

ALCOHOL, DRUGS AND YOUNG DRIVERS

Environmental Predictors of Heavy Episodic Drinking Among College Students: A Preliminary Validation Study

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Keywords

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Abstract

This paper presents three studies examining the predictive validity of environmental factors associated with heavy drinking among college students.

Introduction

Colleges and universities are increasingly adopting environmental approaches to prevent alcohol-related problems experienced by students (Wechsler et. al, 2000b). Little research, however, guides such efforts. This paper augments the current literature in this area by presenting the findings from three sequential studies, which examined the relationship of environmental characteristics as they relate to heavy drinking among college students. The studies build on each other by first examining the relationship between environmental variables and heavy episodic drinking, then confirming these relationships while taking individual-level variables into account using different data sets. Together, these studies begin to establish the predictive validity of a set of environmental characteristics related to heavy episodic drinking events attended by college students. The studies use data collected in separate surveys conducted as part of a federally-funded AOD prevention trial. To strengthen the evidence for the validation of the environmental variables being examined, separate samples were used for each sub-study.

Methods

Study one: A random telephone survey of graduate and undergraduate students attending two large public universities in the southwestern United States was conducted during the Spring and Fall semesters of 2000. A university-based social science research laboratory conducted the telephone interviews. At least 400 students were randomly selected from registration records and interviewed at each school, each semester for an overall sample of 1609 students. For both schools, a sample of 400 students allows for 95% confidence (+/- 5%) when estimating population parameters. Preliminary analyses of the data from the two universities indicate that the schools do not differ on any of the last drinking event or drinking variables assessed here. As such, the data from the two schools were pooled for analysis.

An original interview schedule was developed for this study. The instrument included several items from the Core Survey (Presley et al., 1995) including measures of AOD use and related problems. Presley and associates (1995) reported the psychometric properties of the Core were acceptable. In addition to the standard questions taken from the Core Survey, we included a series of questions measuring contexts of student drinking (see Clapp, Shillington and Segars, 2000; Clapp and Shillington, 2001).

Measures

Environmental predictor variables

As part of this survey, respondents were asked to recall and described characteristics of the last occasion (within the past 28 days) that they attended in which alcoholic beverages were served and at which they drank at least one alcoholic beverage. Participants indicated the nature of the event (i.e., whether it was a fraternity party, non-fraternity party, social gathering with friends or family, etc.) as well as the type of location at which the event took place (i.e., someone's home, restaurant, bar or nightclub, etc.). Additionally, respondents indicated which of a number of different environmental characteristics were present. The particular environmental features concerned to availability of alternative activities besides alcohol (i.e., food), the availability of drugs, beverage service (e.g., BYOB, served by a bartender, etc.), characteristics of the other event attendees (e.g., level of intoxication, gender make-up, etc.) and the presence of structured drinking related activities (i.e., drinking games).

Dependent Measure

Finally, in addition to describing the event, participants were asked to indicate the number of drinks that they consumed during the event. Note that at the beginning of the survey, a "drink" was operationally defined as equaling one 12-ounce can, bottle or glass of beer, a five-ounce glass of wine, or a one-ounce shot of hard liquor, such as vodka, whisky or gin. For analysis purposes, we recoded this continuous measure into a dichotomous variable reflecting whether the event was a heavy drinking episode (five or more drinks) or not.

Analytic Strategy

Discriminate analysis was employed to test whether the environmental event variables could significantly and successfully predict binge drinking using a non-parametric estimation procedure within the SAS system (version 8.0) was used to conduct the analysis.

Analysis involved both an exploratory and a confirmatory phase. The data set was randomly split into two subsets using random number generator within SPSS (version 10.1). One subset was assigned to be exploratory data while the other was assigned to be confirmatory data. The analytic procedure first estimated discriminant functions (predicting heavy episodic drinking from the environmental event variables) from the exploratory data. Then, in a second procedure, the analysis applied the same discriminant functions to the confirmatory data set to test the functions' ability to successfully classify participants as heavy episodic drinkers.

Study 2: Random cross-sectional telephone interviews of graduate and undergraduate students attending the same large public university in the southwestern United States were conducted during semesters beginning in the spring semester of 2001 and ending in the fall semester 2001. The same university-based social science research laboratory conducted telephone interviews. At

least 400 students were randomly selected each semester at each school from registration records for an overall sample of 1614 students. As noted before, for each university, a sample of 400 students allows for 95% confidence (+/- 5%) when estimating population parameters.

Measures

Environmental predictor variables

We included the environmental variables (Food Available, Illegal Drugs Available, Many People Intoxicated, BYOB event, and Drinking Games) that loaded in the discriminant function in Study One as predictors in Study Two. These variables were all dummy coded, with 1=the characteristic was present. *Individual level variables*: In addition to the environmental variables, we included two individual-level demographic variables in the analyses as controls: 1) gender (coded 1=male), and 2) age. *Dependent Measure*: Consistent with study one, we used heavy episodic drinking (five or more drinks at the event) as the criterion (1=a heavy episodic event).

Analysis Strategy

To test the independent relationship of the environmental predictor variables with heavy episodic drinking and alcohol-related problems (event specific) we employed a hierarchical logistic regression approach in which demographic variables were entered on the first block and environmental characteristics were entered on the second block. This approach builds on the approach used in Study One by examining the relationship among the environmental predictor variables and heavy episodic drinking net of individual characteristics.

Study 3: Random telephone interviews were conducted during the summer session of 2001, with 402 undergraduate students attending one of the large public universities used in the previous studies. The purpose of this survey was to generate a sample of student drinking events that could be statistically modeled using the variables identified in Studies One and Two. Specifically, students were queried about their most recent drinking event (past month).

For the purposes of this confirmatory sample, we restricted the sample to students 18-22 years of age who had consumed alcohol at least once in the month prior to being surveyed. Similar to studies 1 and 2, interviews were conducted by trained interviewers at a university based research laboratory. The interview schedule used in this study included the same items as Studies One and Two plus several new environmental variables.

Measures

Environmental predictor variables

We included the environmental variables (Food Available, Illegal Drugs Available, Many People Intoxicated, BYOB event, and Drinking Games) that loaded in the discriminant function in study one as predictors in study two. These variables were all dummy coded, with 1=the characteristic was present. *Individual level variables*: In addition to the environmental variables, we included two individual-level demographic variables in the analyses as controls: 1) gender (coded 1=male), and 2) age. For this study, we also included a measure of respondents' motivations related to their most recent drinking event. In addition, we asked respondents to estimate the motivations of their drinking companions for that event. These motivational variables were used

in the SEMs presented below. *Dependent measure*: Consistent with study one, we used heavy episodic drinking (five or more drinks at the event) as the criterion (1=a heavy episodic event).

Analysis Strategy

The analyses for study three were conducted in two phases. First, we conducted an exploratory factor analysis examining the same environmental variables used in the analysis presented in Study One. Second, we calculated three SEMs to examine the influence of environmental characteristics as they related to drinking behavior taking into account personal history and drinking motivations. The loadings for the BYOB variable were below .5 and therefore excluded from the models. We ran three models: 1) a full model in which all paths were allowed to vary freely; 2) a model in which the path from motivation to drinking was set to zero, and 3) a model in which the path from environment to drinking was set to zero.

Results

Study 1: Discriminant analysis revealed that the set of predictor variables did significantly predict heavy episodic drinking among individual participants, Multivariate $F(12, 573) = 10, p < .01$. The pooled-within canonical structure coefficients are provided in Table 1. The results reveal that the presence of many people who are intoxicated, the availability of illegal drugs and the presence of drinking games all were highly predictive of binge drinking. Events that were “Bring Your Own Beverage” presented a higher likelihood of heavy episodic drinking, although the availability of food appears associated with a reduced likelihood of binge drinking. Private events (vs. Public) and Parties (vs. occasions of socializing) were associated with a higher likelihood of participant heavy episodic drinking, however the interaction between the two did not contribute to the discriminant function.

