An Investigation of Factors Related to Intoxicated Driving Behaviors among Youth*

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ABSTRACT. This study assessed the prevalence of driving under the influence of alcohol and marijuana among a sample of 18 and 21 year olds and examined the across-time relationships between intoxicated driving and consumption, risk-taking/impulsive orientation, negative intrapersonal state, stress and use of alcohol and other drugs to cope with problems. Self-report data were collected from 556 men and women, ages 18 and 21, at two points in time. The data indicated that at least a minimum level of drinking and driving, as well as smoking marijuana and driving, is engaged in at least once for the majority of youth. Correlations between eight driving behaviors and consumption variables indicated that frequency of substance use was strongly related to frequency of driving while intoxicated (DWI). Regression analyses revealed that coping use of substances was the strongest predictor of driving under the influence. A path model examining the effect of stress, negative states and risk-taking orientations (T1) on driving under the influence as mediated through coping use (T2) was tested. Results showed that risk-taking orientation was the strongest predictor of DWI, both directly and indirectly (as mediated through coping use). Findings suggest that impaired driving may be part of a global syndrome of risk-taking behavior and is an activity engaged in most often by those who frequently use alcohol and other drugs to cope with problems. (*J. Stud. Alcohol* **50**: 320-330, 1989)

THE USE OF psychotropic drugs before or while driving is widely accepted as a high-risk behavior and has become an issue of increasing concern as well as the focus of policy debate (e.g., prevention campaigns, methods of detection and deterrence, raising legal drinking age). The degree to which alcohol is involved in fatal crashes has been well documented (Aiken and Zobeck, 1985; Owens et al., 1983) and, to some degree, crashes involving the use of marijuana have been reported in the literature (Compton and Anderson, 1985; Mason and McBay, 1984; McBay and Owens, 1981). Data indicate that there is an overrepresentation of young drivers (ages 16-24) who are involved in motor vehicle accidents where alcohol and/or other drugs are present (National Highway Traffic Safety Administration, 1984; O'Day, 1972).

Marijuana-related traffic violations and accidents are less well documented than are alcohol-related offenses primarily because marijuana intoxication is not easily detected and measured (National Highway Traffic Safety Administration, 1980). There is also scant documentation as to the extent to which young drivers operate a motor vehicle after or while drinking alcohol or smoking marijuana. However, we do know that many teens of driving age use marijuana and alcohol (Johnston et al., 1986) and that 10-50% of these teenagers have reported driving after consuming alcohol and/or marijuana (Beck and Summons, 1987; Burns, 1981; Engs, 1977; Hingson et al., 1982; Mortimer, 1976; Smart, 1974; Williams et al., 1986). In addition, although driving while intoxicated (DWI) arrests have been on the rise because of increased policing of highways, researchers have estimated that for every DWI arrest, between 200 to 2,000 more drivers are driving impaired and undetected (Beital et al., 1974; Borkenstein, 1976). There have been numerous experimental studies of the effect of alcohol or marijuana on various aspects of driving performance that indicate that, generally, essential skills such as judgment, reaction time and muscle coordination are impaired while one is under the influence of these drugs (e.g., Attwood et al., 1981; Benjamin, 1980; Casswell, 1979; Henderson, 1987; Moskowitz, 1985; Peck et al., 1986; Sutton, 1983).

Recent research has investigated characteristics of DWI and accident arrestees and alcoholics who drive impaired (Donovan et al., 1983). Findings from these studies point to a cluster of demographic, situational, attitudinal and personality characteristics predictive of high-risk driving behavior. Factors related to drunken driving include sex and marital status of the offender and amount of alcohol consumed. Person-

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ality traits found to be predictive include externally focused locus of control, heightened levels of impulsivity, hostility, aggression, depression, paranoid ideation, anxiety, exhibitionism and decreased levels of self-esteem (Bradstock et al., 1987; Cameron, 1982; Donovan, 1986; Donovan et al., 1985; Hartmann et al., 1985; Hodgdon et al., 1981; McCord, 1984; Pelz and Schuman, 1974; Selzer and Barton, 1977; Selzer et al., 1977; Wilson and Jonah, 1985). Intoxicated drivers have been found to exhibit increased levels of stress (Bradstock et al., 1977) and to drink in order to relieve stress and to cope with problems (Donovan and Marlatt, 1982; Snow and Wells-Parker, 1986). Finally, attitudes concerning driving while intoxicated as well as the modeling influences of the peer group have been found important in explaining these behaviors (Beck, 1981; Burns, 1981; Pawlowski, 1982; Wilson and Jonah, 1985).

