DRINK-DRIVING

Why Drivers Start Drinking and Driving—A Prospective Study Over a 6-Year Period in the GAZEL Cohort

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Abstract — Aims: To estimate the frequency with which a group of formerly safe drivers adopt driving while alcohol-intoxicated (DWI), and to determine the factors associated with DWI adoption. Methods: Participants were current employees or recent retirees of the French national electricity and gas company. An annual cohort questionnaire that includes two questions about overall alcohol consumption is sent each year to participants. A Driving Behaviour and Road Safety (DBRS) questionnaire was administered in 2001, 2004 and 2007. Only drivers who participated in the 2001 survey received the 2004 and 2007 questionnaires. Results: More than 462 participants ceased DWI between 2001 and 2007, while 511 adopted this behaviour for the first time. Multivariate analysis showed that the risk of adopting DWI was associated with male gender and with several changes over the preceding years: increased alcohol consumption, increased number of close friends, decreased number of close relatives and decreased attitudes in favour of strict enforcement/regulations. Conclusion: A large number of offenders stopped DWI between 2001 and 2007, concomitantly with an increased crackdown on road violations in France. But this success was compromised by the occurrence of new drunk drivers. Preventive strategies should target factors that facilitate DWI adoption—in particular, increased alcohol consumption and low acceptance of law enforcement initiatives.

INTRODUCTION

In France, significant law enforcement initiatives were undertaken in 2002 to reduce traffic violations and related-risk behaviours. Speed control efficiency has markedly improved, with the widespread use of laser binocular and automatic speed radars. Regarding alcohol, penalties for drunk drivers were increased, the number of random breath tests rose by 35% (from 6.6 to more than 9.0 million between 2001 and 2007) and violations for driving while alcohol-intoxicated (DWI) doubled over the same period. Police forces were ordered in 2002 to put an end to traffic penalty cancellations, which tended to occur frequently when the offender had connections with the government or police force (Lagarde et al., 2004b).

Several studies have examined the factors related to dangerous driving behaviour or crash involvement, by comparing offenders with the general population. Evidence shows that male gender (Kirkham and Landauer, 1985; Massie et al., 1997), occupational category (Harrison, 1998), high alcohol consumption (Furr-Holden et al., 2009), negative attitudes towards road safety, higher social support for DWI (Bingham et al., 2007) and depression (Hubicka et al., 2009) are associated with DWI. However, cross-sectional designs ignore the possibility of behaviour change over time, while behaviour changes constitute a key issue for evaluating road prevention initiatives. Exposure to driving as well as factors affecting DWI are also likely to vary over time.

Attitudes towards traffic have been found to correlate with aggressive driving behaviour, speeding and self-reported accident involvement (Parker and Manstead, 1996; West and Hall, 1997; Parker et al., 1998; Nabi et al., 2007). We showed in a previous paper that repressive measures taken by the government led to an increasing acceptance of restrictions, and that a majority of subjects remained, in the long run, in favour of strengthening restrictions related to speeding and drunk driving (Constant et al., 2008). It is still unclear whether or not these changes have affected DWI, since changes in DWI have not been thoroughly investigated.

French national statistics indicate that the percentage of drivers who tested positive for blood alcohol content (BAC) increased between 2001 and 2007. Unlike speeding, DWI offenders cannot be detected through automated devices, thus limiting the probability of being cited (Beck et al., 2009). Strengthening enforcement proved to be ineffective. The results of our previous research in the GAZEL sample were consistent with this trend: the percentage of drunk drivers in our study population increased from 22.9 to 25.3% between 2001 and 2007, while speeding decreased on all types of roads (Constant et al., 2010).

Two explanations might account for this result: either the deterrent effect of law enforcement was insufficient and most drunk drivers continued the practice, or a substantial number of drunk drivers stopped, but a greater number adopted DIW over the same period.