Table 1: Pooled Within-Group Structure Coefficients for the Exploratory and Confirmatory Sub-Samples

Environmental Variable	Exploratory Sub-Sample	Confirmatory Sub-Sample
	<u>β</u>	<u>β</u>
Food Was Available	-.30	-.12
Alcohol Served by Bartender	-.23	-.13
Many People Intoxicated	.70	.66
Illegal Drugs Available	.55	.39
No-Cost Alcohol Provided	-.06	-.12
Didn't Know Many People	.09	.05
BYOB Event	.38	.30
Drinking Games were Played	.62	.63
Attendees all Same Sex	-.15	-.02

Note: Bold coefficients are considered meaningful to the discriminant function

The discriminant function coefficients produced by this analysis were used to classify cases (using the nearest neighbor approach) as heavy episodic or non-heavy episodic drinkers. The environmental predictor variables could successfully identify 94.8% of non-heavy episodic drinkers and 48% of the heavy episodic drinkers. The overall classification error-rate obtained from the discriminant analysis was 9.6%, or 53 misclassifications out of 550 classifiable cases.

The second half of the sample was used for the confirmatory stage of the analysis. The same discriminant function coefficients were applied to data from the confirmation data set to predict

case classification. The overall classification error-rate associated with this confirmatory analysis was notably higher than in the exploratory analysis at 20.5% (i.e., 101 of the 493 classifiable cases). Applying the previous prior probabilities to the confirmatory data set produced classification counts with an overall error rate of 32.5%. Thus, the use of the discriminant functions to classify cases improved over the prior probability approach by 36.9%. If the error rates from the confirmatory analyses (i.e., 20.5% and 32.5%) were obtained from independent samples, they would be statistically significant ($t[491]=4.3, p<.01$).

Study 2: The results of Study Two are presented in Table 2. As can be seen in the table, in block one gender was significant while age was not. Gender remained significant in block two, with females being less likely than males to report heavy episodic drinking events. Two of the environmental predictor variables identified in Study One remained significant in block two—having food available was negatively associated with heavy episodic drinking events, while events in which drinking games were played presented a significant risk for heavy episodic drinking. For both blocks, the model Chi-square statistics were significant. Examination of the Hosmer and Lemeshow Goodness of Fit Chi-squares, suggested that the model fit the data in block two.

Table 2: Hierarchical Multiple Logistic Regression of Heavy Episodic Drinking Event Status on Demographics and Environmental Characteristics

Variable	Block 1 OR	Block 2 OR (95%CI)
<i>Demographic Variables</i>		
Age	1.0	1.0 (.99-1.1)
Gender (0=female)	.68**	.68** (.53--.86)
<i>Environmental Variables</i>		
Food Available		.86* (.75-.98)
Illegal Drugs Available		.93 (.84-1.0)
Drinking Games were Played		2.0** (1.3—3.3)
Many People were Intoxicated		1.0 (.95—1.1)
Event was BYOB		.93 (.83--.1.1)
Chi Square for Model (df)	10.3 (2)**	28.6 (7)**
Hosmer and Lemeshow Goodness of Fit	20.7 (8)**	10.5 (8)

Notes: * $p \leq .05$, ** $p \leq .01$

Study 3: Table 3 presents results from dichotomous factor analysis on eight items. The factor solution was derived using Varimax rotation. Factor loadings above .45 were considered to have significant loadings on each factor. The results indicate that three-factor solution has the best fit for the data and the factor solution appears to explain eight items quite well, as indicated by non-significant chi-square statistics and RMSEA.

As can be seen, in the table, the variables loading on factor two were essentially the same as those that load on the discriminant function in Study One.

In all three SEMs, the path from motivations to environment was strong and significant. The path from the personal risk latent variable to the drinking variable was also statistically significant in each model but with a modest estimated regression coefficient. The path from

personal risk to motivations was also statistically significant in each model with a moderately strong estimated regression coefficient.

Of interest here is unique role of the environment on drinking. Two competing hypotheses were tested with the SEM modeling procedure: (1) The environment has a independent effect on the level of drinking and (2), the environment facilitates motivations to drink. The model was tested including paths from both *motivations* and *environment* to *drinking*. When both constructs were in the model competing for variance, neither was statistically significant. Next, we tested separate models were tested constraining these paths individually to 0. The constrained models fit no better than the unrestrained model (RMSEA for each model =.06). Further, the paths between *motivations* and *environment* to *drinking* were only significant in the restrained models. This indicates environment likely serves as a mediator to motivations to drink.

Table 3: Dichotomous factor analysis on environmental factors (N = 401)

	Factor 1 (Bar Event)	Factor 2 (Party Factors)
Event was in a Bar	1.4	-.18
Event Was BYOB	-.50	.46
No Cost Alcohol was Provided	-.48	-.05
Illicit Drugs were Available	-.09	.69
Food was Available	-.32	-.47
Drinking Games were Played	-.21	.62
The Group was Same Sex	-.12	.20
Many People were Intoxicated	-.19	.64

Chi-square =15.8, df=11
RMSEA=.035

Note: Bold loadings are considered important to the factor solution.

Discussion

Drinking environments are important to understanding and preventing heavy alcohol consumption by college students. Uncontrolled drinking environments with characteristics like those identified above, are actively sought out by students and contribute to heavy drinking. Although much more work is needed to better understand how such factors operate and interact with individual level variables and each other, the findings of the above studies suggest that specific environmental characteristics are important.

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Substance Consumption and Willingness to Drive – a Comparison of Illegal Drugs and Alcohol

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Keywords

Illegal drugs, alcohol, willingness to drive

Abstract

The relationship between illegal drug consumption and the willingness to drive under the influence of illegal drugs was examined using the data of a field study in 1998 funded by the BAST. Young drivers at discotheques were contacted and asked to participate in a short interview concerning drugs and driving. Subjects who had consumed drugs and were driving at this evening or at similar occasions were asked for an extended interview and a driving-simulator test. Moreover, blood, urine and saliva samples were taken. Additionally, sober control subjects and subjects under the influence of alcohol were included.

Due to the patterns of drug consumption, the analyses are constrained to the use of amphetamines / ecstasy, cannabis and alcohol. The results show that on the one hand users of illegal drugs are much more likely to drive under the influence of these drugs as (alcohol) drinkers. On the other hand, a substantial percentage of the drug users is not willing to drive after consuming illegal drugs. Moreover, a comparable positive relationship between level of consumption and willingness to drive under the influence of substances is found for users of illegal drugs and alcohol drinkers. The probability to refrain from driving under the influence of a psychoactive substance is increased when trips under the influence of these substances are condemned, when they are regarded as being risky and when there is a large likelihood of being detected by the police. In drug users, these attitudes are more liberal than in alcohol drinkers and the likelihood of detection for driving with illegal drugs is estimated very low. This explains the larger willingness to drive after consuming illegal drugs. However, modifying these attitudes and increasing detection rates may thus prove an effective tool to reduce this risky behaviour. As increasing detection rate will probably also influence the attitudes. This seems to be the most urgent task of preventing drug-impaired driving.

Introduction

While factors influencing the decision to drive under the influence of alcohol have been examined extensively, it remains uncertain if similar factors are important with regard to driving under the influence of illegal drugs. Additionally, illegal drug consumption (even without driving under the influence of illegal drugs) poses a special problem in Germany: If someone is caught

having consumed illegal drugs, the governmental licensing agencies may re-draw the drivers' licence. It can only be re-granted if a medical-psychological examination ('medizinisch-psychologische Untersuchung' MPU) has been passed by the driver in which he or she has made certain that he or she doesn't consume illegal drugs any more. Thus, the ability to drive depends on refraining from drug use. While this practice may be criticized from several points of view, the underlying assumption remains to be proven: It is argued that illegal drug consumers are either not able or not willing to refrain from consuming drugs when driving and thus should not be allowed to drive at all. This assumption will be examined in the context of this paper by comparing attitudes and behaviour of drivers under the influence of illegal drugs (cannabis, amphetamines and ecstasy) and alcohol.

