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Delinquency and alcohol-impaired driving among young males: A longitudinal study

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Abstract

The present study assessed how the trajectory of delinquency affects the growth curve of alcohol-impaired driving using three-waves of data collected from the Buffalo Longitudinal Survey of Young Men (BLSYM). Using the structural equation modeling method, latent growth modeling was utilized to assess four age cohorts of sixteen, seventeen, eighteen, and nineteen years of age at the first wave. The data indicated that the growth rate of delinquency significantly and positively affects the growth rate of alcohol-impaired driving for the respondents who were sixteen at the first wave. The growth rate of drinking was also significantly and positively associated with the growth rate of alcohol-impaired driving for this age cohort. Although the growth rate of delinquency had no significant effect on the growth rate of alcohol-impaired driving for the age cohort which was seventeen at Wave 1, the growth rates of both drinking and drug use did affect for this age cohort. The data, however, showed that alcohol-impaired driving had a significant increase across the waves for the eighteen year old cohort, but there was no significant variation in the rate across respondents. Finally, for the nineteen year old cohort there was no significant increase in alcohol-impaired driving across the waves, and also no significant variation of the growth rate of alcohol-impaired driving across the respondents. These findings indicated that interventions focused on reducing delinquency, alcohol and drug use by sixteen and seventeen year old male adolescents will also reduce their alcohol-impaired driving.

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Introduction

Alcohol-impaired driving is a major social problem in the United States. Although traffic fatalities in alcohol-impaired-driving crashes have been declining since the 1990s, the nation still has serious work to do to meet the national health objective for 2010 (Paulozzi & Patel, 2004). According to the National Highway Traffic Safety Administration (2008a), a total of 12,998 people were killed in alcohol-impaired-driving crashes in 2007. These alcohol-impaired-driving fatalities accounted for 32 percent of the total motor vehicle traffic fatalities in the United States and represented an average of one alcohol-impaired-driving fatality every forty minutes.

Data also indicated that young drivers are overrepresented in these alcohol-impaired-driving fatalities. The National Highway Traffic Safety Administration (2008b) reported that in 2007, the highest percentage of drivers in fatal crashes who had a BAC level of .08 or higher was for drivers at ages twenty-one to twenty-four (35 percent), followed by those at ages twenty-five to thirty-four (29 percent). In 2007, 13 percent (6,982) of all drivers involved in fatal crashes (55,681) were young drivers at ages fifteen to twenty years old, and 15 percent (1,631,000) of all drivers involved in police-reported crashes (10,524,000) were young drivers.

For the same age group, 31 percent of the drivers who were killed in motor vehicle crashes during 2007 had been drinking. It is well known that motor vehicle crashes are the leading cause of death among young people. In 2007, a total of 3,174 fifteen-to twenty-year-old drivers were killed and an additional 252,000 were injured in motor vehicle crashes. Also, there were 202.8 million licensed drivers in the United States in 2006 (2007 data not available). Young drivers, between fifteen and twenty years of age, accounted for 6.4 percent (13.0 million) of the total, a 7.2-percent increase from the 12.1 million young drivers in 1996 (National Highway Traffic Safety Administration, 2008b).

Although alcohol-impaired driving is still a serious concern, especially a concern with young people, the dynamics and trajectory of alcohol-impaired driving among young people remains unclear (Bingham & Shope, 2004a, 2004b; O'Malley & Johnson, 2007). Building upon previous literature on adolescent problem behaviors and alcohol-impaired driving, the present study explored how the trajectory of delinquency is associated with the growth curve of alcohol-impaired driving among young males using data collected from the Buffalo Longitudinal Survey of Young Men (BLSYM).

Research context

Although alcohol-impaired driving among adolescents is commonly considered as a type of delinquent act, it has different developmental trajectory. Studies indicated that alcohol-impaired driving is highest among persons at ages twenty-one to twenty-four and the percentage of fatal crashes that are alcohol-related is also highest in this age group (Hingson & Winter, 2003; National Highway Traffic Safety Administration, 2008b; Usdan, Moore, Schumacher, & Talbott, 2005; Williams, 2006). In contrast, the age curve of delinquency shows that the rate of delinquency begins rising at ages thirteen to fourteen, peaks at about age eighteen, and then declines sharply as adolescents enter into adulthood ((Blumstein, Cohen, & Farrington, 1988; Farrington, 1986; Flanagan & Maguire, 1990; Hirschi & Gottfredson, 1983; Wolfgang, Figlio, & Sellin, 1972). When comparing these different developmental trajectories in alcohol-impaired driving and delinquent acts, a key research question is: "does an adolescent's trajectory of delinquent acts affect his trajectory of alcohol-impaired driving?"