While stopping DWI might be interpreted as a success of prevention initiatives, the adoption of DWI compromises efforts to improve road safety. Investigating the shift from sober to drunk driving and identifying the predicting factors is essential to design prevention strategies. We conducted a prospective study in a large cohort of French employees and retirees to study the adoption of DWI by a group of formerly safe drivers. The specific objectives were: (a) to estimate frequencies of DWI change between 2001 and 2007; and (b) to determine factors associated with the adoption of consistent DWI, defined as DWI in 2004 and 2007 among drivers who reported no DWI in 2001.
METHODS

Participants were current employees or recent retirees of the French national electricity and gas company, Electricité De France–Gaz De France (EDF-GDF), who volunteered to participate in a research cohort, known as the GAZEL cohort, under strict conditions of anonymity. The GAZEL cohort was established in 1989 and originally included 20,624 EDF-GDF workers, men aged 40–50 and women aged 35–50 at baseline. Since 1989, this cohort has been followed up yearly. The objectives and methods have been described in detail elsewhere (Goldberg et al., 1990, 2007; Melchior et al., 2009). All participants received an information letter describing the objectives of the study, the protocol of which was approved by the French National Review Board (Commission Nationale Informatique et Liberté).

A Driving Behaviour and Road Safety (DBRS) questionnaire was approved in 2001 and administered three times—in 2001, 2004 and 2007 (Lagarde et al., 2004a). Only drivers who participated in the 2001 survey received the 2004 and 2007 questionnaires. Participants were asked to estimate their frequency of driving while alcohol-intoxicated over the past 12 months by responding to the following question: ‘How many times in the last year did you take the wheel after having drunk too much alcohol?’ (Never, a few times a year, once a month or more). Attitudes towards traffic safety were assessed by asking participants whether they agreed or disagreed with a set of 12 statements, referring to two topics related to traffic safety and currently debated in France, namely, (a) ‘relaxing existing regulations’ (six items), reflecting a belief that current traffic regulations are too restrictive, and therefore should be relaxed and (b) ‘increased enforcement/stricter regulations’ (six items), reflecting a belief that current traffic regulations and law enforcement are not severe enough and therefore should be reinforced. Spearman–Brown split-half coefficients indicated a moderate internal consistency for each dimension (0.59 and 0.60, respectively). All items are listed elsewhere (Constant et al., 2008). Agreement for each attitude towards road safety was assessed by adding up the number of affirmative responses within each topic to reach a summary score (range 0–6).

As part of the routine yearly follow-up, the participants were asked about their annual mileage (in kilometres) and two aspects of their alcohol consumption: the number of drinking days per week (‘during the last week, on how many days did you drink alcohol?’) and the maximum number of drinks per drinking day [‘during the last week, what is the maximum number of drinks (beer, wine and liquor) you had in a single day?’]. (The French ‘drink’ is usually deemed to contain about 10 g ethanol.) Depressive symptoms were assessed in 2001 and 2004 using the French version of the Center for Epidemiologic Studies Scale (CES-D). Participants were considered to be depressed if they scored 17 or higher, in accordance with standards of the CES-D French version (Fuhrer and Rouillon, 1989).

Measurements of social networks, obtained through the 1991 and 2004 self-administered questionnaires, included items taken from the New Haven EPESE study (Seeman and Berkman, 1988) and translated into French (Melchior et al., 2003). The size of social networks was measured by two questions: assessing the number of close friends (‘how many close friends do you have, i.e. people you feel at ease with, can talk to about private matters, and can call on for help?’) and the number of close relatives (‘apart from your children, how many other relatives do you have that you feel close to?’). Responses were coded on a 5-point scale (1 = none; 2 = 1–2; 3 = 3–5; 4 = 6–9; 5 = 10 or more).

Socio-demographic data from the cohort database included gender, year of birth (1939–1943, 1944–1948 and 1949–1953) and occupational category (unskilled worker, skilled worker and manager).

Statistical analyses

Participants were considered as adopting DWI if they reported DWI in 2004 and 2007 but not in 2001, and as ‘safe drivers’ if they never reported DWI. Participants were considered as ‘stopping DWI’ if they reported DWI in 2001 but neither in 2004 nor in 2007, and as ‘maintaining DWI’ if they reported DWI in all three surveys. Participants having exhibited other behavioural patterns (for instance, DWI in 2004 but not in 2001 and 2007) were excluded from the analyses, since the changes were considered unstable.