Little research has been conducted examining these factors as predictors of intoxicated driving among teens not involved in violations or accidents (see Farrow, 1985; Scoles et al., 1984; Williams et al., 1986) and even fewer studies have investigated the potential risk factors involved in marijuana smoking and driving by teens. The purposes of this article are: (*1*) to describe the prevalence of accidents occurring as the result of alcohol or marijuana use and the prevalence of use of these substances prior to or while driving among a sample of 18 and 21 year olds, and (*2*) to examine the across-time relationship between intoxicated driving and (*a*) consumption, (*b*) risk-taking/impulsive orientation, (*c*) negative intrapersonal state, (*d*) stress and (*e*) use of alcohol and other drugs to cope with problems.

Method

Design and sample

Data were collected as part of the Rutgers Health and Human Development Project, a prospective longitudinal study that examines the acquisition and maintenance of a variety of behaviors including alcohol and drug-use patterns. The initial sample was obtained through random telephone calls. After the telephone survey, field staff interviewed volunteering subjects and parents in their homes. Following this contact, subjects came to the test site for a full day of testing including physical examinations, blood tests, physiological and perceptual-behavior tests, psychological inventories and the completion of several questionnaires.

The subjects were tested initially between 1979 and 1981 (Time 1) at the ages of 12, 15 and 18. These subjects returned 3 years later in 1982-84 (Time 2) and were retested using essentially the same battery of instruments. The retest yielded a 3-year follow-up rate of 95% (n = 1,308). This sample is currently being tested for the third time. A comparison of central variables at Time 1 between those subjects who were retested and those who dropped out indicates high comparability. (For more extensive details of methodological and theoretical considerations of this study, see Lester et al., 1984; Pandina et al., 1984.)

The sample is predominantly white (90%), a somewhat higher proportion than the 84% of whites in New Jersey (Bureau of Census, 1981). Half of the subjects are Catholic, 30% are Protestant, 9% are Jewish and 11% have another or no religion, analogous to the religious breakdown of New Jersey. The median income of the sample at Time 1, between $20,000 and $29,000, is also comparable to that of the entire state at that time (Bureau of Census, 1981). Participants are comparable to refusers in demographic characteristics and selected behaviors sampled during the original telephone survey. Although participants reported slightly higher income and education levels, there were no serious range restrictions. In addition, the data on the prevalence of alcohol and drug use in our sample are comparable to national surveys using other methods of data collection (e.g., Johnston et al., 1986).

The sample for the present analysis consists of the older subjects (ages 18 and 21 at T2) tested in 1980-81 (T1) and retested in 1983-84 (T2). Those subjects originally tested in 1979 (and retested in 1982) were excluded because the driving questions were first added to our battery in 1983. The youngest subjects (age 15 at T2—not of legal driving age) and 20 additional subjects who did not have driver's licenses were also excluded. The sample consists of 147 18-year-old men (age at T2), 139 18-year-old women, 130 21-year-old men and 140 21-year-old women. All analyses were conducted separately by age and sex.

Data collection, instruments and variables

Self-report questionnaires provide the data used in this study. Self-reports are generally accepted as a reliable indicator of alcohol and drug use (Rouse et al., 1985; Single et al., 1975) and related problems (Clark, 1981; Polich, 1982).

To maximize reliability and validity of the self-report data, questionnaires were administered individually by a trained interviewer assigned to a participant for the length of the testing day. Participants were instructed not to put their name on any questionnaire and were repeatedly assured of the complete confidentiality of all data especially with regard to parents, teachers and public authorities. Testing sessions were

self-paced and lasted 5-6 hours. Questionnaires and tasks were presented in several orders, all arranged so as to mitigate boredom and fatigue effects. Details of the testing regimen may be found in Pandina et al., 1984.

Use variables

Several measures of alcohol and marijuana consumption are included in the analyses: (*1*) age of first use; (*2*) frequency of use during the past year was reported on a 10-point scale ranging from "no use" to "using more than once a day"; (*3*) quantity of each substance consumed on a typical occasion was reported on a 9-point scale; (*4*) extent of use was reported as the number of times used ever at T1 and in the past 3 years at T2; (*5*) subjects' estimated frequencies of getting drunk when drinking beer, wine and hard liquor and the frequency of getting high when smoking marijuana on a 6-point scale ranging from "never" to "always" (scores obtained for beer, wine and hard liquor on each of the latter four consumption variables were combined by selecting for each variable the highest score reported for the three beverage types); and (*6*) problem use was measured by the frequency of experiencing 22 use-oriented negative consequences (see White and Labouvie, 1989, for greater detail on the development of these problem-use indices).

