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Exploring the relationship between alcohol and the driver characteristics in motor vehicle accidents

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Abstract

This study examines the differences in alcohol-related accident involvement among different driver groups in the state of Florida. The driver characteristics considered in this study are: age, gender, race, and residency of the driver of a motor vehicle involved in an accident while under the influence of alcohol, drugs, or alcohol and drugs. The main objective of this study is to test whether there are associations between the different driver characteristics and alcohol involvement in traffic accidents, and to identify the high-risk group within each driver factor. This would improve our understanding of the relationship between alcohol involvement, accidents, and the four aforementioned driver factors. It would also enable us to better design educational and awareness programs targeting specific groups in the population to reduce drinking and driving in the state. The relationship between alcohol-related accident involvement and the driver factors are investigated using general descriptive statistics, conditional probabilities and log-linear models. The results showed that the 25–34 age group experience the highest rate of alcohol/drug involvement in accidents. The rates decline with the increase in the age of the drivers. The results also indicated that there are significant relationships between the driver characteristics and alcohol/drug involvement in accidents. Male, white, and in-state drivers were also more involved in alcohol/drugs-related traffic accidents. © 2000 Elsevier Science Ltd. All rights reserved.

Keywords: Driver characteristics; Alcohol; Accidents; Conditional probability; Log-linear models

1. Introduction

Alcohol is one of the main factors contributing to traffic accident occurrence. It is a well-established fact that drunk driving plays a major role in accidents in general, and severe and fatal accidents in particular. Previous research has demonstrated that alcohol in a driver's bloodstream greatly impairs his ability to operate a vehicle safely. The reductions in traffic accidents from reducing accidents attributable to alcohol far exceed reductions from any other potential countermeasure (Evans, 1991).

Alcohol content in the body is expressed in terms of blood alcohol concentration (BAC), defined as the percent, by weight, of alcohol in the blood. As BAC increases, the likelihood of injury or death from the same impact increases, performance at a whole range of tasks deteriorates, and behavior (mood, aggression, risk-taking, etc.) changes (Evans, 1991). Traffic accident risk increases steeply with increasing BAC, though it is not possible to determine how much of this is due to degraded performance and how much to changed behavior. Alcohol contributes importantly to traffic accidents, with its contribution increasing as accident severity increases. Evans (1991) estimates that about 10% of property damage, 20% of injuries and 47% of fatalities from traffic accidents are attributable to alcohol.

In 1995, 32% of all fatalities occurred in accidents with a driver or a pedestrian with a BAC of at least 0.10. Of the occupant fatalities in single-vehicle fatal accidents, 42% involved an intoxicated driver, compared with 21.9% of the occupant fatalities in multi-vehicle fatal accidents (Burgess and Lindsey, 1997).

Previous studies report that there are gender and age differences in traffic accidents related to alcohol involvement. Male drivers involved in fatal accidents were almost twice as likely as female drivers to be

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intoxicated (Burgess and Lindsey, 1997). Pendleton et al. (1986) reports, based on data from Texas in 1983–1984, that males had 55% of their driving fatalities in traffic accidents while intoxicated, compared to 32% of all female driver fatalities.

Drivers involved in accidents aged 21–24 exhibit the highest rates of intoxication (27.8%) followed by drivers aged 25–29 (27%). Drivers aged 16–20 were intoxicated in 12.7% of the accidents (Burgess and Lindsey, 1997). Mason et al. (1992) states that alcohol involvement in accidents declines with increasing the age of the driver. Pendleton et al. (1986) found that the 21–25 year old drivers had the highest proportion of fatalities involving legally intoxicated drivers, followed by the 26–30 old drivers. The 65 and above age group had the smallest proportion of fatalities involving legally intoxicated drivers according to the same study. A similar result was found in the fatal accident reporting system (FARS) and the general estimates system (GES) data in 1992. The percent of alcohol involvement for the fatal and injury accidents were highest for the 21–24 age group, followed by the 25–34 group (NHTSA, 1992).