Methods

The study was conducted in three larger cities in Bavaria, Germany (Munich, Nuremberg and Wuerzburg). In and around these towns, 29 discotheques were selected where a large part of the visitors attended by car and where experts rated drug use as highly probable. Between July and November of 1998, 66 events were visited. 54.5% of those were so-called Techno-Parties where amphetamines and ecstasy were supposed to be the dominant drugs. The other 45.5% consisted of Heavy Metal, Independent and various events with cannabis as the dominant drug. 62 of the events took place on Friday or Saturday night. Depending on the time schedule of the discotheques, the investigation times were either between midnight and 6 a.m. or between 10 p.m. and 4 a.m.

For the investigation, a camper van was used where a driving simulator was installed. Additionally, two tents were erected for an extended interview and a medical examination. A research team consisted of 6 researchers. Two of these conducted short interviews with potential subjects in order to select participants for the intensive investigation. One researcher performed an extended interview, another attended the driving simulator. A fifth researcher provided coordination between the different researchers. A medical doctor took blood, urine and saliva samples and conducted a short medical examination.

In order to find the subjects of interest, different selection criteria were defined: First of all, when researchers contacted a group of incoming or leaving people, they asked who the driver was and selected him or her for the short interview. If no driver was present, people were asked if anybody was driving regularly at comparable events (but just not at the evening of the study). Thus, either a driver or a potential driver was selected for the short interview.

In the short interview, subjects were asked about drug use and driving under the influence of drugs. The answers provided the basis for the second step of the selection process. First of all, subjects under the influence of drugs were selected. Additionally, five groups of control subjects were searched for: a performance control group (no drug use during the last year), an alcohol control group (BAC between 0.03% and below 1.1%), a group of drug users currently not under the influence of drugs (long-term effects of drug use), drugs users and drivers who do not, however, drive under the influence of drugs, and subjects admitting driving under the influence of alcohol. The latter two groups were not examined in the driving simulator but just questioned extensively. Subjects meeting these criteria were asked to participate in the intensive investigation including driving simulator, extensive interview and a medical examination. For the extensive investigation subjects were rewarded with DM 60 (about \$30 US).

Overall, 3081 subjects were selected for the short interview and 2779 participated (90.2% responder rate). From these, 832 were asked to participate in the extensive investigation, 503 took part in at least some parts of the investigation and n = 483 subjects provided answers in the extended interview concerning the consumption of illegal drugs and alcohol and driving under the influence of illegal drugs and alcohol. The following results are based on this sample of 473 drivers.

Results

Drivers were questioned about illegal drug consumption during the last year and the last month. 67% of the drivers who indicated drug consumption during the last year stated that they had been driving with illegal drugs. 40% of them drove with illegal drugs within the last 30 days. 75% of the drivers who indicated drug consumption during the last 30 days had been driving with illegal drugs. 64% of them did so within the last 30 days. Thus, a quite strong correlation between drug use and willingness to drive with illegal drugs is found. For alcohol, drinking and driving is more likely to be separated. Only 14% of the drivers who were sober at the time of the study indicated that they had been driving with a (self-estimated) BAC of 0.05% and above within the last 30 days. For drivers under the influence of alcohol at the time of the study, this percentage rises to 27%. Moreover, illegal drug drivers state to have been driving 10 of 30 days while alcohol drivers tell of 4 trips under the influence of alcohol during the last 30 days. Thus, on the one hand drug users show a larger willingness to drive under the influence of drugs as compared to the willingness of alcohol drinkers to drive under the influence of alcohol. On the other hand, a quite large percentage of drug users state that they do not drive when having consumed drugs. Thus, illegal drug use does not automatically imply driving under the influence of illegal drugs.

Table 1: Willingness to drive under the influence of alcohol and drugs with regard to the quantity of alcohol and drugs consumed

Alcohol consumption	Driving under the influence of alcohol		Overall
	Doesn't drive	Drives	
Low	32 56.1%	25 43.9%	57 100.0%
High	22 32.8%	45 67.2%	67 100.0%
Overall	54 43.5%	70 56.5%	124 100.0%
Drug use	Driving with illegal drugs		Overall
	Doesn't drive	Drives	
Medium	38 40.0%	57 60.0%	95 100.0%
Strong	12 9.0%	122 91.0%	134 100.0%
Heavy	1 0.8%	118 99.2%	119 100.0%
Overall	51 14.7%	297 85.3%	348 100.0%

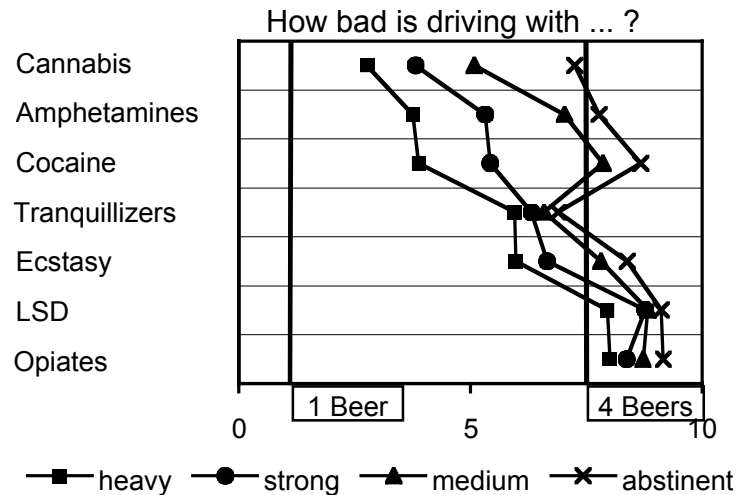
With regard to the quantity of drugs consumed, strong correlations were found which are shown in Table 1. Drug users were divided into three groups: (1) Medium drug use: cannabis, only, in up to 10 of 30 days, (2) strong drug use: cannabis, only, in 11 to 30 of 30 days or amphetamines / ecstasy in up to 10 of 30 days, (3) heavy drug use: amphetamines / ecstasy in 11 to 30 of 30 days or use of other drugs like cocaine, LSD, heroine. Subjects who did not consume any drugs were divided into two groups with regard to alcohol consumption (n = 11 of these subjects were excluded because they did not consume any alcohol): (1) low alcohol consumption: below 45 grams pure alcohol per drinking occasion or less than 75 grams pure alcohol per drinking occasion and only up to 9 of 20 days with alcohol consumption. (2) high alcohol consumption: 45 to 75 grams of pure alcohol in 10 to 20 of 20 days or more than 75 grams of pure alcohol per drinking occasion.

With regard to alcohol consumption, 43.9% of drivers with a low consumption are willing to drive with a (self-estimated) BAC of 0.05% and above as compared to 67.2% of drivers with a high alcohol consumption. A comparable correlation is found with regard to drug consumption: 60% of subjects with medium drug use indicate a willingness to drive with illegal drugs as compared to 91% of subjects with strong drug use and 99.2% of subjects with a heavy drug use.

Thus, for alcohol as well as for illegal drugs the willingness to drive under the influence of a substance depends on the quantity and frequency of substance consumption: The stronger the substance use the larger the probability to drive under the influence of the substance. However, illegal drug users are more willing to drive under the influence of illegal drugs than alcohol drinkers are willing to drive with alcohol.

How can this be explained? On the one hand, cannabis users are convinced to be able to drive as well under the influence of cannabis as without drugs (1). This conviction is probably due to the fact that drivers think that they are able to compensate any negative drug effects. Experimental studies in the driving simulator as well as in real traffic have shown that drivers under the influence of cannabis drive more slowly than without drugs (e.g., 1, 2). This effect is opposite to that of alcohol where drivers tend to drive faster under the influence of alcohol. The combination of the subjectively low danger exerted by drug consumption with the conviction to be able to compensate any drug effects contributes to the high willingness to drive under the influence of illegal drugs.

