Project No. TREN-05-FP6TR-S07.61320-518404-DRUID

DRUID
Driving under the Influence of Drugs, Alcohol and Medicines

Integrated Project
1.6. Sustainable Development, Global Change and Ecosystem
1.6.2: Sustainable Surface Transport

6th Framework Programme
Deliverable 2.2.4

Prevalence study: Main illicit psychoactive substances among all drivers involved in fatal road crashes in France

Due date of deliverable: 14.07.2010
Actual submission date: 27.07.2010

Start date of project: 15.10.2006
Duration: 60 months
Organisation name of lead contractor for this deliverable: UGent
Revision 1.0

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Deliverable D.2.2.4

Prevalence study:
Main illicit psychoactive substances among all drivers involved in fatal road crashes in France

Emmanuelle Amoros[1], Blandine Gadegbeku[1] and the SAM Group[2]

[1] INRETS, UMRESTTE
(Transport, Occupational and Environmental Epidemiology Research and Surveillance Unit)

[2] SAM Group : B Laumon (INRETS, scientific adviser for the SAM project), and other members: MB Biecheler, P Chapuis, C Filou, K Fouquet, Y Gourlet, JL Martin, E Perez, JF Peytavin, P Van Elslande (INRETS), L Campione, R Driscoll, T Hermitte, T Phalempin, D Villeforceix (CEESAR), JY Forêt-Bruno, Y Page (LAB PSA Peugeot-Citroën/RENAULT), F Facy, M Rabaud (INSERM), H Martineau (OFDT) and C Got.

Table of contents

Executive Summary ... 2
INTRODUCTION ... 3
DATA ... 3
  Legal procedure for data collection on alcohol ... 3
  Legal procedure for data collection of illicit drugs ... 4
  Legal procedure for data collection of medicines ... 6
  French positivity thresholds ... 6
  Police reports collection ... 7
  Record-linkage with the national police database ... 8
  Selection of drivers ... 8
METHOD ... 9
  Prevalences in drivers involved in fatal crashes ... 9
  Responsibility assessment ... 9
  Prevalences in the driving population ... 10
  Validation of the control group ... 11
RESULTS ... 12
  Prevalence of psychoactive substances; all drivers involved in fatal crashes ... 12
  Prevalences according to road user type ... 12
  Prevalences according to age and gender ... 13
    All drivers involved in fatal crashes ... 14
    Car drivers involved in fatal crashes ... 15
  Prevalences according to dose level ... 16
    All drivers involved in fatal crashes ... 16
    Car drivers involved in fatal crashes ... 16
  Prevalences of combination of alcohol and cannabis ... 17
    All drivers involved in fatal crashes ... 17
    Car drivers involved in fatal crashes ... 18
  Prevalences according to responsibility status ... 19
    All drivers involved in fatal crashes ... 19
    Car drivers involved in fatal crashes ... 19
  Prevalences in the driving population ... 20
    All drivers ... 20
    Car drivers ... 20
DISCUSSION ... 21
References ... 23
Acknowledgments ... 23
ANNEXES ... 24

Executive Summary

Introduction. In 1999, in France, before considering change in the drug legislation, the government wished to know more on the effect of illicit drugs on the risk of road crashes. A systematic screening of illicit drug on all drivers involved in fatal crashes, was hence made compulsory. We estimate prevalences of alcohol, cannabis, amphetamines, cocaine, and opiates. We provide them for drivers of all vehicles types, as well as for car drivers only. We also provide estimates of prevalences in the general population through the careful selection of a control group.

Material and Method. A total of 10,728 drivers were involved in fatal road crashes in France between October 2001 and September 2003. After exclusion of drivers with missing data on alcohol, cannabis, age, or with age below 18, some 10,519 drivers remain in the dataset. The subset of car drivers contains 7,455 of them. Drivers involved in fatal crashes include killed drivers, injured and non-injured drivers.
Drug dosage is conducted on blood samples. Commonly defined DRUID thresholds are used to define positivity: alcohol (($\geq$ 0.1g/L), cannabis ($\geq$ 1 ng/ml), amphetamines ($\geq$ 20 ng/ml), cocaine($\geq$ 10 ng/ml), opiates($\geq$ 10 ng/ml). Prevalences are also provided according to age and sex.
Since a responsibility study is later conducted on car drivers involved in fatal accidents, we estimate the prevalence of alcohol and illicit drugs on responsible drivers and non-responsible ones. Responsibility is assessed with a method adapted from Robertson and Drummer's. From the group of non-responsible drivers, we choose a control group as close as possible to the general driving population.

Results. In all drivers involved in fatal crashes, alcohol prevalence is estimated at 25.9%, THC prevalence at 6.9%, amphetamines at 0.6%, cocaine at 0.5% and opiates at 0.9%. prevalences of alcohol and cannabis are highest in moped users. Prevalences are higher in men than in women, at all ages. In men, prevalence of cannabis is higher at younger age, whereas in women prevalence of alcohol is highest in the 35-49 year old group. Among drivers who are positive to cannabis, 47% are (also) positive to alcohol.
Prevalence of cannabis is 8.7% in drivers responsible for the crash and 3.8% in non-responsible ones. Prevalence of alcohol is 35.6% in drivers responsible for the crash and 9.4% in non-responsible ones. In the control group, prevalence of cannabis is 2.8%, prevalence of alcohol is 5.0%.

Discussion. For all the substances except cannabis, the commonly defined DRUID thresholds are higher than the French thresholds in use in 2001-2003. We hence very likely miss a high proportion of those between the two thresholds. This means that the estimated prevalences should be considered as lower bounds.
Prevalence of alcohol in our control group using the French threshold (2.7%) is close to the prevalence of the whole driving population, estimated in another study (2.5%); this supports the choice we made for the control group and hence the generalisation of its prevalences to the whole driving population.
Prevalences of alcohol and cannabis are higher in the drivers responsible for the fatal crashes compared to the non-responsible drivers or to the control group. It is only a descriptive and univariate analysis; this will be better analysed in the responsibility study.

INTRODUCTION

In 1999 in France, before considering changes in the drug legislation, the French Government had wished to obtain reliable epidemiological evaluations, especially on the role of cannabis in the occurrence of road crashes. Systematic screening of illicit drugs was hence made compulsory in France, from October 2001 to September 2003, for drivers involved in fatal road crashes. This is the basis of the so-called SAM (illicit drugs and fatal crashes) data and study. A first analysis based on the responsibility approach including all drivers has already been conducted and published (Laumon et al. 2005). The prevalence of alcohol, cannabis, amphetamines, cocaine and opiates among non responsible drivers has been established and an extrapolation to the driving population has already been done. Here within the DRUID project, we propose to estimate the prevalence of these substances among all drivers involved in fatal road crashes, and to detail the different prevalences according to road user type, age and sex.

