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An Integrated Model of Juvenile Drug Use: A Cross-Demographic Groups Study

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Abstract: *This study tests the applicability of an integrated model of deviance – social bonding and learning theories – to drug use among a representative sample of U.S. adolescents (12-17 years old). A structural equation model (SEM) was estimated across all subgroups (age, race, and gender) as well as the overall group. The relationships between exogenous variables (social bond and delinquent peer) and endogenous variables (delinquent peer and drug use) were significant and in the hypothesized direction for the overall group and for each subgroup. The results also showed some differences and similarities across demographic groups. The explained variance in substance use ranged from 0.27 to 0.48. Applications for future study are also discussed.*

Keywords: social bonding theory; learning theories; drug use; structure equation model.

Introduction

The adolescent life-stage is a period of high risk for engaging in many different kinds of problem behaviors, such as substance use (e.g., cigarettes, marijuana, alcohol) and delinquency. Involvement in these acts can place youth at increased risk of future criminal involvement or social maladjustment. Some studies (Elliott 1994; Moffitt 1993; Nagin and Paternoster 1991; Sampson and Laub 1993) have documented that early involvement in antisocial behavior is strongly related to criminality in adulthood.

Among juvenile deviance, drug use is a common phenomenon. A substantial body of research has suggested that involvement in drug use has become a national concern, whether it is alcohol (Barnes 1984; Wechsler et al. 1984), or marijuana use (Smith 1984). Ellickson, Collins, and Bell (1999) have suggested that the use of "hard" drugs (e.g., heroin, cocaine) commonly follows the onset of "gateway" drug use, such as alcohol and marijuana. Moreover, the Office of National Drug Control Policy (ONDCP 2003) has found that youth substance use or abuse can cause many negative consequences, including deviant acts (e.g., early sexual initiation and suicide) and delinquency. For these reasons, identifying and understanding the dynamics underlying youths' drug use are important.

The present study seeks to assess important social factors in understanding adolescent drug use. A theoretical model of adolescent drug use that integrates central ideas from social control theory (Hirschi 1969) and learning theories (Sutherland and Cressey 1966; Akers 1973) is formulated and tested. This research does not aim to compare the usefulness of both theories. Rather, it is hoped that by combining the important concepts of learning theory to social control theory, more insights into juvenile substance use can be obtained. Although many studies have employed the same idea to study juvenile drug use (Aseltine 1995; Ellickson, et al. 1999; Marcos, Bahr, and Johnson 1986; Massey and Krohn 1986), this study departs from previous studies in an important way in that the present study applies this integrated model across different demographic groups (e.g., gender, race/gender). In so doing, this study provides insights of the differences of drug use across demographic groups and adds to the information from previous studies which consider important demographic variables as control variables.

Literature Review

Social Control Theory

Hirschi's (1969) social control theory argued that adolescents who had no strong bond to conventional social institutions were more likely to commit delinquency. Many empirical studies that follow Hirschi's theory have found general support that juveniles who have strong social bonds are involved in fewer delinquent acts (Agnew 1985; Costello and Vowell 1999; Erickson, Crosnoe, and Dornbush, 2000; Hindelang 1973; Hirschi 1969; Junger-Tas 1992; Sampson and Laub 1993; Thornberry et al. 1991). Some studies that specifically employed social control theory to explain juvenile drug use have also found support for this theory (Ellickson et al. 1999; Krohn

et al. 1983; Marcos et al. 1986; Wiatrowski, Griswold, and Roberts 1981). By reviewing these studies, one can find that among the adolescent period (12-17), family and school play influential roles in influencing youngsters' behavior. Whereas a defective family bond increases the probability of youthful drug use or juvenile delinquency (Denton and Kampfe 1994; Wells and Rankin 1991; Rankin and Kern 1994; Radosevich et al. 1980), students who have a weak school bond also have a higher risk of drug use (Ahlgren et al. 1982; Bauman et al. 1984; Radosevich, et al. 1980; Tec 1972).

Learning Theory

Differential association (Sutherland and Cressey 1966) and social learning theory (Akers 1973) were developed in different time periods, but both theories argue that deviant behavior is learned through association with one's original groups (family or peers), which provide pro-deviant definitions and antisocial behavior patterns. Among learning theories' many propositions, the delinquent peer-delinquency association is the most commonly tested proposition. In fact, the effect of differential association with delinquent peers increasing one's delinquent behavior is consistently found in many studies (Akers and Cochran 1985; Akers et. al. 1979; Hindelang 1973b; Jensen and Rojek 1992). And, this peer effect has also been found in juvenile substance use in the U.S. (Elliott, Huizinga, Ageton 1985; Marcos, et al. 1986).

An Integrated Model of Social Control and Learning Theory

Due to empirical support of both control and learning perspectives of youthful substance use, scholars began to integrate both theories. Although the integrated models vary widely, the common model includes some social control variables (e.g., family bond) and delinquent peer association. This common model has been related to substance use cross-sectionally and longitudinally (Agnew 1993; Erickson et al. 2000; Massey and Krohn 1986; Marcos et al. 1986). One conclusion that can be made after reviewing all these studies is that the integrated model provides a promising future for studying juvenile delinquent behavior in general and drug use in particular (Marcos et al. 1986).