Independent variables

The predictor variables are divided into four domains: (*1*) risk-taking/impulsive behavior, (*2*) negative intrapersonal state, (*3*) stress and (*4*) coping use. The independent variables used in these domains were reduced to a set of scale scores. Using separate factor analyses for T1 and T2 data, scales were generally constructed from items with replicable factor loading patterns across both points in time. In constructing indicators of each domain, all measures were standardized and summed together to create a score at both T1 and T2. Change scores (defined as the difference between T2 and T1 scores) were computed for all domain measures.

Risk taking/impulsivity. The disinhibition and experience-seeking subscales from the Zuckerman (1979) Sensation-Seeking scale were combined with a second-order factor scale utilizing the four Personality Research Form–E (PRF-E) subscales of play, impulsivity, harm avoidance and cognitive structure (Jackson, 1974) to form a measure of risk-taking/impulsive orientation (alpha = .58).

Negative intrapersonal state. The depression, anxiety and anger/hostility subscales from the Symptom Checklist-90-R (SCL-90-R) (Derogatis, 1977) were combined with a 4-item measure representing self-derogation (e.g., "I am dumb") and a 3-item measure of emotional outbursts in response to problems (e.g., "I break things") to create a measure of negative intrapersonal state (alpha = .84).

Stress. Respondents were asked how much each of 47 possible stressors bothered them (4-point scale from "does not pertain to me" to "bothers me a lot"). These items include stress due to (*1*) life events (e.g., death of a friend) (Dohrenwend and Dohrenwend, 1974), (*2*) lack of personal competence (e.g., "not enough control of my life") (Rotter, 1966), (*3*) lack of self-acceptance (e.g., "I'm not good-looking"), and (*4*) lack of social competence (e.g., "classmates don't like me") (alpha = .60).

Coping use. A factor analysis of responses to 32 items asking, "When you have a problem, how often do you . . .?", fashioned along the lines of the Response Profile of the Coping Assessment Battery (Wills, 1985), yielded a 4-item measure of coping use (alpha = .77) (e.g., have a drink containing alcohol, take illicit drugs) (see also Labouvie, 1987).

Correlations among the independent variables ranged from .06 to .33 at T1 and .13 to .34 at T2, not high enough to suspect multicollinearity.

Dependent variables

Subjects were asked at T2 to respond on a 5-point scale (ranging from "never" to "more than 10 times") how often in the past 3 years they had done each of the following: (*1*) gotten drunk on alcohol at a party and then driven home (PARALC), (*2*) driven home shortly after having 1-2 drinks of alcohol (ONEALC), (*3*) driven home shortly after having 4-5 drinks of alcohol (FOURALC), (*4*) drank alcohol while you were driving a car (WHILEALC), (*5*) gotten stoned on marijuana at a party and then driven home (PARMAR), (*6*) driven home shortly after having 1-2 tokes of marijuana (ONEMAR), (*7*) driven home shortly after having 4-5 tokes of marijuana (FOURMAR), (*8*) smoked marijuana while you were driving a car (WHILEMAR). These measures correlated among themselves .58-.81 among the alcohol variables and .65-.88 among the marijuana items. The strongest relationships were evident among the men.

Results

Descriptive analyses

Table 1 presents the number of licensed drivers in the sample who responded affirmatively to a series of questions related to involvement in traffic accidents in general and to specific intoxicated driving behaviors. Of the accidents that occurred within the last

TABLE 1. Number of licensed drivers reporting behavior

	Age/sex group			
	18M	18F	21M	21F
Total in sample	147	139	130	140
Licensed drivers and alcohol users	133	128	126	135
Licensed drivers and marijuana users	91	90	96	95
Ever been in a car accident	81	58	110	77
Been in car accident last 3 years	65	51	79	49
Driver in car accident	36	29	64	34
Accident occurred after drinking alcohol	6	2	14	3
Accident occurred after smoking marijuana	2	1	1	2
Accident occurred after drinking and smoking	1	1	0	1
Left a party and driven drunk	70	54	102	70
Been a passenger in a car when the driver was drunk	92	74	104	90
Driven after drinking 1-2 drinks	89	68	115	109
Driven after drinking 4-5 drinks	59	34	93	62
Drank alcohol while driving	54	49	94	58
Left a party and driven stoned	42	32	59	32
Been a passenger in a car when the driver was stoned	58	46	81	59
Driven after smoking 1-2 tokes	49	39	73	46
Driven after smoking 4-5 tokes	36	19	63	28
Smoked marijuana while driving	45	31	70	38

3 years (75% of all accidents experienced by these youth), the majority (67%) of subjects in the study were driving the vehicle at the time. Of those 163 subjects who reported that they were the driver in the car accident, 15% reported that the accident occurred after they had drunk alcohol (the highest percentage being among the 21-year-old men). Only 4% reported having smoked marijuana before an accident.