In brief, the aims of this study are:

- to evaluate the prevalence of drivers under the influence of alcohol and the main illicit psychoactive substances (according to different thresholds), for all drivers involved in fatal road crashes in France, for responsible drivers and for non responsible ones
- to evaluate the prevalence of theses substances in the driving population
- to evaluate the prevalence according to road user type, age and sex

DATA

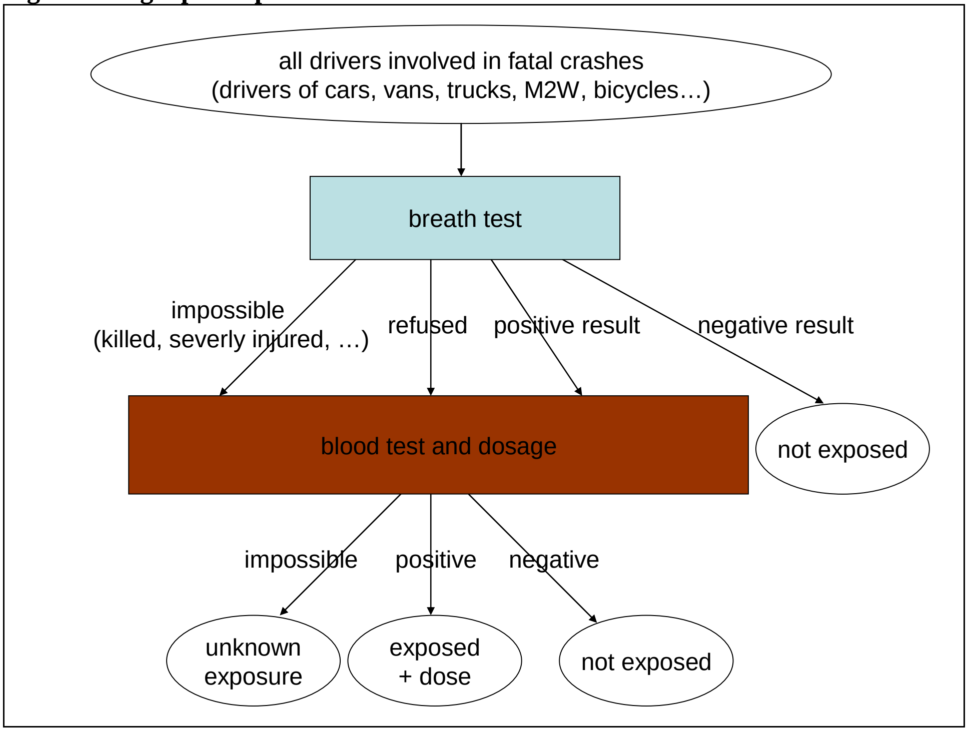
Legal procedure for data collection on alcohol

All drivers, riders and eventually pedestrians involved in a road injury crash (whether fatal or not) must be tested for the presence of alcohol by a breath test carried out by the police (article L 234-3 of the French traffic law, article L 3354-1 of the French public health regulation). If the alcohol concentration in breath is lower than 0.25 mg/l (which is equivalent to a blood alcohol concentration of 0.5 g/l), then the driver is considered to be negative to alcohol; the legal procedure ends there (in particular, no blood test/dosage is conducted).

If the breath test is positive, it is followed by a blood test and dosage.

If the driver refuses the breath test (rarely observed) or if the severity of the crash makes the test impossible (for someone killed or severely injured), then a blood test and dosage is conducted. It can be noted that, in these situations (i.e. as soon as a blood sample is taken), the blood alcohol concentration is precisely known, EVEN for low doses under the French legal threshold of 0.5g/l.

Figure 1 : legal police procedure for the detection of alcohol in road fatal crashes



Elapsed time between the crash and the dosage:
It was requested that the blood sample be taken as soon as possible after the crash. The elapsed time has no importance for immediately killed drivers because concentration of substance in the blood is unchanged after death. The elapsed time matters only for surviving drivers who get a blood alcohol dosage (n=1800, 17% of subjects). The time of blood sampling is not reported in 47% of these drivers. When it is reported, the distribution of elapsed time is less than 10% within 1 hour, and about: one quarter between 1 and 2 hours, one quarter between 2 and 3 hours, 20% between 3 and 4 hours, and 20% after 4 hours. Consequently, doses and prevalences are probably under-estimated.

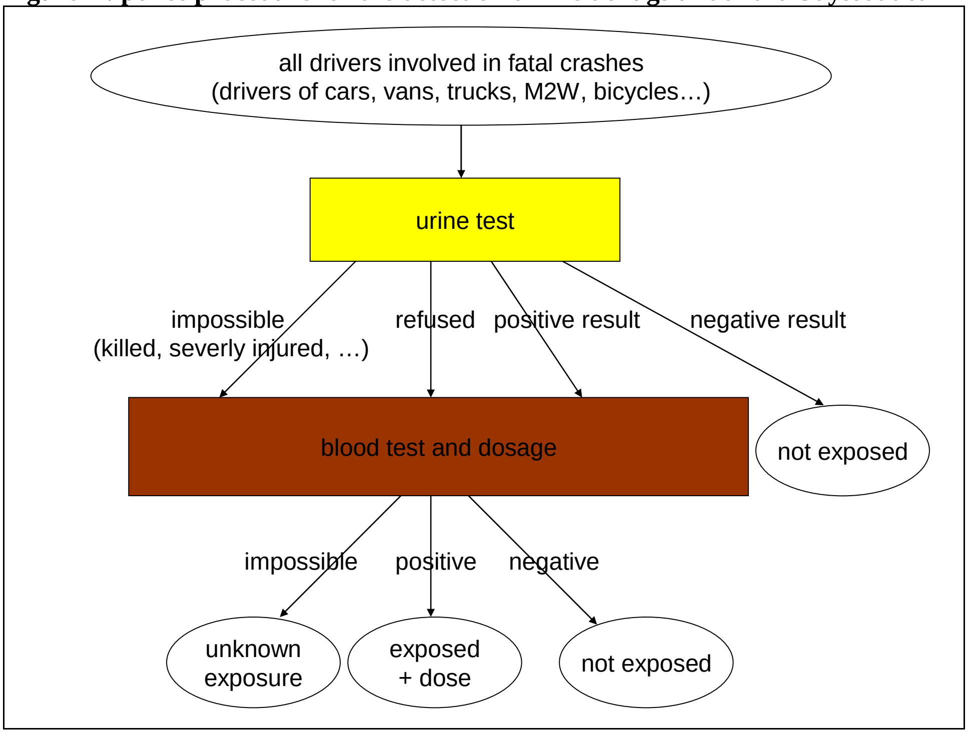
Missing information:

Alcohol exposure is known for 90% of drivers in our dataset (all drivers involved in fatal crashes between October 2001 and September 2003). Missing values correspond mainly to the following situations: the breath test was impossible or refused and no blood sample was taken (almost 90% the missing values); the result of the blood measure was not yet available at the time of data entry in the database (10%). There is also the very rare situation where drivers have a positive or unknown result from the breath test but no blood test or dosage (Biecheler et al. 2008).

Legal procedure for data collection of illicit drugs

For each driver or rider of a vehicle (whether motorised or not), involved in a crash that is immediately fatal, the presence of cannabis, amphetamines, opiates and cocaine is looked for. Pedestrians and passengers are not tested. The different steps of the illicit drugs screening procedure are defined in the Gayssot Act (loi du 18 juin 1999, décret du 27 août 2001, arrêtés des 4 et 5 septembre 2001). They are precisely described, and there is clear distinction between what is ascribed to the police forces, to the physicians and to the biologists. The driver first undergoes a urinary testing. If it is negative, the procedure ends there. If it is positive, or if the testing is impossible or refused, a blood sample is taken, and a biological laboratory or a certified expert is then required for the testing and dosage of illicit drugs. The police forces are required to take the drivers to the appropriate medical places for the blood or urinary samples collection. The blood or urine uptakes must be done in the shortest time after the crash. Results of the tests are to be reported on dedicated forms and attached to the paper police report.

Figure 2 : police procedure for the detection of illicit drugs under the Gayssot act



Time elapsed between crash and blood sampling:
It was requested that the blood sample be taken as soon as possible after the crash. The elapsed time has no importance for immediately killed drivers (n=4933, 47% of subjects) because concentration of substance in the blood is unchanged after death. For surviving drivers, those who were negative to illicit drugs after a urinary test (n=3381, 32% of subjects) can really be considered as negative because these tests are very sensitive. In other words, they are built in such a way that there give very few false negatives. The elapsed time matters only for surviving drivers who get a blood dosage (n=2205, 21% of subjects). It is not excluded that, for some of these, the drug's measured concentration, and particularly the THC concentration, is significantly lower than the concentration at the time of the crash. Unfortunately, the time of the blood sampling is most often not reported (70% of missing values). For drivers where it is reported, the elapsed time is less than 10% within 1 hour, and about: one quarter between 1 and 2 hours, one quarter between 2 and 3 hours, 20% between 3 and 4 hours, and 20% after 4 hours. As a consequence, doses and prevalences are probably somewhat under-estimated.