A few theories of crime and deviance provide discussions of alcohol-impaired driving and other problem behaviors among adolescents (Donovan, 1993; Gottfredson & Hirschi, 1990; Jessor, Turbin, & Costa, 1997; Shope & Bingham, 2002). They believe that alcohol-impaired

driving is part of the whole problem behavior syndrome among adolescents, but it is a distinct type of delinquent act. For example, problem behavior theory assumes that adolescent problem behaviors co-occur within individuals which leads to a behavioral syndrome during the transition from adolescence to adulthood (Donovan, 1993; Jessor, Turbin, & Costa, 1997; Shope & Bingham, 2002). Another example is the self-control theory which posits that alcohol-impaired driving is one of the multiple manifestations of a general construct – low self-control (Gottfredson & Hirschi, 1990). Such illegal behavior can be connected with other problem behaviors among adolescents because they share a common cause.

Building upon these theories, several empirical studies had assessed adolescent problem behaviors and the risk of alcohol-impaired driving (Barnes & Welte, 1988; Berger & Snortum, 1986; Bingham & Shope, 2004a, 2004b; Copeland, Shope, & Waller, 1996; Donovan, 1993; Escobedo, Chorba, & Waxweiler, 1995; Hingson, Heeren, Zakocs, Winter, & Wechsler, 2003; Lapham, Baca, McMillan, & Lapidus, 2006; O'Malley & Johnson, 2007; Sabel, Bensley, & Eenwayk, 2004; Valencia-Martin, Galan, & Rodriguez-Artalejo, 2008). These studies commonly focused on adolescent drinking, drug use, smoking, and their relationships with alcohol-impaired driving. The general findings were that alcohol misuse, drug use (e.g., marijuana use), and smoking are significantly associated with impaired driving. These findings were generated from analyses of cross-sectional and longitudinal data. When longitudinal data were used, studies either employed predictors of drinking, drug use, or smoking in previous waves to predict alcohol-impaired driving in later waves (e.g., Bingham & Shope, 2004a) or compared means or percentages of those problem behaviors and alcohol-impaired driving between waves (e.g., Hingson et al., 2003).

These analytical strategies significantly limit research to explore broader adolescent problem behaviors and their relationships with adolescent alcohol-impaired driving. As studies indicated (e.g., Elliott, Huizinga, & Ageton, 1985), adolescents engage in a wide range of problem behaviors from minor (e.g., disorderly conduct) to general (e.g., buy-sell-hold stolen goods) to serious delinquent acts (e.g., aggravated assault). This wide range of delinquent acts shows a particular age curve that differs from the growth curve of alcohol-impaired driving. Therefore, it is important to assess the association of these different growth curves to better understand the dynamics and trajectory of adolescent alcohol-impaired driving.

Current study

The present study addressed this research issue using latent growth modeling implemented by the structural equation modeling method (Duncan, Duncan, & Strycher, 2006; Hox & Stoel, 2005). As discussed above, the age curve of delinquency differs from that of alcohol-impaired driving among adolescents. Data consistently indicated that while many adolescents are likely to “mature out” of delinquent behavior starting at about seventeen to eighteen years old, some may continue delinquent behavior into adulthood. Such a “maturing out” or “not maturing out” process may be a significant factor that influences the growth curve of alcohol-impaired driving which may peak at ages twenty-one to twenty-four years or older. The major hypothesis for the present study was that adolescents who are not maturing out of delinquent behavior and have a significant increase in delinquency are likely to have a faster growth in alcohol-impaired driving than those who are maturing out of delinquent behavior and do not have an increase in delinquency.

