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Sean Esteban McCabe, Ph.D.
University of Michigan
Substance Abuse Research Center and
Institute for Research on Women and Gender
Ann Arbor, MI, USA 48109

Deborah D. Kloska, M.A.
University of Michigan
Institute for Social Research
Ann Arbor, MI, USA 48106

Philip Veliz, Ph.D.
University of Michigan
Institute for Research on Women and Gender
Ann Arbor, MI, USA 48109

Justin Jager, Ph.D.
Arizona State University
T. Denny Sanford School of Social and Family Dynamics
951 S. Cady Hall, SS 144
Tempe, AZ 85287

John E. Schulenberg, Ph.D.
University of Michigan
Institute for Social Research and
Department of Psychology
Ann Arbor, MI, USA 48106

Please send correspondence to:
Sean Esteban McCabe, Ph.D.
Research Professor and Research Faculty Chair

Author Manuscript

University of Michigan Substance Abuse Research Center
And Institute for Research on Women and Gender
204 South State Street
Ann Arbor, MI, USA 48109

PHONE: (734) 615-8840   FAX: (734) 998-6508   E-MAIL: plius@umich.edu

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Abstract

Aims: To identify the developmental course of nonmedical use of four separate prescription drug classes (opioids, sedatives, stimulants, and tranquilizers) by examining the general functional growth and related covariates during the transition from adolescence to adulthood in the United States.

Design: Nationally representative probability samples of high school seniors were followed longitudinally across five waves (waves 1, 2, 3, 4 and 5: modal ages 18, 19/20, 21/22, 23/24, and 25/26 years respectively).

Setting: Data were collected via self-administered questionnaires to high school seniors and young adults in the United States.

Participants: The sample consisted of over 71,000 individuals in 30 cohorts (high school senior years of 1977-2006) who participated in at least one wave.

Measurements: Self-reports of annual nonmedical use of prescription opioids, sedatives, stimulants, and tranquilizers.

Findings: The annual nonmedical use of prescription opioids, sedatives, stimulants, and tranquilizers was highest at wave 1 over the five waves. There was a consistent descending path (linear and quadratic slopes, p < 001) in annual nonmedical use from baseline across all four prescription drug classes (e.g., opioids linear slope = -.043 and opioids quadratic slope = .034, p <.001). While the annual nonmedical use of stimulants declined over time (linear slope = .063, p <.01; quadratic slope = -.133, p <.001), the same decrease was not observed for the annual

nonmedical use of prescription opioids, sedatives or tranquilizers when controlling for sociodemographic and substance use behaviors at baseline. The covariates associated with the general functional growth differed across the four prescription drug classes.

Conclusions: The nonmedical use of prescription opioids, sedatives, stimulants, and tranquilizers appears to peak during late adolescence, suggesting preventive intervention efforts should be initiated in early adolescence. The developmental course of nonmedical use is not the same among all four classes of prescription drugs, suggesting each drug class warrants individual research.

Keywords: Adolescence, Prescription Drugs, Nonmedical Use, Longitudinal, Prescription Opioids, Prescription Sedatives, Prescription Stimulants, Young Adulthood

Introduction

The nonmedical use of prescription opioids, sedatives, stimulants, and tranquilizers among

adolescents and young adults represents a worldwide public health concern [1-7]. The

nonmedical use of prescription drugs (NUPD) is most prevalent in the United States among

young adults aged 18 to 25 and remains second only to marijuana as the most prevalent form of

illicit drug use among adolescents and young adults [4,5,7]. Indeed, more than one-fourth

(26.6%) of young adults reported NUPD in their lifetime while over half (51.9%) reported

marijuana use [7]. NUPD-related consequences such as emergency department visits and

substance use disorders involving NUPD have significantly increased over the past two decades

in the United States [8,9]. Despite this significant public health problem, a systematic review

concluded that there remains a lack of longitudinal research assessing the developmental course

of NUPD among adolescents and a strong need for greater focus on NUPD involving

prescription sedatives and tranquilizers [10]. With the exception of a few studies focusing on

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nonmedical use of prescription opioids, no national longitudinal study has examined the developmental course of NUPD involving each of the following four prescription drug classes (i.e., opioids, sedatives, stimulants, and tranquilizers).

While the developmental course of cigarette smoking, binge drinking and marijuana use during the transition from adolescence to young adulthood are well-documented in the United States [11-16], relatively little is known about the developmental course associated with NUPD over this key developmental period [10,17]. To date, the majority of research on this topic has been cross-sectional and identified the age-related prevalence and robust correlates associated with NUPD including male sex, race/ethnicity (White), low parental education, low academic performance, no plans for college attendance, truancy/delinquent behavior, more evenings away from home, and other substance use including binge drinking, cigarette smoking, and marijuana use [4,5,7,10,17-19].