Missing information

Illicit drugs exposure is unknown for about 35% of the drivers in our dataset (all drivers involved in fatal crashes between October 2001 and September 2003). Missing values appear in different situations. Most of the time (more than 50%), blood samples were not taken when the urine test was not possible or refused (although this last situation is very rare). A second common situation (one third of all missing values) is that urine tests were possible but were not carried out (one third); a third situation is that blood samples were taken but results were not provided (10%). It is important to note that the proportion, among missing values, of positive tests not followed by a confirmatory blood test or with an unknown blood result is low (2%). Physicians reported that reasons for not conducting a urine or blood test were (apart from the severity status of the casualty), most frequently a lack of appropriate equipment (Biecheler et al. 2008).

Legal procedure for data collection of medicines

In the Gayssot Act, it was clearly defined that psychoactive medicines suspecting to have an effect on driving skills will be tested only for drivers found positive to illicit drugs.

However, if we wish to use information about drivers' exposure to legal drugs (as an exposure of interest, or as confusion factor in a multivariate analysis), there should be no selection bias on who is tested. In other words, the information should be available for all drivers, or at least, on a random sample of the drivers.

As this was not the case, psychoactive medicine status (known for a non-randomly selected sample of only 5% of the drivers of our dataset) can not be used in the study.

French positivity thresholds

French positivity thresholds concerning illicit drugs have been defined by the Gayssot Act, and those concerning alcohol had been previously defined.

Table 1 : testing (yes/no) for psychoactive substance : French positivity thresholds

Substance	Body fluid	Threshold
Alcohol	Breath	0.25 mg/l*
Cannabis (THC-COOH)	Urine	50 ng/ml
Amphetamines	Urine	1000 ng/ml
Cocaine	Urine	300 ng/ml
Opiates	Urine	300 ng/ml

*** equivalent to 0.5 g/l of blood**

Table 2 : dosage for psychoactive substance: French positivity thresholds

Substance	Body fluid	Threshold
Alcohol	Blood	0.1 g/l
Cannabis (THC)	Blood	1 ng/ml
Amphetamines	Blood	50 ng/ml
Cocaine	Blood	50 ng/ml
Opiates	Blood	20 ng/ml

Drug blood dosages were conducted using a technique called gas-phase chromatography coupled with mass spectrometry.

Table 3 : commonly –defined DRUID thresholds

Psychoactive substance	Threshold
Alcohol	0.1 g/l
Cannabis (THC)	1 ng/ml
Amphetamines	20 ng/ml
Cocaine	10 ng/ml
Opiates	10 ng/ml

For each of the five psychoactive substances except cannabis, the DRUID threshold is lower than the French positivity threshold; this implies that we miss some positive drivers: those who are in the range between the DRUID threshold and the French legal threshold. As a consequence, the prevalences provided here using the DRUID thresholds are under-estimates of the true prevalences.

For alcohol, 0.1 g/l is the DRUID threshold and 0.5 g/l is the French legal threshold. There are only two very specific situations where it is nevertheless possible to measure a dose of alcohol within the range 0.1-0.5 (when it is truly in this dose range, of course). The first and most common situation is when drivers are killed or very seriously injured so that it is impossible to conduct a breath test; hence a blood test and dosage is directly conducted (with lower detection threshold at 0.1g/l). The second situation is when the true value is almost at 0.5, and that the breath test (which is more sensitive than the blood test) leads to a positive result and hence a blood test is conducted. For all other drivers with a negative breath test, there is no blood test or dosage, so that it is not possible to know where the true value of the blood alcohol concentration stands between 0 and 0.5 g/l. It is however very likely that most of these doses are true zeros. All of these drivers are categorised in the dose group "[0-0.1[g/l" and none in the dose group [0.1-0.5[g/l.

Police reports collection

Police forces were informed by decree of their obligation to send to OFDT, the French monitoring centre for drugs and drug addiction, a copy of all police reports dealing with immediately fatal road accidents that occurred during the study period. The OFDT, as study coordinator, was in charge of sending these paper police reports to the CEESAR, one of the partner in the project, in order for these paper reports to be coded and registered. The data were then sent as an electronic file to our research team. However, despite of the mandatory aspect of the request, a number of immediately fatal accidents were missing from the paper police reports received by OFDT. These missing police reports were identified by comparison with the national database of road crashes, which consists of records of all police reports of road (injury) crashes, whether fatal or non-fatal. This identification enabled OFDT to send some reminders to the police forces. As a result, 95% of police reports of immediately fatal crashes were finally received at OFDT (two thirds after a reminder). In the end, 10,671 police reports were collected. However, some were highly incomplete and hence 10,614 could be used. These 10,614 fatal crashes correspond to 17,228 drivers (or riders).

Record-linkage with the national police database

All the police reports of road crashes are supposed to be registered in the national police crash database. Each paper police report is registered into an electronic record; a number of pre-defined characteristics are coded. In order to use this readily available information, we restricted the analysis to the drivers that were also registered in this database; this means that instead of basing the analysis on 17,228 drivers, it is based on 16,728 drivers.

Selection of drivers

Selected crashes are crashes that are immediately fatal, and that occurred in France between October 2001 and September 2003. The statistical unit is the driver (not the crash).

We excluded drivers with unknown age (23 of them). We further excluded drivers with missing data on alcohol or illicit drugs (36% of them).

Alcohol status is unknown for 10% of the subjects. More precisely, it is unknown for 3% of the surviving drivers and for 17% of the killed drivers. Since alcohol is tested for almost all surviving drivers, one can not suspect the police forces to select drivers to be tested according to their behaviour (whether they seem sober or not). Concerning the proportion of missing alcohol status in killed drivers, one may suspect some technical/medical difficulties.

Illicit drug status is unknown for 35% of the drivers involved in fatal crashes. According to paper police reports, most of the missing data are due to a lack of appropriate equipment for conducting the test (as reported by the physicians). Indeed, the procedure for testing illegal drugs was new to them, whereas alcohol testing has been mandatory in France for all injury road crashes since the 70's.

These elements rule out a large non-random selection from the police forces, or a large non-random selection because of refusal by some drivers.

We have compared drivers with known drug status to drivers with missing drug status, separately for killed drivers and for surviving drivers, in terms of age and sex ; we did the same for alcohol. We sometimes found some slight differences but nothing systematic.

From all these elements, we can say that the missing data mechanism is not "missing completely at random" (MCAR), but merely "missing at random" (MAR): conditionally on characteristics that are available to us, the data are missing at random. The differences are small between drivers with known or unknown drug status (Laumon et al., in press), so that it should have little influence on the prevalence estimates.

Excluding drivers with unknown drug or alcohol status leaves us with 10,748 subjects.

In order that our analysis follows the DRUID framework, we further excluded drivers below 18 years old. This lead us to 10,519 drivers (all vehicles types).

METHOD

Prevalences in drivers involved in fatal crashes

The most frequently consumed illicit psychoactive substance is cannabis. We evaluate the prevalence of alcohol, cannabis and of others substances: amphetamines, opiates, and cocaine.

It is possible to further evaluate the prevalence of cannabis or alcohol according to their concentration. Common DRUID cut-points have been defined for cannabis : 1, 3 and 5 ng/ml and for alcohol : 0.1, 0.5, 0.8 and 1.2 g/l.

We would like to remind the reader of the following: when the DRUID threshold is lower than the French legal threshold, the prevalence in the dose range between the two thresholds is likely to be under-estimated; and hence the global prevalence (on a yes/no basis).

Prevalences are estimated for all drivers involved in fatal road crashes in France, as well as for specific sub-groups defined by age, sex or type of road user, and in particular for car drivers (useful for task 2.3.3). Common DRUID cut-points have been defined for age: 18, 25, 35 and 50 years old. Estimations of prevalences are also conducted separately for responsible drivers and for non-responsible ones.

Responsibility assessment

A first way of obtaining the responsibility status of drivers involved in crashes is to request some accidentology experts to assess it. Such experts will analyze the police reports in the view of understanding why and how the crash happened.