For the proposed hypothesis, the dependent (endogenous) variable was the growth rate of alcohol-impaired driving. The independent (exogenous) variable was the growth rate of delinquency. The study also included the growth rates of drinking and drug use as two important variables to control for their possible confounding effects on the growth rate of alcohol-

impaired driving. In addition, race and family socio economic status (SES) were also included as control variables in the analysis.

Data and methods

Data

The data used for the present study came from the three waves of the Buffalo Longitudinal Survey of Young Men (BLSYM) conducted from 1993 to 1997. The BLSYM was a panel study of adolescent substance use and delinquency with a probability sample of 625 males aged sixteen to nineteen from the Buffalo, New York area. The sample was recruited by random digit dial, with screening by a brief questionnaire to over-sample young men at risk for delinquency. Those who scored three or more items in the delinquent direction were always invited to participate; the others were recruited a random one-third of the time. The sample contained the full range of individuals in the general population, although the survey oversampled those prone to problem behaviors. Face-to-face structured interviews were conducted by trained interviewers at the Research Institute on Addictions. The interviews for the first wave took place in 1993. The time interval between waves was eighteen months. The sample attrition rate was 4.6 percent for the second wave and 7.6 percent for the third wave. These sample attrition rates had no substantive effect on the representativeness of the sample (see Table 1 for a brief demographic description of the sample).

The BLSYM data provided a unique opportunity to assess the possible association of the trajectory of delinquency and the growth curve of alcohol-impaired driving among young people. The survey selected a male sample with an age range of sixteen to nineteen years old at the first wave. As previous studies indicated, males commit far more delinquent acts than females, and commit particularly high proportions of the most physically threatening crimes (Farrington, 1983). Young males also have much higher rates of alcohol-impaired driving and involvement in fatal crashes related to alcohol-impaired driving (National Highway Traffic Safety Administration, 2008b).

The survey chose the sixteen to nineteen age range for the male sample because the rates of delinquency peak at about seventeen to eighteen years old and then sharply decline, as documented previously. At follow-up, the sample gradually entered into the period of sharply declining delinquency. It allowed the authors to use multiple-wave data to assess how the trajectory of delinquency is correlated with the growth curve of alcohol-impaired driving among young males as these males make the transition from adolescent to adult roles.

Consistent with the findings from prior studies, the BLSYM data revealed an increase of alcohol-impaired driving over the three-wave time period. About 18.8 percent of the respondents reported alcohol-impaired driving at Wave 1, 24.9 percent at Wave 2, and 31.6 percent at Wave 3. In comparison, a decline of delinquency involvement was observed from the data over the same time period. About 85.3 percent of respondents reported involvement with any delinquent act (a total of involvement in minor, general, and index delinquent acts) at Wave 1, 72.6 percent at Wave 2, and 70.2 percent at Wave 3 (see Figure 1 for a graphic presentation of the growth curves).

Measures

The dependent variable for the present study was the growth rate of alcohol-impaired driving over the three-wave interval. It was a repeated measure over the three waves using a survey item asking respondents "How many times in the last twelve months have you driven a motor vehicle while feeling the effect of alcohol?"¹ The responses to the item in each wave were logged to normalize the distribution for analysis.²

The independent variable was the growth rate of delinquency over the three-wave interval. Adopting measures developed by Elliott et al. (1985) for the National Youth Survey, respondents were asked how many times they committed a set of delinquent acts (thirty-three items) in the last year. These self-reported delinquent acts involved three categories: minor delinquency, general delinquency, and index offenses. Minor delinquency included eight items indicating relatively minor acts such as begging for money or things from strangers and being very loud, rowdy, or unruly in public place. General delinquency was measured by seventeen items such as buy-sell-hold stolen goods, carry a hidden weapon, theft of less than \$100, using bad checks, and simple assault. There were eight items for index offenses such as aggravated assault and rape (see Appendix A for a complete list of the delinquency items). The thirty-three items were summed to create a measure of delinquency at each wave and log transformations were performed to normalize the distribution of the measure at each wave.

To control for the possible confounding effects of drinking and drug use on alcohol-impaired driving, the present study included measures of average alcohol consumption and total instances of drug use as control variables. Average alcohol consumption was a combination of self-reported frequency and quantity of using various alcoholic beverages in the last year (see Appendix A for the descriptions of these items). The total instances of drug use were a count of self-reported drug use in the last year (thirteen items; see Appendix A for the descriptions of these items). The measures of average alcohol consumption and drug use were the same for all three waves of the BLSYM. Log transformations were also used for these measures to normalize their distributions for analysis.