A few longitudinal studies have examined the nonmedical use of prescription opioids during adolescence and young adulthood based on regional [17,20] and national samples [21,22]. Taken together, these studies found 1) the annual prevalence of nonmedical use of prescription opioids peaked in the senior year of high school; 2) the majority of individuals who reported nonmedical use of prescription opioids in secondary school did not engage in this behavior following high school; 3) the mean level of annual nonmedical use of prescription opioids held relatively steady

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during adolescence; and 4) most nonmedical use of prescription opioids is both initiated and stopped before the late 20's. Despite this valuable information, these studies were somewhat limited because they either focused exclusively on the nonmedical use of prescription opioids, and/or combined multiple prescription drug classes together including some with minimal abuse potential (e.g., anti-depressants). Regional and national cross-sectional studies indicate the peak ages of risk for initiating nonmedical use of prescription anxiolytics, opioids, sedatives and stimulants were concentrated between 16 to 19 years of age and onset dropped off considerably following 19 years of age [23-25].

To our knowledge, this study will be the first national longitudinal study to describe the developmental course and covariates associated with the nonmedical use of four classes of prescription drugs from adolescence to adulthood. The primary aims of this study were:

1) Estimate the developmental course of nonmedical use of four separate prescription drug classes (i.e., opioids, sedatives, stimulants, tranquilizers) from age 18 to 26; and

2) Compare the similarities and differences in covariates associated with the developmental course of nonmedical use of each prescription drug class.

Methods

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The present study used national panel data from the Monitoring the Future (MTF) study [4,5,11,12]. Based on a three-stage sampling procedure, MTF has surveyed nationally representative samples of approximately 17,000 U.S. high school seniors each year since 1975, using questionnaires administered in classrooms. Stage 1 is the selection of geographic areas within the four regions of the country including the Northeast, South, Midwest, and West. Stage 2 is the random selection of approximately 130 public and private high schools with replacement (schools that decline are replaced with schools that are similar on geographic location, size, and urbanicity). Stage 3 is the selection of students within each school. Approximately 2,400 high school seniors are selected for biennial follow-ups each year using mailed questionnaires. The biennial follow-up surveys begin one year after high school for one random half of each cohort and two years after high school for the other half. For purposes of these analyses, the two halves were combined (combining modal ages 19/20, 21/22, 23/24, and 25/26). Corrective weighting was used to adjust for the unequal probabilities of selection and to best approximate the given population. The project design and sampling methods are described in greater detail elsewhere [4,5,11,12].

Sample

The sample for the present study consisted of respondents who were surveyed as high school seniors (wave 1) in 1977 through 2006, and who were surveyed in their first, second, third, and/or fourth biennial follow-up surveys (waves 2, 3, 4, and 5 respectively). Given the aims of

the present study, the 30 cohorts were combined and analyses were conducted with nearly 72,000 respondents (range was 71,918 for prescription opioids to 71,980 for prescription tranquilizers in the longitudinal sample across the four prescription drug classes) in the MTF longitudinal study who provided data at any of the five waves. The sample consisted of 52.3% females, 73.3% Whites, 12.2% Blacks, 7.7% Hispanics, 2.9% Asian, and 4% other racial/ethnic groups or not specified (see Table 1). The student response rate ranged from 77% to 86% at wave 1 (with nearly all non-response due to respondent being absent rather than refusing to participate) and retention over all five waves was approximately 50% [4,5].

--Insert Table 1--

Measures

Demographic and background characteristics were assessed at baseline (modal age 18) and consisted of student self-reports of the following: gender, race/ethnicity (Black, White, Hispanic, Asian, Other), parental education (some college vs. high school or less), high school grade point average (B- or higher vs. C+ or lower), college plans (any plans vs. no plans), truancy (did not skip any days in the past four weeks vs. one or more skipped days), social evenings out (less than three per week vs. three or more per week), past-month cigarette smoking (any vs. none), past two-week binge drinking (any vs. none), past-year marijuana use (any vs. none). Senior year cohort was split into distinct periods for each prescription drug class based on the high school

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class survey year and these cohort periods were selected due to changes in the prevalence of nonmedical use of each prescription drug class among high school seniors reported elsewhere [4,5]. The cohort breakdown was as follows: prescription opioids (1977-1990, 1991-1996, 1997-2001, 2002-2006), prescription sedatives (1977-1985, 1986-1994, 1995-2006), prescription stimulants (1977-1985, 1986-1989, 1990-1995, 1996-2004, 2005-2006), and prescription tranquilizers (1977-1987, 1988-2000, 2001-2006). Cut-points in the covariates were determined based on sensitivity analyses; categorical covariates were desirable given our analytic and descriptive approaches.

Nonmedical use of prescription drugs was assessed in the same manner at all five waves with items asking respondents on how many occasions (if any) they used each prescription drug class (i.e., opioids, sedatives, stimulants, tranquilizers) on their own, without a doctor's orders during the past 12 months. Extensive lists of examples were provided for each prescription drug class including opioids (e.g., Vicodin®, OxyContin®, Percocet®, codeine), sedatives (e.g., Seconal®, Tuinal®), stimulants (e.g., Ritalin®, Dexedrine®), and tranquilizers (e.g., Librium®, Valium®, Xanax®). The response scale for each drug class ranged from (1) no occasions to (7) 40 or more occasions.