The Role of Gender, Race, and Age

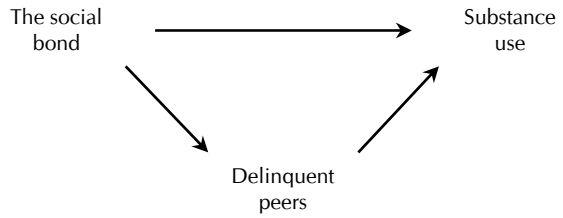
Most criminological and sociological theories of crime and delinquency have concentrated on explaining male deviance. Social control theory (Hirschi 1969), for instance, was developed with direct and exclusive reference to males. Smith (1979) noted that differences in the volume of deviance between males and females do exist; however, he argued that the major theoretical frameworks provided meaningful explanations of these differences. "It appears unwise to search for specific theories to account for female as distinct from male deviance" (Smith 1979:194). In addition, Segrave and Hastad (1985) concluded that "theories of delinquency, largely developed from male populations, are equally applicable to females." Studies that used social learning and social control theories to explain gender difference in delinquency did support that the two theories help to understand gender gap in crime and delinquency (De Li and Mackenzie 2003; Giordano et al. 1999; Mears, Ploeger, and Warr 1998). Hence, the same process which explains male delinquency should also be valid in explaining female antisocial behavior.[1]

Although race is also a critical variable in studying deviance in general and juvenile drug use, race is often considered as a control variable. Cheung (1990) argued that few empirical studies have provided a theoretical framework on racial/ethnic differences in drug use. While some studies have found that racial differences in adult drug use are partly due to socioeconomic and cultural barriers (Wallace 1999), the extent of applying the adult outcome to a juvenile group is unknown. In addition, whether the process of leading a youth to drug use is different across racial groups is also unclear. Consequently, a theoretical framework that not only explains juvenile drug use but also explicates racial differences is needed.

Several studies have employed social control theory and other theoretical perspectives (e.g., differential association) to study gender differences (Cernkovich and Giordano 1992; Erickson et al. 2000; Jensen and Eve 1976; Smith 1979; Smith and Paternoster 1987; White et al. 1986) or race differences (Matsueda and Heimer 1987) in deviance. Several general conclusions can be drawn from these studies: (1) gender-crime and race-delinquency differences do exist, (2) social control theory can explain the gender and race differences, (3) delinquent peers are very important in understanding race and gender differences in delinquency, and (4) gender and race influence one's exposure to social bonds and delinquent peers, which, in turn, affect deviant involvement.

A more complex issue concerns the effect of gender and race on deviance. Jensen and Eve (1976) argue that a gender difference in delinquency may be race specific (also see Farnworth 1984). Some studies support race specific effects on delinquency across gender groups (Smith and Visher 1980; Young 1980). Watt and Rogers (2007) recently found that the process of alcohol use and abuse among youth was different across race and gender

Figure 1. Theoretical Model



groups. Specifically, they found that White females were more likely to be influenced by their peers than Black females. Moreover, Black males were more likely to use alcohol if they lived in a supportive family.

Another important correlate with crime and delinquency is age. Perhaps, the most consistent finding across time, culture, and crime type is that crime peaks in the teenage years and declines thereafter (Gottfredson and Hirschi 1990). Hence, inclusion of age in the study of delinquency and crime is done on a routine basis (Akers and Lee 1999). The age-delinquency relationship can be explained by the variation of social bonding or social learning variables (Akers and Lee 1999; Greenberg 1985, 1994; Warr 2002). Lagrange and White (1985) found social bonding variables had significant effects on delinquency at age 15 and 18 but not 12. Some studies have suggested that the family bond and school bond may have different effects for early teens and older adolescents (Agnew 1985; Dukes and Stein 2001; Friedman and Rosenbaum 1988). While many studies have reported variation in social bonding elements across age stages, Akers and Lee (1999) argue that the underlying mechanism of both bonding and learning theories in explaining substance use remains the same across age groups.

The Present Study

Few studies have examined for similarities or differences in the correlates of juvenile drug use in gender by race subgroups (see Watt and Rogers, 2007 for exception).[2] Often, the social demographic factors (gender, race, and age) are included in most studies as control variables. Another shortcoming of these studies is that they do not investigate the relationship of background variables to delinquency under an integrated theoretical model matching elements of social control and learning theory. The present study tests the combined model (Figure 1), which integrates both social bonding and delinquent peer association variables, across gender, race, and age subgroups. In addition, the present study followed Costello and Vowell (1999) who found that the original social bonding elements actually measured a latent variable—social control. Hence, in the present study, social control is treated as a latent variable which is measured by three social bonding elements (family bond, school bond, and involvement). If the model fits the data in all subgroups, one can conclude there is no difference in the procedures of drug use derived from these theories. And by extension, the mainstream criminological theories can be equally applied to different demographic groups.

Method

Data

The current study utilizes data from the National Household Survey on Drug Abuse (NHSDA 2001), an interview survey of 68,929 individuals (age 12 years or older) drawn from the civilian, noninstitutionalized U.S. population. The participation rate for NHSDA is about 73 percent. The data were collected through a multistage area probability sample drawn from residents living in the United States. The sample is stratified on many levels, beginning with states. Eight states contributed approximately 3,600 respondents while the remaining states (including the District of Columbia) each contributed about 900 respondents. The sampling procedure and the quality control of the NHSDA have been described fully (Allred et al. 2003).

Each eligible respondent is interviewed in his or her home. Questionnaires about drug use and other sensitive behaviors (e.g., criminal acts) are self-administered using audio computer-assisted self-interviewing (ACASI). The computer-assisted design not only assures the confidentiality, but also increases response rate by systematically checking inconsistent and skipped answers. The final sample which is accessible by the public consists of 55, 561 subjects. After weighting according to probability of selection into the study[3] the sample is believed to be representative of the U.S. general population.

The sample for the present study was about 17,429 respondents who were 12 to 17 years old. This subsample represented 31.4 percent of the total sample (55,561). After listwise deletion of missing data (16% of total juvenile sample or n = 2,822) the final sample was 14,607.[4,5] Therefore, the final sample for the present study is 14,607 youngsters who completely answered the relevant questions; they represented nearly 83 percent of the total youth subsample.

The sample consisted of 50.4 percent males (7,356) and 49.6 percent females (7,251). Their age ranged from 12 to 17 years, and all of these participants were enrolled in public, or private schools, or in settings that were similar to a normal school setting. Nonwhite youths (Black, Hispanic, and other) accounted for 30.7 percent (4,489) of the total sample, and Whites were responsible for 69.3 percent (10,118) of the respondents.