In addition, race and family SES were also included as control variables in analysis. Race was a dummy variable coded in the direction of White and family SES was measured in terms of respondents' reports of their family income and parents' education (father's and mother's education, respectively).

Analytical Strategy

The present study used latent growth modeling with the structural equation modeling method to conduct the analysis. For longitudinal data collected from a sample with different age groups, the approach of sample means and covariance-based structural equation modeling may not be appropriate to conduct the analysis because the natural growth of respondents' age in different groups may bias the estimate of the growth curves of delinquency and alcohol-impaired driving and their relationship (Mehta & West, 2000). To avoid the possible bias, the study divided the sample into four cohorts of age sixteen, seventeen, eighteen, and nineteen at the first wave. The subsample size was 166 for the cohort of age sixteen, 142 for the cohort of age seventeen, 134 for the cohort of age eighteen, and 121 for the cohort of age nineteen, respectively (see Table 2 for the descriptive statistics of the variables for each age cohort).

The study estimated two models for each age cohort. It first estimated a single process model that only included alcohol-impaired driving to determine whether the average rate of alcohol-impaired driving varied significantly across waves and across the respondents (see Figure 2). If it did, the study further estimated a multiple process model that included all variables to

¹ Although the dependent variable was measured with a single item, the measure was relatively valid and reliable and was comparable to that used in several national surveys (i.e., Behavioral Risk Survey, National Survey on Drug Use and Health, and the National Survey of National Highway Traffic Safety Administration). There is no standard measure of alcohol-impaired driving. The authors of the present study believe the key issue for measuring alcohol-impaired driving is that the item must include the concept of driving along with the concept of some impairment from alcohol. The exact level of impairment is less important to self-reported drinking and driving because impairment in the field is often difficult to assess even for law enforcement that often relies on sobriety tests.

² Log transformations were used to fit linear estimates of the relationships in the models. There may be outliers. The intent of the present study was to discover the patterns and trends by fitting the most data.

assess how the growth rate of delinquency affected the growth rate of alcohol-impaired driving over the three waves (see Figure 3).

Before turning to the results, it was important to note a methodological concern about the causal order between the growth rates of delinquency and alcohol-impaired driving. For analysis, it was logical to use the growth rate of delinquency as an independent variable and the growth rate of alcohol-impaired driving as a dependent variable because the measure of delinquency had thirty-three items which were much more likely to represent a behavioral pattern. In contrast, alcohol-impaired driving was a single type of act measured with a single item. Alcohol-impaired driving among adolescents was also a behavior that consists of two illegal acts combined, consuming alcohol and driving after drinking. Such combined behavior was likely to occur later than other minor and general delinquent acts. The BLSYM data indeed showed that the age of onset of delinquent acts, especially minor and general delinquent acts, was much earlier than that of alcohol-impaired driving.³

Results

Analysis of the single process model for each age cohort indicated that for the cohort that was eighteen at Wave 1, although the average rate of alcohol-impaired driving had a significant increase across the three waves, there was no significant variation across the respondents in the rate. For the age group of nineteen, the average rate of alcohol-impaired driving had no significant variation across the three waves and across the respondents. There was no need to conduct multiple-process-model analysis of these age groups to determine what factors predicted the increase and variation.

In contrast, the results of single process models for both cohorts of age sixteen and seventeen showed that the average rates of alcohol-impaired driving significantly increased across the three waves (slope mean = 0.23 for the age sixteen cohort and 0.23 for the age seventeen cohort) and individual growth curves significantly varied in these rates (slope variance = 0.34 for the age sixteen cohort and 0.46 for the age seventeen cohort). Based on these results, the study further conducted multiple-process-model analyses for both age cohorts to determine whether the growth rate of delinquency significantly affected the growth rate of alcohol-impaired driving along with the control variables. The results of both single- and multiple-process-model analyses were presented in Table 3.

