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Short communication

Road rage among drug dependent patients

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ABSTRACT

The consumption of alcohol, cocaine and cannabis is associated with aggressive behaviour, being a victim of injuries from various causes, and suffering traffic accidents. On the other hand, there is a significant association between road rage and traffic accidents, yet this has not been studied in persons suffering a substance dependence disorder. This study analyses the prevalence of road rage in substance dependent patients undergoing treatment. 100 patients randomly selected at an outpatient treatment centre were included in the study. 63% of the patients had experienced road rage in the year prior to the interview, and 18% were serious perpetrators. There was a higher frequency among drivers and those who were starting treatment for cocaine and cocaine + heroin. The study shows that road rage is very frequent among patients with disorders due to substance dependence who are undergoing treatment, in particular the most severe form ("serious perpetrators"). Special attention should be addressed to the issue of driving and road rage during the treatment of these patients.

1. Introduction

The consumption of alcohol, cocaine and cannabis is associated with aggressive behaviour (Grisso et al., 1999; Macdonald et al., 2003; Mann et al., 1993, 2001; Moss and Tarter, 1993; Pernanen, 1991; Potter and Jenson, 2003; Reiss and Roth, 1993; Smart et al., 1997; Wells et al., 2000). There is, however, limited information concerning how the consumption of these substances affects the experience of road rage. Although there is no established definition of road rage at a scientific level (Smart and Mann, 2002a,b; 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). 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); although it has been pointed out in another study (Wells-Parker et al., 2002) that it only occurs when road rage is expressed through dangerous driving or through direct confrontation with other drivers.

Driving under the influence of alcohol (Butters et al., 2005; Fierro et al., 2011) has been associated with being a victim and/or a perpetrator of road rage, particularly for those individuals with alcohol related problems (measured according to a subscale of the AUDIT test) (Mann et al., 2004). As for drugs, driving under the influence of cannabis has been associated with being both victim and aggressor (Fierro et al., 2011); while the consumption of stimulants, particularly ecstasy, has been linked to the most severe forms of road rage (Butters et al., 2005, 2006). Cocaine has been linked, in particular, to being both victim and aggressor at the same time (Butters et al., 2005).

Nevertheless, these studies were carried out with the general population, without discriminating between whether the consumption of substances had been recreational or, on the other hand, whether there had been some problem of dependency. In a study carried out among 431 patients undergoing treatment for alcoholism (Yu et al., 2004), no connection was found between alcoholism and road rage, except among those who had driven while being drunk.

Drivers and non-drivers could be involved in road rage, and both were included in the study. While the role of drivers in road rage is easy to understand, it is harder to interpret the effects of passengers on traffic safety, but as noted by Shinar and Compton (2004), the presence or absence of passengers in the vehicle may influence the driver's degree of anger and forms of expression when driving. For example, the presence of older passengers has been associated with lower speeds, whereas young male passengers can have a "speeding-up" effect on young male drivers (Baxter et al., 1990). Both aspects, a propensity to drive faster and a tendency

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to drive more slowly, especially in fast-moving traffic, were signalled as possible causes of road rage, increasing the risk of collision involvement (Mann et al., 2007). On the other hand, road rage usually appears as an interactive process between victim and aggressor (Mann et al., 2007), including an exchange of verbal insults which may make the distinction between victim and aggressor more difficult, besides possibly involving both the driver of the vehicle and the passengers.

It seems reasonable to expect an increase in road rage among patients undergoing treatment for drug dependency (anxiety, hostility, etc.) with respect to the general population due to their special psychological characteristics and psychiatric co-morbidity (Hemenway et al., 2006), in addition to the possibility that, in some cases, these patients may continue to consume alcohol/drugs or, in other cases, they may be subject to withdrawal symptoms. Although an association between road rage and drug dependence disorder may well be expected, that is to say, expecting greater aggressiveness on the road among those patients who are drug-dependent; to date, this question has not been investigated, which is why the present study has been carried out. The aim of this paper is to analyse the prevalence of road rage among patients undergoing treatment for drug dependence and to establish a comparison with the general population.