Of the 261 18 year olds who were licensed drivers and who also had drunk alcohol, 48% had driven home from a party drunk, 60% had driven after consuming 1-2 drinks, 36% had driven after consuming 4-5 drinks and 40% had drunk alcohol while driving. These percentages were even higher for the 261 21-year-old drivers (66%, 86%, 60% and 58%, respectively). In both age groups the men exhibited the higher percentage of drinking drivers.

Of the 181 18 year olds who were licensed drivers and who smoked marijuana, 41% had driven home stoned after a party, 49% had driven after smoking 1-2 tokes, 30% after smoking 4-5 tokes and 42% had smoked while driving (48%, 62%, 48%, 57%, respectively, for the 191 21 year olds). Again, in both age groups, the men showed the higher percentage of smoking drivers. In addition, 65% of this sample had driven with a drunk driver and 44% had driven with a stoned driver. Riding with an intoxicated driver and driving after using either alcohol or marijuana correlated between .6 to .8, indicating that the behaviors may be engaged in by the same individuals.

Table 2 displays the correlations between consumption variables and intoxicated-driving variables. Overall, all consumption measures were positively correlated with driving behaviors. Ages of first use of alcohol and marijuana were moderately negatively correlated with the subjects' respective driving behaviors, meaning that the younger a subject was when he or she began use, the more likely he or she was to use alcohol or marijuana before driving. The correlations for age of first use, however, were the weakest observed. The frequency measures (T2) for both alcohol and marijuana use exhibited the strongest correlations to all dependent variables across age/

TABLE 2. Zero order correlations[a] between consumption variables[b] and intoxicated driving behaviors

	Alcohol				Marijuana			
	PARALC	ONEALC	FOURALC	WHILEALC	PARMAR	ONEMAR	FOURMAR	WHILEMAR
Age first tried	−.21	−.19	−.20	−.25	−.22	−.23	−.24	−.23
No. of times T1	.35	.36	.35	.35	.45	.46	.54	.50
No. of times T2	.44	.44	.43	.41	.52	.57	.58	.60
Frequency T1	.37	.45	.37	.40	.46	.48	.53	.49
Frequency T2	.51	.53	.51	.51	.59	.65	.63	.68
Quantity T1	.30	.32	.33	.32	.37	.39	.45	.38
Quantity T2	.40	.34	.40	.40	.26	.27	.31	.30
Frequency high T1	.44	.44	.42	.41	.36	.40	.41	.38
Frequency high T2	.42	.37	.39	.38	.43	.44	.44	.43
Problem use T1	.33	.28	.35	.36	.24	.27	.29	.27
Problem use T2	.40	.34	.43	.41	.41	.40	.43	.45

[a] All correlations are significant at the $p < .01$ level.

[b] The consumption variables correspond to the appropriate intoxicated driving behaviors (e.g., "age first tried" signifies age first tried alcohol for the alcohol correlations and signifies age first tried marijuana for the marijuana correlations).

sex groups and were stronger than the quantity and intoxication variables. This suggests that it is not necessarily the heaviest users, in terms of intoxication level, but rather the frequent users who engage in these driving behaviors most often. The correlations between problem use and intoxicated-driving behaviors at the same measurement occasion were relatively strong (all are .4 and higher). Thus, it may be that those adolescents engaging in problem use–related behaviors and experiencing negative consequences as a result of their substance use are also more likely to engage in problem (i.e., intoxicated) driving behaviors.

Multiple regressions

Table 3 presents the standardized regression coefficients and R^2's for the alcohol model and Table 4 for the marijuana model. In each table Model 1 uses T1 measures as predictors for each of the eight dependent T2 measures and Model 2 uses both the T1 measures as well as the corresponding change scores as predictors. The R^2 at the bottom of each table followed by (+) denotes those regressions analyses for which there was a statistically significant ($p < .05$) increase (as determined by an F test) in variance accounted for when change scores were added to the model.