From 1977 to 1993, the number of male drivers involved in alcohol-related fatal traffic accidents in the United States decreased 22%; for females there was an 18% increase (Campbell et al., 1995). A national survey on drinking and driving in Canada showed that men are three times more likely than women to report driving after drinking (26% compared to 8%). Also, younger respondents were more likely to drive after drinking than are their older counterparts, 23% of those under 34 have driven after drinking in the year prior to the survey, compared to 13% of respondents aged 45–54 (Health and Welfare Canada, 1988). The National Highway Traffic Safety Administration (NHTSA) reports that research indicates that female drivers are becoming more involved in alcohol-related accidents than they were before. Nevertheless, the alcohol-accident problem is still overwhelmingly a male problem (NHTSA, 1991).

Rock (1991) examined the impact of drinking age laws on traffic accidents in Illinois. He found that the lower drinking age in Illinois from October 1973 to January 1980 was responsible for an increase of more than 5000 accidents per month (14% increase). More than 1000 additional 18- and 19-year-old drivers were involved in accidents each month with the lower age limit (20% increase). When age was raised back to 21 in 1980, the figures reversed a similar amount.

This study examines the differences in alcohol-related accident involvement among the different driver groups in the state of Florida. The driver characteristics considered in this study are: age, gender, race, and residency (whether the driver lives in the same county, different county in the state, out-of-state, or foreign visitor) of the driver of a motor vehicle involved in a accident while under the influence of alcohol, drugs, or alcohol and drugs. As mentioned above, previous research and statistics have shown relationships between alcohol consumption, accidents and both gender and age. While this paper addresses also age and gender, for their significance (large percentage of Florida's population are elderly) and to verify whether the same results identified in the literature are consistent with Florida, it extends the investigation into two variables that have been rarely investigated. Race and residency are two driver characteristics, which are significant in a diverse state such as Florida. The race factor is not intended to judge the safety of different races, but to identify whether a safety problem (driving under the influence – DUI) could be attributed to factors related to culture, habits or attributes that could affect certain driving behavior including DUI, and therefore could be rectified. Also identifying the DUI by residency is very significant in a major tourist-oriented state. Florida receives approximately 42 million visitors per year (from overseas and other states). If DUI would be identified as a problem for a certain group, better programs could be designed to target this group to improve safety.

The main objective of this study is to investigate whether there are associations between the different driver characteristics and alcohol involvement in traffic accidents, and to identify the high-risk group within each driver factor. This would improve our understanding of the relationship between alcohol involvement, accidents, and the four driver factors. It would also enable us to better design educational and awareness programs targeting specific groups in the population to reduce drinking and driving in the state.

2. General descriptive statistics

The 1994 and 1995 Florida accident databases are used in the analysis presented in this paper. This is a relational database maintained by the Florida Department of Highway Safety and Motor Vehicles (DHSMV). The DHSMV's accident database is the most complete accident data available in the state of Florida. DHSMV assembles all the accident reports in the state (from counties, cities, police departments, etc.). In both years, the DHSMV's database included 434 772 reported accidents (Table 1). Alcohol and/or drugs related accidents were 50 641 (about 11.65%). Accidents are considered to be alcohol-related if there is any indication in the accident report that a driver had been using alcohol before the accident. An accident is alcohol-related if at least one driver involved in the accident was under the influence of alcohol. Being under the influence may be indicated by measured blood alcohol concentration (BAC) of 0.08% or higher,

Table 1
Description of the accident database

Year	Total no. of accidents	Alcohol/drug related accidents	No. of drivers involved in the accidents	Drivers involved in accidents while under the influence
1994	206 183	25 356	335 086	25 794
1995	228 589	25 285	378 041	25 930
Total	434 772	50 641	713 127	51 724

or simply by the investigating police officer's observation. Evidence of this may include observations made at the scene or comments made by a driver, or other witness. The use of illegal drugs may be a factor in a small number of DUI-related accidents in which a driver was reported to have been using both drugs and alcohol, or in which some participants were using drugs and others using alcohol. Prescription drugs are included in drug-related accidents in very limited cases, in which the influence of drugs appeared to affect the behavior of the driver in a manner comparable to illegal drugs and alcohol.

Fig. 1 illustrates that male drivers experience higher alcohol/drug-related accident rates than females for all the age groups. The male accident rates are consistently approximately four times that of females. The highest accident rate occurs for the 25–34 age group for both males (6.7accidents/1000 people) and females (1.9 accidents/1000 people).

Fig. 2 shows the rate of alcohol/drug accident involvement by age and race per 1000 of the population. The curve shows that the white drivers of the 25–34 age group have the highest alcohol-related accident involvement rates (4.2 accidents/1000 people). In general, young white drivers (< 45 years old) have higher alcohol-related accident involvement, while the other races (non-white) have higher rates for ages 45 and above.