2. Materials and methods

2.1. Participants and procedures

In the current study two datasets have been used: (i) The newly generated data base for patients on drug dependence treatment, and (ii) data from the Alcohol-Use and Drug-Use Survey of Castile and Leon, Spain.

2.1.1. Drug dependent patients

The number of patients required was determined according to data obtained from previous studies about road rage in the general population of Castile and Leon (Fierro et al., 2011). In this study, road rage was observed in 31.1% [95% CI = 29.3–32.9]. Initially, we hypothesized a 20% increment in the prevalence of road rage in drug dependent patients undergoing treatment as compared to the general population. A sample of 100 patients would be needed to detect these increases, so a randomized sample of 100 patients was finally interviewed. Notice that that the sample size "calculation" is for estimating "prevalence" for the whole sample only.

Non-drivers were included in the study as they could be involved in road-rage as victims and/or perpetrators (i.e., a passenger in a car involving road-rage behaviour). Road rage is frequent in the general population of Castile and Leon at 31.1% (drivers 44.4% and non-drivers 8.0%, either as victims and/or perpetrators) and is also associated with certain behaviour patterns related with the consumption of alcohol and drugs (Fierro et al., 2011).

The study was approved by the Clinical Research Ethics Committee of the University of Valladolid (CEIC code: Protocol 2011/7).

The study was carried out at the Valladolid Care Centre for Drug Dependents of the Spanish Red Cross, a medical centre accredited by the health authorities. The anonymity of the interviewees was guaranteed; the patients participated voluntarily; they were all aged over 18 and were undergoing outpatient treatment for drug dependence. The patients had been diagnosed by the team of physicians according to the criteria of the DSM-IV TR (American Psychiatric Association, 2000). The interviews were carried out between 01/02/2011 and 31/07/2011.

The patients were selected at random from among those who attended a weekly urine control (all the patients undergoing treatment in the centre have to have a weekly urine control to evaluate whether they are following the treatment correctly and to verify abstinence) and were in the first 12 months of treatment.

Information was gathered concerning the participants' sociodemographic factors: gender, age, driving licence, Kilometres driven annually, work activity, sports practised and potentially dangerous tasks carried out in the home. Clinical aspects of the patients enrolled in the study, such as the primary substance for which substance dependence treatment was started, and other drugs consumed, length of treatment, etc., were also recorded. It should be noted that the centre where patients were enrolled was mainly a centre for substance dependence, the inclusion of alcohol dependent patients who usually go to a specific alcohol clinic being infrequent.

2.1.2. Data from the Alcohol-Use and Drug-Use Survey of Castile and Leon, Spain 2008 (Álvarez and Fierro, 2010)

The database of Alcohol-Use and Drug-Use Survey of Castile and Leon (Spain 2008; Álvarez and Fierro, 2010) has been used to contrast our hypothesis about sample size and compare results on road rage (Fierro et al., 2010, 2011). This database was used to obtain prevalence data about road rage and serious perpetrations among the total sample and among those who had taken any drug in the previous year. These later prevalence data had not been analyzed in our previous studies.

Data was collected using the Alcohol-Use and Drug-Use Survey of Castile and Leon, 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 this survey, the same questions regarding road rage as in the current study were addressed. The participants were selected at random from a representative sample of Castile and Leon 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. People from 14 to 70 years of age living in Castile and Leon, Spain, were the target population. A final sample of 2500 valid interviews was selected, 51% ($n = 1276$) were males and 49% ($n = 1224$) females. 63.6% ($n = 1591$) drove vehicles and 36.4% ($n = 909$) did not drive.

2.2. Road rage questionnaire

There are various questionnaires designed to measure road rage. Among those most commonly used are: the Propensity for Angry Driving Scale – PADS (DePasquale et al., 2001), which identifies drivers more likely to participate in acts of road rage; the Driving Anger Scale – DAS (Deffenbacher et al., 1994), which measures the propensity to experience rage while driving; the Driving Anger Expression Inventory – DAX (Deffenbacher et al., 2002), which measures the way of expressing anger while driving; and finally, the indicators from a taxonomy of road-rage behaviour developed by Smart et al. (2004, 2005), which quantify how frequently someone has been involved in road rage as a victim or a perpetrator over the previous 12 months. Our study used the latter for its ease of administration, having only eight items in the questionnaire; while also allowing the results obtained to be compared with the majority of previous studies on road rage and substance use (Butters et al., 2005, 2006; Mann et al., 2004), having been the most widely used instrument for measuring this phenomenon.

