

Alcohol Use, Illicit Drug Use, and Road Rage*

INMACULADA FIERRO, M.D., CLAUDIA MORALES, M.D., PH.D., AND F. JAVIER ÁLVAREZ, M.D., PH.D.†

Institute for Alcohol and Drug Studies, Faculty of Medicine, University of Valladolid, Ramón y Cajal 7, 47005 Valladolid, Spain

ABSTRACT. Objective: This article examines the relationship between the consumption of alcohol and illicit drugs and the experience of road-rage victimization and perpetration among drivers and nondrivers in the general population. **Method:** A cross-sectional survey was designed with 2,500 subjects, ages 14–70 years, living in Castile and León, Spain, of which 1,276 (51%) were males and 1,224 (49%) females. The Alcohol-Use And Drug-Use Survey of Castile and León, Spain 2008 focused on patterns of alcohol, tobacco, and illicit drug consumption. Potential risk factors for road-rage experience for the previous 12 months was assessed, including sociodemographics (7 variables), patterns of alcohol consumption (7 variables), and patterns of drug consumption (10 variables). **Results:** Among drivers, driving under the influence of alcohol and/or cannabis during the previous year was associated with being a

perpetrator of road rage (odds ratio [OR] = 3.72, 95% CI [1.71, 8.10] and 6.77 [1.55, 29.48], respectively), being both a victim and perpetrator of road rage (OR = 1.80 [1.05, 3.07] for alcohol, 5.34 [1.64, 17.41] for cannabis, and 4.81 [1.09, 21.16] for alcohol and cannabis), and with serious road-rage perpetration (OR = 4.97 [2.40, 10.30] for alcohol and 17.75 [5.88, 53.56] for cannabis). Problem drinking (CAGE scores ≥ 2) was associated with being both a victim and perpetrator of road rage (OR = 2.74 [1.67, 4.50]) and with low (OR = 1.77 [1.09, 2.85]) and serious (OR = 3.47 [1.65, 7.30]) road-rage perpetration. **Conclusions:** Driving under the influence of alcohol or cannabis and being a problem drinker are associated with the perpetration of serious road-rage behavior, as well as experiencing road-rage victimization and perpetration. (*J. Stud. Alcohol Drugs*, 72, 185–193, 2011)

ALTHOUGH THERE IS NO ESTABLISHED definition of road rage at a scientific level (Smart and Mann, 2002; Smart et al., 2005), it can be understood as “an attempt to intimidate, threaten, injure, or kill other drivers, passengers, or pedestrians” (Smart et al., 2005, p. 195). There is epidemiological evidence that victims and perpetrators of road rage, as well as *serious* road-rage perpetrators—those who intentionally damage or attempt to damage another driver’s car or injure or attempt to injure the driver or passenger of another vehicle—have a significantly higher risk of becoming involved in traffic accidents (Mann et al., 2007). However, few studies exist about the causes or risk factors of having an experience of road rage, although it has been identified as an emerging problem in several countries such as Australia (Harding et al., 1998), Canada (Smart et al., 2005), the United Kingdom (Joint, 1995), and the United States (Batten et al., 2000), and has been a popular issue in the media.

It has been broadly documented that heavy drinkers and consumers of illicit drugs are often victims or perpetrators of aggression, as well as being “at fault” in traffic crashes (Chipman et al., 2003; Grisso et al., 1999; Harrison et al., 2001; Macdonald et al., 2003; Smart et al., 1997; Wells et

al., 2000) and that cannabis users are frequently observed to be drivers or people injured or killed in traffic accidents (Drummer et al., 2004; Laumon et al., 2005; Ramaekers et al., 2004). However, there are few studies on how the consumption of alcohol and other illicit substances are related to the experience of road rage. Only four such studies have been published.

Mann et al. (2004), with a sample of 2,610 adult residents in Ontario, Canada, ages 18 years or older, found that there was a significant relationship between the problem drinking of alcohol—measured by the Alcohol Use Identification Test (AUDIT)—and the experience of road-rage victimization and perpetration.

Likewise, two studies conducted with 2,421 adults living in Ontario, Canada, concluded that cannabis, cocaine, or Ecstasy use during the previous year and/or problem drinking of alcohol were significantly higher among those involved in most serious road-rage behaviors (Butters et al., 2005), and that cannabis use was associated with the experience of victimization and perpetration of road rage, whereas the use of stimulants significantly increased the likelihood of victimization and being classified as a serious road-rage perpetrator (Butters et al., 2006).

Finally, Yu et al. (2004) studied aggressive driving and road rage in a sample of 431 patients in treatment for alcoholism in New York State. All subjects were undergoing alcoholism treatment because of a drinking and driving-related reason. The results demonstrated that aggressive driving and road rage were two separate behaviors that simultaneously influenced each other, and both tended to be more affected by alcohol problems—measured with the

Received: May 14, 2010. Revision: October 8, 2010.

*This work was supported by grants from the Consejería de Familia e Igualdad de Oportunidades and from the Ministerio de Sanidad y Consumo, Redes Temáticas de Investigación Cooperativa, Red de Trastornos Adictivos (RD06/0001/0020).

†Correspondence may be sent to F. Javier Álvarez at the above address or via email at: alvarez@med.uva.es

Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (American Psychiatric Association, 1994)—and other variables that indicate problem behaviors (such as driving in an inadequate way and depression) rather than the frequency of alcohol use, driving after drinking, and experiencing stressful events.

In Europe, there is a lack of studies on consumption of substances and their effect on road-rage behaviors. The realization of studies at an international level is important both to determine the magnitude of the problem and to carry out comparisons among samples from different countries with the purpose of establishing firm conclusions about the consumption of substances and other factors associated with road rage (Smart and Mann, 2002). Likewise, it is necessary to compare the effect of alcohol consumption with other drugs, determining the extent to which consumers of alcohol and other substances differ in terms of being involved in road-rage behaviors (Yu et al., 2004).