Fig. 3 shows the percentage of alcohol/drug-related accidents by age and residency. The percent of alcohol/drug accidents to the total number of accidents in each category is used instead of rates because of the unavailability of an exposure measure to calculate the accident rates for the residency variable. Residency is classified as in-state (local and in-state drivers) and out-of state (out-of-state and foreign) for simplicity. The figure depicts that out-of-state drivers experience higher percentages of alcohol/drug-related accidents for the younger age groups (< 35). This is reversed for ages 35 and above.

It worth mentioning that in the study period, driving under the influence of alcohol, alcohol and drugs, and drugs, represented 95.4, 3.0, and 1.6 %, respectively, of the total intoxicated drivers involved in traffic accidents.

In the following sections, the relationship between alcohol-related accident involvement and the driver factors is investigated using two methods: (1) conditional probabilities, and (2) log-linear models.

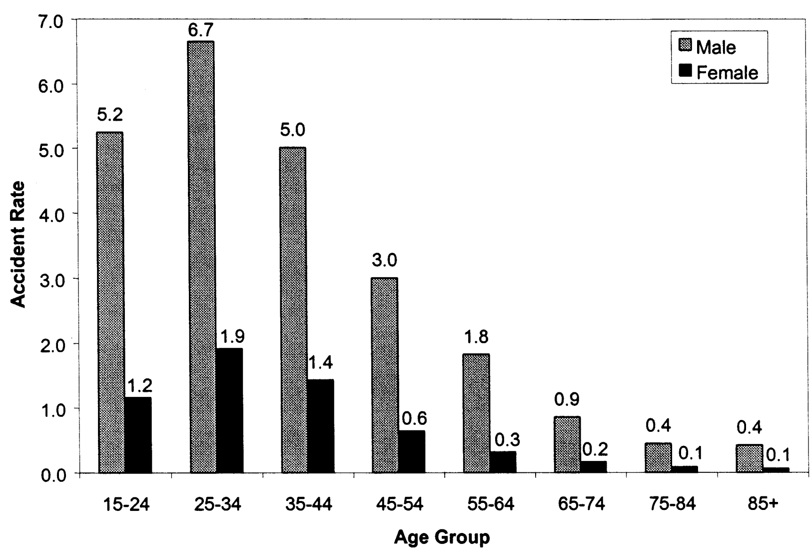

Fig. 1. Alcohol/drug accident involvement by age and gender per 1000 of the population.

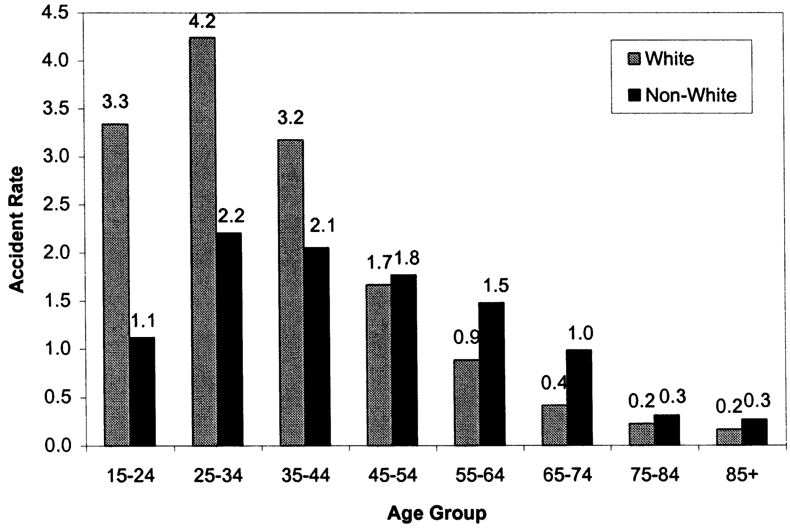

Fig. 2. Alcohol/drug accident involvement by age and race per 1000 of the population