Road rage experience and behaviour 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 previous 12 months, "someone in another vehicle (a) shouted, cursed, or made rude gestures at you or others with you; (b) threatened to hurt you or others with

Table 1
Characteristics of the substance dependent patients included in the study.

Variables		Driver		Statistic
	Total (n = 100) %(n) [95% CI]	Yes (n = 45) % (n) [95% CI]	No (n = 55) % (n) [95% CI]	Pearson Chi-square
Gender				$\chi^2 = 4.456$, $p = 0.035$
Male	85.0 (85) [78–92]	93.3 (42) [86–101]	78.2 (43) [67.3–89.1]	
Female	15.0 (15) [8–22]	6.7 (3) [0.6–14]	21.8 (12) [10.9–32.1]	
Age group				$\chi^2_4 = 5.999$, $p = 0.199$
14–19	2.0 (2) [0.7–4.7]	0.0 (0)	3.6 (2) [1.3–8.6]	
20–29	12.0 (12) [5.6–18.4]	13.3 (6) [3.4–23.3]	10.9 (6) [2.7–19.1]	
30–39	36.0 (36) [26.6–45.4]	46.7 (21) [32.1–61.2]	27.3 (15) [15.5–39]	
40–49	44.0 (44) [34.3–53.7]	35.6 (16) [21.6–49.5]	50.9 (28) [37.7–64.1]	
50–59	6.0 (6) [1.35–10.7]	4.4 (2) [1.6–10.5]	7.3 (4) [0.4–14.1]	
Education				$\chi^2_2 = 5.635$, $p = 0.060$
Middle school or less	76.0 (76) [67.6–84.4]	68.9 (31) [55.4–82.4]	81.8 (45) [71.6–92]	
Bachelor's degree or equivalent	20.0 (20) [12.2–27.8]	22.2 (10) [10.1–34-4]	18.2 (10) [8–28.4]	
University studies	4.0 (4) [0.2–7.8]	8.9 (4) [0.6–17.2]	0.0 (0)	
Employment				$\chi^2 = 12.402$, $p < 0.001$
Employed	29.0 (29) [20.1–37.9]	46.7 (21) [32.1–61.2]	14.5 (8) [5.2–23.9]	
Not employed	71.0 (71) [62.1–79.9]	53.3 (24) [38.8–67.9]	85.5 (47) [76.1–94.8]	
Substance dependence for which treatment was started				$\chi^2_4 = 3.330$, $p = 0.344$
Heroin + cocaine	41.0 (41) [31.4–50.6]	42.2 (19) [27.8–56.7]	40.0 (22) [27.1–52.9]	
Heroin	39.0 (39) [29.4–48.6]	33.3 (15) [19.6–47.1]	43.6 (24) [30.5–56.7]	
Cocaine	10.0 (10) [4.1–15.9]	15.6 (7) [5–26.1]	5.5 (3) [0.5–11.5]	
Other	10.0 (10) [4.1–15.9]	8.9 (4) [0.6–17.2]	10.9 (6) [2.67–19.1]	
Treatment				$\chi^2_2 = 4.241$, $p = 0.120$
Methadone maintenance programme	71.0 (71) [62.1–79.9]	64.4 (29) [50.5–78.4]	76.4 (42) [65.1–87.6]	
Drug-free treatment	18.0 (18) [10.5–25.5]	26.7 (12) [13.7–39.6]	10.9 (6) [2.7–19.1]	
Psychoactive drugs	11.0 (11) [4.9–17.1]	8.9 (4) [0.6–17.2]	12.7 (7) [3.9–21.5]	

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 previous 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".