There are several questionnaires designed to measure the construct of road rage. Among those most used are the Propensity for Angry Driving Scale (DePasquale et al., 2001), used to identify drivers more likely to get angry with others while driving and consequently to participate in hostile driving behaviors or acts of road rage; the Driving Anger Scale (Deffenbacher et al., 1994), which measures the trait of driving with anger or propensity to experience rage while driving; the Driving Anger Expression Inventory (Deffenbacher et al., 2002), which measures the usual way of expressing anger while driving; and last, the indicators from a taxonomy of road-rage behavior developed by Smart et al. (2004, 2005), which quantify the frequency of involvement in acts of road rage as victims and as perpetrators during the last 12 months. In our study, we used these last indicators because the questionnaire has only eight items, making it easy to administer and include in population surveys. It also allows comparison of the results obtained with most previous studies on road rage and substance use (Butters et al., 2005, 2006; Mann et al., 2004) as it has been the most widely used measurement instrument.

The objective of this study is to analyze the association of alcohol and illicit drug consumption on road-rage victimization and perpetration in both drivers and nondrivers. The study used a representative sample of the population from Castile and León, in Spain. We included nondrivers in the study because both drivers and nondrivers (i.e., a passenger in a car when the driver engages in road-rage behavior) could be involved in road-rage behavior, either as victims and/or perpetrators.

Method

This study was approved by the Comité Ético de Investigación Clínica, Facultad de Medicina de la Universidad de Valladolid, Reference number 2008/18.

Sample and fieldwork procedure

Data was collected using the Alcohol-Use and Drug-Use Survey of Castile and León, Spain 2008 and through face-to-face interviews from April 21-May 22, 2008 (Álvarez and Fierro, 2010). The survey, which has been conducted regularly since the late 1980s, focuses on patterns of alcohol, tobacco, and illicit drug consumption in the general population. In its most recent version (2008), questions regarding road rage were addressed for the first time.

The participants were selected at random from a representative sample of Castile and León households that represent 2,528,417 inhabitants, consisting of 1,251,082 males and 1,277,335 females. The sample was taken from the population register data of 2007 (Instituto Nacional de Estadística, 2008). People from 14 to 70 years of age living in Castile and León, Spain, were the target population.

A final sample of 2,500 valid interviews was selected. The sample selection was stratified as follows: first, proportionally according to the number of inhabitants in the communities (using five ranges of size of the population: <10,000, 10,000-49,999, 50,000-99,999, 100,000-249,999, >250,000); second, by province on the basis of the regional administrative division (9 provinces); third, by age group; and fourth, by gender, as in previous surveys with the same target population (Álvarez et al., 2006). If the selected person refused to take part in the study, a new person of the same gender and age range was chosen. Information from 16 surveys was withdrawn because of missing information or incoherence in the responses, and a new person of the same gender and age range was selected. Quality control of the response was done in 414 of the surveys by telephone interview. The field trial and quality control was carried out by the company Telecyl (Valladolid, Spain; www.telecyl.com).

A total of 2,500 subjects participated in the study, of which 51.0% ($n = 1,276$) were males and 49.0% ($n = 1,224$) females. Of the sample 63.6% ($n = 1,591$) drove vehicles, 36.4% ($n = 909$) did not drive. The age distribution of the sample was as follows: 14-19 years = 7.6% ($n = 189$), 20-29 years = 17.9% ($n = 447$), 30-39 years = 20.9% ($n = 522$), 40-49 years = 21.2% ($n = 530$), 50-59 years = 17.0% ($n = 426$), 60-70 years = 15.4% ($n = 386$). The sociodemographic characteristics of the sample are shown in Table 1.

Outcome measures and risk factors

Road-rage experience and behavior for the previous 12 months was measured using eight questions: four items on road-rage victimization and four items on road-rage perpetration (Butters et al., 2005; Mann et al., 2004; Smart et al., 2005). The victimization items measured how many times, during the past 12 months, someone in another other vehicle had (a) shouted, cursed, or made rude gestures at you or

TABLE 1. Descriptive of variables for the total sample, and sample subtypes: Drivers and nondrivers