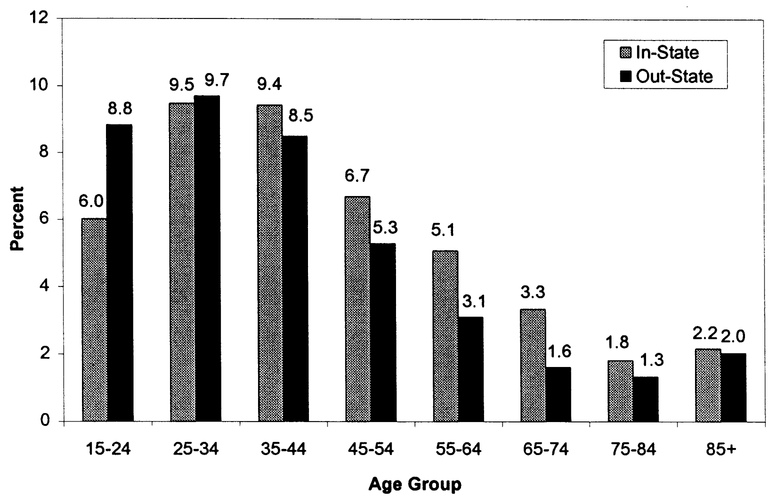

Fig. 3. Percent of alcohol/drug accident involvement by age and residency.

3. Conditional probability analysis

Two-way tables are constructed to calculate the conditional probabilities. In the case presented in this paper, one variable is the driver characteristic variable categories (say, the row variable, X) and the other is alcohol (the column variable, Y). Then, it is informative to construct a separate probability distribution for X at each level of Y. Such a distribution consists of *conditional probabilities* for X, given the level of Y, and is called conditional distribution. For a detailed discussion of this methodology, the reader is referred to Agresti (1996).

From a traffic safety perspective, it is argued that the variable Y in this case, is an implicit measure of exposure. Thus the ratio of the demographic variable to alcohol involvement is indicative of relative over- or under-representation.

It remains to mention that the following section presents only the statistically significant results, i.e. the hypothesis of independence between the demographic variable and alcohol involvement is rejected (significant Pearson χ^2 and $P \leq 0.001$).

3.1. Results

The driver age groups were divided into five categories. Experience from previous research have shown that these categories adequately represent the teenage, young, middle, old, and very old age, respectively (Chen, 1997). Aty et al. (1999) have shown that the accident rates are comparable within each of the five specified categories, however, they are significantly different between the categories. Table 2 shows that the middle (25–64) and the young (20–24) age groups have higher proportions of traffic accidents while driving under the influence of alcohol (rates = 7.39 and 7.16, respectively, mean = 6.35). Middle age drivers also tend to have higher accident proportions with driving under influences of drugs and both alcohol and drugs (rates = 0.13 and 0.23, means = 0.11 and 0.20, respectively). Elderly drivers, however, do not show high accident proportions while driving under the influence.

Table 3 shows the relationship between gender and alcohol/drugs involvement (DUI). Male drivers tend to have higher accident proportions while driving under the influence (especially alcohol with rate = 8.26, mean = 6.35).

Table 4 depicts the association between race and alcohol/drugs involvement. White drivers tend to have higher accident proportions with DUI, followed by Hispanic drivers. Black drivers have the least percentages of accidents while under the influence.

Table 2
Age and alcohol/drug involvement[a]

DUI (age)	No DUI	Alcohol	Drugs	Alcohol and drugs	Undetermined	Total
15–19	75691 (96.48%)	2279 (2.90%)	73 (0.09%)	90 (0.11%)	318 (0.41%)	78451 (100%)
20–24	90919 (91.84%)	7086 (7.16%)	75 (0.08%)	179 (0.18%)	739 (0.75%)	98998 (100%)
25–64	425219 (91.60%)	34285 ***(7.39%)***	582 ***(0.13%)***	1089 ***(0.23%)***	3039 (0.65%)	464214 (100%)
65–79	55935 (97.12%)	1457 (2.53%)	31 (0.05%)	42 (0.07%)	131 (0.23%)	57596 (100%)
80+	13639 ***(98.35%)***	185 (1.33%)	4 (0.03%)	10 (0.07%)	30 (0.22%)	13868 (100%)
Total mean	661403(92.75%)	45292(6.35%)	765(0.11%)	1410(0.20%)	4257(0.60%)	713127(100%)

[a] Statistic χ^2: df, 16; value, 5024.41.491; prob, 0.001.