Taking these items into account, we calculated the percentage of patients that had had *some experience of road rage* in the previous 12 months, whether as a victim, an aggressor or both. The patients in this group were then divided into subgroups: (a) *Only victims*, if they had responded affirmatively to at least one of the questions in this series, but not to those of the perpetration series; (b) *Only perpetrators*, in the inverse case and; (c) *Victims and perpetrators*, if they had responded affirmatively to at least one question in each series. Furthermore, the perpetrators were divided (independently of whether they were also victims or not) (Mann et al., 2007) into "low" perpetrator or showing "aggressive driving" and "serious" perpetrators. It is considered that a person is a "low" perpetrator or shows "aggressive driving" when he/she responds affirmatively only to the question about whether he/she has shouted, insulted or made gross gestures to a driver or passenger of another vehicle, but not to the rest of the road rage perpetration series; while the connotation of "serious" perpetrator is reserved for those who responded affirmatively to any of the last three items of this series. The database of Alcohol-Use and Drug-Use Survey of Castile and Leon (Álvarez and Fierro, 2010) was reanalyzed to obtain prevalence data about road rage and serious perpetrations in consumers of any drug (with or without alcohol) in the previous year.

2.3. Data analysis

The programme PASW Statistics 18 was used to analyse the information gathered. The results are shown as percentages (and 95% Confidence Intervals, 95% CI) or means ± SD. For categorical variables, group comparisons were conducted employing the Chi-square test. Fisher's exact statistic is reported when, in 2×2 cross-tables, cell counts fell below expected values. For continuous variables (age and km driven), group comparisons were conducted employing the independent samples Mann–Whitney U-test. Statistical significance was defined by $p \leq 0.05$.

3. Results

Table 1 shows the sociodemographic characteristics, the substance consumption patterns, treatment and driving patterns of the patients who participated in the study. 100 patients were included in the study, mainly cocaine and heroin dependents (n = 41) and heroin only dependents (n = 39). 10 patients began the treatment for cocaine only dependence and another 10 were dependent on other drugs (cannabis, alcohol, medicaments, amphetamines, etc.). The majority were males (85%). The mean age (±SD) being 38.2 ± 8.4 years, which was similar for males and females (Mann–Whitney U-test = 709.0, $p > 0.05$). A great percentage had middle school studies (complete or incomplete), and 71% were not working. As for the treatment itself, over 2/3 were on the Methadone Maintenance Programme. 45% of the sample was drivers, more frequently males ($p < 0.05$) and workers ($p < 0.001$). The mean km driven annually was 22,922 ± 38,966 km (for gender, Mann–Whitney U-test = 47.5, $p > 0.05$)

63% of the patients had had some experience of road rage in the previous 12 months (Table 2), either as a victim, a perpetrator or both. Of these, 11% were only victims, 4% only perpetrators and 48% both victims and perpetrators. 52% were perpetrators, 34% of whom were "low" perpetrators and 18% "serious" perpetrators. No significant differences were found with respect to age, educational level or work situation. Serious road rage occurred more frequently among males (21.2%) than among females (0%; $p < 0.05$).

Drivers (91.1%) experienced some form of road rage in the previous year with a greater frequency than non-drivers (40%; Table 2); while the percentage of drivers who were both victims and perpetrators at the same time was triple that of the non-drivers (75.6% vs. 25.4%). The "low" perpetrators among the drivers were practically double (46.7%) the percentage among the non-drivers

Table 2
Road rage among substance dependent patients in treatment.

During the last 12 months...		Driver		Statistic
	Total (n = 100) % [95% CI]	Yes (n = 45) (%) [95% CI]	No (n = 55) (%) [95% CI]	Pearson Chi-square
Road rage: yes (victim and/or perpetrator)[a]	63.0 [53.5–72.5]	91.1 [82.8–99.4]	40.0 [27.1–52.9]	χ^2 = 27.737, p < 0.001
Only victim[a]	11.0 [4.9–17.1]	13.3 [3.4–23.3]	9.1 [1.5–16.7]	χ^2 = 0.455, p = 0.536[b]
Only perpetrator[a]	4.0 [0.2–7.8]	2.2 [2.1–6.5]	5.5 [0.5–11.5]	χ^2 = 0.673, p = 0.625[b]
Both victim and perpetrator[a]	48.0 [38.2–57.8]	75.6 [63–88.1]	25.4 [13.9–37]	χ^2 = 24.890, p < 0.001
"Low" perpetrator[a]	34.0 [24.7–43.3]	46.7 [32.1–61.2]	23.6 [12.4–34.9]	χ^2 = 5.850, p = 0.016
"Serious" perpetrator[a]	18.0 [10.5–25.5]	31.1 [17.6–44.6]	7.3 [0.4–14.1]	χ^2 = 9.529, p = 0.002

[a] Results (percentages) for alternative answer have been omitted in the table but considered for the statistic.
[b] p for Fisher's exact test.