TABLE 3. Standardized coefficients and R²'s for Model 1 and Model 2 for alcohol use and driving

	18 year olds							
	PARALC		ONEALC		FOURALC		WHILEALC	
	M	F	M	F	M	F	M	F
Model 1								
Risk taking T1	.25*	.17	.30*	.20*	.22*	.08	.19*	.15
Negative state T1	−.03	.31*	−.07	.15	−.11	.13	−.07	.23*
Stress T1	−.19*	−.06	−.14	<.01	−.09	<.01	−.01	.05
Coping T1	.30*	.22*	.37*	.37*	.54*	.30*	.42*	.15
R^2	.17**	.23**	.25**	.28**	.34**	.15**	.22**	.16**
Model 2								
Risk taking T1	.38*	.27*	.43*	.22*	.30*	.17	.27*	.19*
Risk taking CH	.25*	.26*	.21*	.07	.20*	.25*	.21*	.15
Negative state T1	−.20	.27*	−.23	.06	−.21	.09	−.17	.22*
Negative state CH	−.19	<.01	−.15	−.11	−.10	<.01	−.07	.02
Stress T1	−.22*	.01	−.10	.08	−.11	.06	<.01	.09
Stress CH	−.10	.11	.02	.13	−.07	.09	−.17	.07
Coping T1	.34*	.35*	.39*	.47*	.59*	.40*	.48*	.29*
Coping CH	.01	.24*	<.01	.21*	.09	.19	.14	.23*
R^2	.24**	.39**(+)	.29**	.35**	.38**	.27**(+)	.28**	.25**
	21 year olds							
Model 1								
Risk taking T1	.21*	.07	.22*	.15	.13	.03	.20*	.15
Negative state T1	.07	−.17	.06	−.13	.02	−.25*	.02	−.12
Stress T1	−.11	.03	−.19*	−.11	−.13	<.01	−.11	−.02
Coping T1	.33*	.26*	.24*	.23*	.29*	.25*	.25*	.27*
R^2	.19**	.09**	.13**	.11**	.12**	.09**	.12**	.12**
Model 2								
Risk taking T1	.30*	.07	.31*	.22*	.24*	.04	.23*	.13
Risk taking CH	.19	<.01	.17	.19*	.18	.03	.10	.03
Negative state T1	.05	−.29*	.15	−.28*	.06	.32*	.05	−.13
Negative state CH	<.01	−.16	.14	−.22	.10	−.09	.07	−.01
Stress T1	−.22*	.10	−.31*	−.07	−.22*	.05	−.15	−.14
Stress CH	−.12	.17	−.13	.10	−.08	.15	−.01	−.12
Coping T1	.43*	.48*	.29*	.39*	.41*	.44*	.36*	.44*
Coping CH	.26*	.46*	.18	.31*	.29*	.42*	.25*	.33*
R^2	.28**	.26**(+)	.21**	.22**(+)	.24**(+)	.24**(+)	.19**	.21**

* $p < .05$.

** Indicates the overall F value for the model is significant at $p < .05$.

(+) Indicates a statistically significant gain in the amount of variance accounted for.

TABLE 4. Standardized coefficients and R^2's for Model 1 and Model 2 for marijuana use and driving

	18 year olds							
	PARMAR		ONEMAR		FOURMAR		WHILEMAR	
	M	F	M	F	M	F	M	F
Model 1								
Risk taking T1	.20	.28	.21*	.21	.15	.24*	.22*	.26*
Negative state T1	.04	.05	.06	−.07	.15	−.02	.18	−.04
Stress T1	.03	−.10	.03	.09	<.01	.06	.03	−.08
Coping T1	.30*	.05	.26*	.21	.30*	.16	.25*	.22
R^2	.17**	.10	.14**	.11**	.17**	.11**	.19**	.13**
Model 2								
Risk taking T1	.33*	.27*	.30*	.16	.27*	.24*	.30*	.29*
Risk taking CH	.20	.01	.13	−.06	.15	.04	.15	.07
Negative state T1	−.38	−.13	−.26	−.28*	−.28	−.17	−.14	−.19
Negative state CH	−.43*	−.09	−.34	−.19	−.46*	−.14	−.33	−.09
Stress T1	.05	<.01	.02	.28*	.07	.23	.05	−.04
Stress CH	−.13	.09	−.15	.22	−.03	.23	−.33	<.01
Coping T1	.43*	.41*	.37*	.52*	.40*	.32*	.38*	.45*
Coping CH	.12	.54*	.11	.51*	.09	.28*	.19	.34*
R^2	.26**	.29**(+)	.21**	.31**(+)	.24**	.21**	.26**	.21**
	21 year olds							
Model 1								
Risk taking T1	−.06	.18	.04	.19	−.03	.18	−.03	.07
Negative state T1	−.15	−.19	−.15	−.18	−.17	−.08	−.11	−.10
Stress T1	.09	−.01	.08	−.05	.10	−.04	−.03	−.04
Coping T1	.46*	.31*	.45*	.34*	.48*	.29*	.46*	.30
R^2	.21**	.14**	.22**	.17**	.24**	.13**	.19**	.09
Model 2								
Risk taking T1	−.10	.08	−.03	.15	−.03	.09	−.13	.02
Risk taking CH	−.02	−.23*	−.08	−.09	<.01	−.20	−.14	−.12
Negative state T1	−.17	−.18	−.13	−.22	−.15	−.16	−.06	−.12
Negative state CH	<.01	−.02	.05	−.04	.06	−.09	.07	<.01
Stress T1	.14	−.08	.14	−.06	.17	−.11	.03	−.08
Stress CH	.12	−.09	.11	<.01	.15	−.08	.07	<.01
Coping T1	.58*	.40*	.57*	.44*	.54*	.47*	.54*	.42*
Coping CH	.20	.15	.21	.18	.07	.31*	.12	.24*
R^2	.25**	.20**	.27**	.20**	.27**	.23**	.21**	.15**