Drug Use

The drug use (endogenous variable) of this study is measured by self-reports of the use of five categories of substances—marijuana/hashish (MJ), cocaine (COC), hallucinogens (HAL), inhalants (INH), and alcohol(ALC). Students were asked the frequency of using these five different substances in the past year. Six categories can be chosen from (0=no past year use to 5=use 300-365 days). Due to the skewness of these items, each substance behavior was dichotomized into 2 categories (1=used in the past year; 0=no past year use). The distribution for each substance use is (nonuse vs. use) as follows: 83.9 percent (12,261) vs.16.1 percent (2,346)—marijuana, 98.3 percent (14,362) vs. 1.7 percent (245)—cocaine, 95.5 percent (13,947) vs. 4.5 percent (660)—hallucinogens, 96.3 percent (14,060) vs. 3.7 percent (547)—inhalants, and 63.8 percent (9,322) vs. 36.2 percent (5,285)—alcohol.

A confirmatory factor analysis was conducted on the dichotomized drug use variable using the Mplus 4.1 statistical modeling program (Muthen and Muthen 2006). The model fits the data very well (CFI=0.999[5]; RMSEA=0.016[7]; TLI=0.998[8]). Therefore, in the final model, these five items were observable indicators measuring a single endogenous latent variable (substance use)[9]

Family Bond

There are four items from this data set that can be used to measure family bond. These four items ask respondents: how often in the past 12 months did their parents check if they had done their homework, provide help on homework, say they were proud of the respondent, and let the respondent know they had done a good job? Response options are "1=always," "2=sometimes," "3=seldom," and "4=never."

An exploratory factor analysis, principal axis factoring with Varimax rotation, on these items revealed a one factor solution (eigenvalue=2.42). Each item loaded significantly on the single factor (ranged from 0.50 to 0.85). The correlation coefficients between pairs of these items are all significant at the 0.01 level. Consequently, family bond is represented by the summation of the responses across the four items (α=0.77), with higher scores indicating a weak family bond.[10]

School Bond

Five questions asked respondents about their feelings towards school. These five items are: liking school, feeling interested in school, feeling meaningful of school work, feeling the importance of school courses, and the frequency of praise from teacher (Cernkovich and Giordano 1992; Junger-Tas 1992; Marcos et al. 1986). Response to each item was coded such that a higher value represented negative feelings about the school and teacher. An exploratory principal axis factor analysis revealed all five items loaded significantly on the one latent factor, which had an eigenvalue of 2.62. The loadings range from 0.48 to 0.76, and the correlation coefficients between pairs of these items are all significant at the 0.01 level. The raw items were summed to form the school bond variable. Youngsters who scored high on school bond had weaker school ties (α=0.77).

The foregoing measurement of social bonding variables (family bond and school bond) may seem different from that used in other studies. While many studies (Brezina 1998; Foshee and Hollinger 1996; Simons-Morton et al. 1999; Wells and Rankin 1988) used different variables to capture the concept of social bond (e.g., attachment, commitment), the main proposition of Hirschi's social bonding theory dwelled on relationships between individuals and their various reference groups (e.g., family, school, peers). Hirschi (1969) originally conceptualized each of these bonding institutions as a multidimensional construct. Therefore, although measures of social bond might be different from previous studies, these measures tap the essential meaning of social bond (see footnote 9).

Involvement

Most studies that test social bonding theory do not usually include involvement. Part of the reason is the conceptual overlap with commitment. However, in the present study, four items that can best describe Hirschi's (1969) involvement are used. According to Hirschi, "the

person involved in conventional activities is tied to appointments, deadlines,… and the like, so the opportunity to commit deviant acts rarely arises" (p. 22). The involvement items ask respondents to report the number of conventional activities, such as religious-related activities and school-related activities, they have attended in the past 12 months.

The EFA (principle axis) revealed a single factor solution (eigenvalue=2.05). The loading of each indicator on the latent construct ranged from 0.45 to 0.79, and each was statistically significant. All the correlations between pairs of items were significant at the 0.01 level. Therefore, in the final analysis, involvement is measured by the summation of the four items. These items were reverse coded so that the higher the score on this variable, the fewer conventional activities the youngster had participated in (α=0.68).

While Hirschi (1969) proposed four social bonds, Krohn and Massey (1980) expressed concern regarding the overlap between commitment and involvement. Consequently, they subsumed involvement into commitment, and research that followed usually omitted involvement (Akers and Lee 1999). However, in the present study, the indicators of involvement reflect the original concept of involvement (conventional activities), but they do not coincide with the indicators of school bond (commitment). Therefore, the concern that Krohn and Massey raised would not be a problem here.

Although Hirschi (1969) conceptualized the elements of the social bond as separate, he suggests that these elements are interrelated. Therefore, the present study specified that a latent variable of social control be measured by three social bond elements in the final model. While Hirschi contended that each element of the social bond could influence delinquency independently, the present conceptualization is still consistent with the theory (Costello and Vowell 1999: 823). By and large, social control is an abstract concept that links the more concrete elements of the social bond. Although each of these bonding elements can have an independent effect on delinquency, a model that specifies their collective effects on deviance provides a better test of the theory. Stated differently, if the latent variable of social bond does not fit the data, the assertion of inter-correlation among these social bonding elements is questionable.

Delinquent Peers

The index of a deviant peer association is reflected in four items. The four questions ask respondents about the proportion of students who use various drugs in their grade in school. Although the four indicators do not ask respondents directly about their "friends'" substance use, it seems likely that students who report other students' drug use behavior have knowledge based on a close type of peer relationship.[11] Therefore, using these four items to represent peer influence is close to the central idea of learning theory. The responses options are: "1=none of them," "2=few of them," "3=most of them," and "4=all of them." An exploratory principal axis factor analysis identified a one-factor solution (eigenvalue=2.95), with each item loaded significantly on the factor (range 0.775 to 0.853). Consequently, the summation of these four items was used as a variable in the final model (α=0.88).

All of the actual questions used in this study, with response categories, are shown in Appendix A. Descriptive statistics of all variables, including the demographic variables**,** social bonding variables and delinquent peers, can be found in Table 1 and 2 in Appendix B. In addition, the factor loading of each indicator and its respective latent variable is shown in Table 1.