The drawbacks of using experts' assessments are two types: there is no external validation; in particular there is no international validation; secondly, it is a very heavy procedure to implement for a great number of drivers.

A second way of assessing the responsibility status is to use automated assessment procedures. Some have already been developed; one is proposed by Robertson and Drummer (Robertson 1992). This method consists in computing a responsibility score, based on information from 8 groups of characteristics: road conditions, traffic conditions, vehicle conditions, crash type, complexity of the driving task, complexity of traffic regulation, tiredness of the driver, and witnesses comments.

This Robertson and Drummer method has many advantages: it is very easy to implement, it can be used for any type of crash and moreover it has been used by several research teams worldwide. It has some drawbacks: firstly, it is based on pieces of information that are not always found in police reports; secondly, it uses information on driving offences, and in particular the blood alcohol status. This is problematic because this is a confounding factor: we want to account for its correlation with the risk of being responsible in a fatal crash: its correlation in terms of impairment, of taking more risk, not its correlation in terms of legal sense. At the same time, it is easy to disregard this data (alcohol status) in the automated assessment of responsibility. This is what we did.

We dropped some other items from the method, for other reasons. The item “comments from possible witnesses” it is not part of the recorded police reports. The item “level of tiredness of the driver” is not reliable.

The other six types of characteristics of the Robertson and Drummer method were adapted to the French available police data. It can be pointed out that two items play a strong role in the score: “driving offences” (except alcohol status, excluded from the procedure) and being “declared responsible by the police” (this concerns crashes involving 2 vehicles or more).

The obtained responsibility score is divided into 3 categories: (fully) responsible, partially responsible and non-responsible. In the analysis, partially responsible drivers are grouped together with fully responsible drivers.

The adapted Robertson and Drummer method has been applied on all drivers included in the study. In order to validate (or not) the adapted method, we compared its results with an experts’ group assessment. This was done in a blind way i.e. the experts were not given the results from the adapted automated method. Also, information on alcohol, drug status were NOT provided to them; age and sex data were also hidden as they are correlated with alcohol and drug status.

This experts assessment was conducted on a sub-sample of 3024 drivers (among 10748), from crashes involving two or more vehicles. The two responsibility assessments were compared for this common sub-group. We found a kappa score (agreement score) of 0.67, with 95% CI=[0.65-0.70]). It was concluded that they were similar enough to validate the adapted Robertson and Drummer method (Laumon et al. in press).

Prevalences in the driving population

For the responsibility study, we defined cases and controls. Cases are responsible drivers and controls are a sub-selection of non-responsible drivers.

As previously found with alcohol (Evans 1991), preliminary analysis of the data (Laumon et al. in press) showed a significant increase in the risk of death of non-responsible drivers who tested positive to cannabis. In other words, cannabis is a risk factor for a fatal outcome once the person is injured (all other things being equal). Because this phenomenon would lead to a selection bias in comparison with the driving population, due to the over-representation of crashes in which the only victim killed is a driver detected as cannabis (or alcohol)-positive, we excluded non-responsible drivers who were the sole fatally injured victim in the crash (523 of them, among car drivers above 18 years old). Controls are hence selected as non-responsible drivers, who were not the only fatally injured party. More explanation can be found in the responsibility study (Gadegbeku & Amoros 2010).

The objective of this sub-selection is to have a control group which can be considered as close as possible to the driving population. Therefore, we use the prevalence evaluated on the control group as an estimation of the prevalence in the whole driving French population. This is done for both cannabis and alcohol.

Validation of the control group

The table below provides the prevalence of psychoactive substances in the responsible drivers, in the control group and in the non-responsible drivers that have been excluded from the control group (those who are the sole fatality in the crash). The table does show that the prevalence is much higher (for cannabis and alcohol) among the excluded non-responsible drivers than among the controls.

Table 4 : prevalence of psychoactive substance according to responsibility status for the fatal crash, ALL drivers over 18 years old, using DRUID thresholds, n=10519

Psychoactive substance	prevalence in responsible drivers (n=6620)	prevalence in excluded non-responsible (n=918)	prevalence in control group (n=2981)
Alcohol (≥0.1g/l)	35.6 %	23.4 %	5.0 %
Cannabis (THC≥1 ng/ml)	8.7 %	7.0 %	2.8 %
Amphetamines (≥20ng/ml)	0.8 %	0.3 %	0.3 %
Cocaine (≥10 ng/ml)	0.6 %	0.4 %	0.3 %
Opiates (≥10 ng/ml)	0.8 %	0.9 %	0.9 %

The representativeness of our controls (towards the driving population) can be discussed on the basis of a comparison, between these estimated prevalences and those estimated elsewhere for the whole driving population using other methods. For alcohol, in the same period, the prevalence of alcohol above 0.5 g/l in the driving population in France was found to be 2.5% (ONISR 2004) whereas the corresponding estimation in our control group is equal to 2.7% (results using French thresholds: see annex).

We can also consider drivers involved in slight crashes as close to drivers in the driving population and standardize prevalences obtained in the control group on the characteristics of these drivers. Comparing our controls with non-responsible drivers involved in a slight injury crash allowed us to identify their distinguishing characteristics: driver's sex and age; type of vehicle; and place, time, and type of crash. The prevalence of cannabis (above 1 ng/ml) in our controls was 2.8%, compared with 2.9% when standardised for these variables; both these prevalences were 2.7% for alcohol (above 0.5 g/l) (Laumon et al. 2005).

These similarities contribute to validate our control group as being close to the driving population.

RESULTS

Prevalence of psychoactive substances; all drivers involved in fatal crashes

Table 5 : Prevalence of psychoactive substances in drivers over 18 years old involved in fatal road crashes, France, 2001-2003, n=10 519

Psychoactive substance	prevalence
Alcohol (≥ 0.1 g/l)	25.9 %
Cannabis (THC ≥ 1 ng/ml)	6.9 %
Amphetamines (≥ 20 ng/ml)	0.6 %
Cocaine (≥ 10 ng/ml)	0.5 %
Opiates (≥ 10 ng/ml)	0.9 %

NB: For each of the five psychoactive substances except cannabis, the DRUID threshold is lower than the French legal threshold ; this implies that we miss some positive drivers: those who are in the range between the DRUID threshold and the French legal threshold. As a consequence, the prevalences provided here with the DRUID thresholds are under-estimates of the true prevalences .

With a prevalence of 26%, alcohol is the most frequent psychoactive substance found among drivers involved in fatal crashes. It is much higher than the prevalence of cannabis; this one is estimated at 7% in drivers involved in fatal crashes. Other illicit drugs are not very common among drivers involved in fatal crashes: less than 1%. Consequently, prevalence according to dose level is not estimated for these other drugs.

It must be kept in mind that these are the prevalences in the drivers involved in fatal crashes: they are not restricted to those fatally injured, who have even higher prevalences (see methods and discussion).

Prevalences according to road user type

The different road user categories used here are: bike, moped, motorcycle (including sidecar and registered scooter), car (alone or with a trailer or a caravan), van (with a gross weight between 1.5 and 3.5 tons, alone or towing), truck (with a gross weight from 3.5 tons upwards, alone or towing) and “other” (including bus, small car without driving licence, tractor or special heavy vehicle).