The results of the multiple process model for the age sixteen cohort indicated that the delinquency slope significantly and positively affected the slope of alcohol-impaired-driving ($b = 0.04$), meaning that as the rate of delinquency was rising in this age cohort, the rate of alcohol-impaired driving was likely to increase faster. The drinking slope had a similar effect ($b = .56$). As the rate of drinking was increasing, the rate of alcohol-impaired driving was also likely to increase faster. In contrast, the results of the multiple process model for the age seventeen cohort showed that the delinquency slope had no effect on the slope of alcohol-impaired driving. Both drinking and drug slopes, however, had significant effects on the slope of alcohol-impaired driving ($b = 0.60$ for the drinking slope and 1.47 for the drug slope). As the rates of drinking and drug use were increasing in this age cohort, the rate of alcohol-impaired driving was likely to increase faster.⁴

In addition, the results in Table 3 showed that the average level of alcohol-impaired driving at Wave 1 was statistically significant for both age cohorts (intercept mean = 0.22 for the age

³ Despite these justifications, it should be acknowledged that the causal order still needs to be further explored in future studies.

⁴ The data showed that the correlations between the variables of delinquency, drinking, and drug use within a wave and across waves ranged from about $r = 0.23$ to 0.57 which is not likely to produce problems with multicollinearity.

sixteen cohort and 0.35 for the age seventeen cohort) and it significantly varied across the respondents in each age cohort (intercept variance = 0.31 for the age sixteen cohort and 0.98 for the age seventeen cohort). It implied significant individual variability in the initial status of alcohol-impaired driving in each of these age cohorts at Wave 1. Also, for the age sixteen cohort, there was no significant correlation between the initial status of alcohol-impaired driving at Wave 1 and the growth rate across waves. In contrast, for the age seventeen cohort, there was a significant and negative correlation between the initial status of alcohol-impaired driving at Wave 1 and the growth rate across waves (covariance = -0.42). It implied that if respondents in this age cohort had a higher level of alcohol-impaired driving at Wave 1, they were likely to have a lower growth rate of alcohol-impaired driving across the three waves.

Summary and discussion

Given that alcohol-impaired driving and delinquency have different growth curves during adolescence, the present study assessed the possible effect of the growth rate of delinquency on the growth rate of alcohol-impaired driving using three-wave data collected from the Buffalo Longitudinal Survey of Young Men (BLSYM). Latent growth modeling with the structural equation modeling method was used to conduct the assessment for four cohorts of age sixteen, seventeen, eighteen, and nineteen at the first wave. The analysis revealed several interesting findings.

First, the main finding was that for the cohort of age sixteen, the growth rate of delinquency had a significant effect on the growth rate of alcohol-impaired driving when other important factors such as the growth rates of drinking and drug use were controlled. Young males who had a significant increase in delinquency were likely to have a faster growth rate in alcohol-impaired driving than those who did not in their transition to adulthood. It may suggest that prevention efforts that target delinquency behavior for sixteen year olds would also help to reduce subsequent drinking-driving behavior of these individuals.

Second, the growth rate of drinking also had a significant effect on the growth curve of alcohol-impaired driving for this age group. Young males who showed a significant increase in drinking were likely to have a faster increase in alcohol-impaired driving. This finding was consistent with that discovered for the relationship between drinking and drinking-driving behavior in previous studies (e.g., Bingham & Shope, 2004a, 2004b; Donovan, 1993; Sabel et al., 2004). While this finding was not surprising, it does raise the issue of how to improve success of prevention efforts that target under-age drinking and that these efforts need to be focused not just at the college age level, but also at adolescents in general.

Third, the growth rate of delinquency had no significant effect on the growth rate of alcohol-impaired driving for the age seventeen cohort, but the growth rates of both drinking and drug use had significant effects. Young males who had a significant increase in either drinking or drug use in this age cohort were likely to experience a faster growth in alcohol-impaired driving. These findings were also consistent with the previous studies. They reinforced the point that controlling both drinking and drug use among young people is also critical to prevent or reduce alcohol-impaired driving during their transition to adulthood.

Finally, the data indicated that there was no significant and consistent growth pattern of alcohol-impaired driving in the cohorts of age eighteen or nineteen. These two age groups were closer to the peak age (about twenty-one to twenty-four) of the common curve of alcohol-impaired driving than the age cohorts of sixteen and seventeen across the three BLSYM waves. It might be that by age eighteen and nineteen, the patterns of use for alcohol and drugs had been established and, as a result, their relationship with drinking-driving was more consistent.