Table 1. Explanatory Principal Axis Factor Analysis

Factors	Factor loadings*
Family bond	
Parents check homework	0.496
Parents help on homework	0.596
Parents are proud of you	0.810
Parents praise you	0.845
Sum of squared loadings	**1.97**
School bond	
Like school	0.633
Meaningful of school	0.658
Importance of course	0.643
Interesting of courses	0.758
Teacher praise	0.484
Sum of squared loadings	**2.06**
Involvement	
# of school based activities	0.673
# of community activities	0.788
# of faith-based activities	0.454
# of other activities	0.459
Sum of squared loadings	**1.49**
Delinquent peer	
Students smoke cigarette	0.775
Students use marijuana/hashish	0.796
Students drink alcohol	0.853
Students get drunk	0.801
Sum of squared loadings	**2.60**

* All loading is after Varimax rotation.

Table 2. Model Fit for Demographic Subgroups

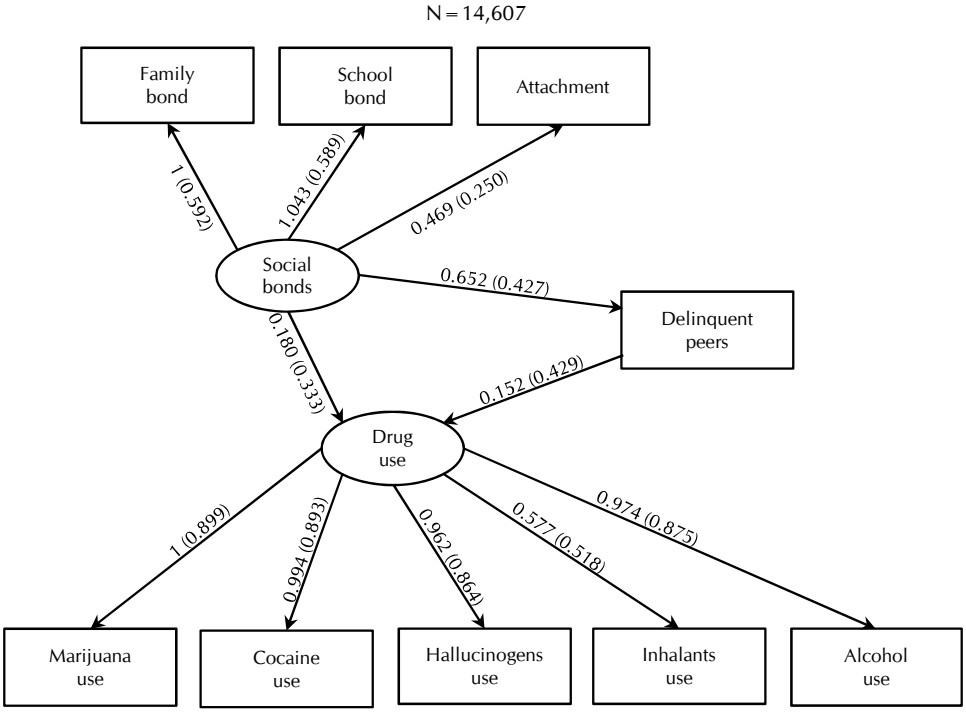
Model	Chi-square	df	p	CFI	TLI	RMSEA
Overall	162.85	21	< 0.001	0.990	0.990	0.022
Age	278.22	66	< 0.001	0.980	0.980	0.026
Race	239.88	42	< 0.001	0.987	0.987	0.025
Gender	206.29	44	< 0.001	0.990	0.990	0.022
Gender/race	249.35	82	< 0.001	0.989	0.989	0.024

Analytic Strategy

The analysis examined the fit of the model,[12] shown in Figure 1, for all samples, and across three demographic (age, gender, and race) and four gender/race subgroups by using M-plus 4.1 (Muthen and Muthen 2006), which estimates the model through MLSM[13] estimation. The present study uses a multiple group analysis approach, where the factor loadings, intercepts, and means/thresholds are held equal across the groups; however, the intercepts for the relationship between latent variables and delinquent peers are not held equal (Muthen and Muthen 2006: 331-333). In multiple group analysis the structural parameters (regression coefficients) are free, but in the present analysis these coefficients are constrained to be equal across the subgroups. Consequently, if the model fits the data well, the process through which juveniles are involved in drug use will be the same across various demographic groups.

The overall sample size is large (14,607), and even though the sample is further divided into different subgroups (e.g., gender/race, age), each group still has over 2,000 subjects. The chi-square goodness-of-fit statistic is not a good model fit index because it is sensitive to large sample sizes. Therefore, other goodness-of-fit statistics (CFI, TLI, and RMSEA) are used to assess the model fit

Figure 2. SEM for Overall Sample*



Chi-square = 162.85; df = 21, p < 0.001.
CFI = 0.990; TLI = 0.990
RMSEA = 0.022
R-square = 0.417

* All loadings and path coefficients are statistically significant (p < 0.05); standardized scores are in parentheses.

for each analysis. The model fit statistics for overall and each subgroup are reported in Table 2.

Results

Overall

The overall model fits the data very well (CFI=0.990, TLI=0.990; RMSEA=0.022). In addition, the loading and path coefficients are all significant and in the theoretically expected directions (see Figure 2). For example, the latent social control variable is significantly related to delinquent peers (β=0.427) and drug use (β=0.333). In addition, the delinquent peers also have a significant effect on drug use (β=0.429). Hence, a juvenile is more likely to use various drugs when he has lower social control and is aware many students in his or her grade use drugs. The model explained about 42 percent of the variance in substance use, which is moderate to high.