Table 6 : Prevalence of psychoactive substances in drivers over 18 years old involved in fatal road crashes, by road user type, France, 2001-2003, using DRUID thresholds

Road user type	n	Alcohol	Cannabis	Amphet.	Cocaine	Opiates
Bike	131	22.1 %	3.8 %	0.0 %	0.0 %	0.0 %
Moped	217	55.8 %	14.3 %	1.4 %	1.4 %	0.9 %
Motorcycle	1 018	32.9 %	9.0 %	0.4 %	0.4 %	0.9 %
Car	7 455	28.5 %	7.5 %	0.8 %	0.5 %	1.0 %
Van	340	13.2 %	5.0 %	0.9 %	0.3 %	0.3 %
Truck	1 092	3.8 %	1.9 %	0.2 %	0.5 %	0.3 %
Other	266	9.8 %	0.4 %	0.0 %	0.0 %	0.4 %

Positivity (blood dosage) : alcohol ≥ 0.1 g/l, THC ≥ 1 ng/ml, Amphet ≥ 20 ng/ml, Cocaine ≥ 10 ng/ml, Opiates ≥ 10 ng/ml

The prevalences of psychoactive substances in drivers involved in fatal crashes differ according to the road user type. Concerning prevalences of alcohol and cannabis, among drivers involved in fatal crashes, drivers of motorised two-wheel vehicles, especially moped drivers, have higher prevalences than other road users. At the opposite, drivers of trucks have very low prevalences. Prevalences for car drivers are slightly higher than those observed for all drivers.

Concerning other substances, it is interesting to note the high prevalences of opiates in car drivers and motorcycle or moped riders. For moped riders, a higher prevalence of amphetamine and cocaine is also observed.

In the following we do not go on displaying prevalence for each road user type; we provide prevalences for ALL drivers (involved in fatal crashes) and for CAR drivers (involved in fatal crashes). Indeed, car drivers are the sub-population of drivers, for which a responsibility analysis is conducted within the DRUID project.

Prevalences according to age and gender

Age and sex are very important characteristics, because they are associated both with drugs consumption and with crash involvement.

We display below the prevalences of alcohol among drivers involved in fatal crashes, according to age and sex, in ALL drivers, and later on in CAR drivers, involved in fatal crashes.

All drivers involved in fatal crashes

Table 7 : alcohol prevalence in ALL drivers over 18 years old involved in fatal crashes, by age and sex, France, 2001-2003, n=10519

age	men n	men Prevalence alcohol≥0.1g/l	women n	women Prevalence alcohol≥0.1g/l
18-24 year old	2 094	34.5 %	317	13.6 %
25-34 year old	2 215	32.3 %	377	12.7 %
35-49 year old	2 518	27.4 %	482	17.8 %
50 +	2 057	18.3 %	459	9.2 %
All	8 884	28.1 %	1 635	13.4 %

Among drivers involved in fatal crashes, more than 80% are men.

The prevalence of alcohol is higher in men than in women, globally and whatever the age group (among drivers involved in fatal crashes). In men, the younger the age, the higher the prevalence. In women, the pattern is different with the 35-49 year old group having the highest prevalence.

Table 8 : cannabis prevalence in ALL drivers over 18 years old involved in fatal crashes, by age and sex, France, 2001-2003, n=10519

age	men n	men Prevalence THC≥1 ng/ml	women n	women Prevalence THC≥1 ng/ml
18-24 year old	2 094	19.5 %	317	7.3 %
25-34 year old	2 215	9.4 %	377	2.9 %
35-49 year old	2 518	2.3 %	482	1.0 %
50 +	2 057	0.4 %	459	0.7 %
All	8 884	7.7 %	1 635	2.6 %

The prevalence of cannabis is higher in men than in women (involved in fatal crashes), globally and whatever the age group, except in the last group (above 50 years old). For both men and women, the younger the age, the higher the prevalence of cannabis.

Car drivers involved in fatal crashes

The following two tables provide the prevalence of alcohol and cannabis in the restricted group of CAR drivers (involved in fatal crashes).

Table 9 : alcohol prevalence in CAR drivers over 18 years old involved in fatal crashes, by age and sex, France, 2001-2003, n=7455

age	men n	men Prevalence alcohol≥0.1g/l	women n	women Prevalence alcohol≥0.1g/l
18-24 year old	1 653	38.2 %	302	13.6 %
25-34 year old	1 369	39.2 %	347	12.7 %
35-49 year old	1 413	32.8 %	456	17.5 %
50 +	1 486	19.4 %	429	9.3 %
All	5 921	32.4 %	1 534	13.4 %

We observe the same pattern in the alcohol prevalence in the car drivers subgroup than in drivers for all vehicle types (involved in fatal crashes): much higher prevalence in men than in women, globally and whatever the age group. There is also, in men, a higher prevalence in the younger age groups, and in women, a higher prevalence in the 39-45 year old group.

Table 10 : cannabis prevalence in CAR drivers over 18 years old involved in fatal crashes, by age and sex, France, 2001-2003, n=7455

age	men n	men Prevalence THC≥1 ng/ml	women n	women Prevalence THC≥1 ng/ml
18-24 year old	1 653	20.0 %	302	7.0 %
25-34 year old	1 369	10.4 %	347	2.9 %
35-49 year old	1 413	2.9 %	456	1.1 %
50 +	1 486	0.4 %	429	0.7 %
All	5 921	8.8 %	1 534	2.5 %

For car drivers involved in fatal crashes, the prevalence of cannabis is higher in men than in women, globally and whatever the age group. For both men and women, the younger the age, the higher the prevalence of cannabis.

Prevalences according to dose level

For alcohol and cannabis, frequencies of positive drivers (involved in a fatal crash) are large enough to enable splitting the group of positive drivers into doses categories.

All drivers involved in fatal crashes

Table 11 : alcohol prevalence, according to dose, ALL drivers over 18 years old involved in fatal crashes, France, 2001-2003, n=10 519

Alcohol (g/l)	prevalence
negative + [0-0.1[	74.1 %
[0.1-0.5[	4.8 %
[0.5-0.8[	2.3 %
[0.8-1.2[	3.1 %
[1.2+[	15.8 %

For alcohol, the legal limit in France is 0.5 g/l. The proportion of drivers involved in fatal crashes who are above this limit reaches 21%. In particular, the proportion of drivers (involved in fatal crashes) above 1.2 g/l is high, almost 16%. When adding a cut-point at 2 g/l, we can notice that 7,4% of drivers are in the dose level from 1.2 to 2 g/l and 8,3% of drivers are in the dose level equal or above 2 g/l.

As mentioned earlier, the estimated prevalence for the dose level [0.1-0.5[g/l is likely to be under-estimated.

Table 12 : cannabis, according to dose, ALL drivers over 18 years old involved in fatal crashes, France, 2001-2003, n=10 519

Cannabis (THC ng/ml)	prevalence
[0-1[	93.1 %
[1-3[	3.0 %
[3-5[	1.4 %
[5 +	2.5 %

For cannabis, prevalences according to dose levels are more balanced than for alcohol; between 1.4% and 3.0% of the drivers (involved in fatal crashes) are positive to cannabis in one of the three levels [1-3[, [3-5[or 5 ng/ml and above.

Car drivers involved in fatal crashes

Table 13: alcohol according to dose, CAR drivers over 18 years old involved in fatal crashes, France, 2001-2003, n=7 455

Alcohol (g/l)	prevalence
Negative + [0-0.1[	71.5 %
[0.1-0.5[	4.9 %
[0.5-0.8[	2.4 %
[0.8-1.2[	3.5 %
[1.2-+	17.7 %

The pattern of alcohol concentration in car drivers involved in fatal crashes is similar to that of drivers of all vehicle types, with 24% of these drivers above the legal limit, and a high proportion above 1.2 g/l. For each dose level, prevalences observed in car drivers are slightly higher than those observed in all drivers (involved in fatal crashes).

Table 14 : cannabis, according to dose, CAR drivers over 18 years old involved in fatal crashes, France, 2001-2003, n=7 455

Cannabis (THC ng/ml)	prevalence
[0-1[	92.5 %
[1-3[	3.1 %
[3-5[	1.6 %
[5 +	2.8 %

The pattern of cannabis concentration in car drivers (involved in fatal crashes) is similar to that of drivers of all vehicle types. Prevalences according to dose levels are more balanced than for alcohol: from 1.6% to 3.1% according to the different levels.