Alcohol intake was expressed as drinks per weeks for years 2001 and 2004. Participants were classified into three categories according to the changes in their alcohol consumption between 2001 and 2004, namely: ‘decrease’ or ‘increase’ if they decreased or increased their alcohol consumption by more than one drink/week; and ‘unchanged’ if they maintained the same alcohol consumption ± 1 drink per week. A change in driving mileage was considered as significant if mileage increased or decreased by at least 5000 km in 2004 when compared with 2001.

Changes regarding attitudes towards road safety were considered as significant if the scores in 2004 increased/decreased by at least two units (on a 7-point scale), compared with 2001. For social networks, changes were considered as significant if the scores in 2004 increased/decreased by at least 1 unit (on a 5-point scale), compared with 1991. Changes in depression status (CES-D score ≥17 vs. ≤16) were assessed by comparing the scores in 2004 with those in 2001.

Since our study outcome was binomial, we used logistic regression models to estimate the odds ratios (ORs) of adopting DWI in 2004 and 2007 as a function of gender and factor changes in the preceding period (2001–2004). In order to address the potential confounding effect of each factor, we used two series of models. First, the association of gender and of each factor change with the risk of adopting DWI was assessed separately (models 1; one model per factor). Baseline factor values, year of birth (three categories: 1939–1943, 1944–48 and 1949–1953) and occupation (three categories: unskilled workers, skilled workers and managers) were also included in the analysis as potential confounding variables. Then, all variables significantly associated with the risk of adopting DWI in models 1 were included in a single multivariate analysis (model 2), with adjustment on the same set of potential confounders as for models 1.

RESULTS

As already reported by Constant et al. (2010), of the 11,240 participants who sent back the 2001 and 2004 DBRS questionnaire and who were still driving a motorized vehicle in
Why drivers start drinking and driving

2004, 9837 (87.5%) returned the 2007 questionnaire. Those who reported having stopped driving in 2007 (n = 263), and those who did not answer questions about DWI either in 2001, 2004 or 2007 (n = 265), were excluded from this study, yielding a sample of 9309 participants.

In 2001, 2171 participants reported DWI. Of these, 462 (21.3%) reported no DWI in 2004 and 2007 and were considered as having stopped DWI, while 1150 (53.0%) continued the practice. The remaining 559 participants (25.7%) exhibited other behavioural change patterns.

In 2001, 7138 participants did not report DWI. Of these, 511 (7.2%) reported DWI in 2004 and 2007 and were considered as adopting DWI, while 5710 (80.0%) remained ‘safe drivers’. The remaining 917 participants (12.8%) exhibited other behavioural change patterns.

The ‘safe drivers’ and ‘DWI adopters’ were selected for the present phase of the study into the predictors of change to DWI (n = 6221). Participants’ characteristics and changes between 2001 and 2004 are shown in Table 1. Most respondents were males (71.8%) and skilled workers (58.5%). The CES-D score exceeded the cut-off for depression in 16.9% of participants in 2001, and in 15.1% in 2004. Between 2001 and 2004, the number of drinks per week increased from 8.83 to 9.04 (P < 0.001), the maximum number of drinks per occasion rose from 3.70 to 3.78 (P < 0.001), while the annual mileage decreased from 16,368 to 13,495 km (P < 0.001).

The average score reflecting support for relaxing current regulations decreased from 1.44 in 2001 to 1.05 in 2004, which represents a 27% decrease (P < 0.001). The average score reflecting support for increased enforcement/stricter regulations decreased slightly from 3.66 in 2001 to 3.46 in 2004, which represents a 5% decrease (P < 0.001).

Non-parametric paired tests showed that the average score assessing the number of close friends increased from 2.74 in 1991 to 2.86 in 2004 (P < 0.001), while the average score assessing the number of close relatives did not change over the same period (3.19 vs. 3.21, P > 0.05).