Age (12–13 vs. 14–15 vs. 16–17)

The analysis through multiple-group comparison and regression coefficients are also forced to be equal across groups. The proposed model fits the data well. However, upon inspection, the modification indices indicated that relaxing the school bond intercept in the 16-17 age group would improve the fit. Consequently, the reported results incorporate this change. This final model fits the data well (see Table 2 for fit indices). Hence, one can conclude that the process that leads a juvenile to drug use is similar across different age groups. That is, students from ages 12 to 17, who have strong social control (strong family and school bonds, and are involved in more conventional activities) and know fewer same grade students who use drugs, are less likely to be involved in drug use (see Table 3). While the same process for juvenile drug use can be generalized to all three age groups, the intercepts for each group are different. The general pattern is that drug use prevalence and proportion of peer drug use increases along with age. The explained variance of drug use for each age group is 0.278 (12–13), 0.306 (14–15) and 0.310 (16–17) respectively.

Race (White vs. Nonwhite)

The original goodness-of-fit statistics are acceptable. However, close inspection of the modify indexes reveals that relaxing the intercept for school bond in the White group can improve the fit dramatically. Consequently, the model reported here reflects this specification. The fit indices indicate the model fits the data quite well (see Table 2). All the regression coefficients are significant and in the expected directions, and the same conclusion can be made for the results in the age group analysis (see Table 4). Although the unstandardized path coefficient of social control-drug use is higher than delinquent peers-drug use, the standardized coefficients in each racial group reveal that the effect of delinquent peers on juvenile drug use behavior is stronger than social control. However, the standardized coefficient of social control-delinquent peers is higher than the delinquent peers-drug use relationship in Whites (0.438>0.437) than in Nonwhites (0.386<0.452). The intercept of drug use is different wherein Whites (0.036) use more drugs than Nonwhites (0.00).[14] The most salient difference between these two groups is the school bond because the intercept has been

Table 3. Path Coefficients and Loadings for Age Subgroups*

N = 14,607

	12–13				14–15				16–17			
Variables	Social bond		Substance use		Social bond		Substance use		Social bond		Substance use	
Family bond	1	(0.594)			1	(0.522)			1	(0.474)		
School bond	1.261	(0.624)			1.261	(0.646)			1.261	(0.602)		
Involvement	0.485	(0.217)			0.485	(0.236)			0.485	(0.221)		
Marijuana			1	(0.904)			1	(0.894)			1	(0.866)
Cocaine			0.968	(0.875)			0.968	(0.920)			0.968	(0.870)
Hallucinogens			0.921	(0.832)			0.921	(0.856)			0.921	(0.867)
Inhalants			0.550	(0.497)			0.550	(0.544)			0.550	(0.643)
Alcohol			1.008	(0.911)			1.008	(0.845)			1.008	(0.801)
Delinquent peer	0.483	(0.306)	0.136	(0.324)	0.483	(0.329)	0.136	(0.325)	0.483	(0.521)	0.136	(0.313)
Substance use	0.218	(0.328)			0.218	(0.354)			0.218	(0.363)		
R^2	0.278				0.306				0.310			

* All loadings and path coefficients are statistically significant ($p < 0.05$); standardized scores are in parentheses.

Table 4. Path Coefficients and Loadings for Race*

N = 14,607

	Nonwhite				White			
Variables	Social bond		Substance use		Social bond		Substance use	
Family bond	1	(0.533)			1	(0.626)		
School bond	1.050	(0.604)			1.050	(0.601)		
Involvement	0.512	(0.264)			0.512	(0.280)		
Marijuana			1	(0.846)			1	(0.941)
Cocaine			1.033	(0.873)			1.033	(0.909)
Hallucinogens			1.026	(0.868)			1.026	(0.866)
Inhalants			0.613	(0.519)			0.613	(0.523)
Alcohol			1.016	(0.860)			1.016	(0.888)
Delinquent peer	0.642	(0.386)	0.145	(0.452)	0.642	(0.438)	0.145	(0.437)
Substance use	0.160	(0.300)			0.160	(0.328)		
R^2	0.399				0.423			

All loadings and path coefficients are statistically significant ($p < 0.05$); standardized scores are in parenthese

relaxed. Specifically, the level of school bond for Whites (10.901) is significantly higher than Nonwhites (9.142), which indicates that White students report weaker school ties than Nonwhite students.[15] The explained variance is somewhat higher in the White group (0.423) than is it in the Nonwhite group (0.399).

Gender (Male vs. Female)

The model fit both gender groups well after relaxing equal intercept constraints on involvement for the female group (CFI=0.990, TLI=0.990, RMSEA=0.022). The model can be seen in Table 5. Again, delinquent peers (βmale=0.429; βfemale=0.436) have stronger effects on drug use than does social control (βmale=0.313; βfemale=0.344). The inhibiting power of social control on drug use is mainly from the negative relationship between social bond and delinquent peers (βmale=0.415; βfemale=0.449). The differences of intercept between these two groups are generally consistent with common knowledge that indicates females have a higher social level of social control and lower level of drug use than males. Moreover, females are involved in more conventional activities than are males because females have a lower level intercept of involvement (10.446) than males (11.240). The R-square for females is 0.443 and 0.394 for males.

Table 5. Path Coefficients and Loadings for Gender*

N = 14,607

	Nonwhite				White			
Variables	Social bond		Substance use		Social bond		Substance use	
Family bond	1	(0.594)			1	(0.587)		
School bond	1.050	(0.627)			1.050	(0.558)		
Involvement	0.477	(0.260)			0.477	(0.252)		
Marijuana			1	(0.918)			1	(0.877)
Cocaine			1.016	(0.922)			1.016	(0.891)
Hallucinogens			0.982	(0.862)			0.982	(0.861)
Inhalants			0.583	(0.531)			0.583	(0.511)
Alcohol			1.003	(0.884)			1.003	(0.880)
Delinquent peer	0.657	(0.449)	0.151	(0.436)	0.657	(0.415)	0.151	(0.429)
Substance use	0.174	(0.344)			0.174	(0.313)		
R^2	0.443				0.394			

All loadings and path coefficients are statistically significant ($p < 0.05$); standardized scores are in parenthese

Up to this point, the present model fits well for specific demographic subgroups (e.g., White vs. Nonwhite). Hence, one can conclude that the process that leads juveniles to drug use is similar across age, gender, and racial subgroups. However, there also presents some differences, as the intercept has to be relaxed in some subgroups. While the tests so far confirmed that the proposed model is invariant across each different demographic group, these tests are similar to those made in previous research, which addressed one demographic variable at a time. In a further test of our model, we examined the fit of the model in four different demographic subgroups (White-male, White-female, Nonwhite-male, and Nonwhite-female), where both gender and race were taken into consideration simultaneously.