Table 3
Gender and alcohol/drug involvement[a]

DUI (gender)	No DUI	Alcohol	Drugs	Alcohol and drugs	Undetermined	Total
Male	398104 (90.63%)	36268 ***(8.26%)***	519 ***(0.12%)***	1044 ***(0.24%)***	3304 (0.75%)	439239 (100%)
Female	263299 ***(96.13%)***	9024 (3.29%)	246 (0.09%)	366 (0.13%)	953 (0.35%)	273888 (100%)
Total mean	661403 (92.75%)	45292 (6.35%)	765 (0.11%)	1410 (0.20%)	4257 (0.60%)	713127 (100%)

[a] Statistic, χ^2; df, 4; value, 7657.26; prob. 0.001.

Table 4
Race and alcohol/drug involvement[a]

Race DUI	No DUI	Alcohol	Drugs	Alcohol and drugs	Undetermined	Total
White	480758 (91.95%)	36788 ***(7.04%)***	646 ***(0.12%)***	1206 ***(0.23%)***	3438 (0.66%)	522836 (100%)
Black	120755 ***(95.81%)***	4621 (3.67%)	81 (0.06%)	129 (0.10%)	448 (0.36%)	126034 (100%)
Hispanic	51776 (92.81)	3567 ***(6.39%)***	35 (0.06%)	68 (0.12%)	342 (0.61%)	55788 (100%)
Other	8114 (95.81%)	316 (3.73%)	3 (0.04%)	7 (0.08%)	29 (0.34%)	8469 (100%)
Total Mean	661403 (92.75%)	45292 (6.35%)	765 (0.11%)	1410 (0.20%)	4257 (0.60%)	713127 (100%)

[a] Statistic χ^2; df, 12; value, 2402.50; prob. 0.001.

Table 5
Residency and alcohol/drug involvement[a]

Race DUI	No DUI	Alcohol	Drugs	Alcohol and drugs	Undetermined	Total
Local	551865 (92.77%)	37697 ***(6.34%)***	616 (0.10%)	1166 (0.20%)	3526 (0.59%)	594870 (100%)
In-state	78242 (92.34%)	5633 ***(6.65%)***	106 (0.13%)	187 (0.22%)	568 (0.67%)	84736 (100%)
Out-state	26277 (93.32%)	1655 (5.88%)	36 (0.13%)	46 (0.16%)	143 (0.51%)	28157 (100%)
Foreign	5019 (93.57%)	307 (5.72%)	7 (0.13%)	11 (0.21%)	20 (0.37%)	5364 (100%)
Total mean	661403 (92.75%)	45292 (6.35%)	765 (0.11%)	1410 (0.20%)	4257 (0.60%)	713127 (100%)

[a] Statistic χ^2; df 12; value, 52.94; prob. 0.001.

The association between residency and alcohol/drugs involvement is investigated. Residency is divided into four categories. A local driver is defined as a driver that lives in the same county of the accident. An in-state driver is a Florida resident but resides in another county. Out-of-state drivers reside out of Florida, and were visiting Florida at the time of the accident. Foreign drivers are visiting Florida, but they are coming from overseas. Table 5 illustrates that in-state and local drivers tend to have higher accident proportions with alcohol involved (rate = 6.65 and 6.34, respectively). In-state (different county) drivers tend to have slightly higher accident proportions with alcohol and drugs (rate = 0.22). In general, the differences between the four residency groups are small.

4. Log-linear models

A log-linear model is a generalized linear model (GLM) for Poisson-distributed data; it specifies how the size of a cell count depends on the levels of the categorical variables for that cell. The nature of this specification relates to the association and interaction structure among the variables. A log-linear model describes the association and interaction patterns among a set of categorical variables (Agresti, 1990).

In practice, we try to fit a model so as to avoid using saturated models. A saturated model is the model with as many (maximum possible number) parameters as it has Poisson observations, which is why it has a perfect fit. Therefore, the results of a saturated model are complicated to explain. An unsaturated model is better for analysis because its' fit smoothes the sample data and yields simpler interpretations. For three-way and higher-dimensional tables, unsaturated models can include association terms. The unsaturated log-linear model is more commonly used to describe associations (through two-factor terms) than to describe odds (through single-factor terms). After fitting a log-linear model, estimates of parameters are converted to estimate the conditional odds between variables (Agresti, 1990).