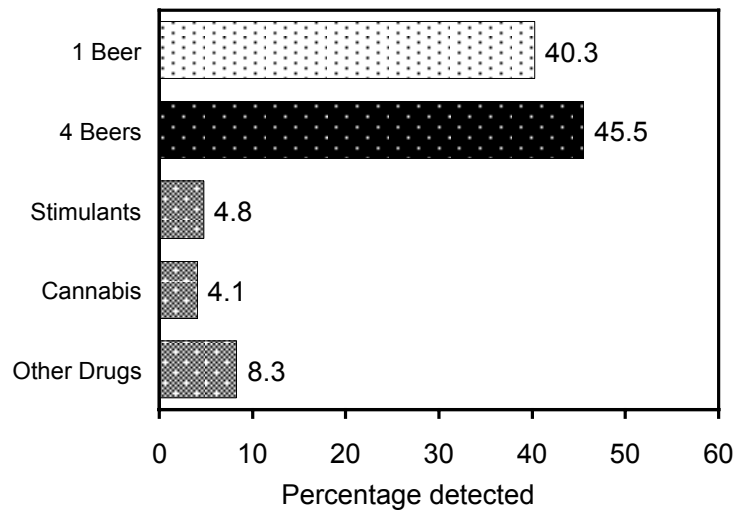
Figure 1: Subjective evaluation of driving under the influence of illegal drugs and alcohol with regard to quantity of drug use. As reference lines, the subjective evaluation of driving with 1 beer (0.5 liter) and 4 beers (2 liters) are given



On the other hand this conviction is highly correlated with the subjective evaluation of illegal drug driving ('How bad is it to drive under the influence of illegal drugs?'). Figure 1 gives the subjective evaluation (0: 'not bad at all', 10: 'extremely bad') with regard to quantity of drug use and the kind of drug used. Subjects who do not consume drugs regard driving under the influence of any drug comparable to driving with 4 beers (2 liters of beer, clearly above the legal limit). Drug users differentiate between different drugs. This effect is seen most strongly for cannabis: The higher the quantity and frequency of drugs consumed, the less driving with cannabis is condemned. Driving with amphetamines and cocaine is evaluated as somewhat worse, however less bad than driving with alcohol. On the one hand, this differentiation reflects the actual risk exerted by the drugs. On the other hand, subjective evaluation of driving with illegal drugs clearly depends on the quantity of drugs consumed.

Last but not least the amount and effectiveness of police controls exerts a decisive influence. Figure 2 shows the answers to the question 'How likely is it that drug consumption is detected in a police control?'. For alcohol, drivers indicate a detection rate of 40.3% and 45.5% for one and four beers (0.5 liters), respectively. For cannabis and stimulants this percentage lies below 5%.

Figure 2: Estimated percentage of substance use detected in police controls with regard to the kind of substance used



Discussion

Summing up the results, both driving under the influence of alcohol and drugs depends on similar factors. Drivers are more likely to refrain from driving under the influence of a substance if they believe the substance to be dangerous and if they think it is bad to drive under the influence of the substance. This conviction results from the objective danger posed by the drug, by legal consequences of driving under the influence of the substance and by the probability to be detected when driving under the influence of the substance. The subjective evaluation will be less negative, if more of the substance is consumed. Thus, the large willingness to drive under the influence of illegal drugs as compared to alcohol does not depend on other decision processes in drug users but is due to a lower subjectively estimated danger posed by illegal drugs, a less negative evaluation of drug use while driving and a lower subjective probability to be detected when driving under the influence of illegal drugs.

On the one hand, illegal drug users are thus more likely to drive under the influence of illegal drugs as compared to alcohol. On the other hand, some percentage of drug users refrains from driving when being under the influence of illegal drugs. Moreover, influencing factors are similar when alcohol and illegal drugs are compared. However, the negative subjective evaluation of drug effects and driving under the influence of drugs as well as the probability to be detected when driving with illegal drugs is lower as compared to alcohol. For alcohol it has been shown that increasing the probability to be detected by the police is the most effective tool to reduce driving under the influence of alcohol. Thus, this also seems to be the most important factor with regard to illegal drugs. From this point of view the most urgent task for drug driving prevention remains to increase the possibilities to detect drug use when driving.

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Driving Drunk, Driving High: A Comparison of Student Attitudes Towards Driving while Drunk Versus Driving while High on Cannabis

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Keywords

Alcohol, Cannabis, Driving

Abstract

This article reports on a comparison of high school students' attitudes towards driving under the influence of alcohol and driving under the influence of cannabis. Very few students, less than 5%, thought that it was acceptable to drink and drive. On the other hand, students were much more willing to endorse

Introduction

A recent U.S. survey of attitudes towards drinking and driving showed that, although most people are supportive of zero tolerance for drinking and driving, many people still drive after consuming alcohol. Almost 1/5th of the population reports driving a vehicle within two hours of drinking an alcoholic beverage. Younger adults are more likely to be drinker-drivers, and consume, on average, about 6 drinks prior to driving. These numbers have remained relatively stable over the past decade.

In Manitoba substantial effort has been invested in a public awareness campaign designed to educate people about the dangers of drinking and driving. This campaign seems to be working, especially with young people. Rates of drunk driving have been declining with young adults, programs in beverage rooms (e.g., free non-alcoholic drinks for designated drivers) have been implemented and there is a general perception that younger adults have a negative attitude towards drunk driving. One of the purposes of this research is to examine high school students' attitudes towards drunk driving to test this perception.

Furthermore, there has been very little systematic examination of the perceptions of adolescents with respect to driving under the influence of cannabis. Therefore an additional purpose of this research is to examine student's attitudes towards stoned driving.

Rates of alcohol and cannabis use

Alcohol is the most widely used drug by high school students. Depending on the year and the format of the survey, estimates suggest that about 25% of students are drinking at least weekly. Many of them are also old enough to drive and have access to cars. In terms of drug use, after a

period of relative stability, cannabis use has been increasing in the past decade. In some provinces rates have almost doubled in the past ten years, with estimates of about 10% of youth using marijuana at least monthly. Many of the students who drink heavily are also using marijuana.

Effects of Marijuana on Driving

A common misperception about drug use and driving is that the effects of drugs, especially marijuana, are less powerful than the effects of alcohol. That is, because the effects are less physical and more cognitive, marijuana users think that they will be more able to hide their level of intoxication, and compensate for poor driving by driving slower. However, there is a substantial literature detailing the effects of marijuana on motor performance and on driving-related tasks. This literature can be summarized by suggesting that stoned drivers are more cautious, because they need to be to adjust for their lack of attention to important details (like signs). Although many of the potential consequences of driving while under the influence of cannabis are lessened by increased vigilance, cannabis is second only to alcohol in terms of its presence in motor vehicle accidents.

Method

The attitudes and behaviours described in this report were measured using a survey developed by the AFM and Proactive Information Services Inc. The data were collected in a manner that would allow us to make valid comparisons with the previous alcohol and drug use surveys. However, some questions were added to gather additional information on gambling and risk perception. As a result, some previously asked questions were omitted in order to keep the survey at a reasonable length. Questions were included that asked about the frequency of alcohol or marijuana use, and about attitudes towards drinking and driving.

Description of the Sample

Thirty-two schools participated in the survey as a result of their involvement or interest in AFM programs. Altogether approximately 14,000 students attend these schools. From this total population, we randomly selected a sample of 4,680 students. Packages with instructions for principals and teachers, and the required numbers of questionnaires for each student were mailed to participating schools in April 2001. Of the 6,650 questionnaires that were sent, a total of 4,680 completed questionnaires were returned. This represents a response rate of 70.4%. The sample is 49.5% female, and 50.5% male. The average age is 16.7 years. The sample was stratified by grade to ensure equal representation of each grade level and age.