Gender/Race (NF vs. NM vs. WF vs. WM)

The results of the tests of the model indicated a good fit to the data (CFI=0.961, TLI=0.965, RMSEA=0.05). Inspection of the modification indices suggested the fit of the model could be improved by relaxing the intercept levels to be estimated: (1) on school bond for both White-females (WF) and White-males (WM), and (2) the involvement levels for White-females (WF). Hence, the final model included these specifications. The model fit the data quite well (CFI=0.989, TLI=0.989, RMSEA=0.024); moreover, all the path coefficients were statistically significant and in the expected direction (see Table 6).

Although the unstandardized loadings and path coefficients are the same across each gender/race group, some variations and similarities can still be found when looking at the standardized coefficients in each group. For example, while the peer effect on drug use is the most influential factor for three subgroups (NFβ=0.475>0.410; NMβ=0.440>0.378; WMβ=0.438>0.427), the social

Table 6. Path Coefficients and Loadings for Race/Gender*

N = 14,607

	Nonwhite female				White female			
Variables	Social bond		Substance use		Social bond		Substance use	
Family bond	1	(0.530)			1	(0.640)		
School bond	1.042	(0.617)			1.042	(0.644)		
Involvement	0.504	(0.261)			0.504	(0.289)		
Marijuana			1	(0.871)			1	(0.936)
Cocaine			1.037	(0.857)			1.037	(0.920)
Hallucinogens			1.085	(0.837)			1.085	(0.878)
Inhalants			0.634	(0.510)			0.634	(0.541)
Alcohol			1.032	(0.843)			1.032	(0.891)
Delinquent peer	0.643	(0.410)	0.139	(0.475)	0.643	(0.461)	0.139	(0.441)
Substance use	0.148	(0.323)			0.148	(0.338)		
R^2	0.456				0.446			
	Nonwhite male				**White male**			
Variables	Social bond		Substance use		Social bond		Substance use	
Family bond	1	(0.544)			1	(0.619)		
School bond	1.042	(0.589)			1.042	(0.561)		
Involvement	0.504	(0.264)			0.504	(0.272)		
Marijuana			1	(0.830)			1	(0.895)
Cocaine			1.037	(0.860)			1.037	(0.902)
Hallucinogens			1.085	(0.900)			1.085	(0.855)
Inhalants			0.634	(0.526)			0.634	(0.512)
Alcohol			1.032	(0.856)			1.032	(0.891)
Delinquent peer	0.643	(0.378)	0.139	(0.440)	0.643	(0.427)	0.139	(0.438)
Substance use	0.148	(0.276)			0.148	(0.311)		
R^2	0.361				0.405			

All loadings and path coefficients are statistically significant ($p < 0.05$); standardized scores are in parenthese

bond-delinquent peers association is the most important path for the WF groups (β=0.461>0.441). The relaxed intercept reveals that WF (10.283) are involved in more conventional activities than any other groups (11.334) and WF (10.575) have stronger school ties than WM (10.948); however, both groups have a weaker school bond than NF and NM (9.188). The R-square for each group is 0.361 (NM), 0.456 (NF), 0.405 (WM) and 0.446 (WF) respectively.

Discussion and Conclusion

This study examined an integrated model of adolescent drug use drawn from two criminological theories on deviant behavior. While this model is not unique, previous studies have not investigated this model across gender/race subgroups (Matsueda 1982; Marcos et al. 1986). Using data from the National Household Survey on Drug Abuse, and employing a structural equation model (SEM) and multiple group analysis, this study has been able to produce some important insights into juvenile substance use.

The proposed model fits all groups well, which indicates that the model is useful for explaining drug use (marijuana, cocaine, hallucinogens, inhalants, and alcohol) regardless of one's gender, race, and age. Juveniles (12-17) who have strong social control (strong family and school bond and are involved in various conventional activities) are less likely to use drugs and know same grade students who use drugs. This general finding is consistent with previous studies (Agnew 1993; Brook et al. 1990; Erickson et al. 2000; Ginsberg and Greenley 1978; Marcos et al. 1986; Matsueda 1982; Matsueda and Heimer 1987; Preston 2006). This conclusion is firm and may be generalized to juveniles who are 12-17 in the U.S. One limitation needs to be addressed, however. Although the sample is representative, the nature of this data set is cross-sectional, which prevents any causal conclusions from being made. Massey and Krohn (1986) used longitudinal data to test their integrated model, which is similar to the present model, on juvenile smoking and found similar causal sequences among variables that are specified in the present study. However, Thornberry (1987) and Agnew (2005:82) argued that scholars should pay attention to the non-recursive relationship between variables. Hence, longitudinal data that measure various concepts from different theories, and examine for reciprocal effects are needed.

Another interesting general result is the variation across different demographic groups. The relative contribution (loadings) and intercepts for each element on the latent variable of social control provides insights into the cross group differences. For example, the intercept of involvement for females needed to be relaxed to improve the fit when comparing males and females. However, the gender differences in the present study are actually a result of a high level of White-female student involvement because in the final model, the intercept of White-females was relaxed. This finding highlights the importance of considering the interaction between gender and race. If one only considers gender or race separately, the results will mask some the true differences. Another example is that the intercept of school is significantly different between Whites and Nonwhites. A close inspection of the final model reveals the differences not only between Whites and Nonwhites but also between White-males and White-females. Besides the relaxed intercept, the standardized path coefficients also indicate some variations. For example, in the final model (gender/race), the most important path through which white-females constrain their drug use behavior is the negative social control-delinquent peers relationship.