The reader is referred to Agresti (1990) for a detailed explanation of the methodology of estimating log-linear models and calculating the odds multipliers. In studying the relationship of alcohol/drugs involvement, a driver characteristic, to a third variable, log-linear models with three variables as in Kim et al. (1995) are fitted. In this way, the relationship between alcohol/drugs and a driver factor will be explained, while adjusting for the value of the third variable. This, in general, leads to a more accurate description of these relationships than obtained by using two-variable models while not complicating the interpretation process too much. In this paper, no attempt will be made to fit models with more than three variables, which may indicate that there are more complicated relationships among these variables, since the main focus of the paper is to investigate the relationship between each demographic variable and alcohol.

To estimate the odds of the different driver groups of being involved in alcohol/drugs related traffic accidents, four log-linear models are estimated and odds multipliers are calculated. In each model three variables are included. The first, is one of the driver factors (i.e. age, gender, race or residency), the second, is alcohol/drugs, and a third variable that is related to the accident. There was an attempt to estimate the four models with the same third variable for consistency. Only one variable could be included in three of the models (the gender, race, and residency models). This variable is the trafficway character (i.e. whether the location of the accident was on a straight or curve section). The model that included age, alcohol/drugs, and trafficway character was not significant. Therefore, trafficway character was substituted with the location type (rural or urban).

4.1. The relationship between alcohol/drugs, gender, and trafficway character

This model was estimated to investigate the association between gender and both driving under the influence of alcohol and/or drugs and trafficway character (curve or straight section of roadway). The main objective of this model is to develop the odds multipliers for alcohol/drugs involvement in accidents for both males and females. This will enable us to determine which gender has higher odds. The model was developed using the following variables:

x = gender	i = level: *male* and *female*
y = DUI	j = level: *yes* and *no*
z = trafficway character	k = level: *straight* and *curve*

This is a three variable model with variables x (gender groups), y (alcohol/drugs involved), and z (trafficway character). Normally, the G^2 goodness-of-fit statistic and P-value are used to determine the rejection or acceptance of a model. The larger the value of G^2, the more evidence there is against the null hypothesis (H_0), where H_0 is 'model fits the relationship' and H_a is 'model doesn't fit the relationship'. Hence, the smaller G^2 is better, but it depends on the degrees of freedom. The larger P-value (> 0.05) indicates that the estimated model fits the relationship.

The best-fitting model containing all three main effects and all three possible two-way interactions had $G^2 = 2.91$, df = 1, and P-value = 0.0879. This is the model that was used since no other simpler model fits the data.

Table 6
Parameter estimates of log-linear model of gender, DUI, and trafficway character[a]

Gender (gender*DUI)	Male	Female
No DUI	−0.2363) (1)	0.2363 (1)
Yes DUI	0.2363 **(1.604)**	−0.2363 (0.623)

[a] Numbers between parentheses are the odds multipliers.

Table 7
Parameter estimates of log-linear model of race, DUI, and trafficway character[a]

Race (race*DUI)	White	Black	Hispanic	Other
No DUI	−0.1851 (1)	0.1558 (1)	–0.1346 (1)	0.1639 (1)
Yes DUI	0.1851 **(1.448)**	−0.1558 (0.732)	0.1346 (1.309)	−0.1639 (0.721)

[a] Numbers between parentheses are the odds multipliers.

From the log-linear model equation, using DUI category y, no DUI, as the baseline, the logit model for DUI is estimated and the odds multipliers are calculated (Agresti, 1990). After exponentiating both sides of the logit models, the first factor is the baseline odds of being in DUI category j relative to no DUI, the first level. The second factor is the odds multipliers for gender at two gender groups. The parameter estimates for individual and interaction terms and odds multipliers for gender and alcohol involvement are presented in the Table 6. The logit model and odds multipliers for gender and trafficway character or DUI and trafficway character could be estimated. However, this is not addressed in this study, since the main interest here is the relationship between alcohol/drugs and gender.

Table 6 shows that male drivers have higher odds of DUI accidents than females. This result indicates that there is a need to emphasize and direct more safety programs addressing the dangers of drinking and driving to male drivers.