Variables	Total sample (<i>N</i> = 2,500)	Drivers (<i>n</i> = 1,591)	Nondrivers (<i>n</i> = 909)	Statistic
Sociodemographic data				
Gender (<i>n</i> ; %)				
Male	1,276; 51.0	983; 61.8	293; 32.2	$\chi^2 = 202.17, p = .0001$
Female	1,224; 49.0	608; 39.2	616; 67.8	
Age, <i>M</i> (<i>SD</i>)	41.4 (15.2)	41.2 (13.0)	41.9 (18.5)	$F = 1.44, p = .23$
Civil status (<i>n</i> ; %) ^a				
Married/with couple	1,297; 51.9	882; 55.4	415; 45.7	$\chi^2 = 22.17, p = .0001$
Others	1,203; 48.1	709; 44.6	494; 54.3	
Education level (<i>n</i> ; %) ^a				
Basic studies/no studies	1,945; 77.8	1,142; 71.8	803; 88.3	$\chi^2 = 91.85, p = .0001$
Higher than basic studies	555; 22.2	449; 28.2	106; 11.7	
Population size of community (<i>n</i> ; %) ^a				
≥10,000 inhabitants	1,432; 57.3	887; 55.8	545; 60.0	$\chi^2 = 4.18, p = .041$
<10,000 inhabitants	1,068; 42.7	704; 44.2	364; 40.0	
Thousands of km/year conducted, <i>M</i> (<i>SD</i>)	17.2 (26.1)			
Alcohol consumption				
Current drinker (<i>n</i> ; %)	889; 35.6	639; 40.2	250; 27.5	$\chi^2 = 40.47, p = .0001$ $F = 24.99, p = .0001$
SDU/week, <i>M</i> (<i>SD</i>)	4.5 (9.7)	5.2 (10.0)	3.2 (8.9)	
Alcohol consumption level ^b				
Low consumption, males ≤21 SDU/wk and females ≤14 SDU/wk (<i>n</i> ; %)	713; 28.5	506; 31.8	207; 22.8	$\chi^2 = 46.56, p = .000$
Moderate consumption, males 22-50 SDU/wk and females to 15-35 SDU/wk (<i>n</i> ; %)	154; 6.2	121; 7.6	33; 3.6	
High consumption, males >50 SDU/wk and females >35 SDU/wk (<i>n</i> ; %)	22; 0.9	12; 0.8	10; 1.1	
Five or more alcoholic drinks on one occasion (<i>n</i> ; %)	439; 17.6	299; 18.8	140; 15.4	$\chi^2 = 4.60, p = .032$
CAGE scores ≥2 (<i>n</i> ; %)	153; 6.1	99; 6.2	54; 5.9	$\chi^2 = 0.080, p = .77$
Driving under the influence of alcohol in the previous year (<i>n</i> ; %)	108; 4.3	108; 6.8	0; 0.0	$\chi^2 = 64.53, p = .001$
Being a passenger with a driver under the influence of alcohol (<i>n</i> ; %)	144; 5.8	94; 5.9	50; 5.5	$\chi^2 = 0.177, p = .67$
Drug consumption				
Consumption of cannabis in the previous year (<i>n</i> ; %)	192; 7.7	142; 8.9	50; 5.5	$\chi^2 = 9.26, p = .002$
Consumption of amphetamines in the previous year (<i>n</i> ; %) ^b	21; 0.8	16; 1.0	5; 0.6	$\chi^2 = 1.44, p = .23$
Consumption of cocaine in the previous year (<i>n</i> ; %) ^b	47; 1.9	43; 2.7	4; 0.4	$\chi^2 = 16.05, p = .0001$
Consumption of designer drugs/Ecstasy in the previous year (<i>n</i> ; %) ^b	22; 0.9	19; 1.2	3; 0.3	$\chi^2 = 4.95, p = .03$
Consumption of tranquilizers in the previous year (<i>n</i> ; %) ^b	13; 0.5	10; 0.6	3; 0.3	$\chi^2 = 1.00, p = .32$
Consumption of opiates in the previous year (<i>n</i> ; %) ^b	10; 0.4	10; 0.6	0; 0.0	$\chi^2 = 5.74, p = .02$
Consumption of hallucinogens in the previous year (<i>n</i> ; %) ^b	12; 0.5	11; 0.7	1; 0.1	$\chi^2 = 4.10, p = .043$
Consumption of inhalants in the previous year (<i>n</i> ; %) ^b	2; 0.1	1; 0.1	1; 0.1	$\chi^2 = 0.16, p = .69$
Driving under the influence of cannabis (<i>n</i> ; %)	35; 1.4	35; 2.2	0; 0.0	$\chi^2 = 20.28, p = .0001$
Passenger with a driver under the influence of cannabis (<i>n</i> ; %)	63; 2.5	48; 3.0	15; 1.7	$\chi^2 = 4.40, p = .036$
Alcohol and cannabis				
Current drinker and consumption of cannabis in the previous year (<i>n</i> ; %)	135; 5.4	101; 6.3	34; 3.7	$\chi^2 = 7.70, p = .006$
Driving under the influence of alcohol and cannabis in the previous year (<i>n</i> ; %)	12; 0.5	12; 0.8	0; 0.0	$\chi^2 = 6.89, p = .009$
Being a passenger with a driver under the influence of alcohol and cannabis (<i>n</i> ; %)	25; 1.0	19; 1.2	6; 0.7	$\chi^2 = 1.67, p = .19$

Notes: SDU = standard drink unit; wk = week. ^aSociodemographic variables with more than two categories that were dichotomized in two categories; ^bvariable excluded in the regression analysis because of collinearity.

others with you; (b) threatened to hurt you or others with you or threatened to damage the vehicle you were in; (c) intentionally damaged or attempted to damage the vehicle you were in; or (d) intentionally hurt or attempted to hurt you or others with you. The perpetration items measured how many times, during the past 12 months, the respondent had (a) shouted, cursed, or made rude gestures at a driver or passenger in another vehicle; (b) threatened to hurt a driver or passenger in another vehicle or threatened to damage their vehicle; (c) intentionally damaged or attempted to damage another driver's vehicle; or (d) intentionally hurt or attempted to hurt a driver or passenger in another vehicle.

The eight items show an acceptable reliability: $\alpha = .674$ (George and Mallery, 1994). In an interitem correlation analysis of the four perpetration items, with a sample of aggressors only, there was a negative correlation of the first item with the second ($r = -.10$) and the third ($r = -.87$) and a positive correlation among items 2 and 3 ($r = .25$). Therefore, the perpetrators' items 2, 3, and 4 were collapsed as "serious" road-rage perpetration. (Although there were no correlations with the fourth item because there was a lack of answers to it in the aggressors-only sample, the question can be considered as serious perpetration.)

The road-rage outcome was established in different categories: (a) no road-rage experience, (b) victim of road rage only, (c) perpetrator of road rage only, and (d) being either victim or a perpetrator of road rage. Likewise, the road-rage perpetrator experience was divided in two categories: low perpetrator, which consisted of responding positively to the first perpetration item only, and serious perpetrator, which was based on a positive response to at least one of the last three perpetration items.

Road-rage experience was assessed among both drivers and nondrivers. The latter have been included in the study because nondrivers could be passengers in a car when the driver engages in road-rage behavior. Furthermore, note the way in which the eight questions that refer to road rage are formulated: None of them specifies that the person being interviewed was necessarily driving at the time road rage was observed, nor is it specified that the person who suffered or perpetrated the aggression was at that particular time the driver (Butters et al., 2005; Mann et al., 2004; Smart et al., 2005). The questionnaire to evaluate road rage in this study has already been used in other studies with samples from the general population, not just drivers (Butters et al., 2005; Mann et al., 2004; Smart et al., 2005).

Potential risk factors for road rage were classified into three groups (Table 1): (a) sociodemographics (7 variables), (b) patterns of alcohol consumption (7 variables), and (c) patterns of drug consumption (10 variables).