In summary, the findings provided evidence that there was an association between the trajectories of delinquent behavior and alcohol-impaired driving; however, the relationship was complex and varied by age cohorts. The younger the age cohort was, the greater the association between delinquency and impaired driving. A more consistent finding was the association of alcohol and drug use with impaired driving trajectories across the age cohorts. Although the present study was more towards a type of “pure” research which was aimed to increase our knowledge and understanding of the relationship between delinquent behavior and alcohol-impaired driving among adolescents, the findings had some policy implications. They might highlight the value of prevention programs to control delinquent acts, drinking, and drug use in reducing the risk of drinking and driving among adolescents.

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Appendix A. Description of measures

Delinquency

Index offenses

- Stolen or tried to steal a motor vehicle
- Stolen or tried to steal something worth more than \$100
- Purposely set fire to a building, a car, or other property, or tried to do so
- Attached someone with the idea of seriously hurting or killing that person
- Been involved in gang fights
- Had sexual relation with someone against their will
- Used force or strong-arm tactics to get money or things from people
- Broken or tried to break into a building or vehicle to steal something or just look around

General delinquency

- Had a motor vehicle accident and left the scene without letting the other person know about the accident
- Purposely damaged or destroyed property that did not belong to you or someone you live with
- Knowingly bought, sold, or held stolen goods, or tried to do any of these things
- Carried a hidden weapon
- Stolen or tried to steal things worth \$100 or less
- Been paid for having sexual relations with someone
- Used checks illegally to pay for something or intentionally used over drafts
- Sold marijuana or hashish
- Hit or threaten to hit anyone other than the people you live with
- Sold hard drugs other than marijuana or hashish

- Tried to cheat someone by selling them something that was worthless or not what you said it was
- Avoided paying for such things as food, movies, or bus or subway rides
- Used or tried to use credit cards of someone you didn't live with, without the owner's permission
- Made obscene telephone calls
- Snatched someone's purse or wallet or picked someone's pocket
- Embezzled money
- Purposely destroyed or damaged property belonging to someone you live with

Minor delinquency

- Stolen money or other things from someone you live with
- Hit or threaten to hit someone you live with
- Stolen money, goods, or property from the place you work
- Paid someone to have sexual relations with you
- Used or tried to use the credit cards of someone you live with, without permission
- Been very loud, rowdy, or unruly in public place
- Taken a vehicle for a ride without the owner's permission – gone joyriding
- Begged for money or things from strangers

Alcohol consumption

Frequency

How often respondents usually drank the following 6 types of alcoholic beverages (i.e., malt liquors, beers, wine coolers, fortified wines, wines, and liquors) in the last twelve months
Response categories range from “everyday” to “less than once a month, but at least once in the past 12 months.

Quantity

- How many 12-oz. bottles, cans, glasses or cups of malt liquor (as shown on the picture) respondents had on a typical day when they drank
- How many 12-oz. bottles, cans, glasses or cups of beer (as shown on the picture) respondents had on a typical day when they drank
- How many 12-oz. bottles, cans, glasses or cups of wine coolers (as shown on the picture) respondents had on a typical day when they drank
- How many 4-oz. glasses or cups of fortified wine (as shown on the picture) respondents had on a typical day when they drank
- How many 4-oz. glasses or cups of wine (as shown on the picture) respondents had on a typical day when they drank
- How many mixed drinks or one and one-half ounce shots of liquor (as shown on the picture) respondents had on a typical day when they drank

Drug use

Thirteen questions used to ask respondents how many times they used the following drugs in the last year. The drugs were: marijuana, hallucinogens, amphetamines, tranquilizers, barbiturates, codeine, narcotics, crack, cocaine, ice, inhalants, angel dust, and other drugs.