Statistical Analysis

The estimated prevalence rates and means of annual NUPD were examined separately for each prescription drug class (i.e., opioids, sedatives, stimulants and tranquilizers) over the five waves of the study. Next, growth trajectories of the mean frequency of NUPD were examined using latent growth curve models (LGCM) for each prescription drug class (Mplus v7.3) [26]. Preliminary analyses examined both prevalence rates and means because previous research has examined both types of outcomes [10-22]. However, in analyses presented here, we focused on trajectories of the mean frequency of NUPD (i.e., continuous outcomes) rather than prevalence of NUPD (i.e., dichotomous outcomes) because the continuous outcomes accounted for frequency of nonmedical use associated with each prescription drug class, the continuous outcomes are consistent with earlier work examining trajectories of binge drinking and marijuana use [15,16], and the continuous outcomes had the best fit with the data (i.e., two dichotomous models did not converge). The time invariant covariates included in the models were all drawn from wave 1, including gender, race/ethnicity, senior year cohort, high school grade point average, truancy, social evenings out, college plans, parental education, 30-day cigarette smoking, two-week binge drinking, and past-year marijuana use based on previous work [4,5,7,10,17-22]. Previous attrition analyses of the MTF study revealed that those retained in the MTF study differed at age 18 from those who attrited [22]. For instance, individuals retained were more likely to be female, White, report good grades, have higher parental education, and have lower rates of truancy, evenings out, 2-week binge drinking, 30-day cigarette use, past-year marijuana use, and past-year NUPD. To adjust for effects of attrition, full information maximum

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likelihood (FIML) was used on the outcomes, and missing data on the covariates was handled by including the covariates in the model via modeling variances [27]. Because MTF samples 12th graders via samples of school and uses a three-stage sampling design, it is necessary to adjust for the complex sample design when analyzing the cross-sectional 12th grade data. However, MTF has shown that it is not necessary to include adjustments for 12th grade design effects in panel analyses such as those conducted in this study (28). Analyses were, however, weighted for follow-up sampling selection.

Results

As shown in Figures 1a and 1b, the estimated prevalence rates and means for the annual nonmedical use of prescription opioids, sedatives, stimulants and tranquilizers indicate the annual nonmedical use of each prescription drug class were highest at wave 1 (modal age 18) over the five waves and there was a consistent decrease from wave 1 (modal age 18) to wave 2 (modal ages 19 and 20) across all four prescription drug classes. In general, annual NUPD had a descending path over time but the rate of decline was not the same across all prescription drug classes. More specifically, the decline in mean levels and prevalence of annual nonmedical use of prescription stimulants appeared larger from wave 1 (age 18) to wave 5 (ages 25 and 26) than the declines over this same time period for the annual nonmedical use of prescription opioids, sedatives and tranquilizers. As illustrated in Figure 1a, the decline in the prevalence rate of annual nonmedical use of prescription stimulants was 12.3% at wave 1 (modal age 18) to 4.8% at

wave 5 (modal ages 25 and 26). Additional analysis of a small subset of the sample used in the

present study indicated the modal age of onset among nonmedical users was 9th grade for

prescription sedatives, stimulants and tranquilizers and 10th grade for prescription opioids (data

not shown).

--Insert Figures 1a/1b--

Figure 2 illustrates the general latent growth curve model (LGCM) approach used for all four

prescription drug classes. For each prescription drug class, model comparisons based on Chi-

square difference tests indicated that the growth model specifying linear and quadratic slopes

provided a better fit compared to the growth model specifying only a linear slope (Models

without covariates - Opioids $\Delta\chi2(df = 4) = 134.52$, p <.001; Sedatives $\Delta\chi2(df = 4) = 74.43$, p

<.001; Stimulants $\Delta\chi2(df = 4) = 526.96$, p <.001; Tranquilizers $\Delta\chi2(df = 4) = 115.15$, p <.001:

Models with covariates - Opioids $\Delta\chi2(df = 20) = 535.31$, p <.001; Sedatives $\Delta\chi2(df = 19) =$

370.28, p <.001; Stimulants $\Delta\chi2(df = 21) = 1569.98$, p <.001; Tranquilizers $\Delta\chi2(df = 19) =$

436.14, p <.001). For the growth models including linear and quadratic slopes, complete fit

statistics are listed separately for models without and with covariates in Table 2.

--Insert Figure 2/Table 2--

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As illustrated in Table 2 (where coefficients are provided for intercepts, linear slopes, and quadratic slopes), the LGCM's that were estimated without covariates show two distinct growth trajectories that were similar to what was found in figures 1a and 1b. First, nonmedical use of prescription stimulants was found to have a significant rate of change in terms of both linear and quadratic change that indicated a decrease in the mean frequency of use between the ages of 18 and 26 with an accelerated rate of decline over time. Second, nonmedical use of prescription opioids, sedatives, and tranquilizers was found to have a significant rate of change in terms of both linear and quadratic change that indicated an overall decrease in mean frequency of use and then a slower but continued rate of decline between ages 18 and 26. In addition, the LGCM's that were estimated with covariates found that the nonmedical use of prescription stimulants had a significant rate of change in terms of both linear and quadratic change. The inclusion of covariates in the LGCM's for prescription opioids, sedatives, and tranquilizers resulted in non-significant growth trajectories with respect to the combination of linear and quadratic change over time.