(23.6%), and the "serious" perpetrators more than four times the percentage (31.1% vs.7.3%).

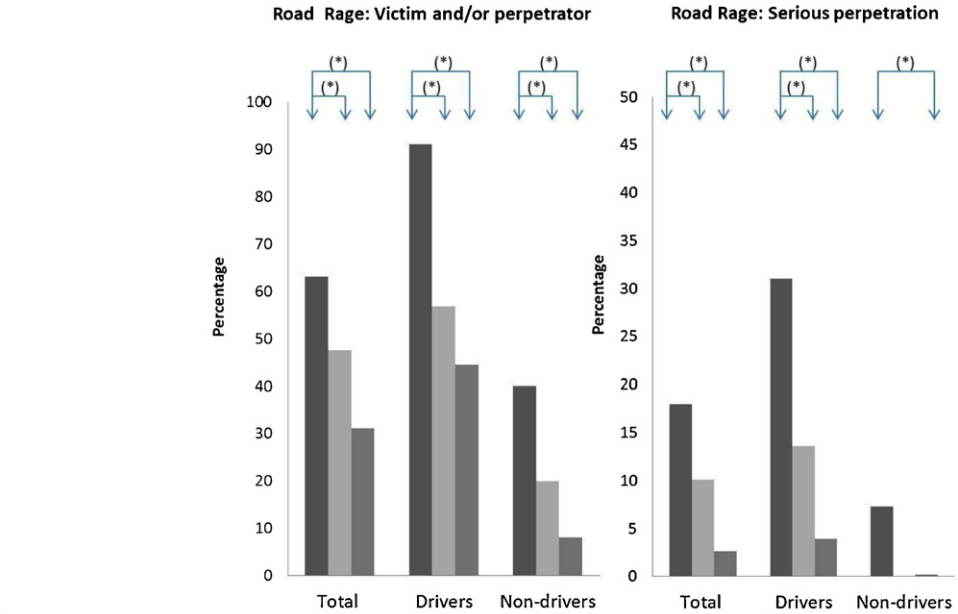
Road rage was higher among drug dependent patients than either the general public or those who had taken some kind of drug in the previous year (Fig. 1). This applies to both drivers and non-drivers. As for serious road rage, the trend was similar: 18% among drug dependent patients, 10.1% among those who had taken drugs in the previous year and 2.6% among the general public (Fig. 1). This also applies to drivers and, to some extent, to non-drivers.

9 out of 10 cocaine dependent patients referred to having experienced road rage in the previous 12 months (Table 3). This percentage was 70.7% among those who were dependent on cocaine + heroin, 51.3% among those dependent on heroin and 50.0% among those dependent on other drugs. The high percentage of serious perpetrators among those who were undergoing treatment for cocaine (4 out of 10) and those undergoing treatment for cocaine + heroin (22%) must be noted.

4. Discussion

This study shows that nearly two out of three patients in treatment for their drug dependency have reported road rage in the previous year. This frequency is higher than those reported for the general population, even when comparing with consumers of drugs in the previous year. The percentage of "serious" perpetrators was worth noting. In studies carried out in Canada in 2001 and 2003, 47.5% and 40.6% of the population, respectively, admitted having had experience of road rage during the previous year, 31.0% and 33.2% being perpetrators for each year (Smart et al., 2005).