In models 1, the risk of adopting DWI increased significantly with male gender, manager status and with several changes in factors from the preceding years: increased alcohol consumption, increased number of close friends, decreased number of close relatives and decreased attitudes in favour of strict enforcement/ regulations (Table 2). The risk of adopting DWI decreased significantly with reductions in driving mileage and increased attitudes in favour of stricter enforcement/regulations. When adjusted for the potential confounding effect of each factor on the others (model 2), the risk of adopting DWI was associated with: male gender, increased alcohol consumption, increased number of close friends, decreased number of close relatives and decreased attitudes in favour of stricter enforcement/ regulations.

**DISCUSSION**

DWI behaviour was adopted by 511 employees in the study period. Multivariate analysis showed that the risk was associated with male gender and with several changes in factors from the preceding years: increased alcohol consumption, increased number of close friends, decreased number of close relatives and decreased attitudes in favour of stricter enforcement/ regulations.

Heavy alcohol consumption and depression have been reported as risk factors for DWI in numerous studies (Beer et al, 1988; Furr-Holden et al, 2009). Many of these studies, however, included ‘hardcore’ drunk drivers, repeat offenders (Nocha and Stasiewicz, 2006) and young inexperienced drivers (Impinen et al, 2009), who are not representative of the general population in terms of alcohol use and driving behaviours. Moreover, as alcohol use and depression are often strongly correlated, it is difficult to distinguish their relative contributions to DWI (Lapham et al, 2001, 2006). In our study, overall alcohol consumption remained at moderate levels, with less than 1.3 drinks per day on average in 2004. But the maximum number of drinks per occasion was high (3.78 drinks on average). Accordingly, increased alcohol consumption had a significant impact on the adoption of DWI, while changes in depression status did not. These results suggest that, among drivers exempt from severe alcohol and psychological issues, adopting DWI is associated only with changes in alcohol consumption.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Change between 2001 and 2004 n (%)</th>
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<tbody>
<tr>
<td>Depressive state (CES-D) n = 5584</td>
<td>Unchanged 4814 (86.2)</td>
</tr>
<tr>
<td>Alcohol consumption (in drinks/week) n = 5959</td>
<td>Unchanged 2508 (42.1)</td>
</tr>
<tr>
<td>Annual mileage (in kms) n = 5833</td>
<td>Unchanged 3006 (51.5)</td>
</tr>
<tr>
<td>Attitudes towards road safety</td>
<td>Unchanged 4532 (80.2)</td>
</tr>
<tr>
<td>Relaxing existing regulations n = 5649</td>
<td>Decreased 870 (15.4)</td>
</tr>
<tr>
<td>Increased enforcement/stricter regulations n = 5582</td>
<td>Increased 247 (4.4)</td>
</tr>
<tr>
<td>Social network</td>
<td>Unchanged 3991 (71.6)</td>
</tr>
<tr>
<td>Number of close friends in general n = 5606</td>
<td>Decreased 941 (16.9)</td>
</tr>
<tr>
<td>Number of close relatives in general n = 5588</td>
<td>Increased 647 (11.5)</td>
</tr>
<tr>
<td>Gender n = 621</td>
<td>Female 1755 (28.2)</td>
</tr>
<tr>
<td>Occupation n = 6193</td>
<td>Male 4466 (71.8)</td>
</tr>
<tr>
<td>Unskilled workers</td>
<td>Unskilled workers 978 (15.8)</td>
</tr>
<tr>
<td>Skilled workers</td>
<td>Skilled workers 3620 (58.5)</td>
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<tr>
<td>Managers</td>
<td>Managers 1595 (25.8)</td>
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</tbody>
</table>
In many countries, the number of drinking occasions was increasing the number of drinking before driving occasions. The size of the close friends between 1991 and 2004, and conversely lower industrialized countries. Our results support this hypothesis: drinking alcohol before and during dinner with friends and family and at their driving, except on rare occasions. Drinking alcohol drivers manage to dissociate their usual alcohol intake from their driving, and phoning while driving (Nabi et al., 2006). DWI is reported in our study population as a rare event few times a year. In the European Union, it is estimated that only 1% of journeys are associated with an illegal BAC (SafetyNet, 2009). It is thus likely that most drivers manage to dissociate their usual alcohol intake from their driving, except on rare occasions. Drinking alcohol before and during dinner with friends and family and at social events is common practice in France and several other industrialized countries. Our results support this hypothesis: the risk of DWI was higher among participants who gained close friends between 1991 and 2004, and conversely lower among those who lost close friends over the same period (when compared with those with no change). The size of the social network might be correlated with the risk of DWI, by increasing the number of drinking before driving occasions. In many countries, the number of drinking occasions was associated with negative consequences independently of the volume consumed (Kuntsche et al., 2008). The picture is different when it comes to family: participants who lost relatives between 1991 and 2004 were at a higher risk of DWI. One possible explanation is that a reduced family network reflects changes in marital status such as separation, divorce and widowhood, which are risk factors for alcohol abuse and DWI (McCormack, 1985; C’De Baca et al., 2001; Overbeek et al., 2006).