* $p < .05$.
** Indicates the overall F value for the model is significant at $p < .05$.
(+) Indicates a statistically significant gain in the amount of variance accounted for.

Alcohol models

All of the models of drinking and driving behaviors were statistically significant ($p < .05$). The T1 predictors explained between 9% and 34% of the variance in these behaviors. Among the 18 year olds, explained variance within Model 1 was highest in ONEALC for the women and FOURALC for the men; however, by age 21 there was little difference in the amount of explained variance in the dependent variables by sex of the subject. The most striking result seen in Table 3 is that, overall, coping use at T1 was the best predictor for all four dependent variables across all four age/sex groups. Risk-taking/impulsive orientation at T1 was a significant predictor for men. Negative intrapersonal state at T1 was significant for younger women for PARALC and for WHILEALC. An unexpected finding appeared for older women; negative state at T1 exhibited a significant negative relationship to drinking four or five drinks and driving (i.e., the more anxious, hostile or angry one is, the less likely one is to drive after drinking a lot). (Note, however, that the R^2 for the model is small.) This finding contradicts previous research (e.g., Donovan et al., 1983) and will be addressed in the discussion. Stress at T1 proved to be the weakest measure. Another unexpected finding appeared for men: stress at T1 exhibited a significant negative relationship in two of the model tests. Again,

explanations for this unanticipated finding are reserved for the discussion.

The R^2's were larger for Model 2 than for Model 1, ranging from .19 to .38. Yet, significant ($p < .05$) increases in R^2's were apparent for only six of the 16 regression analyses. Five of these six models exhibiting a significant R^2 increase were for women. Here, PARALC and FOURALC displayed significant gain in variance accounted for. For the most part, it was change in coping use and change in risk-taking orientation that contributed most to the R^2 increase in Model 2. Change in coping use in Model 2 was especially important for the younger women and for 21 year olds in most analyses. Risk-taking/impulsive orientation at T1 was a significant predictor for men and for the younger women in Model 2. Change in risk taking was also significant for all younger men and women for PARALC and FOURALC. With only one exception, change in risk taking was not significant in the 21-year-old models. Change scores for both negative state and stress were not significant.

Marijuana models

The R^2's for the tests of Model 1 on marijuana and driving were lower than those obtained for alcohol. Two were not statistically significant and the remainder ranged from .11 to .24. Overall, the initial model exhibited higher R^2's for the men than for the women. Paralleling the findings for alcohol, coping use at T1 was the best predictor for all four dependent variables in the initial models for men and older women. Risk taking at T1 was an important predictor in several analyses for 18 year olds but not for the 21 year olds. The two remaining T1 measures, negative interpersonal state and stress, with only two exceptions, did not significantly explain any variance in the dependent variables.

With the addition of change measures, all R^2's were significant (ranging from .15 to .31). Only two of the models were improved significantly by the addition of change variables, both in the younger female groups. PARMAR and ONEMAR were improved significantly with the addition of change, primarily because of the contribution of change in coping use.

Path analyses

Since it is known that coping use of substances is strongly related to actual use patterns (Labouvie, 1987) and therefore directly related to our dependent measures, an issue we wished to address was whether coping use, by taking up the majority of explained variance in the dependent variables, masked the unique effects of the other predictor variables. Therefore, a second set of analyses (not shown) were