Fierro et al. carried out a study of the general population of Castile and Leon, in which 31.1% of those interviewed admitted having had experience of road rage over the previous 12 months (Fierro et al., 2010). In this current study, carried out with drug dependent patients from the same geographical region, the percentage of patients who had experienced road rage (63%) was double the previous one. Perpetrators reached 52%; of whom the "low" perpetrators (34%) were approximately double those from the study of the general population (17.6%); while the percentage of "serious" perpetrators (18%) was almost 7 times greater than the other (2.6%). In other studies of the general population of Canada (Smart et al., 2003), the percentage of low perpetrators (31.7%) was not that different from that of our patients (34%), but in the case of the serious perpetrators, the difference was similar



	Road Rage: Victim and/or perpetrator				Road Rage: Serious perpetration		
	Total	Drivers	Non-drivers		Total	Drivers	Non-drivers
Drug dependent patients	63.0	91.1	40.0		18.0	31.0	7.3
General population (Drug consumers previous year)	47.5	56.8	20.0		10.1	13.6	0.0
General population (Total)	31.1	44.4	8.0		2.6	3.9	0.2

Fig. 1. Prevalence of road rage and serious perpetration in dependent patients under treatment, and in the general population, and those who refer to drug use in the previous year. Results for alternative answers ("no road rage" and "no serious perpetration"), have not been presented in the figure but considered for the statistic. Statistical significances ($p \leq 0.05$) of Chi-square tests marked as (*).

Table 3
Road rage according to the substance for which they were being treated.

During the last 12 months...		Substance dependence				Statistic
	Total ($n=100$) (%) [95% IC]	Heroin ($n=39$) (%)[95% IC]	Cocaine ($n=10$) (%)[95% IC]	Heroin + cocaine ($n=41$) (%)[95% IC]	Other ($n=10$) (%)[95% IC]	Pearson Chi-square
Road rage: yes (victim and/or perpetrator)[a]	63.0 [53.5–72.5]	51.3 [35.6–67]	90.0 [71.4–109]	70.7 [56.8–84.7]	50.0 [19–81]	$\chi^2_3 = 7.201$, $p = 0.066$
Only victim[a]	11.0 [4.9–17.1]	5.1 [1.8–12.1]	0.0	19.5 [7.4–31.6]	10.0 [8.6–28.6]	$\chi^2_3 = 5.654$, $p = 0.130$
Only perpetrator[a]	4.0 [0.2–7.8]	5.1 [1.8–12.1]	10.0 [8.6–28.6]	2.4 [−2.3 to 7.2]	0.0	$\chi^2_3 = 1.744$, $p = 0.627$
Both victim and perpetrator[a]	48.0 [38.2–57.8]	41.0 [25.6–56.5]	80.0 [55.2–105]	48.8 [33.5–64.1]	40.0 [9.6–70.4]	$\chi^2_3 = 5.129$, $p = 0.163$
"Low" perpetrator[a]	34.0 [24.7–43.3]	33.3 [18.5–48.1]	50.0 [19–81]	29.3 [15.3–43.2]	40.0 [9.6–70.4]	$\chi^2_3 = 1.718$, $p = 0.633$
"Serious" perpetrator[a]	18.0 [10.5–25.5]	12.8 [2.3–23.3]	40.0 [9.6–70.4]	22.0 [9.3–34.6]	0.0	$\chi^2_3 = 6.617$, $p = 0.085$

[a] Results (percentages) for alternative answer have been omitted in the table but considered for the statistic.

to that already mentioned (2.1% as opposed to 18% in our patients).

We find a high prevalence of habitual drivers among patients undergoing treatment for substance dependence (45%). As expected, road rage was closely related to the fact of being a driver. Those who did not drive any vehicle can have experienced it, but to a much lesser degree. Clearly, it is drivers who are much more likely to be involved in road rage situations, and thus have the higher percentages. Very significant differences were also observed among the general population between drivers and non-drivers for road rage in its many different forms (Fierro et al., 2010, 2011). Even so, the percentages found in our patients were, in all cases, much higher than those of the general population, for both drivers and non-drivers.

When reanalysing the data for the general population, and considering those who reported drug use within the previous year, we have observed a progression in road rage/serious perpetrators in relation with substance use: figures are higher for those who are dependent than for those who refer to some kind of drug use in the previous year, and finally the general population.