Prevalences of combination of alcohol and cannabis

All drivers involved in fatal crashes

Table 15 : Prevalence of alcohol and cannabis, ALL drivers over 18 years old involved in fatal crashes, France , 2001-2003, n=10 519

Frequency Total percent Row percent Col. percent		alcohol		
		No (<0.1 g/l)	Yes (≥0.1 g/l)	All
cannabis	No (<1 ng/ml)	n=7,410 70.4 % 75.7 % 95.0%	n=2,382 22.6 % 24.3 % 87.5 %	n=9,792 93.1 % 100 % -
	Yes (≥1 ng/ml)	n=386 3.7 % 53.1 % 5.0 %	n=341 3.2 % 46.9 % 12.5 %	n=727 6.9 % 100 % -
	All	n=7,796 74.1 % - 100.0 %	n=2,723 25.9 % - 100.0 %	n=10,519 100.0 % - -

Among all drivers involved in fatal accidents, 3.2% are positive to both alcohol and cannabis, 3.7% are positive to cannabis and not to alcohol; almost one fourth (22.6%) are positive to alcohol and not to cannabis, and a little more than two thirds (70.4%) are negative to both.

One can also read in this table that, most of the time, when positive, drivers involved in fatal crash are only positive to alcohol. Among those who are positive to alcohol, 12.5% are also positive to cannabis. Among drivers (involved in fatal crashes) who are positive to cannabis, almost half of them (46.9%) are also positive to alcohol.

Table 16 : Prevalence of alcohol and cannabis by dose,
ALL drivers over 18 years old involved in fatal crashes, France, 2001-2003

Total percent Frequency		Alcohol (g/l)					
		[0-0.1[	[0.1-0.5[	[0.5-0.8[	[0.8-1.2[	[1.2-+[	All
Cannabis (ng/ml)	[0-1[	70.4 % 7 410	4.3 % 455	2.0 % 212	2.6 % 277	13.7 % 1438	93.1% 9792
	[1-3[	1.8 % 185	*0.2 %* *18*	*0.1 %* *10*	*0.2 %* *20*	0.8 % 83	3.0% 316
	[3-5[	0.8 % 80	*0.1 %* *8*	*0.0 %* *2*	*0.1 %* *12*	0.5 % 48	1.4% 150
	[5 +[	1.2 % 121	*0.2 %* *23*	*0.1 %* *13*	*0.1 %* *15*	0.8 % 89	2.5% 261
	All	74.1% 7 796	4.8% 504	2.3% 237	3.1% 324	15.8% 1658	100% 10 519

This table shows that many cells in the cross-tabulation of dose categories of alcohol and cannabis have very small frequencies; a number of them are too small for the estimates to be reliable (displayed in italics).

Car drivers involved in fatal crashes

Table 17 : Prevalence of alcohol and cannabis, CAR drivers over 18 years old
involved in fatal crashes, France, 2001-2003, n=7 455

Frequency Total percent Row percent Col. percent		alcohol		
		No (<0.1 g/l)	Yes (≥0.1 g/l)	All
cannabis	No (<1 ng/ml)	N=5053 67.8% 73.3% 94.8%	N=1842 24.7% 26.7% 86.7%	N=6895 92.5% 100% -
	Yes (≥1 ng/ml)	N=277 3.7% 49.5% 5.2%	N=283 3.8% 50.4% 13.3%	N=560 7.5% 100% -
	All	N=5330 71.5% - 100%	N=2125 28.5% - 100%	N=7455 100.0% - -

Among car drivers involved in fatal accidents, 3.8% are positive to both alcohol and cannabis, 3.7% are positive to cannabis and not to alcohol; one fourth (24.7%) are positive to alcohol and not to cannabis, and two thirds (67.8%) are negative to both.

One can also read in this table that, most of the time, when positive, car drivers involved in fatal crashes are only positive to alcohol. Among those who are positive to alcohol, 13.3% are also positive to cannabis. Among car drivers (involved in fatal crashes) who are positive to cannabis, almost half of them (50.4%) are also positive to alcohol.

As frequencies were already too small for all drivers to estimate prevalence of the association of cannabis and alcohol by dose, this is not conducted for car drivers.

Prevalences according to responsibility status

All drivers involved in fatal crashes

Table 18 : prevalence of psychoactive substance according to responsibility status for the fatal crash, ALL drivers over 18 years old, using DRUID thresholds

Psychoactive substance	Prevalence in responsible drivers (n=6 620)	Prevalence in non-responsible drivers (n=3 899)
Alcohol (≥ 0.1 g/l)	35.6 %	9.4 %
Cannabis (THC ≥ 1 ng/ml)	8.7 %	3.8 %
Amphetamines (≥ 20 ng/ml)	0.8 %	0.3 %
Cocaine (≥ 10 ng/ml)	0.6 %	0.3 %
Opiates (≥ 10 ng/ml)	0.8 %	0.9 %

With a first splitting among responsible and non-responsible drivers (among those involved in fatal crashes), one already sees a difference in the prevalence. For cannabis and alcohol, the prevalence is clearly higher in the responsible group (a little more than 2 times higher for cannabis, and almost 4 times higher for alcohol). This is only a descriptive univariate analysis. The responsibility study will better answer the question of the association between being under the influence of a psychoactive substance and the risk of being responsible for a fatal crash. It will take confounding effects into account.

Car drivers involved in fatal crashes

Table 19 : prevalence of psychoactive substance according to responsibility status for the fatal crash, among CAR drivers, using DRUID thresholds, n=7 455

Psychoactive substance	prevalence in responsible drivers (n=4 946)	prevalence in non-responsible drivers (n=2 509)
Alcohol (≥0.1g/l)	37.6 %	10.5 %
Cannabis (THC≥1 ng/ml)	9.4 %	3.9 %
Amphetamines (≥20 ng/ml)	1.0 %	0.4 %
Cocaine (≥10 ng/ml)	0.6 %	0.4 %
Opiates (≥10 ng/ml)	0.9 %	1.2 %

The pattern is the same for car drivers than for drivers of all vehicles types: the prevalences of cannabis and alcohol among the car drivers who are responsible for the fatal crashes are higher than the prevalences among the non-responsible drivers (a little more than 2 times higher for cannabis, and almost 4 times higher for alcohol).

Prevalences in the driving population

We remind the reader that prevalences in the driving population are approximated by prevalences observed in the control group, which has been carefully defined (see the methods section). The representativity of this control group towards the driving population has been positively assessed (see the methods section).

All drivers

Table 20 : prevalence of psychoactive substance in the control group, ALL drivers over 18 years old, using DRUID thresholds, n=2981

Psychoactive substance	Control group
Alcohol (≥ 0.1 g/l)	5.0 %
Cannabis (THC ≥ 1 ng/ml)	2.8 %
Amphetamines (≥ 20 ng/ml)	0.3 %
Cocaine (≥ 10 ng/ml)	0.3 %
Opiates (≥ 10 ng/ml)	0.9 %

Based on these estimations, alcohol is the main psychoactive substance in the driving population, with a prevalence of 5%. The prevalence of cannabis is about 3%. Other drugs are not very common in the driving population: less than 1%.

Prevalences for alcohol and cannabis estimated in the driving population are definitively lower than those observed in drivers involved in fatal crashes (26% for alcohol and 7% for cannabis).

Car drivers

Table 21 : prevalence of psychoactive substance in the car driving population, CAR drivers over 18 years old, using DRUID thresholds, n=1 986

Psychoactive substance	Control group of car drivers
Alcohol (≥ 0.1 g/l)	6.8 %
Cannabis (THC ≥ 1 ng/ml)	3.3 %
Amphetamines (≥ 20 ng/ml)	0.4 %
Cocaine (≥ 10 ng/ml)	0.3 %
Opiates (≥ 10 ng/ml)	1.2 %

When restricting the dataset to car drivers, the same pattern as for drivers of all vehicles types is observed, to a slightly higher level. Thus, based on these estimations, alcohol is the most frequent psychoactive substance in the car driving population, with a prevalence of 7%. The prevalence of cannabis is estimated at about 3%. The prevalence of opiates is about 1%; other drugs are not very common.

Prevalences of cannabis and alcohol estimated in the car driving population are much lower than those observed in car drivers involved in fatal crashes.

