Trajectories of Adolescent Risk Factors over Time as Predictors of Subsequent Driving Behavior

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Keywords: Adolescence; Automobile driving; Accidents, traffic; Alcohol drinking; Interpersonal relations; Risk factors

ABSTRACT

This study examines the effects of trajectories of adolescent alcohol use, friends' involvement with alcohol, susceptibility to peer pressure, and tolerance of deviance on early driving behavior (serious offenses and serious crashes).

INTRODUCTION

Injury, and motor vehicle injury in particular, is the major cause of death and disability among adolescents and young adults (1-3). A better understanding of the factors that predispose young people to high-risk driving is needed in order to develop interventions to prevent such outcomes. In several studies, various adolescent lifestyle factors have been identified as predictors of subsequent high-risk driving behavior. These psychosocial and behavioral risk factors, such as substance use, personality measures, and lack of family involvement were related to offenses, serious offenses, crashes, and serious crashes (4-10). Another approach to the study of such predictors is to determine if the course or trend of a particular measure over time, that is its increasing, decreasing, or consistent trajectory, is a significant predictor. For example, adolescents' trajectories of self-esteem have been studied for their relationship to alcohol use among other behaviors (11), and young adults' trajectories of binge drinking have been examined for their role in successful transitions to young adulthood (12).

Longitudinal data collection during the evaluation of a school-based alcohol misuse prevention study provided the opportunity to develop trajectories on several measures that seemed likely to affect adolescent driving: alcohol use, friends' involvement with alcohol, susceptibility to peer pressure, and tolerance of deviance.

METHODS

Self-administered questionnaire data, including demographic, substance use, and psychosocial variables, were collected from 9,714 students in two cohorts (graduating classes of 1991 and 1992) from grades five through ten (about ages 10 to nearly 16). Surveys were administered in six southeastern Michigan public school districts beginning in the Fall of 1984. The graduating class of 1991 was followed from grade 6 to grade 12, and the class of 1992 was followed from grade 5 to 12. Beginning in 1992, students' names and birth dates were submitted to the Michigan Secretary of State's Office annually, and driver history data were obtained for 7,505 matched subjects (77%). In Michigan, most young people obtain a

driver's license as soon as possible after turning 16 years old. For 2,715 students with driver history data, questionnaire data were available only at only one time point, so trajectories on measures could not be obtained. Those subjects, therefore, were not included in the analyses. Thus, these analyses used survey and driver history data for 4,790 subjects, whose characteristics are given in Table 1.

Measures. Two outcome variables, created from the driver history variables, were considered indicative of high-risk driving, rather than simply the inexperience or carelessness of a young, novice driver. Number of serious offenses was a count that included those offenses that were alcohol-related; speeding in excess of 15 miles/hour over the speed limit; reckless driving, vehicular homicide, and other major offenses; and non-driving drug offenses. Typically, these offenses were assigned more points by the Secretary of State than less serious offenses (such as lesser speeding, no proof of insurance, license plate and vehicle offenses, and fraudulent identification). Number of serious crashes was a count that included each individual subject's crashes that were alcohol related, at-fault, or single-vehicle. Care was taken not to count the same crash more than once if it was included in more than one category. Both serious offenses and serious crashes were counted for the first year of driving, as well as for the first three years.

Table 1: Characteristics of Study Sample (N = 4,790)

	n	%
White race	4,039	84
Men	2,506	52
Step-parent family (first survey) [a]	232	12
Single-parent family (first survey) [a]	452	23
Family structure change over time	889	19
Serious offenses in first year of driving	532	11
Serious offenses in first three years of driving	1,381	29
Serious crashes in first year of driving	537	11
Serious crashes in first three years of driving	1,015	21

[a] n = 1,962

Four demographic measures were used. Age and sex are straightforward. Race was reported by students as white, black, or other race, and subsequently collapsed to a dichotomous variable, white and other race. Family structure as reported at the first survey, was based on a single item, "Which of your parents do you live with most of the time?" Possible responses included mother and father, parent and a step-parent, a single parent, or someone else. For modeling purposes, three indicator variables were created, and living with both parents served as the baseline category. The first indicator variable included those respondents who lived with a parent and a step-parent. The second indicator variable included those respondents who lived with a single parent (mother or father). Because responses on this question changed over time for 19% of the respondents (n = 889), a variable indicating this change was also included in these analyses.