Regarding sociodemographics, these were dichotomized variables with more than two categories. The variables considered were (a) gender, (b) age (as a continuous variable), (c) civil status (married or with couple/others), (d) education level (basic studies or no studies/higher than basic studies), (e) driver (yes/no; driver was considered those with a valid driving license and those who drove at least 1 day in the previous year), (f) population size of community 10,000 or more inhabitants (yes/no), and (g) thousands of kilometers per year driven (as a continuous variable and only considered for drivers).

Regarding patterns of alcohol consumption variables, the following were considered:

(a) *Current drinker (yes/no)*. This was defined as those who have had at least one drink per week during the past year.

(b) *Alcohol consumption in standard drink unit (SDU): SDUs per week (mean)*. Current drinkers were split into weekly and occasional drinkers. Weekly drinkers were those who had drunk alcohol at least once a week over the preceding year. Occasional drinkers were those who had drunk alcohol less than once a week over the preceding year. The survey assessed drinkers for alcohol intake using a retrospective weekly recall for those who drank at least once a week (weekly drinkers). For those who drank less frequently than once a week (occasional drinkers), a quantity/frequency approach was used. The amount of alcohol was expressed either in grams of absolute alcohol ingested daily or in

SDUs, based on the alcohol content of Spanish drinks and the intake level of each of the different beverages (Álvarez et al., 2006). A Spanish SDU was set at 10 g of pure ethanol (Gual et al., 1999).

(c) *Alcohol consumption level*. Drinkers were classified as having consumption levels as follows: low consumption = 21 or fewer SDUs per week for males and 14 or fewer for females; moderate consumption = 22-50 SDUs per week for males and 15-35 for females; high consumption = more than 50 SDUs per week for males and more than 35 for females (Álvarez et al., 2006).

(d) *To have consumed five or more alcoholic drinks in one occasion during the previous 30 days (yes/no)*.

(e) *CAGE scores of 2 or greater (yes/no)*. The CAGE questionnaire, in the Spanish validated version (Rodríguez-Martos et al., 1986), was used with current drinkers, and we consider a score of 2 or more as defining a "problem drinker" (Álvarez and Del Río, 1994).

(f) *Driving under the influence of alcohol in the previous year (yes/no)*. This was considered for drivers.

(g) *Being a passenger with a driver under the influence of alcohol (yes/no)*. This was considered for nondrivers.

Related to other illicit drugs, the variables were the following:

(a) *To have consumed cannabis, amphetamines, cocaine, designer drugs (e.g., Ecstasy), tranquilizers, opiates, hallucinogens, and inhalants in the previous year (yes/no)*.

(b) *Being a passenger with a driver under the influence of cannabis (yes/no)*. This was considered for nondrivers.

(c) *Driving under the influence of cannabis in the previous year (yes/no)*. This was considered for drivers.

The following interaction factors were assessed:

(a) *Current Drinker (yes/no) × To Have Consumed Cannabis in the Previous Year (yes/no)*. This was considered for drivers and nondrivers.

(b) *Driving Under the Influence of Alcohol (yes/no) × Driving Under the Influence of Cannabis (yes/no)*. This was considered for drivers.

(c) *Being a Passenger With a Driver Under the Influence of Alcohol (yes/no) × Being a Passenger With a Driver Under the Influence of Cannabis (yes/no)*. This was considered for nondrivers.

Statistical analysis

The statistical analysis was performed using SPSS version 15.0 (SPSS Inc., Chicago, IL).

To assess risk factors for road rage, we used one-way analysis of variance for univariate continuous variables and the chi-square test for categorical variables. In addition, we conducted Fisher's exact test whenever the expected value of at least one cell of the chi-square was less than 5.

Because of the large number ($n = 24$) of potential risk factors, we avoided multicollinearity among the explanatory variables by performing collinearity diagnostic analyses

(Belsley et al., 1980; Kleinbaum et al., 1998). We performed the stepwise selection of variables from the models with the following criteria: tolerance greater than 0.4 or variance inflation less than 2.5, condition number less than 10, and a variance of two or more variables no greater than 0.5. The variables that were excluded because of collinearity are identified in Table 1.

Multinomial logistic regression analysis with forward step was carried out separately for drivers and nondrivers. In a first analysis the dependent variable was type of road rage (none, only victim, only perpetrator, and either victim and perpetrator). In a second analysis, the dependent variable was type of road-rage perpetration (none, low perpetration, and serious perpetration). For all models, the adjusted odds ratio (OR) indicated the association of interest. OR and 95% confidence interval (CI) are given. A *p* value of .05 or less was considered significant.

Results

Road rage

Regarding the road-rage experience, among drivers, 55.6% (*n* = 885) had not had an experience of road rage, 15.3% (*n* = 243) were victims only, 5.0% (*n* = 80) were per-

petrators only, and 24.1% (*n* = 383) were both victims and perpetrators. And finally, among the nondrivers, 92.1% (*n* = 836) had not had an experience of road rage, 3.5% (*n* = 32) were victims only, 1.2% (*n* = 11) were perpetrators only, and 3.2% (*n* = 29) were both victims and perpetrators.

Considering the different levels of road-rage perpetration, among drivers, 25.2% (*n* = 400) were low-level perpetrators and 3.9% (*n* = 62) were serious perpetrators; and, among nondrivers, 4.3% (*n* = 39) were low perpetrators and 0.2% (*n* = 2) were serious perpetrators.

Road-rage experience and risk factors

In Tables 2 and 3, the variables are presented that, in the regression model, were significantly associated with being a victim and/or perpetrator of road rage (Table 2) and with the level of road-rage perpetration (Table 3), for drivers and nondrivers (passengers), respectively.

Being only a *victim* of road rage was associated with drivers from communities with 10,000 or more inhabitants (OR = 1.78), with a higher education (OR = 1.53), and with increased thousands of kilometers driven per year (OR = 1.01). Among nondrivers, no variables were associated with being a victim only.