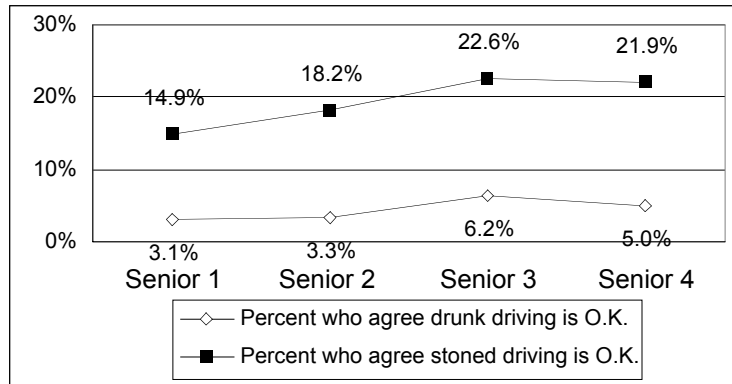
Results

Although about 80% of students had an alcoholic drink in the past year, less than 5% thought that drinking and driving was acceptable. This percentage has been declining, suggesting that public education about the dangers of drunk driving are reaching the younger age groups. On the other hand, there is a much higher level of tolerance from young people towards smoking marijuana and driving. Over 25% of male students and 13% of female students thought that it was at least “somewhat acceptable” to smoke marijuana and drive. Given the relative normalcy of this behavior (approximately 38% of the students in this survey had smoked marijuana at some time in the past year) it would appear to be important to educate students about the dangers of this attitude.

Figure 1 shows that the pattern of acceptance of driving while under the influence of alcohol or marijuana separately for each grade. Students in Senior 2 usually turn 16 years of age, the legal

driving age in Manitoba. Students in the older grades (who are legally able to drive) are more accepting of driving stoned than the younger students, with over 20% stating that they “agree” or “strongly agree” with the statement “There is nothing wrong with using cannabis and driving”.

Figure 1: Percent of students (by grade) who agree that driving drunk and driving stoned is O.K.

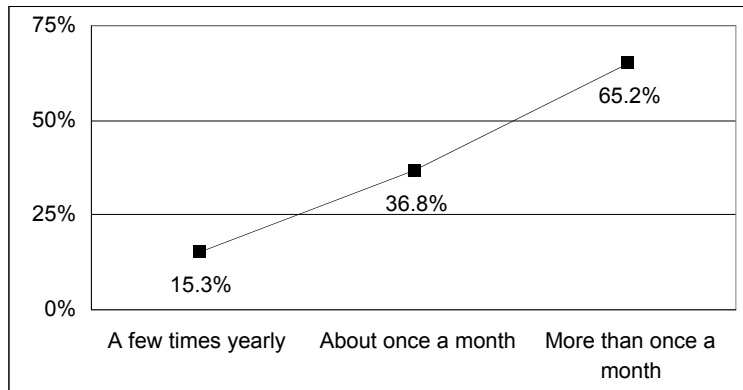


Overall, males were much more likely than females to think that it is all right to drive under the influence of either alcohol (7.5% vs. 1.3% of female students) or cannabis (25.7% vs. 12.6% of female students). This is consistent with previous findings on adolescent risk-taking and gender differences.

We also examined whether student’s personal substance use history with either illegal drugs or alcohol impacted on their perceptions of driving risk. Adolescents who were more likely to think that driving stoned or drunk is O.K. were more likely to be cigarette smokers. Oddly, kids who were current drinkers (i.e., had drunk in the past year) were just slightly more likely to think that it is O.K. to drink and drive ($p = .049$), but they were much more likely to think that it is O.K. to drive stoned. Similarly, adolescents who had smoked marijuana in the past year were much more likely to think that it is O.K. to drive drunk or drive stoned.

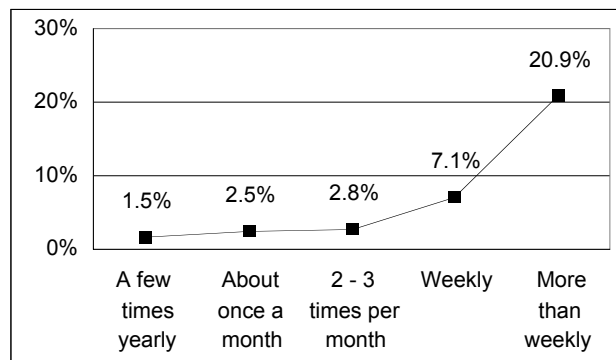
It also appears that heavier users of either cannabis or alcohol are much more likely to think that it is acceptable to drive under the influence of either substance. These data are shown on Figures 2 and 3.

Figure 2: Percent of students and the frequency they smoke cannabis who agree than driving stoned is O.K.



This figure shows that about 15% of the students who use marijuana “a few times a year” (about 12% of the sample) agree or strongly agree with the statement “there is nothing wrong with using cannabis products and driving”. Over 65% of the students who use marijuana more than once a month (about 15% of the total sample), agreed or strongly agreed with this statement. Clearly, heavier users are more likely to find driving stoned acceptable.

Figure 3: Percent of students and the frequency they drink alcohol who agree than driving drunk is O.K.



Likewise, students who drink more heavily are more likely to agree or strongly agree with the statement “there’s nothing wrong with drinking and driving”. Very few of the students who drink only occasionally (which is about 28% of the sample) thought that this is acceptable, whereas over 20% of the students who drink at least once a week (which is about 10% of the sample) agreed with this statement.

Discussion

Adolescents are much more accepting of smoking cannabis and driving than drinking and driving. Regardless of whether they drink or use cannabis, they are more likely to suggest that driving under the influence of marijuana is more acceptable than driving under the influence of alcohol. The difference likely reflects a couple of processes. First, primary prevention efforts, mostly aimed at the drinking driver, have been moderately successful. Coupled with increased enforcement and punishment the rates of drinking and driving charges to young people in Manitoba have decreased over the past few years. Nevertheless, this age group is still over-represented in terms of alcohol and driving offences. Second, we know from focus groups with adolescents that their acceptance of driving under the influence of cannabis is influenced by their perception that there is not a quick test (like a breathalyser) that can determine whether they are high on cannabis. Therefore, they mistakenly think that they cannot be charged with impaired driving. Unfortunately for the stoned driver who gets apprehended by the police, officers **are** able to arrest people for driving under the influence if they have reasonable suspicion. The field sobriety test provides evidence to support this suspicion. The breathalyser identifies the amount of alcohol that may be contributing to the suspicion, regardless; the behavioural signs of being stoned can also be used. In either case, a charge and a conviction for driving under the influence is a likely consequence.

A public education program needs to be implemented to help youth realize that they can be convicted of driving under the influence of marijuana. Some teenagers may be doing this under the mistaken perception that they are immune from prosecution. An education package about the dangers of driving (besides getting caught) also needs to be implemented. This is especially true since many of the heavier drug users also drink heavily, and the combination of alcohol and drugs may make them more vulnerable to the consequences of driving impaired. The main difficulty of implementing either of these programs will be reluctance on the part of funders to accept the policy position of harm reduction: that adolescents may experiment with using substances and combining this use with driving. Since the goal of good policy is to reduce the harmful consequences associated with such risky behavior funders must balance the immediate need for harm reduction with the erroneous perception that they are supporting use of marijuana.

The New Graduated Licensing System in Québec: Impact on the Number of New Drivers and on Nighttime Single Crashes

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Keywords

Novice drivers; alcohol; evaluation; graduated licensing; single nighttime crashes

Abstract

This paper presents the main features of the new graduated licensing system in Québec in effect since June 30, 1997, then the methodology used to evaluate the impact of this new system. The results show an impact on the number of new licence holders as well as a reduction in the number of victims resulting from single nighttime crashes.

Introduction

More than 85 % of the new drivers in Québec in 1996 were under the age of 25. As in other jurisdictions where motor vehicle use is widespread, road crashes involving young drivers are an important public health concern. People under age 25 accounted for 12 % of all licence holders but 24 % of drivers involved in bodily injury crashes in Québec in 1996.

The main factors that would explain the overrepresentation of young drivers in crashes is a high degree of risk-taking and a lack of driving experience, while driving skills seem to be much less of a cause. Thus, any program that aims to reduce the crash toll of new drivers should seek to diminish their risk-taking and the acquisition of driving experience in a safer context.

