

## ORIGINAL ARTICLE

# Prevalence of alcohol and drugs in urine of patients involved in road accidents

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## Key words

Alcohol • Drug • Road accident • Urine

## Summary

**Objective.** Road injuries are the leading injury-related cause of death among people aged 15-44. A clear dose-effect relationship has been demonstrated for drug and alcohol use and road traffic accidents. The objective of our study was to estimate the prevalence of drug and/or alcohol use in subjects admitted for road traffic accidents to an Emergency Department.

**Methods.** In this study, conducted between January and April 2006, 100 patients of both sexes (age 18-65) examined after road traffic accidents were consecutively enrolled. A commercial rapid urine test was used to detect drugs by the Emergency Department staff. The alcohol concentration was determined from a blood sample at the central laboratory.

**Results.** Most of the patients were drivers under 35 years of age. 67/100 road traffic accidents occurred at the weekend (Friday-Sunday), nearly 60% between 24:00-09:00 hrs; on non-weekend days about 80% of road traffic accidents were recorded between 14:00-24:00 hrs ( $p < 0.0001$ ). With the alcoholemia test and urine test for drugs detection 43/100 patients showed a single or multiple positivity. Alcohol and drug presence is relevant during the weekend (37/43 cases), in contrast with non week-

end (6/43 cases) [OR 3.04 (95% CI 1.43; 6.46)]. Alcohol was the most frequently detected abuse substance (72%), followed by benzodiazepines (42%), tetrahydrocannabinol (21%) and cocaine (14%).

**Discussion.** 43% of patients examined were under the influence of psychotropic substances (alcohol, drugs or both). The greater part of road traffic accidents in positive test patients occurred during the week-end, in particular during the late night/early morning hours, probably after recreational time. The high incidence of alcohol and/or drug abuse may have caused physical and/or psychological problems, therefore the high number of road traffic accidents, especially if taken in combination.

**Conclusion.** The rapid urine test used cannot represent a diagnosis, and requires a confirmation test. It can be used for medical purposes as an easy and fast preliminary response which enables a faster diagnostic and therapeutic guideline, but it cannot be used for sanctions. Further studies are advisable with an increase of number of patients, in a wider temporal range, including control subjects, and using confirmation tests.

## Introduction

A traffic accident is defined as any vehicle accident occurring on a public road (i.e. originating on, terminating on, or involving a vehicle partially on the road). These accidents therefore include collisions between various kind of vehicles, or with bicyclists, or pedestrians, or fixed obstacles. According to ISTAT, the Italian National Institute of Statistics, in Italy in 2003 there were 225,141 road traffic accidents (RTA), about 71,000 (31.5%) of them serious, with 6,015 (2.7%) deaths [1]. The World Health Organization reports that road injuries are the leading injury-related cause of death among people aged 15-44 [2] and estimates that injuries are expected to take the third place in the rank order of disease burden by 2020 [3, 4].

Drug and alcohol use may be associated with injuries, and in particular a clear dose-effect relationship

between alcohol and road traffic accidents has been demonstrated [5-11]. Many medicines (prescription or over-the-counter) and illicit drugs affect the nervous system [12]. Driving under the influence of drugs in addition to alcohol is considered to be an increasing cause of traffic accidents worldwide [11, 13]. Causality between both licit and illicit drugs or/and alcohol consumption and trauma is multifactorial [14]. Such factors include age, fatigue, personality traits, medical conditions, and environmental conditions. Many observational studies have shown that drug use, as determined by biological sampling among drivers, is prevalent and increasing [15-17].

Different approaches have been made to this problem, including toxicological screening and self report questionnaires in seriously injured trauma patients admitted to a trauma centre, trauma patients with altered levels of consciousness, drivers under arrest, and RTA fatalities [11].

It could be argued that the Emergency Department doctors have a medical and social responsibility to detect reversible influences such as alcohol and drug intoxication, as studies have shown that such intoxication is associated with recurrent trauma, and shelter from culpability [18-21].

The objective of our preliminary study was to estimate the prevalence of drug and/or alcohol use in subjects admitted for RTA to an Emergency Department in the Verona area (North Italy).