TABLE 2. Regression results: significant variables associated with road rage experience in total sample. drivers and nondrivers (no road rage experience as reference category)

Variable	Drivers OR [95% CI]; <i>p</i>	Nondrivers OR [95% CI]; <i>p</i>
Road rage: Victim only		
Education level (university studies)	1.53 [1.11, 2.11]; .009	—
Population size (≥10,000 inhabitants)	1.78 [1.31, 2.42]; .001	—
Thousand of km/year conducted	1.010 [1.005, 1.016]; .001	—
Road rage: Perpetrator only		
Age (14-70 years)	0.97 [0.95, 0.99]; .001	—
Gender (male)	2.28 [1.30, 4.00]; .004	—
Driving Under the Influence of Alcohol (no) × Driving Under the Influence of Cannabis (yes) ^a	6.77 [1.55, 29.48]; .011	—
Driving Under the Influence of Alcohol (yes) × Driving Under the Influence of Cannabis (no) ^a	3.72 [1.71, 8.10]; .011	—
Passenger With Driver Under the Influence of Alcohol (yes) × Passenger With Driver Under the Influence of Cannabis (no) ^b	—	8.71 [2.27, 33.40]; .002
Road rage: Victim and perpetrator		
Age (14-70 years of age)	0.97 [0.96, 0.98]; .001	0.96 [0.94, 0.99]; .005
Education level (university studies)	1.40 [1.05, 1.86]; .020	—
Thousand of km/year conducted	1.009 [1.004, 1.014]; .001	—
CAGE scores ≥ 2	2.74 [1.67, 4.50]; .001	—
Driving Under the Influence of Alcohol (yes) × Driving Under the Influence of Cannabis (no) ^a	1.80 [1.05, 3.07]; .031	—
Driving Under the Influence of Alcohol (no) × Driving Under the Influence of Cannabis (yes) ^a	5.34 [1.64, 17.41]; .005	—
Driving Under the Influence of Alcohol (yes) × Driving Under the Influence of Cannabis (yes) ^a	4.81 [1.09, 21.16]; .038	—
Passenger With Driver Under the Influence of Alcohol (yes) × Passenger With Driver Under the Influence of Cannabis (no) ^b	—	5.31 [1.19, 14.70]; .001
Passenger With Driver Under the Influence of Alcohol (no) × Passenger With Driver Under the Influence of Cannabis (yes) ^b	—	6.53 [1.14, 37.51]; .035
Passenger With Driver Under the Influence of Alcohol (yes) × Passenger With Driver Under the Influence of Cannabis (yes) ^b	—	11.90 [1.95, 72.79]; .007

^aReference: Driving Under the Influence of Alcohol (no) × Driving Under the Influence of Cannabis (no); ^breference: Passenger With Driver Under the Influence of Alcohol (no) × Passenger With Driver Under the Influence of Cannabis (no).

TABLE 3. Regression results: significant variables associated with low and serious road rage perpetration in total sample, drivers and nondrivers

Variable	Drivers OR [95% CI]; <i>p</i>	Nondrivers OR [95% CI]; <i>p</i>
Low perpetration		
Gender (male)	1.36 [1.06, 1.75]; .016	—
Age (14-70 years)	0.98 [0.97, 0.99]; .001	0.96 [0.94, 0.99]; .002
CAGE scores ≥ 2	1.77 [1.09, 2.85]; .020	—
Passenger With Driver Under the Influence of Alcohol (yes) \times Passenger With Driver Under the Influence of Cannabis (no) ^b	—	6.41 [2.76, 14.89]; .001
Passenger With Driver Under the Influence of Alcohol (no) \times Passenger With Driver Under the Influence of Cannabis (yes) ^b	—	5.73 [1.03, 31.94]; .046
Passenger With Driver Under the Influence of Alcohol (yes) \times Passenger With Driver Under the Influence of Cannabis (yes) ^b	—	8.62 [1.54, 48.14]; .014
Serious perpetration		
Gender (male)	2.49 [1.23, 5.05]; .011	—
Age (14-70 years)	0.95 [0.93, 0.98]; .001	—
CAGE scores of ≥ 2	3.47 [1.65, 7.30]; .001	—
Driving Under the Influence of Alcohol (yes) \times Driving Under the Influence of Cannabis (no) ^a	4.97 [2.40, 10.29]; .001	—
Driving Under the Influence of Alcohol (no) \times Driving Under the Influence of Cannabis (yes) ^a	17.75 [5.88, 53.56]; .000	—

^aReference: Driving Under the Influence of Alcohol (no) \times Driving Under the Influence of Cannabis (no); ^breference: Passenger With Driver Under the Influence of Alcohol (no) \times Passenger With Driver Under the Influence of Cannabis (no).

Being only a road-rage *perpetrator* was associated with male drivers (OR = 2.28), as well as with driving under the influence of cannabis (OR = 6.77) or alcohol (OR = 3.72), and the association decreased with age (OR = 0.97). Among nondrivers, being a passenger of a driver under the influence of alcohol was associated with road-rage perpetration only (OR = 8.71).

Being both victim and perpetrator of road rage was associated with drivers with a higher education (OR = 1.40), increases in the thousands of kilometers driven per year (OR = 1.009), drivers who had driven under the influence of alcohol (OR = 1.80) or cannabis (OR = 5.34) or alcohol and cannabis (OR = 4.81), and problem drinkers (OR = 2.74), and it decreased with age (OR = 0.97). Among nondrivers, being both victim and perpetrator of road rage was associated with being a passenger of a driver under the influence of alcohol (OR = 5.31), cannabis (OR = 6.53), or alcohol and cannabis (OR = 11.90), and the risk decreased with age (OR = 0.96).

Being a low perpetrator was associated with male drivers (OR = 1.36) and with problem drinkers (OR = 1.77), whereas the association decreased with older driver age (OR = 0.98). Among nondrivers, low perpetration was associated with being a passenger of a driver under the influence of alcohol (OR = 6.41), of cannabis (OR = 5.73), or of alcohol and cannabis (OR = 8.62), and the risk decreased with age (OR = 0.96).