DISCUSSION

Drug status is missing on 35% of the subjects, and alcohol is missing on 10% of the subjects (36% altogether). The missing mechanism seem mostly a lack of appropriate equipment and some technical difficulties. Excluding drivers with missing data on drug and/or alcohol should hence have little effect on the results.

For alcohol, amphetamines, cocaine and opiates, the DRUID thresholds are lower than the French legal thresholds. This leads to under-estimating the prevalence of low doses and thus the global prevalence (which includes low doses in the positive doses). In order to avoid this problem of under-estimation, one can use the prevalences with the thresholds used for detection, ie the French legal ones. These prevalences are provided in annex for information.

The fact that the DRUID thresholds are lower than the French legal thresholds is problematic for urinary test or breath test with a negative result. Indeed, in this case, no blood sample is taken and it is hence impossible to obtain a dose that is lower than the French legal thresholds. Moreover, this concerns mostly uninjured or slightly injured drivers (since killed or severely injured drivers, who can not undergo a urine or breath test are directly tested with a blood test). It can be a problem when comparing groups (responsible versus non-responsible drivers, or cases versus controls). Indeed, the proportion of uninjured or slightly injured drivers is higher in non-responsible drivers than in responsible ones (see Annex, tables 27 and 28). Therefore, the under-estimation of prevalences is more important in non-responsible drivers than in responsible ones. This phenomenon is described in details in the SAM report (Laumon et al. in press) focusing on low doses of alcohol.

The legal procedure requested that the blood sampling to be conducted as soon as possible after the crash. The time elapsed between the two matters only for surviving drivers. It is unknown most of the time (and when it is known it is mostly within 1 and 4 hours). As a consequence, doses and hence prevalences are probably somewhat under-estimated.

When applying the DRUID thresholds, prevalence of alcohol above 0.1 g/l in drivers above 18 years old involved in fatal crashes in France reaches 25.9% (at least) and prevalence of cannabis above 1 ng/ml is 6.9%. Comparisons with other studies are not easy because of many differences in thresholds, methods or population of interest. However, consistency with other studies concerning drivers involved in crashes can be observed for prevalence of alcohol, as well as prevalence of cannabis when measured by THC level in blood (Drummer et al. 2004; Longo et al. 2000) and not by the THC-COOH metabolite in urine.

The pattern of cannabis consumers in the general population in France shows a higher prevalence for men than for women, and a higher prevalence at younger age. This is the same pattern as in many European countries (Ravera & de Gier 2008). The same pattern is observed for the sub-group of drivers involved in fatal crashes (at a higher level).

In our study, prevalences for car drivers are not very different from those provided for all drivers, only slightly higher. Prevalences for car drivers are provided in this report because car drivers is the sub-population of drivers, for which a responsibility analysis is conducted within the DRUID project. Prevalence of alcohol and cannabis is higher in riders of two-wheel motorised and lower in drivers of trucks than in other drivers. This has already been noticed in an Australian study (Longo et al. 2000).

Consumption of drugs is often combined with alcohol. In our data, alcohol is found in about half of the drivers positive to cannabis. This was also observed, between one third and a half, in other studies (Brault et al. 2004; Dussault et al. 2002; Jones et al. 2003; Longo et al. 2000).

Prevalence of amphetamine, cocaine and opiates appear to be very low in drivers involved in fatal crashes: less than 1%. This result is consistent with the prevalences of consumers of amphetamine and cocaine in the general population in France, which seem to be low compared to most of other European countries (Ravera & de Gier 2008). Currently, these drugs do not appear as a major issue in terms of public health in France. It is a pity that prevalence of medicinal drugs could not have been estimated on our data (NB: they were tested only for drivers who were already positive to illicit drugs).

As several previous studies noticed, prevalences in drivers involved in crashes are higher than those in non-involved drivers, and more especially if the drivers are killed or seriously injured in the crash (Longo et al. 2000); this may be the result of a higher probability of being responsible of a crash but also of a higher probability of dying, when exposed to psychoactive substance; the first one is evaluated in the responsibility report. Because of these, it is important to estimate prevalences in the driving population. In our study, we paid a lot of attention to construct the control group, to make it as close as possible to the driving population. Prevalences in the control group can therefore be considered as good estimations of prevalences in the whole driving population. Thus, the prevalence of alcohol above 0.1 g/l in drivers above 18 years old is at least of 5.0% in the driving population, and the prevalence of cannabis above 1 ng/ml is at least equal to 2.8%. As expected, these prevalences are much lower than those observed in drivers involved in fatal crashes.

As a mean of validation of this control group and of its prevalences, the obtained prevalences have been compared, in France, with prevalences obtained by other methods. For alcohol, in the same period, the prevalence of alcohol above 0.5 g/l in the driving population was found to be 2.5% by the National inter-ministerial road safety Observatory (ONISR 2004), whereas the corresponding estimation on our control group is equal to 2.7% (Laumon et al. 2005). We can also consider drivers involved in slight crashes as close to drivers in the driving population and standardize prevalences obtained in the control group on the characteristics of these drivers. Comparing our controls with non-responsible drivers involved in a slight injury crash allowed us to identify their distinguishing characteristics: driver's sex and age; type of vehicle; and place, time, and type of crash. The prevalence of cannabis (above 1 ng/ml) in our controls was 2.8%, compared with 2.9% when standardised for these variables; both these prevalences were 2.7% for alcohol (above 0.5 g/l) (Laumon et al. 2005).
These similarities contribute to validate that the prevalences observed in the control group are good estimates of prevalences in the driving population.

References

Biecheler, M. B., Peytavin, J. F., the SAM group, Facy, F. & Martineau, H. 2008 SAM survey on "Drugs and Fatal Accidents": Search of Substances Consumed and Comparison between Drivers Involved under the Influence of Alcohol or Cannabis. In *Traffic Injury Prevention*, vol. 9:1, pp. 11-21.

Brault, M., Dussault, C., Bouchard, J. & Lemire, A. M. 2004 The contribution of alcohol and other drugs among fatally injured drivers in Quebec: Final results. In *Proceedings of the 17th International Conference on Alcohol, Drugs and Traffic Safety*. Glasgow: International Council on Alcohol Drugs and Traffic Safety.

Drummer, O. H., Gerastomoulos, 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. *Accid Anal Prev* **36**, 239-48.

Dussault, C., Brault, M., Bouchard, J. & Lemire, A. M. 2002 The contribution of alcohol and other drugs among fatally injured drivers in Quebec; some preliminary results. In *Alcohol, Drugs and Traffic safety*, pp. 423-30. Quebec: SAAQ.

Evans, L. 1991 *Traffic Safety and the Driver*: Van Nostrand Reinhold, New York.

Laumon, B., Gadegbeku, B., Martin, J. L. & and the SAM group. in press Stupéfiants et accidents mortels de la circulation routière (Projet SAM), Partie I: analyse épidémiologique [Drugs and fatal road traffic accidents (SAM Project), Part I: epidemiological analysis]. Paris: OFDT ed.

Laumon, B., Gadegbeku, B., Martin, J. L., Biecheler, M. B. & and the SAM Group. 2005 Cannabis intoxication and fatal road traffic crashes in France: population based case control study. *British medical journal* **331**, 1371-1374 (full text on www.bmj.com).

Longo, M. C., Hunter, C. E., Lokan, R. J., White, J. M. & White, M. A. 2000 The prevalence of alcohol, cannabinoids, benzodiazepines and stimulants amongst injured drivers and their role in driver culpability. Part I: the prevalence of drug use in drivers, and characteristics of drug-positive group. *Accid Anal Prev* **32**, 613-22.

ONISR. 2004 La securité routière en France. Bilan de l'année 2003 [Road safety in France. 2003 report], pp. 240. Paris: Rapport annuel de l'observatoire national interministériel de sécurité routière.

Ravera, S. & de Gier, J. J. 2008 Prevalence of Psychoactive Substances in the General Population, Deliverable 2.1.1., pp. 67: DRUID 6th Framework Programme.