The above results suggest the importance of considering gender/race interaction in studying juvenile drug use. This echoes Watt and Rogers (2007) who also found different influences of peers, for instance, on alcohol use across gender/race subgroups. Although their study focused on contextual effects (e.g., SES), their results, combined with the present study and that of Cernkovich and Giordano (1992), highlight the importance of considering variation across gender and race/ethnicity subgroups. As Watt and Rogers (2007: 70) assert, one cannot simply "control" race/ethnicity in the model and expect to apply the same model to different groups. By extension, simply controlling for other important demographic variables (e.g., age, gender) may mask any underlying differences.

Many previous studies examining social control neglect involvement, due to the conceptual overlap with commitment, which may underestimate the constraining power of social control. In the present study, while involvement is less important than family and school, it nevertheless contributes to the social control. According to Hirschi (1969), students who are involved in various conventional activities simply have no time to be involved in delinquency. By extending Hirschi's idea, involvement can be seen as one's social capital, which can help a student expand his or her relationship with a broad social environment or enhance the juvenile's abilities (White and Gager 2007). As studies have shown, youth involvement in school activities increases their social capital, helping them achieve certain goals or increase their educational aspiration and attainment (Dika and Singh 2002).

Notwithstanding the benefits of involvement, Foshee and Hollinger (1996) found that higher conventional activity involvement caused higher delinquency. They argued that involvement provided a social milieu wherein juveniles spend more time with their peers, which, in turn, produced more opportunities for becoming involved in delinquency. Hence, whether involvement is beneficial to juveniles or detrimental is not so clear at this time; future research should attempt to clarify the role that involvement plays in teenage life.

The purpose of the present study is to use an integrated model, which combines social control and learning theory, to investigate juvenile drug use behavior. While this model is useful, one important concept is left out—strain/stress. As many studies have suggested, teenage years are relatively stressful when compared to childhood and adulthood (Agnew 2003; Hoffmann and Su 1998), and stressful life events/strain have lead to drug use (Asetine and Gore 2000; Hoffmann and Cerbone 1999). Consequently, in order to understand juvenile drug use behavior fully, we not only need to consider family, school, and peers, but also the strain juveniles face during their developmental stage. To complicate the matters further, as the present study has pointed out; various demographic variables need to be taken into account simultaneously. As Katz (2000) had suggested, strain theory is important in studying the crime and deviance of women, especially minority females (Preston 2006).

The present study confirmed that social control and delinquent peers affect juvenile drug use and these effects are similar across various demographic groups. However, there remains some "hidden valley" that this study does not take into account – strain/stress. Future studies need to consider these important variables when studying juvenile drug use. Moreover, when testing these integrated models, the relative importance of different theoretical variables on different demographic subgroups needs to be tested as well.

Endnotes

1. Although studies using "mainstream" criminological theories have found support for the process that leads males to delinquency also applies to females, feminists argue that female specific theories are needed. Consequently, these feminist scholars have provided various perspectives or theories to explain female crime through a "women's view" (Adler 1975; Chesney-Lind 1989; Steffensmeier 1980). The present study does not intend to settle the argument whether mainstream theories are potent enough to explain female crime; instead, this study is interested in whether an integrated model can explain both female and male adolescents' drug use and gender/race variability.

2. Another study that the present author is aware of is Cernkovich and Giordano's (1992) study which was concerned more with the effects of the school bond on youth delinquent behavior across gender/race subgroups. The limitation of this research is that this study did not study social bonds other than the school bond, and the sample size is relatively small when compared to the present study.

3. The weighting procedure in the present study not only takes into account various adjustments (e.g., nonresponse, poststratification) but also adjusts for the variance. Therefore, the weighted sample is believed to be representative of the U.S. population.

4. The excluded subjects are due to two reasons: (1) they did not complete the interview (e.g., refused to answer or skipped) or misplacement (e.g., adult subjects); and (2) some respondents (n = 92) were homeschoolers and others (n = 1,565) did not attend either public or private school.

5. Although listwise deletion excluded about 16 percent of the total juvenile sample, 59 percent of these excluded subjects were either homeschoolers or not in any type of school. A series of statistic comparison between final sample, homeschool subjects, and students who were not in school was conducted. As one would expect, those who were not in any type of school (n = 1,565) were less likely to have good family bond ($t = 68.1$, $p < 0.05$) and be involved in conventional activities ($t = 11.2$, $p < 0.05$). However, these youngsters were not more likely to use drugs than their counterparts who were in the school system. Instead, they were less likely to report drug use than school kids ($t = -6.3$, $p < 0.05$).

6. The Comparative Fit Index (CFI), which ranges from 0 to 1, indicates the improved fit of the hypothesis model (Bentler, 1990). CFI 0.9 or higher is desirable.

7. RMSEA (Root Mean Square Error of Approximation) is also another indicator of model fit, which takes degrees of freedom into account. RMSEA that is 0.05 or less indicates a good fit; a value of RMSEA that is between 0.05 and 0.08 is acceptable. However, a model that has a RMSEA value over 0.1 is unacceptable (Brown and Cudeck 1993).

8. The Tuck-Lewis coefficient was discussed by Bentler and Bonett (1980) in the context of moment structure. The typical range for TLI is between 0 and 1 although sometimes TLI value can exceed 1. TLI value that is greater than 0.95 indicates a good fit (Hu and Bentler 1999).

9. One anonymous reviewer raised 2 questions about this scale. First, while all observable variables loaded very well on one latent variable, one should not lump all drug use behavior together. Admittedly, each drug use behavior is somewhat different from one another. The present study focused more on the "drug use" behavior, not a particular drug use. So, the present study summed all individual variables together as many previous studies did when the research purpose was about drug use behavior in general (Erickson et al. 2000; Dembo et al. 1986; Maddox and Prinz 2003). Second, whether the distribution of the latent variable violated the assumption of SEM. The distribution of the latent drug use variable had a kurtosis value equal to 2.792, which is not highly skewed (Kim et al. 2003: 133).

10. This variable, although not perfect, measured two important dimensions of family bond: parental direct control (first two items) and parent-child affective interaction (last two items).