The concept of gradual access to the driving privilege came forth as the option with the greatest potential in improving the safety record. This avenue was examined in greater depth by seeking a balance between the need for mobility and the safety of individuals. Thus, guiding principles for the program were that new drivers must have the necessary knowledge and skills for the safe operation of a vehicle, whereas driving experience would be acquired progressively. Further, the program must grant privileges as new drivers gain experience and the program must favour responsible and safe road use behaviour. Finally, from an operational viewpoint, the measures decided upon must be easy to apply and monitor (Dussault and Letendre, 1999).

Description of the program

The graduated licensing program applies to all new Québec drivers. The system operates at two levels, first at level of the learner's licence and then at the probationary licence. Subject to provisions relating to the age of probationary licence holders set out below, the minimum length of the full learning process is now 36 months (32 months if the new driver takes a practical course given by a recognized driving school) as compared to 27 months before the reform was instituted.

Learner's licence

Once an aspiring driver, who must be 16 years of age or older, has passed the driving knowledge test, he or she is issued a learner's licence for at least twelve months. This period was only three months before the reform. However, the twelve-month period may be reduced to eight months if the learner takes a practical course given by a recognized driving school. The lengthier initial learning period is intended to allow the learner to acquire better driving experience. The learner is allowed to drive accompanied by someone who has held a valid driver's licence for at least 24 months.

Another important aspect of the learner's licence requirement is that the number of demerit points triggering learner's licence suspension went from ten down to four. However, the length of the suspension remains the same as prior to the reform, three months.

Zero tolerance toward drinking and driving also came into force. The learner is prohibited from driving with any amount of blood alcohol. Before the reform, the limit was 80 mg of alcohol per 100 ml of blood. A learner intercepted with any alcohol in the blood is subject to licence suspension for three months.

The probationary licence

The probationary licence differs from the learner's licence in that it confers on the holder the right to drive without having an accompanying rider who holds a regular driver's licence. It is issued for two years or until the holder reaches age 25, whichever comes first. Thus only those new drivers who are under 25 become subject to a probationary licence, while formerly, all learners were issued a probationary licence for two years once they had passed their road test, regardless of age.

In order to foster responsible behaviour on the road, probationary licence holders are now subject to the same demerit point ceiling as learners, four points, and the same zero tolerance for alcohol use and driving, whereas before the reform, the legal limit was 80 mg of alcohol per 100 ml of blood and the trigger for licence suspension was ten demerit points.

Methods

Even though graduated licensing applies to all new drivers, motorcycle as well as passenger vehicle operators, this assessment takes into account only car drivers. For learners and drivers during their probationary period, safety record indicators were established, namely the number of victims involved in crashes according to levels of injury severity, for the first three years of the reform, that is from July 1, 1997 through June 30, 2000. The indicators were compared with those obtained for the three years period prior to the reform from January 1, 1994 through December 31, 1996, covering the same months in each case.

Left out of consideration is the six-month period immediately before the reform, January through June 1997, to avoid the effect of anticipation as evidenced by the considerably more numerous learner's licence holders than normal, reflecting the desire to avoid being subject to the legal framework of the reform.

Since the comparison covers different years, factors other than the reform could have influenced safety record changes. For that reason, it was decided to consider the corresponding variation in the crash toll for a control group, very similar to the groups compared, comprised of drivers under age 25 who are regular licence holders.

Results

Before examining the impact of graduated access to the driving privilege on the number of crashes, we must first look at changes in the number of learner's licence and probationary licence holders as well as the number of regular licence holders under age 25. For this part of the evaluation, we will also consider the period from July 2000 to June 2001.

Change in the number of learner's licence holders

Graph 1 shows the month-by-month change in the number of learner's licence holders. Their number remained stable at around 75,000 through 1994, 1995, 1996 and in early 1997, then shot up during May, June and July 1997 to reach almost 94,000 people, which can be explained by the much greater number of learner's licences issued during April, May and June, as compared to previous years. This strong increase in the number of learner's licences issued during the last three months before the reform points to anticipation on the part of prospective drivers to avoid being subject to the new requirements.

Then, their number declined until December 1997, easily explained by the minimum period of three months that applied for those holders who had been issued a learner's licence before July 1997.

After that, the number of learner's licence holders rose sharply from January 1998 until the beginning of 1999; the reason is twofold, one being the arrival of new learner's licence applicants and, the other, the lengthening of the time learners are required to hold their licence before they can be issued a probationary licence.

Finally, during the 2 years period from the middle of 1999 until June 2001, the population of the learner's licence holders was very stable at around 120,000 drivers.

Thus, the population of learner's licence holders has increased, as an impact of the new graduated licensing system in Québec, from around 75,000 learners before the reform to around 120,000 learners afterward. One can expect, other things being equal, that this increase should translate into a higher number of crash victims among that population.

Change in the number of probationary licence holders

Figure 1 also shows the month-by-month change in the number of probationary licence holders. Their number first increased considerably in 1994, then also in 1995, but less than in 1994, and increased slightly at the beginning of 1996 to around 160,000 probationary drivers. This growth proceeds from the introduction of the probationary licence for the first time at the end of 1991.

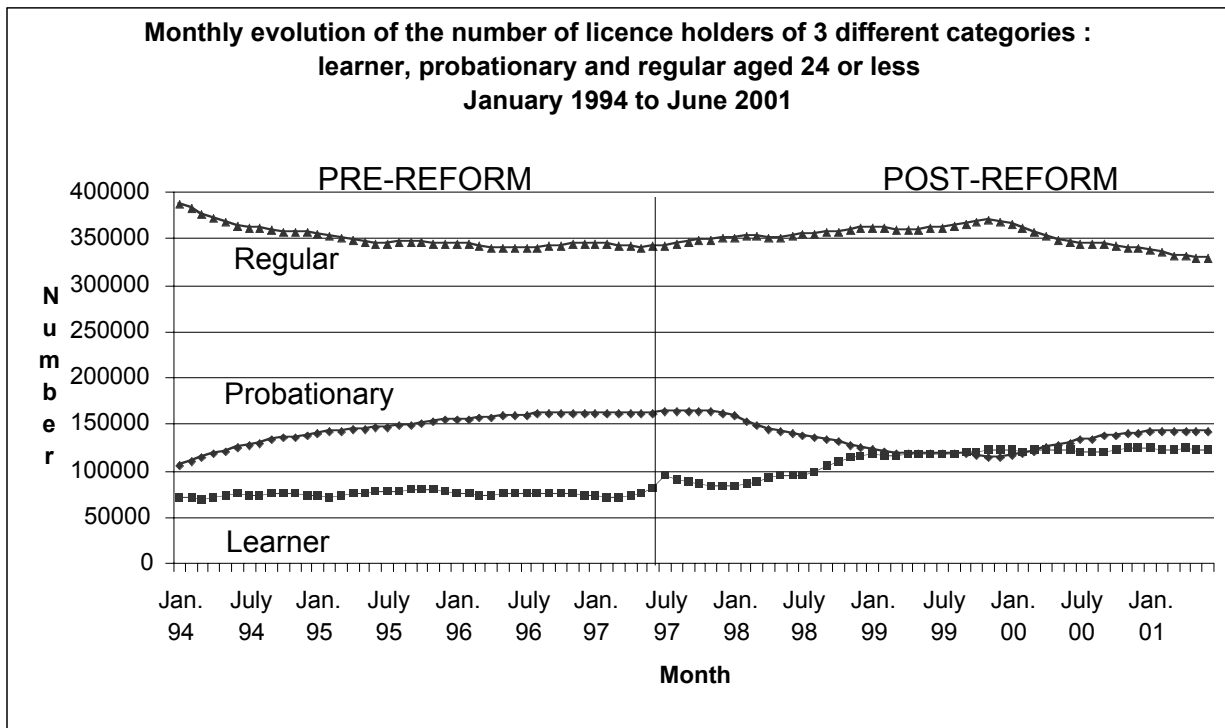
Since this licence is issued for two years, this population has been growing since the end of 1991 until maturity was attained in 1996.