With respect to the covariates associated with the growth factors modeling the mean frequency of NUPD across the five waves, the analyses found several differences across the four drug classes (Table 3). For instance, while males had a higher mean frequency of nonmedical prescription opioid use at age 18 when compared to females, females had a higher mean frequency of nonmedical use of sedatives, stimulants and tranquilizers at age 18 when compared

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to males. Moreover, males had faster rates of decline in the mean frequency of use across all of the drug classes when compared to females.

--Insert Table 3--

With respect to race, White respondents had a higher mean frequency of NUPD across the four prescription drug classes at age 18 and similar rates of decline across the five waves when compared to Black and Hispanic respondents. Respondents who were classified as 'other race' had a higher mean frequency of nonmedical use of sedatives and stimulants at age 18 and a slower rate of decline when compared to Whites (White and 'other race' respondents had comparable growth trajectories with respect to opioids and tranquilizers). Moreover, Asian respondents had similar growth trajectories with respect to nonmedical use of opioids and tranquilizers when compared to White respondents (except for mean frequency of use at age 18). However, while Asian respondents had similar mean frequencies of nonmedical stimulant use at age 18 when compared to White respondents, Asian respondents had slower rates of decline in nonmedical stimulant use when compared to Whites.

It should also be noted that cigarette use, binge drinking, and marijuana use at age 18 were all associated with a higher mean frequency of nonmedical opioid, sedative, stimulant, and tranquilizer use at age 18. However, only binge drinking at age 18 was consistently found across

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all four prescription drug classes to be associated with slower rates of decline across the transition to adulthood. In fact, cigarette use at age 18 was associated with slower rates of decline in the mean frequency of nonmedical use of opioids, sedatives and tranquilizers, while marijuana use at 18 was only associated with slower rates of decline in sedatives and tranquilizers. Finally, the estimates for the different cohorts presented in Table 4 indicate that mean frequency of nonmedical use of prescription opioids, sedatives, and tranquilizers at age 18 was higher among later cohorts, while mean frequency of nonmedical use of prescription stimulants at age 18 was lower among later cohorts. Although there were few differences across cohorts with respect to linear and quadratic change for nonmedical use of prescription opioids, sedatives, and tranquilizers, later cohorts have slower rates of decline with respect to nonmedical use of prescription stimulants between the ages of 18 and 26.

--Insert Table 4--

Discussion

The findings of this longitudinal study extend previous knowledge regarding the developmental course of the nonmedical use of four classes of prescription drugs among adolescents as they move into adulthood in several important ways. The annual nonmedical use of prescription opioids, sedatives, stimulants, and tranquilizers all reached the highest levels in the senior year of high school just prior to the start of the transition into adulthood. Other research that includes

cross-sections of MTF 8th, 10th, and 12th graders indicates that use is highest at 12th grade [5], highlighting that together with our findings, 12th grade is the likely peak prevalence. This developmental trend of reaching peak levels of nonmedical use for each prescription drug class is also similar to previous regional and national longitudinal studies examining the general patterns of binge drinking, marijuana use, nonmedical use of prescription opioids, and other illicit drug use during the transition from secondary school to young adulthood [13-17,20,22]. Furthermore, the modal age of onset among nonmedical users of prescription sedatives, stimulants and tranquilizers (9th grade) and opioids (10th grade) in the present study was consistent with prior research [23-25]. Taken together, these findings reinforce the importance of implementing preventive intervention efforts in early adolescence before NUPD is initiated and reaches peak levels.

We found the mean levels of annual nonmedical use of prescription opioids, sedatives and tranquilizers decreased relatively modestly during adolescence and young adulthood. These national findings extend results from an earlier regional study examining changes in the nonmedical use of prescription opioids [17]. Catalano and colleagues [17] used longitudinal data from a regional sample of 912 adolescents and observed no significant linear trend over time in frequency of nonmedical use of prescription opioids from 10th grade to 20 years of age. Although the present study did not find increases in NUPD over time, this should not be taken to ease concerns about such drug use during the transition to adulthood. There are well-documented

adverse consequences associated with NUPD [8-10,20,21,29]. For example, the number of U.S. emergency department visits involving nonmedical use of prescription opioids, sedatives, stimulants and tranquilizers more than doubled between 2004 and 2011 for each prescription drug class [9]. The findings of the present study along with the results of these prior studies indicate the potential development of serious adverse consequences related to NUPD during the transition from adolescence to adulthood despite declines or minimal changes in mean levels and prevalence rates of NUPD during this developmental period at the population-level.

The majority of previous studies regarding NUPD among adolescents have been cross-sectional and many studies have been limited because they have combined multiple prescription drug classes. The results of the present study indicate there are distinct patterns and covariates associated with the rate of changes across prescription drug classes suggesting the need for prescription opioids, sedatives, stimulants and tranquilizers to be examined separately instead of combined in future practice and research. For instance, White respondents had lower mean frequency of nonmedical use of stimulants and sedatives at age 18 and faster rates of decline over the study period when compared to respondents who indicated 'other race,' however, this pattern was not found with respect to nonmedical use of opioids and tranquilizers.

This study has several notable strengths that build upon previous research examining NUPD. First, this longitudinal national study focuses on the developmental period (young adulthood)

associated with the highest prevalence of NUPD [4,5,7]. Second, multiple cohorts were followed longitudinally across five waves to examine the historical course of NUPD within the same individuals over time. Third, this study includes four distinct prescription drug classes and nationally representative samples of U.S. high school seniors.