Four predictor variables were investigated. Alcohol use, in drinks per week, was calculated for each student at each data collection point by multiplying frequency of alcohol use by quantity for each substance used: beer, wine, and liquor (range = 0 - 42) (13). Values greater

than 42 (0.3%) were included in the category, 42. For modeling purposes, a natural log transformation was used because of the apparent skewness of this measure.

A susceptibility to peer pressure measure was created, based on seven survey items, that ranged from 7 (less susceptible) to 28 (highly susceptible). The items had four response choices (no, probably not, probably, yes), and included: "If a friend dares you to tear a page out of a school library book, would you do it?" "If you are at a party where your friends are drinking alcohol, would you feel left out if you are not drinking alcohol?" "If your best friend is skipping school, would you skip school too?" "If a friend offers you a drink of alcohol, would you drink it?" "If a friend offers you a drink of alcohol, would you want to try it?" "If your friends are going to the movies and you have to study for a test, would you go to the movies anyway?" "If a friend dares you to smoke a cigarette and your parents don't want you to smoke, would you smoke it?" (14).

Friends' involvement with alcohol was a measure based on five questionnaire items, and ranged from 0 (friends not involved) to 16 (friends very involved). The items had four response choices (never, rarely, sometimes, often), and included: "How often have your friends talked about trying alcohol?" " How often have your friends talked about how much they drink alcohol?" "How often have your friends offered you a drink of alcohol?" "How often have your friends 'put pressure' on you to drink alcohol?" "How do your friends feel about kids your age drinking alcohol?"

Tolerance of deviance was a measure based on five questionnaire items, and ranged from 4 (not tolerant) to 16 (very tolerant) (15). The items had four response choices (very wrong, wrong, a little bit wrong, not wrong), and included: "How wrong do you think it is to smoke without your parent's permission?" "How wrong do you think it is to go to a movie instead of studying for a test?" "How wrong do you think it is to skip school without an excuse?" "How wrong do you think it is to drink alcohol before you're 21 years old?" "How wrong do you think it is to tear a page out of a school library book?"

The study sample's levels on each of the four predictor variables tended to increase over time, as shown in Table 2, which also shows the proportion for whom an increase was noted.

Table 2: Mean (and Standard Deviation) of Predictor Measures over Time

Grade:	5/6	6/7	6/7	7/8	10	% Increasing Slope
Alcohol Use (drinks/week)	0.1 (1.1)	0.2 (1.4)	0.4 (2.4)	1.1 (4.4)	2.6 (6.4)	54
Susceptibility to Peer Pressure	9.2 (3.2)	10.1 (3.7)	11.5 (4.5)	13.4 (5.0)	14.9 (4.8)	73
Friends' Alcohol Involvement	2.3 (2.0)	2.8 (2.3)	3.5 (2.8)	4.8 (3.3)	6.1 (3.3)	76
Tolerance of Deviance	5.5 (1.9)	5.9 (2.1)	6.6 (2.6)	7.6 (2.9)	8.9 (2.8)	73

Data Analysis. The longitudinal (trajectory) information on each predictor variable of interest for each subject was summarized using two statistics: 1) The slope of the regression line relating the predictor variable and time, as a measure of the yearly change (from school grade 5 through grade 10) in the predictor measure; 2) The last value or 10th grade response, as a measure of the most recent predictor value. For subjects who were missing a 10th grade response, an estimate based on the regression line just described was used. These two summary statistics were then used as predictors in a logistic regression model for one-year driving outcomes and a Poisson regression model for three-year driving outcomes, with the number of serious offenses or crashes as dependent variables. Other confounding variables (age, race, sex, family structure) were included in the model to derive adjusted estimates. The statistical significance of the regression coefficients for slope and the last value in the logistic and Poisson regression modes, primary quantities of interest, were assessed using the z-test.