From the middle of 1996 until the end of 1997, that population remained stable at around 160,000 drivers. Then, with fewer new probationary licence holders at the end of 1997 and in early 1998 because of the longer learning period and the fact that some probationary licence holders graduated to a regular licence, their number declined sharply in 1998 and also in 1999 until the end of that year, when they were less than 115,000 drivers.

Then the number of these drivers increased in 2000 given that the population of the learners had reached its maximum and was now more contributing to the probationary drivers population. Finally, that population remained quite stable at around 140,000 drivers until the end of the period considered, June 2001.

Thus, the population of probationary licence holders has decreased, as an impact of the new graduated licensing system in Québec, from around 160,000 drivers before the reform to around 140,000 drivers in 2001 where that population seems to have reached a stationary level. One can expect, other things being equal, that this decrease should translate into a lower number of crash victims among that population.

Figure 1



Change in the number of regular driver's licence holders aged 24 or younger (control group)
The number of regular driver's licence holders aged 24 or less, also shown on Graph 1, has followed the opposite but corresponding way of the probationary drivers in 1994, 1995 and early

1996, namely a sharp decline from almost 390,000 to 340,000 drivers. During the second half of 1996 and the first half of 1997, that population hovered around 340,000, a phenomenon that also applied to the number of probationary drivers.

In the second half of 1997, in 1998 and also in 1999, that population has grown to reach almost 370,000 drivers, that being possible because of the high number of new probationary drivers in 1995, 1996 and 1997.

Finally, that population has diminished from the beginning of 2000 until the end of the period considered, namely June 2001, to the level of 330,000 drivers, because of the corresponding decrease that happened two years earlier for probationary drivers.

Impact on single nighttime crashes

Even though the reform of the graduated licensing system aims to reduce the total number of crashes of whatever sort, only those crashes at night (from 21:00 to 5:59) involving a single vehicle are considered here, in order to measure the impact of the zero tolerance for alcohol (well-known proxy measure). These crashes are a substitute for the real number of crashes involving alcohol and their value as substitute improves as the crashes become more severe.

As the number of these crashes is very small for learners, it is not appropriate to distinguish the learners from probationary drivers. In other words, their total number of crashes of a given severity will be considered.

First, the number of deaths resulting from the single nighttime crashes is examined. Table 1 shows that for the years 1994-1995-1996, which is the period considered before the reform came into effect, a total of 67 people died in crashes involving regular licence holders age 24 or younger which constitute the control group. Following the reform, during the 3 year-period from July 1997 to June 2000, that number was up to 78 victims, an increase of 16.4 %.

During the same period before the reform, the corresponding total number of deaths for the learners and probationary drivers was 47. Taking into account the increase of 16.4 % for the control group, one can expect a total number of 55 deaths (the precise expectation is 54.7) for the learners and probationary drivers during the 3 years period following the reform. But in fact, the number of deaths in that period is 43 people. This is 21.4 % less than the number expected.

Consequently, based on this methodology, the impact of the reform would be a reduction of 21.4 % of the number of deaths resulting from single nighttime crashes sustained by learners and probationary drivers. But that evolution of the number of deaths before and after the reform is not significantly different for these two groups according to the χ^2 test at a level of confidence of 95 %.

Using the same methodology, the impact of the reform on victims severely injured (hospitalized) in single nighttime crashes would be a reduction of 14.7 %. As for the victims killed, the result of the χ^2 test is that the evolution of the number of these victims before and after the reform is not significantly different for these two groups.

So, for the total of the victims killed or severely injured in these crashes, the impact would be a reduction of 15.7 %. Once again, the result of the χ^2 test is that the evolution of the number of these victims before and after the reform is not significantly different for these two groups.

As far as the victims slightly injured in single nighttime crashes are concerned, the impact would be a reduction of 9.8 % and the result of the corresponding χ^2 test is significant. For the total of the victims injured in these crashes, the impact would be a reduction of 10.5 % and the result of the χ^2 test is significant. Finally, for all the victims killed or injured, the impact would be a reduction of 10.8 % for the learners and the probationary drivers and the result of the χ^2 test is also significant.

Table 1: Impact of the new graduated licensing system in Québec on the number of victims in single nighttime crashes

CATEGORY OF VICTIMS	CONTROL GROUP REGULAR LIC. HOLDERS AGE <25			TEST GROUP LEARNERS + PROB. DRIVERS			IMPACT	
	BEFORE 1/94-12/96	AFTER 7/97-7/00	VAR. %	BEFORE 1/94-12/96	AFTER 7/97-7/00	VAR. %	N	N/ 100,000 Lh.
Deaths	67	78	+ 16.4 %	47	43	- 8.5 %	- 21.4 % *	- 28.1 %
Severely inj.	499	488	- 2.2 %	386	322	- 16.6 %	- 14.7 % *	- 21.9 %
D.+ Sev. inj.	566	566	0.0 %	433	365	- 15.7 %	- 15.7 % *	- 22.8 %
Slightly inj.	2 436	2 462	+ 1.1 %	1 990	1 815	- 8.8 %	- 9.8 % **	- 17.4 %
Injured	2 935	2 950	+ 0.5 %	2 376	2 137	- 10.1 %	- 10.5 % **	- 18.1 %
All victims	3 002	3 028	+ 0.9 %	2 423	2 180	- 10.0 %	- 10.8 % **	- 18.3 %

* Non significant at the level of confidence of 95 %

** Significant at the level of confidence of 95 %

Since the number of learners as well as the number of probationary drivers have changed because of the reform, it is appropriate to consider the effect of these changes on the impact of the reform in terms of victims for a given number of licence holders. To do so, the rate of the number of victims based on 100,000 licence holders has been computed. The impact then calculated is a reduction more important of around seven percentage points than the impact measured using only the number of victims, and that, for each severity of injuries sustained by the victims (i.e. - 28.1 % vs - 21.4 % for the deaths). This is because the number of learners has increased while the number of probationary drivers has decreased because of the reform and the numbers of victims associated with the learners are much smaller than those for the probationary drivers mainly because the learners drive less.

An attempt has been made to consider the kilometres driven by each category of drivers. Since adequate data are not available for all these three groups of drivers before and after the reform, some scenarios had to be made: the number of kilometres being lowest for the learners and highest for the regular licence holders. Based on these scenarios, the impact of the reform goes back nearly to the impact measured using only the numbers of victims as done in the first place.

Discussion

The impact of the reform of the graduated licensing system in Québec which came into force on June 30, 1997 has had an impact on the number of new drivers as well as on the number of victims involved in single nighttime crashes.

The number of learners has increased from a level of around 75,000 people before the reform to around 120,000 people in the middle of 2001. This increase is explained by the longer minimum duration that the learner must hold his/her licence. This duration was three months before the reform and is now twelve months (or eight months if the learner takes a practical course given by a recognized driving school). On the other hand, the number of probationary drivers has decreased from around 160,000 people before the reform to around 140,000 drivers in 2001. This is explained by the larger number of learners who also hold their licence longer.

As far as the impact of that reform on the number of victims in single nighttime crashes is concerned, the results show a reduction for every severity of injury considered and that reduction is more important for the more severe injuries. Thus, the reduction would be 21.4 % for the victims killed, 14.7 % for the severely injured and 9.8 % for the slightly injured.

An evaluation done after two years of implementation of the reform (Bouchard et al, 2000; Simard et al, 2000), had produced the following results: a reduction of 36.7 %, 14.5 % and 7.0 % respectively for the victims killed, severely injured and slightly injured. The difference for the victims killed reported in this article is explained by the smaller number of victims involved, which makes the numbers more subject to variation and that is reflected in the result of the χ^2 test.

Finally, one could be interested in the "lasting" effect of the reform that could influence the regular licence holders once they have completed the whole process: learner and then probationary. If it is so, then the control group is affected or "contaminated" by this effect and this has the consequence of under evaluating the impact of the reform on the number of victims in crashes involving learners and probationary drivers. This issue will be considered in the final report which will also consider not only the single nighttime crashes but all crashes of any kind.