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Figure 1.
Prevalence of delinquency and alcohol-related driving over the three survey waves (N = 563)

Figure 2.
Single process model of alcohol-impaired driving

Figure 3.
Multiple process model of delinquency and alcohol-impaired driving

Table 1

Brief demographic characteristics of respondents at Wave 1

Background Variable	Frequency	%
<i>Age</i>		
16	180	28.8
17	159	25.4
18	155	25.8
19	131	21.0
<i>Race</i>		
White	290	46.4
Non-White	335	53.6
<i>Education</i>		
Less than high school graduate	105	16.8
Enrolled in high school	348	55.7
High school graduate	68	10.9
Enrolled in post high school trade	27	4.3
Enrolled in college	77	12.3
<i>Family on welfare</i>		
No	488	78.0
Yes	137	22.0

Table 2

Descriptive statistics of variables

Variable	Age cohort									
	16	17	18	19	Mean	SD	Mean	SD	Mean	SD
Alcohol-impaired driving at Wave 1 (logged)	0.24	0.35	0.67	0.99	1.26	1.40	0.76	1.01	0.67	1.26
Alcohol-impaired driving at Wave 2 (logged)	0.38	0.71	0.84	1.04	1.35	1.51	1.00	1.25	0.84	1.35
Alcohol-impaired driving at Wave 3 (logged)	0.70	0.77	1.12	1.19	1.51	1.53	1.29	1.30	1.12	1.51
Total delinquency at Wave 1 (logged)	15.57	12.63	12.11	12.33	11.05	10.17	14.82	12.09	12.11	11.05
Total delinquency at Wave 2 (logged)	11.43	8.88	7.55	6.75	7.30	7.30	13.87	10.34	7.55	9.52
Total delinquency at Wave 3 (logged)	10.14	6.95	6.57	6.57	8.02	8.02	12.96	8.26	6.57	7.76
Race (White) at Wave 1	0.39	0.52	0.51	0.47	0.50	0.50	0.49	0.50	0.51	0.50
Family SES at Wave 1	2.80	2.54	2.88	3.05	1.47	1.47	1.48	1.34	2.88	1.59
Average alcohol consumption at Wave 1 (logged)	1.01	1.28	1.40	1.65	0.90	0.90	0.92	0.97	1.40	0.97
Average alcohol consumption at Wave 2 (logged)	1.12	1.40	1.57	1.71	0.83	0.83	0.95	0.95	1.57	0.87
Average alcohol consumption at Wave 3 (logged)	1.34	1.42	1.57	1.76	0.79	0.79	0.96	0.90	1.57	0.90
Total drug use at Wave 1 (logged)	1.41	1.67	1.84	2.24	1.80	1.80	1.73	1.82	1.84	1.76
Total drug use at Wave 2 (logged)	2.01	1.81	2.02	2.26	1.92	1.92	1.91	1.83	2.02	1.87
Total drug use at Wave 3 (logged)	2.11	1.72	2.06	2.26	2.01	2.01	2.00	1.95	2.06	1.96
N	166	142	134	121						

Note: The measure of family SES is available only at Wave 1.

Table 3

SEM growth curve models of delinquency and alcohol-impaired driving with alcohol-impaired driving as the endogenous variable

	Age cohort of sixteen		Age cohort of seventeen	
Variable	Single process model	Multiple process model	Single process model	Multiple process model
Delinquency slope	-----	0.04** (0.01)	-----	0.03 (0.06)
Race (White)	-----	0.17 (0.09)	-----	0.03 (0.09)
Family SES	-----	-0.01 (0.03)	-----	0.04 (0.03)
Drinking slope	-----	0.56** (0.18)	-----	0.60** (0.15)
Drug use slope	-----	0.06 (0.08)	-----	1.47* (0.62)
DWI intercept mean	0.22** (0.06)	-----	0.35** (0.09)	-----
DWI slope mean	0.23** (0.06)	-----	0.23** (0.07)	-----
Covariance of DWI intercept and slope	-0.09 (0.07)	-----	-0.42** (0.12)	-----
Variance				
Intercept	0.31** (0.10)	0.17** (0.05)	0.98** (0.21)	0.79** (0.18)
Slope	0.34** (0.07)	-----	0.46** (0.10)	-----
Model fit indexes				
χ^2	1.759	79.673	2.990	115.291*
df	1	63	1	64
GFI	0.984	0.934	0.956	0.901
CFI	0.990	0.983	0.963	0.931

Notes: n = 166 for the age cohort of sixteen and 142 for the age cohort of seventeen.

*
p < .05

**
p < .01