To summarize results from the fitted logistic and Poisson regression models, four sample trajectories for each predictor variable were selected from the many possible. "Low-Low" subjects were those whose last value was one standard deviation below the mean and whose slope was zero. These subjects had consistently low levels of the predictor variable. "High-Low" subjects were those whose last value was one standard deviation below the mean and whose slope was one standard deviation below zero. These subjects had decreasing levels of the predictor variable over time. "Low-High" subjects were those whose last value was one standard deviation above the mean and whose slope was also one standard deviation above zero. These subjects had increasing levels of the predictor variable over time. "High-High" subjects were those whose last value was one standard deviation above the mean and whose slope was zero. These subjects had consistently high levels of the predictor variable. Because alcohol use seemed normative among the subjects, the high last value was defined as two standard deviations above the mean. The fitted regression models, with confounding variables set at their average values, were used to estimate the predicted probabilities or rates of serious offenses and serious crashes, for first-year and for first-three-years of driving for each of the four sample trajectories.

RESULTS

All four predictor variables were important in predicting subsequent driving behavior as the significant regression results show in Table 3. The predicted probabilities for the four sample trajectories in general increase, with the Low-Low trajectories having considerably lower probabilities of serious offenses and serious crashes than the High-High trajectories. For example, subjects who were consistently low in terms of friends' involvement with alcohol had a 7.5 % chance of having a serious offense in the first year of driving, whereas subjects whose friends had consistently high involvement with alcohol had more than twice that probability (16.2%). Not surprisingly, differences were greater, that is the trajectories discriminated better, for the first year of driving than for the first three years of driving. Generally, the Low-Low trajectory had the lowest probabilities followed by the High-Low, Low-High and High-High trajectories. For serious offenses, the most recent behavior, as well as the trajectory, were significant predictors.

DISCUSSION

Young people's alcohol use, friends' involvement with alcohol, susceptibility to peer pressure, and tolerance of deviance increase during adolescence and have been shown previously to be important predictors of various health risk behaviors. In this study, examining the trajectories of these measures as predictors of driving behavior has shown that,

both the slope of each measure over time, and the last value prior to the onset of driving contributed to the predicted probabilities regarding serious offenses. For serious crashes the last value was more important. The implications of these findings should encourage those who work with young people to maintain their focus on preventing young people's alcohol use, involvement with friends who use alcohol, susceptibility to peer pressure and acceptance of deviance, even when these may have been problems at some point in time. These analyses, however, addressed only the separate, not the combined, effects of the predictor variables. While this type of analytic approach could be used with other predictor variables, the results found in this study serve as a reminder of the personality and behavioral factors which prevention programs need to address.

Table 3: Predicted Probabilities (%) of Serious Offenses and Serious Crashes in the First Year and First Three Years of Driving by Trajectories on Four Predictor Measures

FIRST YEAR DRIVING:	Serious Offenses				Serious Crashes			
	Alcohol Use [b]	Friends' Alcohol [b]	Suscep Peer Pressure [b]	Tolerance Deviance [b]	Alcohol Use	Friends' Alcohol [a]	Suscep Peer Pressure [a]	Tolerance Deviance
Low-Low	7.7	7.5	7.8	8.1	8.8	9.6	9.5	9.8
High-Low	9.5	10.5	11.0	10.2	9.5	10.4	10.5	9.8
Low-High	15.4	11.7	11.6	11.8	13.8	11.9	12.1	11.8
High-High	18.7	16.2	16.0	14.6	14.8	12.9	13.3	11.8

FIRST 3 YEARS DRIVING:								
	Alcohol Use [a]	Friends' Alcohol [b]	Suscep Peer Pressure [b]	Tolerance Deviance [b]	Alcohol Use	Friends' Alcohol [a]	Suscep Peer Pressure [a]	Tolerance Deviance
Low-Low	28.0	27.3	26.5	26.9	19.4	19.6	19.4	19.9
High-Low	28.4	32.1	31.5	31.1	20.2	20.8	20.2	19.7
Low-High	35.4	32.9	33.6	34.2	24.0	22.6	22.7	22.1
High-High	36.5	38.4	39.5	39.2	25.0	23.9	23.7	21.9

[a] last value significant at $p < .05$

[b] last value and slope significant at $p < .05$

ACKNOWLEDGEMENTS
This research was supported by the National Institute on Alcohol Abuse and Alcoholism, Grants RO1 AA09026 and RO1 AA06324. The authors are grateful for the support and assistance of the local school districts, the Michigan Secretary of State's Office, and the research staff.

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