## Methods

This was a prospective hospital based study, conducted between January and April 2006 in an Emergency Department in northern Italy with an admission of approximately 98,800 patients per year, with approximately 53,458 trauma victims among with over 1,920 subjects concerned by RTA.

Inclusion criterion was based on the consecutive enrolment of the first 100 patients aged between 18 and 65 years of both sexes examined for RTA with a prognosis  $\geq 7$  days. Each day was considered beginning at 00:01 to 24:00 hrs. So the weekend was considered from 00:01 hrs on Friday to 24:00 hrs on Sunday.

All these subjects were tested for the presence of alcohol, drugs or pharmaceuticals usable as drugs respectively in blood and urine.

The protocol was carried out according to the Helsinki Declaration and approved by the local ethical committee. A written informed consent was obtained from all the patients before the urine and blood samples were taken. When samples were taken anonymous matching bar codes, non-specific to the patient, were used. Additional data added to the matching bar codes were sex (male or female), age (18-65 years), and notices on RTA (by car, motorcycle, bicycle; driver, passenger, pedestrian; type of road where accident occurred).

The urine test for the drug screening was performed by a commercially multi-column drug profiling system (TOX/See™ Rapid Urine Drug Screen Tests, Bio-Rad® Laboratories, Hercules, Ca, USA) [22] performed by the Emergency Department staff. This system permits the qualitative detection of 10 among pharmaceutical agents, drugs or drug metabolites in human urine. The final result is obtained after approximately 5-10 minutes. The test results are stable and readable for a minimum of one hour to accommodate busy laboratory schedules. Urine may be conserved at + 2/+ 8 °C with a time limit of 48 hours, or at - 20 °C for a longer time.

The urine samples were tested for pharmaceuticals as benzodiazepines (BZO), cut-off value of the test (c.o.) = 300 ng/mL; tricyclic antidepressant (TCA), c.o. = 1,000 ng/mL; barbiturates (BAR), c.o. = 300 ng/mL; abuse-drugs as single substance as tetrahydrocannabinol (THC), c.o. = 50 ng/mL; cocaine (COC), c.o. = 300 ng/mL; opiates (OPI), c.o. = 300 ng/mL; amphetamines

(AMP), c.o. = 1,000 ng/mL; 3,4-Methylenedioxyamphetamine (MDMA), c.o. = 500 ng/mL; methamphetamine (MET), c.o. = 1,000 ng/mL; methadone (MTD) c.o. = 300 ng/mL [23].

The alcohol concentration was determined from the blood sample within one hour at the central laboratory of the same hospital as the Emergency Department, using the enzymatic "alcohol dehydrogenase" method, with the UV spectrophotometer. The minimum measurable amount was of 0.1 g/L. Blood samples were collected in well sealed tubes containing K3EDTA + NaF as anticoagulant and preserved at + 4/+ 8 if not immediately processed [24].

## STATISTICAL ANALYSIS

In order to report the results of the analysis, categorical variables were presented as numbers and percentages; the comparison between subgroups was carried out using Chi-square test or Fischer test, when appropriate, for qualitative data.

The main outcome considered was positivity to alcohol and drugs.

P-values were considered significant when less than or equal to 0.05.

## Results

The characteristics of the 100 consecutively enrolled patients (47 males and 53 females) victims of RTA examined at the Emergency Department are shown in Table I.

Tab. I. Characteristics of the 100 patients enrolled after road traffic accidents.			
Driver characteristics	N. = 100	Circumstances	N. = 100
Age group (years)	N.	Role	N°
18-35	42	Drivers (car & motorcycle)	56
36-55	33	Passengers	15
56-65	25	Bicyclists	12
		Pedestrians	17
Gender			
Male	47		
female	53		
Kind of trauma	N°	Road	N°
Cranial	32	urban road	43
Cervical	15	extra urban road	50
Thoracic	7	motorway	7
Limb fracture	14		
Polytrauma	16		
Contusions	16		

Most of them are under 35 years of age, drivers, with a cranial trauma; only few RTA occurred on the motorway. Out of the 100 RTA recorded during the whole week (Monday 00:01 hrs–Sunday 24:00 hrs), 67 have occurred at the weekend (Friday 00:01 hrs–Sunday 24:00 hrs); the weekly distribution were: 5 on Monday, 7 on Tuesday, 10 on Wednesday, 11 on Thursday, 21 on Friday, 31 on Saturday, 15 on Sunday.