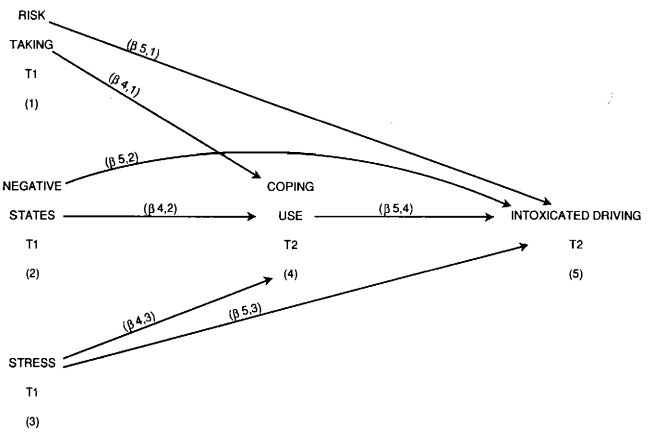

FIGURE 1: Path model for independent domains to intoxicated driving

conducted (eliminating coping use) and results indicated that the remaining variables alone exhibited R^2's ranging from .05 to .19 in the alcohol model. Only one-fourth of the marijuana analyses were statistically significant. Given the fact that risk taking, negative state and stress alone explained little of the variance in intoxicated-driving behaviors, we hypothesized that their effect on driving may, in fact, be mediated through their direct effect on coping use. That is, we postulated that these variables are predictors of the use of substances to deal with problems and that coping use in turn predicts intoxicated driving (Bry et al., 1982; Donovan and Marlatt, 1982; Labouvie, E.W., Pandina, R.J., White, H.R. and Johnson, V. Risk factors of adolescent drug use: A cross-sequential study, unpublished manuscript, 1987). Path analyses were conducted to test this hypothesis.

Figure 1 displays the path model tested for each of the four dependent variables separately by age and sex. Because it was found above that risk-taking orientation was a significant predictor in the positive direction and stress and negative intrapersonal states were significant predictors in both the positive and negative direction, these direct paths were also estimated in the path analyses.

Table 5 presents the significant standardized path coefficients for the alcohol model and Table 6 for the marijuana model. In examining the coefficients, similarities and differences can be seen between the dependent variables by the age and sex of the subjects.

Alcohol path model

Risk-taking orientation was the only significant direct T1 path to the dependent variable for the younger men. The indirect effects of risk-taking and negative states were also important as they were mediated through coping use. Risk taking was directly

TABLE 5. Significant path coefficients* for alcohol model

	18 year olds								21 year olds							
	PARALC		ONEALC		FOURALC		WHILEALC		PARALC		ONEALC		FOURALC		WHILEALC	
PATH	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
5,1	.25	.16	.31	.23	.20				.18		.19					
5,2		.27		.17				.20		−.19				−.27		
5,3											−.19					
5,4		.38	.21	.37	.36	.37	.34	.31	.40	.49	.31	.35	.43	.46	.36	.40
4,1	.27		.27		.27		.27		.23	.24	.23	.24	.23	.24	.23	.24
4,2	.20	.21	.20	.21	.20	.21	.20	.21		.18		.18		.18		.18

* $p < .05$.

related to the dependent variable for the younger women and, interestingly, negative intrapersonal states both directly and indirectly influenced drinking and driving. Among the older men, both direct and indirect paths from risk-taking orientation to driving behaviors were significant. Negative state and risk taking were mediated through coping use for the older women; however, negative state had a direct negative effect on intoxicated driving.

In addition, there were some differences in the path models among the dependent variables. Path results for PARALC and ONEALC were similar; however, in the youngest age group, negative states exhibited no direct effect on FOURALC as it had in the other models. Also note that, for the most part, coping use appeared to display the primary effect on drinking while driving (WHILEALC). It may be that those who use alcohol to cope with problems or tension may also drive in order to reduce stress and that these two activities may be engaged in at the same time to reduce tension.

Marijuana path model

In the models for the older men, results indicate that there were no direct paths from any of the T1 domains to intoxicated driving; risk-taking orientation and negative state were important only as they were mediated through coping use. For the younger men, risk taking (both directly and indirectly) was important in explaining some dependent variables. Analyses of the women indicated a direct link from risk taking and an indirect link from negative states to smoking and driving. Like the alcohol analysis, coping use displayed the only direct effect for WHILEMAR in the older age group.

Discussion

These self-report data indicate that at least minimum levels of drinking and driving and smoking marijuana and driving are behaviors engaged in at least once for the majority of adolescents and young adults aged 18 to 21. About 70% of drinkers have operated a motor vehicle after consuming a drink or two, 57% have driven drunk and about 50% have consumed alcohol while driving. Similarly, about 50% of the marijuana users have smoked marijuana while driving and have driven stoned.