4.2. The relationship between alcohol/drugs, race, and trafficway character

This model was estimated to investigate the association between race and both driving under the influence of alcohol and/or drugs and trafficway character (curve or straight section of roadway). The main objective of this model is to develop the odds multipliers for alcohol/drugs involvement in accidents for the different race groups. The model was developed with the following variables:

x = race	i = level: *white*, *black*, *hispanic*, and *other*
y = DUI	j = level: *yes* and *no*
z = trafficway character	k = level: *straight* and *curve*

This is a three variable model with variables x (race groups), y (alcohol/drugs involved), and z (trafficway character). The best-fitting model containing all three main effects and all three possible two-way interactions had $G^2 = 2.74$, df = 3, and P-value = 0.4340. This is the model that was used since no other simpler model fits the data.

From the log-linear model, using DUI category y, no DUI, as the baseline, the logit model for DUI is estimated and the odds multipliers are calculated (Agresti, 1990). After exponentiating both sides of the logit models, the first factor is the baseline odds of being in DUI category j relative to no DUI, the first level. The second factor is the odds multipliers for race at four race groups. The parameter estimates for individual and interaction terms and odds multipliers for race and alcohol involvement are presented in Table 7.

Table 8
Parameter estimates of log-linear model of residency, DUI, and trafficway character[a]

Residency (residency*DUI)	Local	In-state	Out-state	Foreign
No DUI	−0.0209 (1)	−0.0336 (1)	0.0263 (1)	0.0282 (1)
Yes DUI	0.0209 (1.043)	0.0336 **(1.070)**	−0.0263 (0.949)	−0.0282 (0.945)

[a] Numbers between parentheses are the odds multipliers.

Table 7 shows that white followed by hispanic drivers have higher odds of DUI accidents than black and the other races. This result indicates that there is a need to emphasize and direct more safety programs addressing the dangers of drinking and driving to these groups. There is also a need for more studies to understand the driving behavior of the identified groups to rectify the problem.

4.3. The relationship between alcohol/drugs, residency, and trafficway character

This model was estimated to investigate the association between residency and both DUI (alcohol and/or drugs involvement) and trafficway character. The model was developed with the following variables:

x = residency — i = level: *local*, *state*, *out-state*, and *foreign*
y = DUI — j = level: *no* and *yes*
z = trafficway character — k = level: *straight* and *curve*

The best-fitting model contains all three main effects and all three possible two-way interactions with $G^2 = 7.49$, df = 3, and P-value = 0.0578.

The parameter estimates for individual and interaction terms and odds multipliers are presented in the Table 8. The results show that the foreign group has lower odds of alcohol-related traffic accidents than the other three groups. In-state followed by local drivers seem to have the highest odds of accidents while under the influence of alcohol/drugs.

4.4. The relationship between alcohol/drugs, age, and location

This model was estimated to investigate the association between age and both location and alcohol and/or drugs involvement (DUI). The model was developed using the following variables:

x = age — i = level: very young (15–19 year-old)
young (20–24 year-old)
middle (25–64 year-old)
old (65–79 year-old)
very old (>80 year-old)
y = alcohol involved — j = level: *yes* and *no*
z = location — k = level: *urban* and *rural*

The best-fitting model containing all three main effects and all three possible two-way interactions had $G^2 = 5.36$, df = 4, and P-value = 0.2522. This is the model that was used since no other simpler model fit the data.

The parameter estimates for some of the interaction terms and the corresponding odds multipliers are presented in Table 9.

Table 9 depicts that the odds of alcohol/drugs involvement are much higher for young and middle age drivers involved in accidents. The odds are especially high for middle age. In the U.S.A., the legal drinking age is at and after the age of 21; thus, the odds of alcohol are higher for young and middle age drivers since they can legally consume alcohol. Elderly drivers are less likely to be involved in accidents while under the influence of alcohol/drugs. The analysis confirms the results in Chen (1997) and Evans (1991). Drivers between the age of 25 and 44 were found to have higher percentage of accidents while under the influence of alcohol (Chen, 1997), and elderly drivers (60 year-old and above) are less likely to be involved in accidents that involve alcohol (Evans, 1991). The results also

Table 9
Parameter estimates of log-linear model of age, DUI, and location[a]

Age groups (age*alcohol)	Very young	Young	Middle	Old	Very old
No DUI	0.0994 (1)	−0.3657 (1)	−0.3887 (1)	0.1745 (1)	0.4805 (1)
Yes DUI	−0.0994 (0.820)	0.3657 **(2.078)**	0.3887 **(2.176)**	−0.1745 (0.705)	−0.4805 (0.383)

[a] Numbers between parentheses are the odds multipliers.

confirm the findings of the conditional probabilities presented in this paper.