There were also some limitations of large-scale longitudinal survey research using self-administered surveys that should be noted when considering the implications of the study results. There are particular challenges to monitoring NUPD over time due to the emergence of new medications and the need to update prescription drug categories. For instance, the MTF study experienced such updates for prescription opioids (e.g., Talwin®, laudanum, and paregoric were replaced with Vicodin®, OxyContin®, and Percocet®) and prescription tranquilizers (e.g., Miltown® was replaced with Xanax®) categories in 2002. Notably, similar changes were made to prescription drug questions in other national studies conducted in the United States (e.g., NSDUH) and on balance, updating questions that include "current" prescription drugs is more important than maintaining items with obsolete wording [7]. In addition, more research is needed to decompose NUPD into its constituent parts because the measure to assess NUPD (i.e., on their own, without a doctor's orders) encompasses a wide range of behaviors such as someone using higher doses than prescribed or using leftover medication from a previous prescription (30).

Next, we acknowledge the CFIs for the models with covariates were relatively low (< .90) compared to typical standards. There were also some important high-risk subgroups of the adolescent population missing from the MTF data such as those absent from class at the time of data collection and those that have dropped out of school are not included in the sample [4,5,31], suggesting that our findings may underestimate NUPD. Based on the high rates of co-ingestion among adolescents who report NUPD, future longitudinal research should consider the temporal associations of NUPD and polydrug use, including whether the course of NUPD influences illicit drug use [2,32-34]. Future longitudinal research is needed to examine developmental trajectories associated with nonmedical use of each prescription drug class such as previous work examining binge drinking, marijuana use, and illicit drug use [14-16,35,36], including assessment at an earlier age and longer timeframe to adequately capture age of onset and the full developmental course of NUPD.

In summary, the findings of the present study indicate the annual nonmedical use of each of the four prescription drug classes peaked in late adolescence and supports initiating preventive intervention efforts in early adolescence. We also found distinct patterns between individual prescription drug classes and the covariates associated with changes in each prescription drug class, thus providing strong evidence for considering each prescription drug class separately in future practice and research.

Acknowledgments

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Table 1. Baseline Descriptive Statistics for the Longitudinal Sample at Age 18

Baseline characteristics at age 18	%	(95% CI)	% missing at age 18
Sex			0.0
Female	52.3	(51.9-52.6)	
Male	47.7	(47.3-48.1)	
Race/Ethnicity			1.5
White	73.3	(72.9-73.6)	
Black	12.1	(11.8-12.3)	
Hispanic	7.7	(7.5-7.9)	
Asian	2.9	(2.7-3.0)	
Other race	4.0	(3.8-4.2)	
Parental Education			2.9
At least one parent has a college degree or higher	64.1	(63.6-64.4)	
Grades in the 12th Grade			3.1
C+ or lower	23.2	(22.9-23.6)	
College Aspirations			5.5
Definitely will attend college	48.5	(48.1-48.8)	
Truancy			2.6
Skipped school at least once during the 12th grade	35.4	(35.1-35.8)	
Evening Out During a Typical Week			4.2
Went out three or more times	49.2	(48.7-49.5)	
Substance Use			
Cigarette use (past 30 days)	29.6	(29.3-29.9)	1.4
Binge Drinking (past 2 weeks)	32.2	(31.8-32.6)	5.0
Marijuana use (past year)	35.4	(35.1-35.8)	2.3
Opioid Cohorts			0.0
1977-1990	45.7	(45.3-46.1)	
1991-1996	21.7	(21.4-22.1)	
1997-2001	17.1	(16.8-17.4)	
2002-2006	15.4	(15.1-15.7)	
Stimulant Cohorts			0.0
1977-1985	28.1	(27.7-28.4)	
1986-1989	13.9	(13.6-14.2)	
1990-1995	21.9	(21.6-22.2)	
1996-2004	30.8	(30.1-31.2)	
2005-2006	5.1	(5.0-5.4)	
Tranquilizer Cohorts			0.0
1977-1987	34.9	(34.5-35.3)	
1988-2000	46.2	(45.8-46.6)	
2001-2006	18.8	(18.5-19.1)	
Sedative Cohorts			0.0
1977-1985	28.1	(27.7-28.4)	
1986-1994	32.3	(31.9-32.6)	
1995-2006	39.5	(39.1-39.9)	

Note: The average amount of missing data across waves is about 30% for each of the four outcomes.