Being a *serious perpetrator* was associated with male drivers (OR = 2.49), drivers who during the previous year had driven under the influence of alcohol (OR = 4.97) or cannabis (OR = 17.75), and problem drinkers (OR = 3.47). Older drivers were associated with a significantly smaller likelihood of being a serious perpetrator of road rage (OR =

0.95). Among nondrivers, no variables were associated with serious road-rage perpetration.

Discussion

Road rage is a frequent phenomenon: more people are likely to be both victims and perpetrators, and most are low-level perpetrators. The present study shows that driving under the influence of alcohol and/or cannabis and being a "problem drinker" (CAGE scores ≥ 2) are associated with serious road-rage perpetration and with the highest prevalence of experiences of road-rage victimization and perpetration. Among nondrivers, being the passenger of a driver under the influence of alcohol and/or cannabis increases the probability of being both victim and perpetrator, and a low perpetrator of road rage.

As combined use of substances is frequent, in the current study we have assessed the effect of the interaction of alcohol and cannabis use (Current Drinker [yes/no] \times To Have Consumed Cannabis in the Previous Year [yes/no]). The results show that alcohol and/or cannabis use was related to road rage. Furthermore, it is well known that combined use of substances (drug/drug or alcohol/drug) leads to an increased risk for road traffic involvement (Drummer et al., 2004; Mathijssen and Houwing, 2005).

In our study, none of the variables related to patterns of alcohol consumption (such as frequency or quantity) were associated with road rage, whereas certain behaviors related to drinking—like driving under the influence of alcohol or being a passenger of a driver under the influence of alcohol—were associated with road rage. It is noteworthy that heavy volume drinking and even consumption of five or more drinks were not associated with road rage unless the

respondents reported driving under the influence of alcohol (or riding as a passenger with a driver under the influence). Our findings regarding alcohol consumption are consistent with the results of previous studies in this area, although the comparison of results should be carried out with caution because different variables or factors associated with road rage were used. A significant relationship has been noted between the subscale of problematic alcohol consumption of the AUDIT questionnaire and the experience of victimization and perpetration in road-rage incidents (Mann et al., 2004), drivers with drinking problems as measured by the AUDIT are significantly more likely to be serious road-rage perpetrators (Butters et al., 2005), and a significant association exists between measures of road rage (angry/threatening driving) and driving above the blood alcohol concentration limit in the previous year (Wells-Parker et al., 2002).

Butters et al. (2005, 2006) found that consumption of cannabis during the previous year was associated with road-rage victimization and perpetration, and with the most serious forms of road-rage perpetration. Our study also found that those who had driven under the influence of cannabis were more likely to be perpetrators and victims of road rage, to be perpetrators only, and to be serious perpetrators. It is necessary to explore the mechanisms by which this illegal drug is related to road rage, as pointed out by other authors (Butters et al., 2005). Although it is known that alcohol has disinhibitory effects, thus contributing to aggressive behavior, cannabis is rarely associated with aggression; on the contrary, it tends to produce calm and passivity (Pliner et al., 1972). It has been documented that cannabis-dependent subjects who report problems controlling their violent behavior while intoxicated tend to react with aggression (Arendt et al., 2007); chronic cannabis users (equivalent to smoking daily for approximately 14 years) tend to demonstrate higher levels of aggressive behavior during the first week of abstinence, by which we can understand aggressive behavior as an additional component in the withdrawal symptoms of cannabis (Kouri et al., 1999). However, our sample was composed mainly of recreational cannabis users rather than dependent patient or long-term daily cannabis users. In a recent study, driving under the influence of cannabis was associated with risky driving (careless style of driving) but not with aggressive driving (Richer and Bergeron, 2009). Furthermore, sensation seeking and impulsivity were found to be predictors of driving under the influence of cannabis (Richer and Bergeron, 2009).

Our data are also consistent with previous studies that postulated that the use of alcohol and illicit drugs is more strongly associated with road-rage perpetration than with victimization (Butters et al., 2005). In our study, we found no variables regarding the consumption of alcohol or illicit drugs associated with the experience of being only a victim of road rage.

Among the sociodemographic variables, the age variable is particularly noteworthy because it was the only variable that was significantly associated with all the types of road-rage experience: At younger ages, subjects were more likely to experience road rage in general. Being young has been documented previously as a risk variable in being both perpetrator and victim of road rage (Butters et al., 2005; Mann et al., 2004; Smart et al., 2003). Another aspect that stands out is gender: Being a man has been identified as a crucial variable in being a perpetrator (but not a victim) of road rage (Asbridge et al., 2003; Butters et al., 2005; Mann et al., 2004; Smart et al., 2004). This was also demonstrated by our results, where there were no significant differences by gender in those who were victims of road rage only. In our study, having a higher educational level was associated with both being a victim of road rage only and being both victim and perpetrator. In previous studies, road rage, or some form of road rage such as threatening someone, is more frequent among those whose educational level is lower (Smart et al., 2003). In our opinion, the fact that in our sample the proportion of drivers with university studies is much greater determines the greater probability of those drivers experiencing road rage, compared with other studies (Smart et al., 2003). In addition, we have used educational level as a dichotomized variable (basic studies or no studies vs. higher than basic studies), whereas in other studies several categories were used (Smart et al., 2003). Furthermore, however, the existence of cultural differences between studies (Canadian population vs. Spanish population), for instance, cannot be ignored.

Our results agree with studies that show that a greater number of people living in towns or driving in urban areas leads to a greater likelihood of experiencing road rage (Asbridge et al., 2003; Mann et al., 2004; Smart et al., 2003, 2004). Some authors refer to the fact that victimization and aggression are significantly higher in drivers as the number of kilometers driven increases, perhaps because drivers with a lot of experience in the vehicle may experience more frustration when they fail to use their greater performance capacity on congested urban roads (Smart et al., 2004). In our study, there was a significantly greater probability of experiencing victimization in municipalities with 10,000 or more inhabitants and as the kilometers driven per year increased.

