		*−494.15 (5)*		*−529.02 (5)*		*−326.74 (5)*	
Model 3												
Gender	1.13	0.60–2.11	0.31**	0.19–0.52	1.05	0.74–1.50	0.64**	0.47–0.88	1.04	0.78–1.40	1.73**	1.15–2.62
Alcohol	0.97	0.75–1.25	1.00	0.85–1.17	0.79**	0.71–0.89	0.94	0.85–1.04	1.22**	1.11–1.35	1.09	0.95–1.26
Cigarettes	1.06	0.86–1.32	1.03	0.85–1.25	1.28**	1.12–1.47	1.23**	1.08–1.42	1.16*	1.03–1.31	1.16	0.99–1.36
Marijuana	1.51**	1.17–1.94	1.03	0.88–1.21	1.12	0.99–1.26	1.03	0.93–1.14	0.97	0.88–1.07	1.05	0.92–1.21
Other drugs (not NMPO)	1.30**	1.11–1.52	1.19*	1.01–1.39	1.14*	1.01–1.28	0.97	0.88–1.07	1.09	0.99–1.21	1.13*	1.00–1.27
LLR[a]	*−157.49 (6)*		*−269.95 (6)*		*−414.79 (6)*		*−494.02 (6)*		*−527.19 (6)*		*−324.70 (6)*	
Model 4												
Gender	0.99	0.54–1.82	0.30**	0.18–0.50	1.02	0.72–1.45	0.64**	0.47–0.88	1.03	0.77–1.38	1.68*	1.11–2.54
Alcohol	0.98	0.76–1.26	0.98	0.84–1.15	0.80**	0.71–0.90	0.94	0.85–1.04	1.21**	1.10–1.33	1.08	0.94–1.24
Cigarettes	1.11	0.89–1.37	1.03	0.85–1.25	1.30**	1.13–1.49	1.22**	1.06–1.40	1.15*	1.02–1.29	1.16	0.99–1.36
Marijuana	1.62**	1.28–2.04	1.05	0.92–1.21	1.15	1.02–1.29	1.01	0.92–1.11	0.96	0.87–1.06	1.06	0.94–1.19
NMPOs (not other drugs)	1.19*	1.01–1.39	1.19*	1.01–1.39	1.06	0.94–1.19	1.02	0.91–1.15	1.22**	1.11–1.35	1.17*	1.04–1.32

	Drug disorder		Mood disorder		No school/work		Poor/fair health		Violence		Property crime	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
LLR[a]	*−161.26 (6)*		*−270.15 (6)*		*−416.85 (6)*		*−494.06 (6)*		*−521.84 (6)*		*−323.43 (6)*	
Model 5												
Gender	1.12	0.60–2.09	0.31**	0.18–0.51	1.05	0.74–1.50	0.64**	0.47–0.87	1.03	0.77–1.38	1.72*	1.14–2.59
Alcohol	0.96	0.74–1.24	0.99	0.85–1.16	0.79**	0.71–0.89	0.94	0.85–1.04	1.21**	1.10–1.33	1.08	0.94–1.24
Cigarettes	1.06	0.86–1.32	1.01	0.83–1.23	1.28**	1.12–1.47	1.23**	1.08–1.42	1.15*	1.02–1.29	1.15	0.98–1.35
Marijuana	1.49**	1.16–1.92	1.02	0.87–1.19	1.12	0.99–1.26	1.03	0.93–1.14	0.95	0.86–1.05	1.04	0.91–1.19
Other drugs	1.27**	1.09–1.49	1.13	0.96–1.32	1.14*	1.01–1.28	0.96	0.85–1.08	1.02	0.91–1.15	1.07	0.94–1.23
NMPOs	1.05	0.88–1.25	1.12	0.94–1.33	1.00	0.87–1.15	1.04	0.93–1.17	1.21**	1.08–1.36	1.14	0.99–1.31
LLR	*−157.31 (7)*		*−268.99 (7)*		*−414.76 (7)*		*−493.79 (7)*		*−521.78 (7)*		*−322.95 (7)*	

[a] Log likelihood ratio.

* Significant at the .05-level in a two-tailed test.

** Significant at the .01-level in a two-tailed test