Walsh, J. M., Flegel, R., Atkins, R., Cangianelli, L. A., Cooper, C., Welsh, C. & Kerns, T. J. 2005 Drug and alcohol use among drivers admitted to a Level-1 trauma center. *Accident Analysis and Prevention* **37**, 894-901.

Acknowledgments

We wish to thank the reviewer of this deliverable, G. Berghaus, for his valuable comments.

ANNEXES

Table 22 : Prevalence of psychoactive substances in drivers over 18 years old involved in fatal road crashes, France, 2001-2003, using French legal thresholds, n=10,519

Psychoactive substance	prevalence
Alcohol (≥ 0.5 g/l)	21.1 %
Cannabis (THC ≥ 1 ng/ml)	6.9 %
Amphetamines (≥ 50 ng/ml)	0.5 %
Cocaine (≥ 50 ng/ml)	0.2 %
Opiates (≥ 20 ng/ml)	0.9 %

Table 23 : Prevalence of psychoactive substances in drivers over 18 years old involved in fatal road crashes, by road user type, France, 2001-2003, using French legal thresholds

Road user type	n	Alcohol	Cannabis	Amphet.	Cocaine	Opiates
Bike	131	16.8 %	3.8 %	0.0 %	0.0 %	0.0 %
Moped	217	50.2 %	14.3 %	0.9 %	0.9 %	0.9 %
Motorcycle	1 018	24.3%	9.0 %	0.3 %	0.1 %	0.9 %
Car	7 455	23.6 %	7.5 %	0.5 %	0.2 %	1.0 %
Van	340	11.2 %	5.0 %	0.6 %	0.3 %	0.3 %
Truck	1 092	2.1 %	1.9 %	0.2 %	0.3 %	0.3 %
Other	266	6.8 %	0.4 %	0.0 %	0.0 %	0.4 %

Table 24 : alcohol prevalence in ALL drivers over 18 years old involved in fatal crashes, by age and sex, France, 2001-2003, using French legal thresholds

Alcohol positivity (≥ 0.5 g/l) by age and gender	men		women	
	n	prevalence	n	prevalence
18-24 year old	2 094	28.6 %	317	8.8 %
25-34 year old	2 215	27.8 %	377	10.3 %
35-49 year old	2 518	23.5 %	482	13.7 %
50 +	2 057	12.0 %	459	7.0 %
All	8 884	23.1 %	1 635	10.1 %

Table 25 : Prevalence of alcohol and cannabis, ALL drivers over 18 years old involved in fatal crashes, France , 2001-2003, using French legal thresholds, n=10,519

Alcohol (g/l)	Cannabis (ng/ml)	prevalence
No (<0.5)	No (<1)	74.8 %
	Yes (≥1)	4.1 %
Yes (≥0.5)	No (<1)	18.3 %
	Yes (≥1)	2.8 %

Table 26 : prevalence of psychoactive substance according to responsibility status for the fatal crash, ALL drivers over 18 years old, using using French legal thresholds

Psychoactive substance	Prevalence in responsible drivers (n=6620)	Prevalence in non-responsible drivers (n=3864)
Alcohol (≥ 0.5 g/l)	30.0 %	5.9 %
Cannabis (THC ≥ 1 ng/ml)	8.7 %	3.8 %
Amphetamines (≥ 50 ng/ml)	0.6 %	0.2 %
Cocaine (≥ 50 ng/ml)	0.3 %	0.1 %
Opiates (≥ 20 ng/ml)	0.8 %	0.9 %

Table 27 : prevalence of psychoactive substance in the driving population, ALL drivers over 18 years old, using using French legal thresholds, n=10,519

Psychoactive substance	responsible drivers	non-responsible drivers	
		only fatally injured	not only fatally injured
	(n=6 620)	(n=918)	(n=2 981)
Alcohol (≥ 0.5 g/l)	30.0 %	16.3 %	2.7 %
Cannabis (THC ≥ 1 ng/ml)	8.7 %	7.0 %	2.8 %
Amphetamines (≥ 50 ng/ml)	0.6 %	0.3 %	0.2 %
Cocaine (≥ 50 ng/ml)	0.3 %	0.0 %	0.1 %
Opiates (≥ 20 ng/ml)	0.8 %	0.9 %	0.9 %

Table 28 : injury severity according to responsibility status for the fatal crash, ALL drivers over 18 years old, France 2001-2003, n=10,519

Injury severity	Responsible drivers	Non-responsible drivers
Non-injured	23.2 %	39.6 %
Slightly injured	10.9 %	20.5 %
Seriously injured	8.4 %	11.2 %
Killed	57.5 %	28.8 %
All	100.0 %	100.0 %

Table 29 : injury severity according to cases and controls, ALL drivers over 18 years, France 2001-2003, n=9606

Injury severity	cases	controls
Non-injured	23.2 %	51.7 %
Slightly injured	10.9 %	26.8 %
Seriously injured	8.4 %	14.6 %
Killed	57.5 %	6.9 %
All	100.0 %	100.0 %

Biecheler, M. B., Peytavin, J. F., the SAM group, Facy, F. & Martineau, H. 2008 SAM survey on "Drugs and Fatal Accidents": Search of Substances Consumed and Comparison between Drivers Involved under the Influence of Alcohol or Cannabis. In *Traffic Injury Prevention*, vol. 9:1, pp. 11-21.

Brault, M., Dussault, C., Bouchard, J. & Lemire, A. M. 2004 The contribution of alcohol and other drugs among fatally injured drivers in Quebec: Final results. In *Proceedings of the 17th International Conference on Alcohol, Drugs and Traffic Safety*. Glasgow: International Council on Alcohol Drugs and Traffic Safety.

Drummer, O. H., Gerastomoulos, 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. *Accid Anal Prev* **36**, 239-48.

Dussault, C., Brault, M., Bouchard, J. & Lemire, A. M. 2002 The contribution of alcohol and other drugs among fatally injured drivers in Quebec; some preliminary results. In *Alcohol, Drugs and Traffic safety*, pp. 423-30. Quebec: SAAQ.

Evans, L. 1991 *Traffic Safety and the Driver*: Van Nostrand Reinhold, New York.

Gadegbeku, B. & Amoros, E. 2010 Responsibility study: main illicit psychoactive substances from drivers involved in fatal road crashes in France. In *DRUID, WP2,Task 2.3.3*, pp. 1-28.

Jones, R. K., Shinar, D. & Walsh, J. M. 2003 State of knowledge of drug-impaired driving. Washington: National Highway Traffic Safety Administration.

Laumon, B., Gadegbeku, B., Martin, J. L. & and the SAM group. in press Stupéfiants et accidents mortels de la circulation routière (Projet SAM), Partie I: analyse épidémiologique [Drugs and fatal road traffic accidents (SAM Project), Part I: epidemiological analysis]. Paris: OFDT ed.

Laumon, B., Gadegbeku, B., Martin, J. L., Biecheler, M. B. & and the SAM Group. 2005 Cannabis intoxication and fatal road traffic crashes in France: population based case control study. *British medical journal* **331**, 1371-1374 (full text on www.bmj.com).

Longo, M. C., Hunter, C. E., Lokan, R. J., White, J. M. & White, M. A. 2000 The prevalence of alcohol, cannabinoids, benzodiazepines and stimulants amongst injured drivers and their role in driver culpability. Part I: the prevalence of drug use in drivers, and characteristics of drug-positive group. *Accid Anal Prev* **32**, 613-22.

ONISR. 2004 La securité routière en France. Bilan de l'année 2003 [Road safety in France. 2003 report], pp. 240. Paris: Rapport annuel de l'observatoire national interministériel de sécurité routière.

Ravera, S. & de Gier, J. J. 2008 Prevalence of Psychoactive Substances in the General Population, Deliverable 2.1.1., pp. 67: DRUID 6th Framework Programme.

Robertson, L. S. 1992 *Injury Epidemiology*: Oxford University Press, USA.