Among the limitations of our study was its cross-sectional design, which did not allow us to prove conclusively that the use of illicit drugs or alcohol directly affects or causes road-rage behavior. Likewise, the association of alcohol consumption in conjunction with other illegal substances such as cocaine and amphetamines (among others) was not included in the analysis. Finally, other psychological characteristics of drivers that have been shown in previous studies to be associated with the victimization and perpetration of road rage were not considered in the analysis, such as anxiety, hostility,

anger, mental stress, psychiatric morbidity, personality traits and specific measures such as competitiveness during driving, and "driving anger," among others (Butters et al., 2005, 2006; Fong et al., 2001; Galovski and Blanchard, 2002, 2004; Smart et al., 2003).

Driving under the influence of substances (alcohol, drugs) is frequent, and, with recent concern about cannabis, has been recognized as a risk for road traffic accidents (Álvarez et al., 2007; Blows et al., 2005; Matthews et al., 2009), with intervention to reduce drug-related crashes being seen as a priority (European Commission, 2001; European Monitoring Centre for Drugs and Drug Addiction, 2007; Walsh et al., 2008). Furthermore, as shown in our study, road rage is a frequent phenomenon that requires attention and is associated with certain behaviors related with the consumption of alcohol and drugs. The findings from the present study have implications for the development of appropriate targeted interventions aimed at reducing risky driving practices.

References

- Álvarez, F. J., & Del Río, M. C. (1994). Screening for problem drinkers in a general population survey in Spain by use of the CAGE scale. *Journal of Studies on Alcohol*, 55, 471-474.
- Álvarez, F., & Fierro, I. (2010). *El consumo de drogas en Castilla y León, 2008*. Valladolid, Spain: Junta de Castilla y León, Consejería de Familia e Igualdad de Oportunidades.
- Álvarez, F. J., Fierro, I., & Del Río, M. C. (2006). Alcohol-related social consequences in Castile and León, Spain. *Alcoholism: Clinical and Experimental Research*, 30, 656-664.
- Álvarez, F. J., Fierro, I., & Del Río, M. C. (2007). Cannabis and driving: Results from a general population survey. *Forensic Science International*, 170, 111-116.
- American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.
- Arendt, M., Rosenberg, R., Fjordback, L., Brandholdt, J., Foldager, L., Sher, L., & Munk-Jørgensen, P. (2007). Testing the self-medication hypothesis of depression and aggression in cannabis-dependent subjects. *Psychological Medicine*, 37, 935-945.
- Asbridge, M., Smart, R. G., & Mann, R. E. (2003). The "homogamy" of road rage: Understanding the relationship between victimization and offending among aggressive and violent motorists. *Violence and Victims*, 18, 517-531.
- Batten, P. J., Penn, D. W., & Bloom, J. D. (2000). A 36-year history of fatal road rage in Marion County, Oregon: 1963-1998. *Journal of Forensic Sciences*, 45, 397-399.
- Belsley, D. A., Kuh, E., & Welsch, R. E. (1980). *Regression diagnostics: Identifying influential data and sources of collinearity*. Hoboken, NJ: John Wiley and Sons.
- Blows, S., Ivers, R. Q., Connor, J., Ameratunga, S., Woodward, M., & Norton, R. (2005). Marijuana use and car crash injury. *Addiction*, 100, 605-611.
- Butters, J. E., Mann, R. E., & Smart, R. G. (2006). Assessing road rage victimization and perpetration in the Ontario adult population: The impact of illicit drug use and psychiatric distress. *Canadian Journal of Public Health*, 97, 96-99.
- Butters, J. E., Smart, R. G., Mann, R. E., & Asbridge, M. (2005). Illicit drug use, alcohol use and problem drinking among infrequent and frequent road ragers. *Drug and Alcohol Dependence*, 80, 169-175.
- Chipman, M. L., Macdonald, S., & Mann, R. E. (2003). Being "at fault" in traffic crashes: Does alcohol, cannabis, cocaine, or polydrug abuse make a difference? *Injury Prevention*, 9, 343-348.
- Deffenbacher, J. L., Lynch, R. S., Oetting, E. R., & Swaim, R. C. (2002). The driving anger expression inventory: A measure of how people express their anger on the road. *Behaviour Research and Therapy*, 40, 717-737.
- Deffenbacher, J. L., Oetting, E. R., & Lynch, R. S. (1994). Development of a driving anger scale. *Psychological Reports*, 74, 83-91.
- DePasquale, J. P., Geller, E. S., Clarke, S. W., & Littleton, L. C. (2001). Measuring road rage: Development of the Propensity for Angry Driving Scale. *Journal of Safety Research*, 32, 1-16.
- Drummer, O. H., Gerostamoulos, J., Batziris, H., Chu, M., Caplehorn, J., Robertson, M. D., & Swann, P. (2004). The involvement of drugs in drivers of motor vehicles killed in Australian road traffic crashes. *Accident Analysis and Prevention*, 36, 239-248.
- European Commission. (2001). *White Paper—European transport policy for 2010: Time to decide*. Luxembourg: Office for Official Publications of the European Communities.
- European Monitoring Centre for Drugs and Drug Addiction. (2007). *EMCDDA Selected Issue 2007: Drugs and Driving*. Luxembourg: Office for Official Publications of the European Communities.
- Fong, G., Frost, D., & Stansfeld, S. (2001). Road rage: A psychiatric phenomenon? *Social Psychiatry and Psychiatric Epidemiology*, 36, 277-286.
- Galovski, T. B., & Blanchard, E. B. (2002). Psychological characteristics of aggressive drivers with and without intermittent explosive disorder. *Behaviour Research and Therapy*, 40, 1157-1168.
- Galovski, T. E., & Blanchard, E. B. (2004). Road rage: A domain for psychological intervention? *Aggression and Violent Behavior*, 9, 105-127.
- George, D., & Mallery, P. (1994). *SPSS/PC + step by step: A simple guide and reference*. Florence, KY: Wadsworth Publishing (Cengage Learning).
- Grisso, J. A., Schwarz, D. F., Hirschinger, N., Sammel, M., Brensinger, C., Santanna, J., . . . Teeple, L. (1999). Violent injuries among women in an urban area. *New England Journal of Medicine*, 341, 1899-1905.
- Gual, A., Martos, A. R., Lligoña, A., & Llopis, J. J. (1999). Does the concept of a standard drink apply to viticultural societies? *Alcohol and Alcoholism*, 34, 153-160.
- Harding, R. W., Morgan, F. H., Indermaur, D., Ferrante, A. M., & Blagg, H. (1998). Road rage and the epidemiology of violence: Something old, something new. *Studies on Crime and Crime Prevention*, 7, 221-238.
- Harrison, L. D., Erickson, P. G., Adlaf, E., & Freeman, C. (2001). The drugs-violence nexus among American and Canadian youth. *Substance Use & Misuse*, 36, 2065-2086.
- Instituto Nacional de Estadística. (2008). *Padrón municipal*. Madrid, Spain: Author. Retrieved from: <http://www.ine.es>
- Joint, M. (1995). *Road rage*. Washington, DC: AAA Foundation for Traffic Safety.
- Kleinbaum, D., Kupper, L., Muller, K., & Nizam, A. (1998). *Applied regression analysis and other multivariable methods*. Pacific Grove, CA: Duxbury Press.
- Kouri, E. M., Pope, H. G., Jr., & Lukas, S. E. (1999). Changes in aggressive behavior during withdrawal from long-term marijuana use. *Psychopharmacology*, 143, 302-308.
- Laumon, B., Gadegbeku, B., Martin, J.-L., & Biecheler, M.-B., & the SAM Group. (2005). Cannabis intoxication and fatal road crashes in France: Population based case-control study. *BMJ*, 331, 1371-1376.
- Macdonald, S., Anglin-Bodrug, K., Mann, R. E., Erickson, P., Hathaway, A., Chipman, M., & Rylett, M. (2003). Injury risk associated with cannabis and cocaine use. *Drug and Alcohol Dependence*, 72, 99-115.
- Mann, R. E., Smart, R. G., Stoduto, G., Adlaf, E. M., & Ialomiteanu, A. (2004). Alcohol consumption and problems among road rage victims and perpetrators. *Journal of Studies on Alcohol*, 65, 161-168.