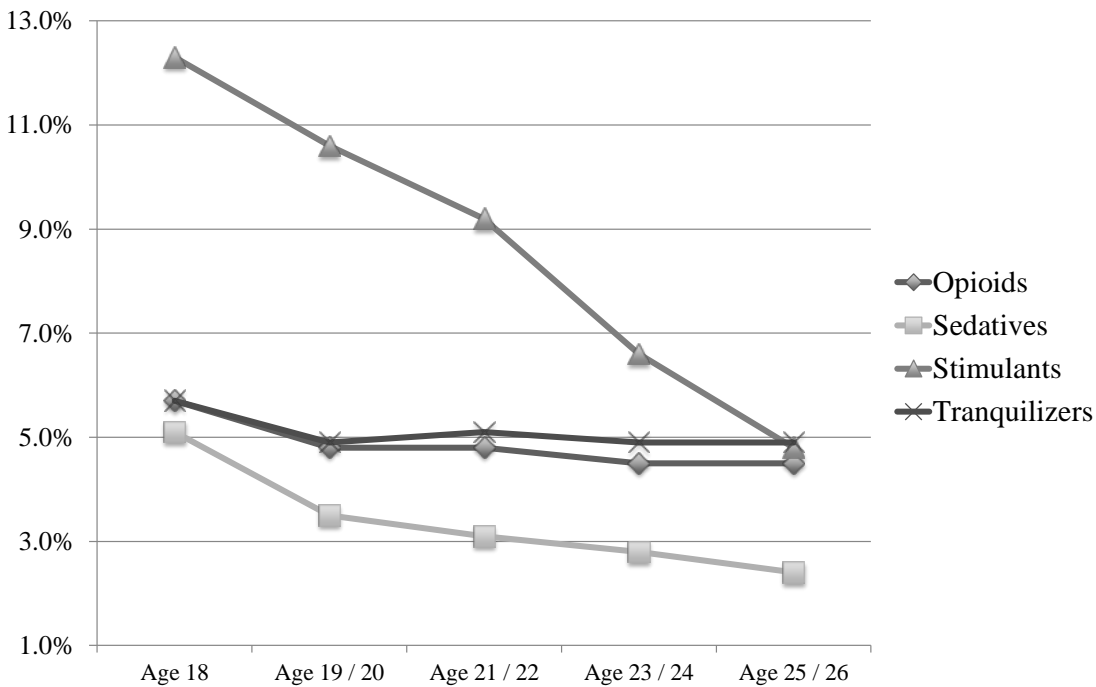FIGURE 1a. Estimated Prevalence Rates of Annual Nonmedical Use of Prescription Drugs: Ages 18-26

FIGURE 1b. Estimated Mean Frequency of Nonmedical Use of Prescription Drugs: Ages 18-26
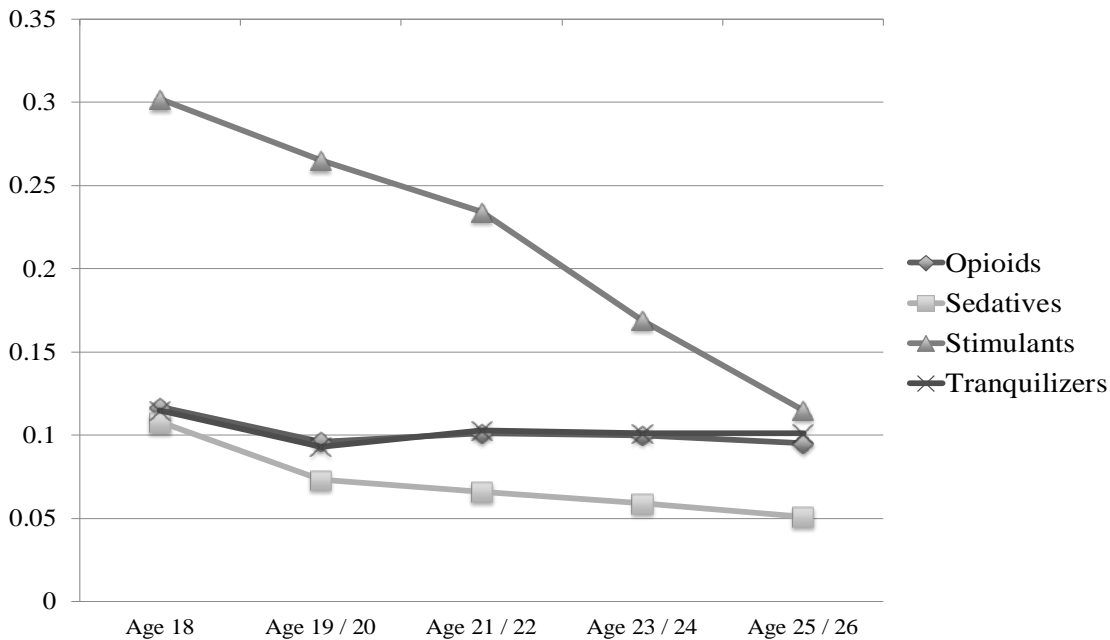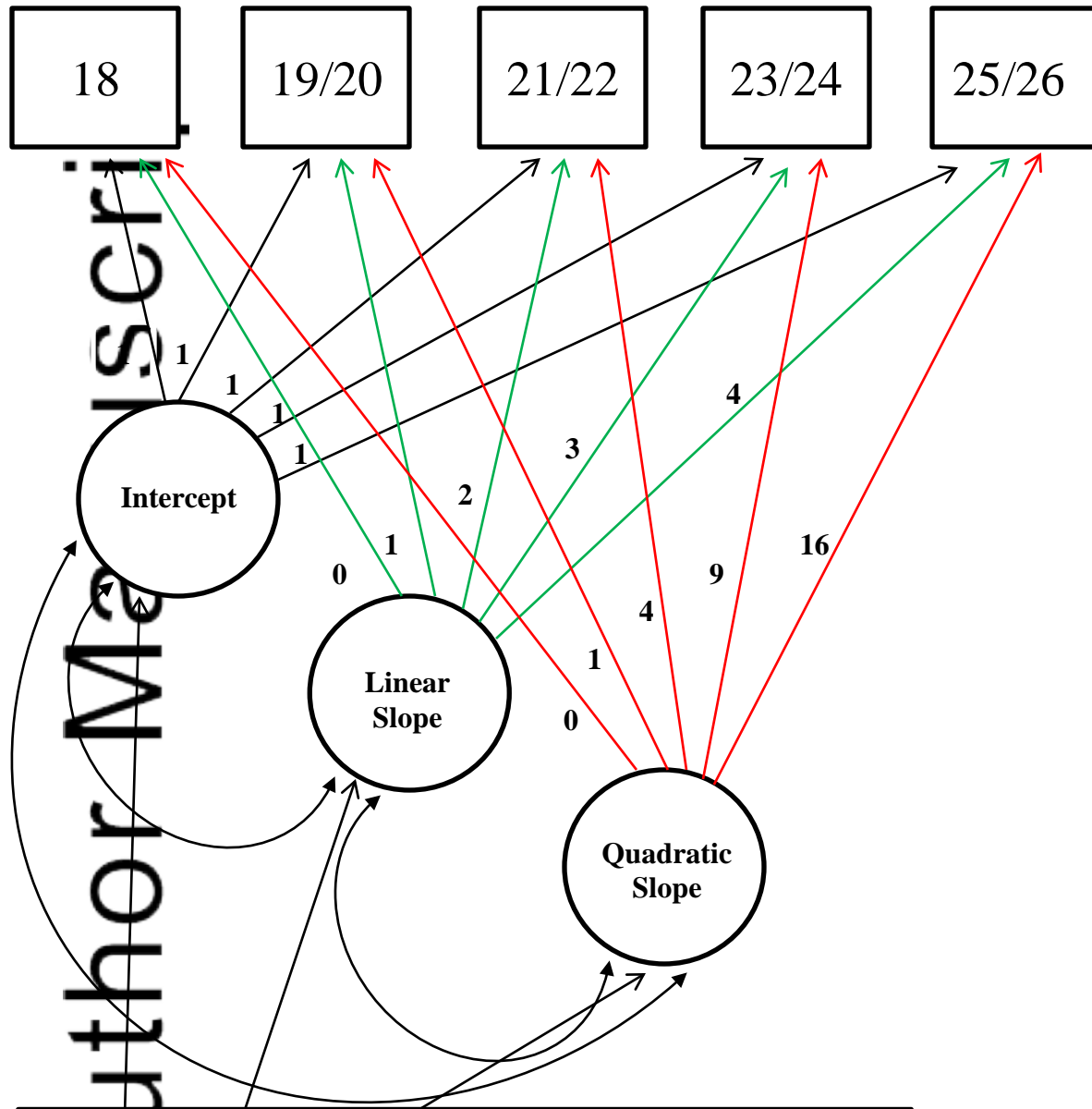
FIGURE 2. Latent Growth Curve Model