In France, attitudes towards road safety changed to reflect better acceptance of traffic regulations between 2001 and 2004 (Constant et al., 2008). These changes are all the more crucial since attitudes towards road safety have a significant influence on risk behaviours (Constant et al., 2009). In the present study, a decline in support for enforcement between 2001 and 2004 was associated with an increased risk of subsequent DWI adoption, suggesting that drivers who became upset with law enforcement were more likely to adopt DWI, and/or that drivers intending to drink-drive take a negative attitude to enforcement. Internalization of social norms requires understanding why they are of value or why they make sense (Etzioni, 2000). Better acceptance of preventive measures, which are increasingly implemented in France, is therefore required to ensure further improvement of road safety. Our results suggest that DWI may be driven by a combination of adverse life events or living conditions and positive experiences such as dinner with close friends. This might explain why it seems so difficult to prevent DWI.

Socially stigmatized behaviours such as DWI and alcohol intake are prone to be underreported in studies using self-report questionnaires (Crowne and Marlowe, 1960). There are strong elements, however, supporting the reliability of self-reported behaviours in our survey, since Road Traffic Collision trends paralleled trends in self-reported behaviours in the GAZEL cohort, such as speeding, DWI, sleepy driving, and phoning while driving (Nabi et al., 2007; Constant et al., 2009). The results are from voluntary participants, all of whom have or had secure employment, aged 45–60 at baseline (Goldberg et al., 2007) (Goldberg et al., 2001). Most of them retired during the study period. These factors may limit the extrapolation of our results, which are likely to be conservative since the participants were experienced drivers with moderate alcohol intake, hence under-represented in fatal road accidents (Kim et al., 2006; ONISR/DSCR, 2008a, b). In addition, we demonstrated in a previous study of the same participants that retirement had no influence on DWI or attitudes towards road safety (Bhatti et al., 2008). Because our cohort is large and includes diverse trades and socioeconomic groups, it offers a unique opportunity to study road-related behaviours and may continue to prove valuable in evaluating traffic regulation initiatives aimed at reducing road fatalities.

In conclusion, a large number of offenders stopped DWI between 2001 and 2007, concomitantly with an increased crackdown on road violations in France. But this success was compromised by the occurrence of new drunk drivers with specific risk factors. Preventive strategies should aim at modifying these factors—in particular, increased alcohol consumption and low acceptance of law enforcement. While the latest prevention initiatives have rightfully focused on younger drivers (Maxwell et al., 2009), they should also depict DWI as a concern for drivers of all ages, and encourage those who drive after social events to abstain from alcohol during the event.

<table>
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<tr>
<th>Table 2. Association between changes between 2001 and 2004 and adoption of driving while alcohol intoxicated between 2004 and 2007</th>
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<tr>
<td>Model step 1: ORs in univariate analysis adjusted for baseline values</td>
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<td>OR 95% CI</td>
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<td>Depressive state (CES-D)</td>
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<td>Became depressed</td>
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<td>Recovered from depression</td>
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<td>Alcohol consumption (in drinks/week)</td>
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<td>Decreased</td>
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<td>Increased</td>
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<td>Annual mileage (in kms)</td>
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<td>Number of close relatives</td>
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<td>Increased</td>
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<td>Gender</td>
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<td>Managers</td>
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</table>

Odds ratios (ORs) with 95% CI determined by logistic regression. 
*One model for each listed variable. 
**P < 0.05; ***P < 0.01; ****P < 0.001.
REFERENCES