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Reciprocity between Drinking Driving and Riding with Drunk Drivers: A Study of College Students

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Keywords

Drinking driving, riding with drunk driver

Abstract

This research examined drinking driving (DD) and riding with drunk drivers (RWDD) among college students.

Introduction

Few efforts have examined the relationship between drinking driving and riding with drunk drivers among college students. Yu and Shackel (1) argued that drinking driving and riding with drunk drivers are two closely related behaviors since a person who would not ride with an impaired driver is not likely to be involved in drinking driving and vice versa. Furthermore, the relationship between the two behaviors may be reciprocal, in that frequent involvement in riding with drunk drivers may increase the chance of drinking driving, and frequent drinking driving may enhance the risk of riding with drunk drivers.

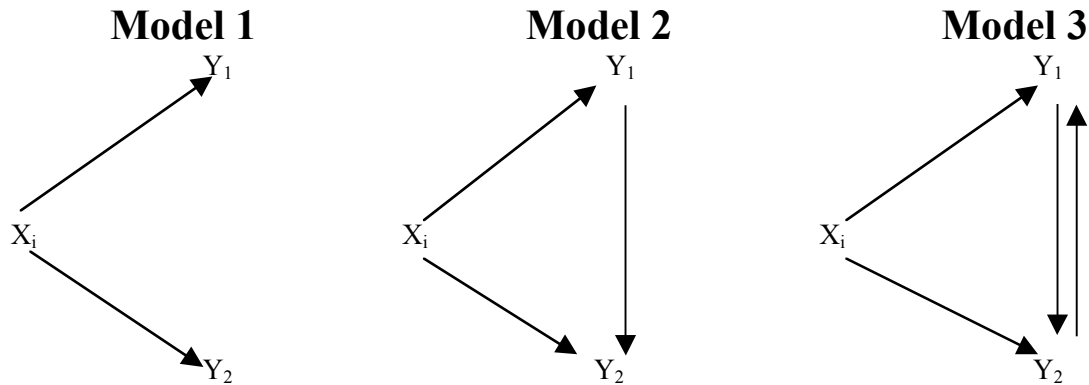
For college students, however, unique conditions may aggravate their risks for drinking driving and riding with drunk drivers. Students tend to have easy access to cars, and about half of the students have a car or truck with them while attending college (2). Students usually live closely together in dorms or apartments and tend to go out together to consume alcohol at parties or at bars, in many of these cases cars being the means of transportation. Also, more importantly, in most situations students do not have direct parental supervision while in college, which tends to decrease youth involvement in drinking driving (3). Thus, college students are not only at high risk of drinking driving but also have a high chance of riding with impaired drivers.

Two specific hypotheses were developed. First, drinking driving (DD) and riding with drunk drivers (RWDD) are two closely related behaviors. Thus, conditions that increase the chance of drinking driving may also increase the chance of riding with drunk drivers.

Second, DD and RWDD may constitute two dynamic aspects of the same behavior pattern. A student may be a driver on one trip and a passenger on another. Students who are constantly engaged in RWDD are more likely to engage in DD; similarly, students who are frequently

involved in DD have increased chances of RWDD. This hypothesis suggests simultaneity; that is, DD and RWDD enhance each other.

Figure 1: Conceptual models of drinking driving and riding with drunk drivers among college students



Where:

Y_1 : Riding with a drunk driver

Y_2 : Drinking Driving

X_i : Vector of predictor variables

Methods

Data

In 1998, the New York State Office of Alcoholism and Substance Abuse Services conducted the College Alcohol-Related Risks Survey (CARS). The sampling procedure was completed in two phases: First, five colleges in New York State were randomly selected, and, second, a sample of students was randomly drawn from each of the colleges. The systematic random sampling method was utilized to draw a student sample in each selected college. Students were interviewed via telephone during the spring semester of 1998, and the surveys were conducted by an independent research company. The response rate, 46 percent, was calculated with the formula: (number of completed interviews) / (number of connected calls). A total of 813 students were interviewed. The sampling error at the 95 percent confidence level is 3.5 percent.

Measures

Drinking Driving and Riding with Drunk Driver

Drinking driving and riding with drunk drivers in the past 30 days are two endogenous conditions for this analysis.

Alcohol Use and Problems

Alcohol consumption (ALCOHOL) is a multiplicative product of students' alcohol use frequency and number of drinks consumed per occasion in the month prior to the interview, divided by 30 (the average number of days per month).

The DSM-IV diagnostic criteria were used as the primary indicator of students' alcohol problems (4-6). The 11 items of DSM-IV specify alcohol-related disorders into alcohol abuse and alcohol dependence are used to reflect a single dimension of the severity of alcohol problems.

Drinking and Drinking Driving in High School

The two drinking-driving-related variables in this section are the estimates of the number of times the students were involved in drinking driving (HSDD) and riding with drunk drivers in senior year in high school (HSRWDD).

Control Variables

Access to cars is the foremost precondition for the involvement in drinking driving. This variable is a dummy, with one indicating having a car and zero not having one.

Students' gender is a two category variable (GENDER), with zero being female and one being male.

Procedures

Since 78 percent of the sampled students reported having not been involved in drinking driving in the past 30 days prior to the survey; 15 percent of them were randomly selected for the analysis, so that the sample would be relatively balanced with students who reported and did not report DD. The LISREL program was executed based on a subsample of 167. The LISREL provides a simpler and more efficient solution to the estimation problem of structural models and has been widely used by researchers in resolving simultaneous systems (7,8).

Results

Table 1: Descriptive Information about the Study Variables

Var Name	Mean	Std Dev.	N
DD	1.77	2.45	171
RWDD	1.45	4.31	171
ALCOHOL	2.04	1.94	167
DSM	3.19	2.54	171
HSHALC	3.37	1.70	171
HSHDD	.52	1.50	171
HSHRWDD	2.49	5.05	171
	Percent		
CAR	74.3 (yes)		171
GENDER	42.1 (male)		171

Table 2: Maximum Likelihood for DD and RWDD Models

	Model 1		Model 2		Model 3	
	RWDD	DD	RWDD	DD	RWDD	DD
CAR	.005	.290**	.005	.289**	.003	.289**
GENDER	-.031	.111	-.031	.117	-.032	.117
ALCOHOL	.349**	.287**	.349**	.213*	.346	.216
HSHALC	-.016	-.020	-.016	-.016	-.016	-.016
DSM	.163*	.084	.163*	.049	.162	.051
HSHDD	-.130	.197*	-.130	.224**	-.132	.223
HSHRWDD	.310*	.022	.310**	-.043	.310**	-.041
RWDD	--	--	--	--	.211**	-- .203
DD	--	--	--	--	.008	--

*: $p < .05$; **: $p < .01$.

Discussion

The current study supplements previous studies by examining drinking driving among college students as two related processes: drinking driving and riding with drunk drivers. Although there is a lack of evidence for a reciprocal effect between drinking driving and riding with drunk drivers, several patterns emerge from the analysis. Both drinking driving and riding with drunk drivers are affected by students' use of alcohol. Students' past experience in drinking driving in high school increases their chance of drinking driving in college, and their past experience of riding with drunk drivers directly enhances their current risk of riding with drunk drivers. Furthermore, students with a car on campus are more likely to drive after drinking than those without. Some prevention and intervention implications can be derived from this study. Anti-drinking-driving programs on campus should also include messages preventing students from riding with drunk drivers, since riding with drunk drivers is closely associated with the behavior of drinking driving and increases the chance of drinking driving. Prevention efforts for drinking driving in college may need to start in high school. Data from this study indicate that students who were involved in drinking driving and riding with drunk drivers in high school run significantly higher risks of being engaged in these behaviors in college than those who were not. Therefore, prevention of drinking driving, including riding with drunk drivers, in high school may significantly reduce students' drinking-driving risks in college.

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