TABLE 2. Fit Statistics Estimating Growth Curve Models for Mean Frequency of Annual Nonmedical Use of Prescription Drugs

LGCM Models with No Covariates (Means)	Prescription Opioids	Prescription Sedatives	Prescription Stimulants	Prescription Tranquilizers
Intercept	2.87(.075)***	3.08(.083)***	1.74(.022)***	2.81(.066)***
Linear	-.043(.008)***	-.124(.011)***	-.058(.007)***	-.049(.008)***
Quadratic	.034(.009)***	.084(.013)***	-.042(.007)***	.047(.009)***
(Variances)				
Intercept	.150 (.008)***	.129 (.007)***	.560 (.015)***	.157 (.008)***
Linear	.079 (.007)***	.052 (.006)***	.253 (.013)***	.071 (.007)***
Quadratic	.004 (.001)***	.002 (.001)***	.011 (.001)***	.003 (.001)***
χ^2	66.251***	34.922***	133.637***	53.513***
DF	6	6	6	6
CFI	.984	.986	.982	.989
TLI	.973	.976	.971	.982
RMSEA	.012	.008	.017	.010
n	71918	71946	71958	71980

LGCM Models with Covariates (Means)	Prescription Opioids	Prescription Sedatives	Prescription Stimulants	Prescription Tranquilizers
Intercept	2.30(.063)***	2.65(.074)***	1.54(.024)***	2.42(.060)***
Linear	.040(.122)	.061(.027)*	.063(.024)**	-.025(.026)
Quadratic	-.016(.029)	-.057(.033)	-.133(.027)***	.021(.030)
(Variances)				
Intercept	.128 (.008)***	.113 (.007)***	.415 (.014)***	.139 (.007)***
Linear	.077 (.007)***	.051 (.006)***	.243 (.013)***	.071 (.006)***
Quadratic	.004 (.001)***	.002 (.001)***	.011 (.001)***	.003 (.001)***
χ^2	4557.834***	4763.620***	6732.432***	4823.374***
DF	77	62	92	62
CFI	.807	.650	.830	.807
TLI	.775	.520	.824	.735
RMSEA	.028	.032	.032	.033
	71918	71946	71958	71980

***p<.001, **p<.01, *p<.05; Standard Errors are in parentheses.

Note: The CFIs for the models with covariates were relatively low (< .90) compared to typical standards. Moreover, unstandardized variance estimates are presented to compare models with and without covariates.