The distribution of the RTA rate (RTA/hour rate = n. of RTA per 1 hour during each day interval) in the 24 hours both during the entire week, weekend and non-weekend days is shown in Figure 1. Considering all the 100 RTA occurring during the entire week, two major peaks were recorded: between 19:01 and 24:00 (30%) and between 00:01 and 04:00 (25%). The distribution of RTA appears significantly different when comparing weekend days (from Friday 00:01 hrs to Sunday 24:00 hrs) and other days (from Monday 00:01 hrs to Thursday 24:00 hrs): the majority of the events (nearly 60%) occur between 24:00 and 09:00 hrs on weekend days, while about 80% between 14:00 and 24:00 hrs on non-weekend days ( $p < 0.0001$ ).

With the urine test for drugs detection and alcoholemia test 43 out of 100 patients resulted positive. A multiple positivity to psychoactive substances can be found in a single subject as alcohol plus psychoactive, or for more than one psychoactive (substance).

Out of the 43 positive-test-subjects, the alcohol and drug presence is relevant during the weekend (37 cases) in contrast with the Monday-Thursday period (6 cases) [OR 3.04 (95% CI 1.43; 6.46)] (Fig. 2).

As regards to alcohol consumption there is no significant difference among RTA studied groups of subjects but a significantly higher proportion of drug users was found in passenger and bicyclists than other groups ( $p = 0.001$ ) (Fig. 3).

Figure 4 describes the distribution of alcohol and psychoactive substances revealed in the 43 positive subjects. The total rate may be over 100% as a patient may result positive to more than one tested substance. Alcohol is the most frequently detected substance of abuse (rate of cases total: 72%; alone: 27%; with BZO: 21%; with THC: 14%). In relation to the frequency of positivity to substances abuse, in second place there is BZO (cases total: 42%; alone: 16%; with alcohol: 21%; with TCA: 5%), and respectively, in third and fourth places, there is THC (cases total: 21%; alone: none; with alcohol: 14%; with AMP: 7%) and COC (cases total: 14%; alone: 7%; with opiates: 5%; with alcohol: 9%).

Among all the detected substances, including alcohol, in over 65% of cases the use of sedatives was found.

## Discussion

57% of the 100 RTA patients studied at the Emergency Department resulted negative to alcohol and drug tests, and their road accidents can probably to be ascribed to