- Mann, R. E., Zhao, J., Stoduto, G., Adlaf, E. M., Smart, R. G., & Donovan, J. E. (2007). Road rage and collision involvement. *American Journal of Health Behavior, 31*, 384-391.
- Mathijssen, R., & Houwing, S. (2005). *The prevalence and relative risk of drink and drug driving in the Netherlands: A case-control study in the Tilburg police district. Research in the framework of the European research programme IMMORTAL* [Impaired motorists, methods of roadside testing and licensing] (R-2005-9 second edition). Leidschendam, The Netherlands: SWOV Institute for Road Safety Research.
- Matthews, A., Bruno, R., Johnston, J., Black, E., Degenhardt, L., & Dunn, M. (2009). Factors associated with driving under the influence of alcohol and drugs among an Australian sample of regular ecstasy users. *Drug and Alcohol Dependence, 100*, 24-31.
- Pliner, P., Cappell, H., & Miles, G. (1972). *Observer judgments of intoxicated behavior during social interaction: A comparison of alcohol and marijuana*. New York: Futura Publishing.
- Ramaekers, J., Berghaus, G., van Laar, M., & Drummer, O. (2004). Dose related risk of motor vehicle crashes after cannabis use. *Drug and Alcohol Dependence, 73*, 109-119.
- Richer, I., & Bergeron, J. (2009). Driving under the influence of cannabis: Links with dangerous driving, psychological predictors, and accident involvement. *Accident Analysis and Prevention, 41*, 299-307.
- Rodríguez-Martos, A., Navarro, R., Vecino, C., & Pérez, R. (1986). Validación de los cuestionarios KFA (CBA) y CAGE para diagnóstico del alcoholismo. *Drogalcohol, 11*, 132-139.
- Smart, R. G., Asbridge, M., Mann, R. E., & Adlaf, E. M. (2003). Psychiatric distress among road rage victims and perpetrators. *Canadian Journal of Psychiatry, 48*, 681-688.
- Smart, R. G., & Mann, R. E. (2002). Is road rage a serious traffic problem? *Traffic Injury Prevention, 3*, 183-189.
- Smart, R., Mann, R. E., & Stoduto, G. (2003). The prevalence of road rage: Estimates from Ontario. *Canadian Journal of Public Health, 94*, 247-250.
- Smart, R. G., Mann, R. E., & Tyson, L. A. (1997). Drugs and violence among Ontario students. *Journal of Psychoactive Drugs, 29*, 369-373.
- Smart, R. G., Mann, R. E., Zhao, J., & Stoduto, G. (2005). Is road rage increasing? Results of a repeated survey. *Journal of Safety Research, 36*, 195-201.
- Smart, R. G., Stoduto, G., Mann, R. E., & Adlaf, E. M. (2004). Road rage experience and behavior: Vehicle, exposure, and driver factors. *Traffic Injury Prevention, 5*, 343-348.
- Walsh, J., Verstraete, A., Huestis, M., & Morland, J. (2008). Guidelines for research on drugged driving. *Addiction, 103*, 1258-1268.
- Wells, S., Graham, K., & West, P. (2000). Alcohol-related aggression in the general population. *Journal of Studies on Alcohol, 61*, 626-632.
- Wells-Parker, E., Ceminsky, J., Hallberg, V., Snow, R. W., Dunaway, G., Guiling, S., Anderson, B. (2002). An exploratory study of the relationship between road rage and crash experience in a representative sample of US drivers. *Accident Analysis and Prevention, 34*, 271-278.
- Yu, J., Evans, P., & Perfetti, L. (2004). Road aggression among drinking drivers: Alcohol and non-alcohol effects on aggressive driving and road rage. *Journal of Criminal Justice, 32*, 421-430.