Further, 25 subjects reported being the driver in a car accident after drinking. Given that none of these 25 subjects reported ever having been convicted of DWI, we speculate that either (*1*) their self-report of "intoxication" was actually lower than the legal limit (.10 in NJ) or (*2*) their blood alcohol levels (BALs) were not tested or (*3*) less likely, subjects were reluctant to report their DWI arrests. It has been demonstrated elsewhere that young drivers who are involved in auto accidents exhibit a lower BAL than adults involved in alcohol-related accidents (Farrow,

TABLE 6. Significant path coefficients* for marijuana model

	18 year olds								21 year olds							
	PARMAR		ONEMAR		FOURMAR		WHILEMAR		PARMAR		ONEMAR		FOURMAR		WHILEMAR	
PATH	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
5,1		.25	.20	.20		.24		.27		.20		.21				
5,4	.20	.46		.49		.32	.24	.35	.41	.25	.41	.34	.35	.39	.34	.36
4,1	.22		.22		.22		.22		.22		.22		.22		.22	
4,2		.30		.30		.30		.30	.22	.21	.22	.21	.22	.21	.22	.21

* $p < .05$.

1985). The findings reported here also support other researchers' contention that for every DWI arrest, a significant number of drivers are driving intoxicated yet undetected (Beitel et al., 1975; Borkenstein, 1976).

The data indicate that there was a moderately strong relationship between frequency of alcohol and marijuana use and frequency of driving under the influence of these substances. This finding supports similar research conducted on adults (Donovan et al., 1983). In fact, intoxicated-driving behaviors were more strongly related to frequency of substance use than to quantity and degree of intoxication.

Clearly, coping use of substances was the strongest predictor of DWI. This finding supports other research indicating a strong relationship between reasons for use (especially escape reasons) and intoxicated-driving behavior (e.g., Donovan and Marlatt, 1982; Snow and Wells-Parker, 1986). It is also linked to other findings that demonstrate that people who tend to drink for "personal" (e.g., escape) reasons tend to have more problems with their drinking (Cahalan and Room, 1974; Polich and Orvis, 1979) and drink more heavily (Beckman and Bardsley, 1981; Brown et al., 1980; Ratcliff and Burkhart, 1984).

The finding of a negative effect of intrapersonal state on the dependent variables suggests that perhaps these 21-year-old women who feel bad about themselves and are depressed or anxious are less likely to go out and socialize, and therefore are less likely to engage in any of the impaired-driving behaviors.

Stress appeared to have no direct effect on intoxicated driving (with one exception—a negative effect) nor any indirect effect mediated through coping use. This finding contradicts literature suggesting that DWI offenders tend to have heightened levels of stress (e.g., Bradstock et al., 1987). Perhaps those youths experiencing the most stress (*1*) use alternative coping mechanisms, (*2*) acknowledge their own level of stress and try harder to avoid situations where poor performance might result in an increased level of stress or (*3*) do not reach levels of stress as high as those of adults.

Risk-taking orientation was an important predictor of DWI both in terms of its direct effect and its indirect effect through coping use. It appears that impaired driving may be part of a more global syndrome of risk-taking behaviors. Hodgdon and his colleagues (1981) reported that youthful drivers are, in general, more hazardous drivers (as measured by such driving characteristics as speed, passing and driving in adverse conditions) and the findings here reinforce the notion that youths who are sensation-seekers, risk-takers and impulsive in their behavior will use substances more often to cope with problems or tensions and will more often drive impaired. Other research on these data also indicate a strong association between a risk-taking orientation and substance use (Bates et al., 1986) as well as delinquency (White et al., 1985).

These results, taken together, suggest that the factor(s) predicting impaired driving among youth may be the same factor(s) predicting substance use and other forms of deviant behavior. Thus they add support to a problem behavior perspective such as that proposed by Jessor and Jessor (1977). Jessor and Jessor defined problem behavior as "behavior that is . . . undesirable by the norms of conventional society . . . and its occurrence usually elicits some kind of social control response" (p. 33). In a later study, Donovan and Jessor (1985) confirmed that alcohol intoxication, drug use, delinquency and precocious sexual behavior constitute a problem behavior "syndrome" among youth. They suggest that the syndrome of problem behavior reflects a general underlying dimension of unconventionality including psychosocial attributes such as lower academic achievement orientation, lower religiosity, higher value on independence and greater orientation to friends than to parents. The results of our study, however, suggest that problem behavior syndrome may be predicted by an underlying dimension of risk-taking. An important consideration for future research is the investigation of the association between risk-taking orientation (as measured in this study) and other personality and social environmental attributes of unconventionality as measured by Jessor and colleagues.

Finally, there are some limitations in our study with regard to additional driving variables that are not available in the database. For example, we have no measures of driving history (e.g., miles driven, time-of-day driving, prior traffic violations), accessibility to a car or motivations for driving. Nor do we have any method for determining the actual BALS of our subjects when driving. However, we have replicated other studies that indicate the predictive ability of consumption patterns, reasons for use and intrapersonal style for intoxicated driving.

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