5. Summary and conclusions

Alcohol is one of the main factors contributing to traffic accident occurrence. The reductions in traffic accidents from reducing accidents attributable to alcohol far exceed the reductions from any other potential countermeasure. This study examines the differences in alcohol-related accident involvement among the different driver groups in the state of Florida. The driver groups considered in this study are: age, gender, race, and residency of the driver of a motor vehicle involved in an accident while under the influence of alcohol, drugs, or alcohol and drugs. The main objective of this study is to test whether there are associations between the different driver characteristics and alcohol/drugs involvement in traffic accidents, and to identify the high-risk group within each driver factor. This would improve our understanding of the relationship between alcohol/drug involvement, accidents, and the four aforementioned driver factors. It would also enable us to better design educational and awareness programs targeting specific groups in the population to reduce drinking and driving in the state.

A chart of the alcohol/drug accident involvement by age and gender illustrated that the male drivers have approximately four times the accident rates of female drivers for all the age groups. Investigating alcohol/drug accidents by age and race showed that white young drivers (44 years old and below) experience higher rates of accident while under the influence of alcohol/drugs. The differences between white and non-white drivers are specifically high for ages between 15 and 34. This trend is reversed at age 45 and above, with non-white drivers experiencing higher rates. A chart that illustrated the alcohol/drug related accident percentages by age and residency showed that these percentages are higher for out-of-state drivers at and below the age of 34, while consistently higher for in-state drivers at the age 35 and above. All the relationships have depicted that the 25–34 age group consistently experiences the highest accident rates followed by the 35–44 age group.

Conditional probability results have indicated that larger percentages of young (20–24 years old) and middle age (25–64) drivers are involved in traffic accidents while under the influence of alcohol. Also, higher proportions of middle age drivers are involved in Drugs- and alcohol and drugs-related accidents. The results of the log-linear modeling effort have confirmed that middle age drivers have higher odds of being involved in traffic accidents while under the influence of alcohol and/or drugs followed by the young drivers. This result is expected since very young drivers cannot legally purchase and consume alcohol. The results also indicate that there is no problem with the elderly drivers with respect to driving under the influence. This issue is particularly important in Florida, which receives many elderly and retired people because of the good weather and lower taxes. The results are also consistent in general with many of the previous studies. For example, Mason et al. (1992) found that alcohol involvement in accidents declines with increasing age. Most studies, e.g. Pendleton et al. (1986), Burgess and Lindsey (1997), and NHTSA (1992), have found that the 21–24 experience the highest proportion of accidents involving alcohol. However, this study showed that in Florida middle age drivers (25–64) experience higher proportions than the younger drivers (20–24).

Both methods of analysis have showed that male drivers are more involved in alcohol/drugs-related traffic accidents than females. The alcohol involvement in accidents of male drivers is more than double that of females. This result confirms many of the previous findings (NHTSA, 1991; Pendleton et al., 1986; Burgess and Lindsey, 1997)

The analysis indicated that white drivers are more involved in DUI-related accidents than the other races in the state, followed by the Hispanic drivers. Investigating race as one of the driver-related variables is not intended to evaluate the safety of each race group, but rather it might help identify the characteristics, behavior or cultural differences that might affect drinking and driving and be related to a certain group. This result is important in Florida because of the diversity of the population. Safety programs in the Spanish language, that address the dangers of DUI, could be directed to the large Hispanic community in Florida.

Including residency as one of the driver factors is important in Florida, since the state receives many out-of-state (e.g. elderly and tourists), and foreign (tourists) drivers (about 42 million visitors/year). The conditional probability and the log-linear analysis have indicated that in-state and local drivers in Florida have the highest rates/odds of being involved in accidents while under the influence of alcohol. Drug involvement was comparable between the out-state and foreign drivers. Indicating a need to familiarize foreign visitors with the laws of the state. However, drinking and driving seems to be a somewhat greater problem for Florida residents than for visitors.

These results improve our understanding of the relationship between alcohol/drugs involvement, accidents, and the four different driver factors. It would also enable us to better design educational and awareness programs targeting specific groups in the population to reduce drinking and driving in the state. Several organizations and community groups (with members of the groups that were identified to be at higher risk) could play a pivotal role in decreasing drinking and driving.

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