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TABLE 3. Growth Curve Model With Covariates: Estimates for Mean Frequency of Annual Nonmedical Use for Each Prescription Drug Class

	Prescription Opioids	Prescription Sedatives	Prescription Stimulants	Prescription Tranquilizers
	coef.	coef.	coef.	coef.
Intercept	2.30***	2.65***	1.54***	2.42***
Male	.010*	-.012**	-.068***	-.016***
Black	-.037***	-.040***	-.072***	-.041***
Hispanic	-.036	-.019***	-.028***	-.023***
Other Race	.003	.012**	.010*	.007
Asian	-.007*	.001	.001	-.005
Grades(C+ or lower)	.014**	.027***	.028***	.009
Truancy	.050***	.048***	.055***	.042***
Evenings out	.067***	.060***	.058***	.061***
Parental Education	.012**	-.010*	-.002	.000
Plans to go to college	-.021***	-.036***	-.049***	-.025***
Cigarette use (past 30 days)	.106***	.108***	.114***	.106***
Binge drinking (past two weeks)	.091***	.097***	.140***	.087***
Marijuana use (past year)	.205***	.178***	.260***	.176***
Linear	.040	.061*	.063**	-.025
Male	.023**	.024**	.069***	.029***
Black	.002	.014*	.024***	.008
Hispanic	.010	.002	.008	-.005
Other Race	-.008	-.020*	-.021**	-.018*
Asian	-.008	-.001	-.012*	-.005
Grades(C+ or lower)	-.017	-.009	-.021**	-.013
Truancy	-.010	-.037***	-.012	-.014
Evenings out	-.027***	-.042***	-.012	-.022**
Parental Education	.009	.015	.006	.015*
Plans to go to college	.034***	.032***	.044***	.038***
Cigarette use (past 30 days)	-.039***	-.065***	-.041***	-.034***
Binge drinking (past two weeks	-.054***	-.055***	-.071***	-.042***
Marijuana use (past year)	-.043***	-.086***	-.068***	-.036***
Quadratic	-.016	-.057	-.133***	.021
Male	-.021*	-.021*	-.054***	-.026**
Black	-.002	-.005	-.006	-.007
Hispanic	-.006	.007	.000	.011
Other Race	.004	.022*	.024**	.015
Asian	.005	-.004	.014*	.000
Grades(C+ or lower)	.020*	.005	.021*	.009
Truancy	.006	.032**	.000	.012
Evenings out	.018*	.037***	-.001	.019*
Parental Education	-.014	-.016	-.012	-.019*
Plans to go to college	-.036***	-.023*	-.038***	-.032***
Cigarette use (past 30 days)	.034**	.055***	.017	.033**

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| Binge drinking (past two weeks) | .037*** | .032* | .037*** | .026* |
| Marijuana use (past year) | .021 | .052*** | -.006 | .026* |

Note: All models control for cohort periods for each specific drug class (estimates presented in table 4).

***p<.001, **p<.01, *p<.05.

TABLE 4. Growth Curve Model With Covariates - Estimates for Mean Frequency of Annual Nonmedical Use for Each Prescription Drug Class Across Cohorts

Prescription Opioids		Prescription Sedatives		Prescription Stimulants		Prescription Tranquilizers	
	coef.		coef.		coef.		coef.
Intercept	2.30***	**Intercept**	2.65***	**Intercept**	1.54***	**Intercept**	2.42***
1977-1990	ref.	1977-1985	ref.	1977-1985	ref.	1977-1987	ref.
1991-1996	.007	1986-1994	-.040***	1986-1989	-.092***	1988-2000	-.039***
1997-2001	.043***	1995-2006	.044***	1990-1995	-.125***	2001-2006	.041***
2002-2006	.122***			1996-2004	-.123***		
				2005-2006	-.056***		
Linear	.040	**Linear**	.061*	**Linear**	.063**	**Linear**	-.025
1977-1990	ref.	1977-1985	ref.	1977-1985	ref.	1977-1987	ref.
1991-1996	.013***	1986-1994	.032***	1986-1989	-.064***	1988-2000	.042***
1997-2001	.050***	1995-2006	.021	1990-1995	-.039***	2001-2006	.031**
2002-2006	.046***			1996-2004	-.037***		
				2005-2006	-.001		
Quadratic	-.016	**Quadratic**	-.057	**Quadratic**	-.133***	**Quadratic**	.021
1977-1990	ref.	1977-1985	ref.	1977-1985	ref.	1977-1987	ref.
1991-1996	.010	1986-1994	-.014	1986-1989	.103***	1988-2000	-.013
1997-2001	-.009	1995-2006	-.021	1990-1995	.092***	2001-2006	-.018
2002-2006	-.038**			1996-2004	.095***		
				2005-2006	.029**		

***p<.001, **p<.01, *p<.05; ref. = reference group.

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