11. One anonymous reviewer pointed out that this measure of peer delinquency was weak because these four items were simply asking students to guess the proportion of other students' substance using behavior. Admittedly, this is not a perfect measure of peer delinquency; however, the present author still keeps this variable in the final model for 2 reasons. First, the common measure of peer delinquency is asking respondents to report their "friends'" involvement in delinquency. While this kind of measure has better wording than the present study (friends' involvement vs. students in the same grade), the common measure also has suffered the same problem of the present measure- respondent's gauge. As Gottfredson and Hirschi (1990: 157) strongly argued, this could cause an artifact of measurement because peer delinquency and one's delinquency are both reported by the same person; therefore, the individual may ascribe his or her behavior to others or report wrongly in other ways (see Matsueda and Anderson 1998, for excellent discussion). Hence, either measure suffers the same problems. Second, the influence of peers on an individual's behavior is evident not only because peer groups control one's reinforcement, but also provide an environment that is conducive to delinquency. Consequently, a student who is surrounded by other delinquent students may increase the chance of becoming delinquent. As footnote 2 has revealed, juveniles who are in the school system are actually involved in more substance use than those who are not. This result also partially validates this measurement. Accordingly, the present measure may not be perfect and as common as others have used, but it provides the similar meaning as the usual "delinquent peer variable" and also suffers the same measurement problems.

12. In the present model, only the social control variable and drug use are treated as latent continuous variables because each is measured by several observable variables. The delinquent peer variable is an observed variable. One anonymous reviewer raised a question about the second order measure of social control variable. The present study keeps the whole model simple as it is presented in here for one reason. If the social control variables are presented as second order in the final model, the proposed model will hardly fit the data. Even if it fits the data when doing multiple group comparison procedure, the analysis does not converge or is under-identified. Hence, preventing the more complex and detailed model to be examined here as the reviewer had suggested.

13. WLSMV "is a weighted least square parameter estimator which is using a diagonal weight matrix with standard errors and mean- and variance- adjusted chi-square test statistic that use a full weight matrix" (Muthen and Muthen 2006: 426).

14. For multiple group analysis, the first group is set at zero in order to estimate other groups. This is because "latent variable means generally cannot be identified for all groups" (Muthen and Muthen 2006:335).

15. This result may be counterintuitive because scholars have argued that schools might be an aversive environment for minority students (Cohen 1955). However, as Cernkovich and Giordano (1992: 269) found, Blacks actually have a higher school bond than Whites. Gibson and Ogbu (1991: 279) also found that Blacks (both parents and children) reported a greater desire for education credentials. The present measure of school bond indicates one's attitude to school, not necessarily his or her school performance. Hence, although Nonwhites are usually having a lower academic performance, this does not mean that they will have a lower school bond.

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Appendix A. Questions Used in Study

Family Bond

1. During the past 12 months, how often did your parents check if you've done homework?
2. During the past 12 months, how often did your parents provide help with your homework when you need it?
3. During the past 12 months, how often did your parents let you know that they are proud of what you have done?
4. During the past 12 months, how often did your parents let you know that you have done a good job?
   1 = Always
   2 = Sometimes
   3 = Seldom
   4 = Never

School Bond

1. Which of the statements below best describes how you felt overall about going to school during the past 12 months?
   1 = You liked going to school a lot
   2 = You kind of liked going to school
   3 = You don't like going to school very much
   4 = You hated going to school
2. During the past 12 months, how often did you feel that the school work you were assigned to do was meaningful and important?
   1 = Always
   2 = Sometimes
   3 = Seldom
   4 = Never
3. How important do you think the things you have learned in school during the past 12 months are going to be to you later in life?
   1 = Very important
   2 = Somewhat important
   3 = Somewhat unimportant
   4 = Very unimportant
4. How interesting do you think most of your courses at school during the past 12 months have been?
   1 = Very interesting
   2 = Somewhat interesting
   3 = Somewhat boring
   4 = Very boring
5. During the past 12 months, how often did your teachers at school let you know when you were doing a good job with your school work?
   1 = Never
   2 = Seldom
   3 = Sometimes
   4 = Always

Involvement

1. During the past 12 months, in how many different kinds of school-based activities, such as team sports, cheerleading, choir, band, student government, or club, have you participated?
2. During the past 12 months, in how many different kinds of community-based activities, such as volunteer activities, sports, clubs or groups have you participated?
3. During the past 12 months, in how many different kinds of church or faith-based activities, such as clubs, youth groups, Saturday or Sunday school, prayer groups, youth trips, service or volunteer activities have you participated?
4. During the past 12 months, in how many different kinds of other activities, such as dance lessons, piano lessons, karate lessons, or horseback riding lessons, have you participated?
   1 = 3 or more
   2 = Two
   3 = One
   4 = None

Delinquent Peer

1. How many of the students in your grade at school would you say smoke cigarettes?
2. How many of the students in your grade at school would you say use marijuana or hashish?
3. How many of the students in your grade at school would you say drink alcoholic beverages?
4. How many of the students in your grade at school would you say get drunk at least once a week?
   1 = None of them
   2 = A few of them
   3 = Most of them
   4 = All of them

Appendix B. Descriptive Statistics

Table 1. Description of Demographic Groups of the Youths in the Study

N = 14,607

		N	%			N	%
Age				**Race**			
	12–13	4,559	31.2 %		Nonwhite	4,489	30.7 %
	14–15	5,076	34.8		White	10,118	69.3
	16–17	4,972	34.0				
Gender				**Race/gender**			
	Male	7,356	50.4 %		Nonwhite male	2,233	15.3 %
	Female	7,251	49.6		White male	5,123	35.1
					Nonwhite female	2,256	15.4
					White female	4,995	34.2

Table 2. Descriptive Statistics of Social Bonding Variables and Delinquent Peers

Variables	Minimum	Maximum	Mean	Standard deviation
Family bond	4	16	6.90	2.72
School bond	5	20	9.92	2.94
Involvement	4	16	10.81	3.11
Delinquent peer	4	16	8.49	2.50