Although there are factors, such as that of being a driver, which are closely related with road rage, it is also clear that there is a relationship between substance use and road rage. Fierro et al. found that a driver under the influence of cannabis, or alcohol and cannabis, was associated with being a victim and a perpetrator of road rage (Fierro et al., 2011). Butters et al. found an association between the consumption of cannabis in the previous 12 months and experience as a victim and a perpetrator, but not as a "frequent perpetrator" (Butters et al., 2005, 2006). As for cocaine, its consumption in the previous 12 months was associated with experiencing road rage as both a victim and a perpetrator (Butters et al., 2005).

Road rage, and especially "serious" road rage, was frequently found among cocaine and cocaine + heroin dependent patients. The study was not designed to assess differences regarding substance use type, and therefore, this relevant finding should be confirmed in later studies. In any case, before drawing conclusions concerning the consumption of substance type and its relationship to road rage, it is necessary to consider the matter carefully and to remember that patients undergoing treatment have relapses and sporadic periods of consumption in which they can consume the substance for which treatment started, or other substances.

The association between the consumption of illicit drugs and road rage could be explained by a direct pharmacological effect. There is important evidence in the literature relating stimulants with aggressive behaviour (Cherek et al., 1987; Moss and Tarter, 1993; Reiss and Roth, 1993; Smart et al., 1997). In some cases, road rage could be possible due to the fact that the patients were experiencing withdrawal symptoms. Nevertheless, there are alternative explanations for this association. It is possible that those individuals who report frequent aggressive behaviour on the roads share factors of a social nature or personality traits that also link them to the consumption of drugs (Mann et al., 2004). In other words, the use of these substances could, in some way, lead to road rage; or both behaviour patterns could share a common origin, as suggested by the Theory of Problematic Behaviour (Donovan and Jessor, 1985), according to which there would be an underlying causal mechanism that could explain a wide range of activities that involve taking risks. Serious perpetrators of road rage could be individuals immersed in an aberrant lifestyle, which may include relatively frequent law-breaking and a general indifference to legal sanctions (Donovan and Jessor, 1985). For these individuals, road rage would simply be a manifestation of their general propensity towards anti-social and criminal conduct.

The present study has some limitations which should be pointed out. Firstly, the study has included a limited number of patients to test whether drug dependent patients have higher figures for road rage than the general population; so the findings should be confirmed in later studies. On the other hand, it is based on self-reported data concerning road rage, rather than information from an objective source, such as traffic camera video recordings. Thus, the patients' answers cannot be verified. In addition, self-reporting can lead to over-estimations or omissions, especially when the information being asked for is some time in the past (some of the questions refer to facts that could have taken place up to 12 months prior to the interview). However, others have reported good validity for self-evaluation information among drug users (Harrison and Hughes, 1997). Furthermore, over or under reported road rage could be biased towards social desirability. Other limitations are that, due to the descriptive design of the study, causal relationships cannot be inferred, while the test on road rage, although used in previous studies, was not validated in the population in which the study was carried out.

The relationship between the consumption, abuse of and/or dependence on substances and road rage undoubtedly needs to be explored more extensively. The understanding of the underlying mechanisms through which these behaviour patterns are associated with each other is of great importance and will allow us to tailor legislation and treatment to the patients' real situation. Furthermore, patients included in the study were under treatment. We have no information about the occurrence of road rage in substance dependents without treatment, and whether simply entering treatment has any effect, or not, on road rage.

5. Conclusion

The present study shows that road rage is very frequent among patients undergoing treatment for substance dependence, in particular the most severe form ("serious perpetrators"), and that, in spite of the treatment being carried out, the percentages of the different forms of road rage are far higher than those for the general population. Considering that road rage has been related with a greater incidence of traffic accidents (Mann et al., 2007), these patients make up an important target group for the prevention of road traffic accidents. Health professionals and policy makers should be aware of this, and implement appropriate measures to reduce and avoid this type of behaviour. The involvement of health service personnel from the treatment centres is essential, not only to give information about the risks of such behaviour, but especially in designing the treatment programmes, since the effectiveness of such psychological intervention programmes in drivers committing acts of road rage has already been demonstrated (Galovski and Blanchard, 2004). The possibilities for developing road rage preventive measures have been reviewed recently (Asbridge et al., 2006), and actions at legal, judicial (court-based programmes), car redesign, mass-media campaigns, and changes in society, have all been proposed.

Conflict of interest

The authors declare that no conflict of interest exists.

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