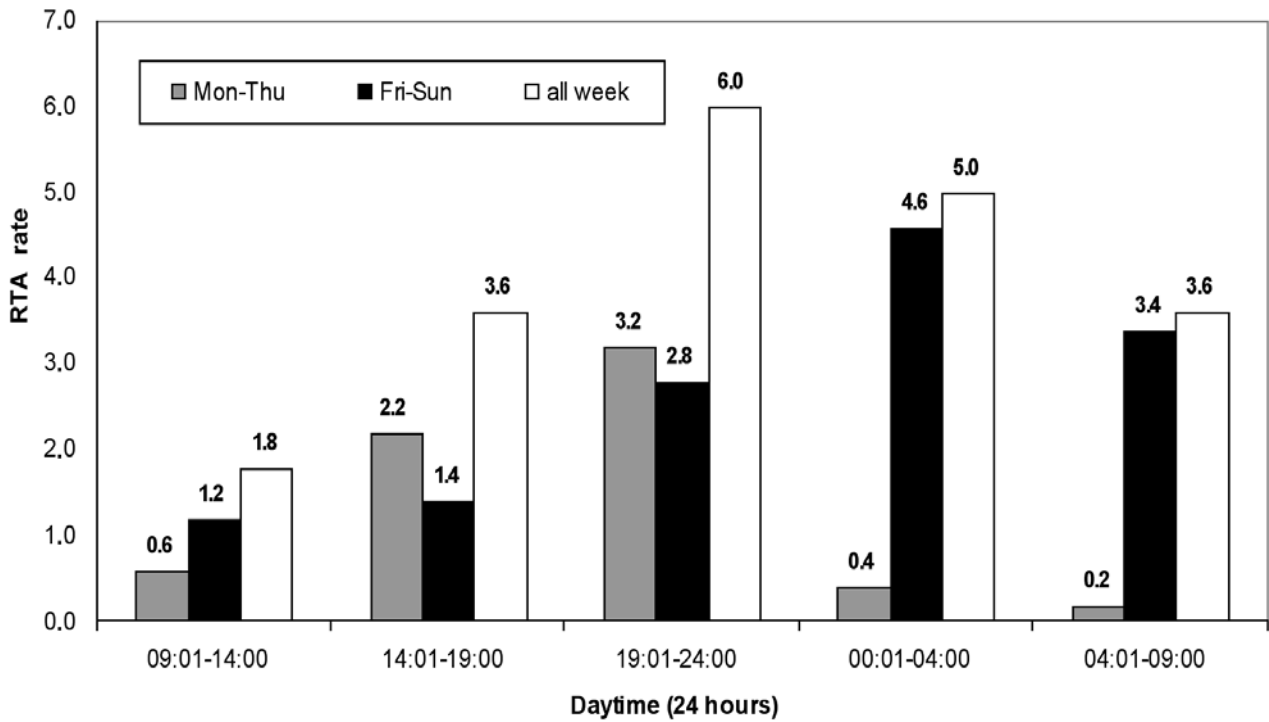
hurry, tiredness after work time, inattention, adverse road or meteorological conditions, fatality. Nevertheless this study found that nearly half of the sample examined (43%) was under the influence of psychotropic substances. As reported by International literature, alcohol, drugs and some pharmaceuticals lead to driving disability and to a higher number of RTA [25-27]. 31% of the drivers were found positive to alcohol testing: 12% positivity only to alcohol and 19% with drug association (THC, COC, BDZ). Given that even low alcoholemic levels ( $> 50$  mg/100 ml) produce disabilities to drive [28, 29], about one third of drivers tested were in psychophysical altered conditions. As regards exclusive drug intoxication, another the 31% of tested patients resulted positive. The most frequently detected substance was BZO, then COC, THC and AMP. The larger portion (over 65% of cases) of the detected psychotropic substances was the sedatives. In positive subjects to psychotropic substances the greater part of RTA is found during the week-end and in particular during the late night/early morning hours, probably after recreational time (parties, weekend get together, clubs, leisure time) [30]. The high incidence of alcohol and/or drug abuse may explain the high number of RTA, and if taken in combination they increase exponentially the degree of physical and psychological disability, hence the risk of RTA [31-33]. There is experimental and epidemiological evidence about the disabling role of drugs which affect the ability to drive through an effect of sedation (e.g. opiates, hypnotics etc.) or altered perception of risk (e.g. cocaine, amphetamines), exacerbated by the simultaneous intake of alcohol. The effects of stimulant drugs cause heightened alertness and confidence. This may give a false sense of security regarding their actual levels of impairment and may make the person feel to be “in full control” and able to drive a motor vehicle [31]. This study shows that alcohol and drug use involves not only car drivers, bicyclists and motorcyclists, but also passengers and pedestrians. Each of them may be involved in an accident because of a self alteration, or the effects of someone else’s psychophysical disturbances.

The rapid urine test used cannot represent a diagnosis, and requires a confirmation test with the GC/MS method. However for the majority of the urine samples studied, the triage with the rapid urine test produce identical results to other commercial-instrument-based immunoassay [34].

The most significant advantage with on-site testing is provision of rapid results, usually within 5-10 minutes. Disadvantages are the risks of false positive and false negative results, the fact that numerous drugs cannot be tested for, and the limited possibilities to detect manipulation.

Positivity to the urine drug test gives a qualitative answer and does not allow us to determine the substance concentration, its intoxication level or its administration route. Nevertheless the cut-off value used by the commercial test employed to detect drugs or their metabolites in the urine allows to consider positive results

Fig. 1. Distribution time (24 h) of the RTA/hour rate\* during the entire week, Monday-Thursday and Friday-Sunday.



RTA = road traffic accident; Monday-Thursday = from 00:01 to 24:00 hrs; Friday-Sunday = from 00:01 to 24:00 hrs; \* = RTA/hour rate (n° of RTA per 1 hour during each day interval)

Fig. 2. Distribution of positivity to drug and alcohol consumption on week days in subjects involved in RTA.

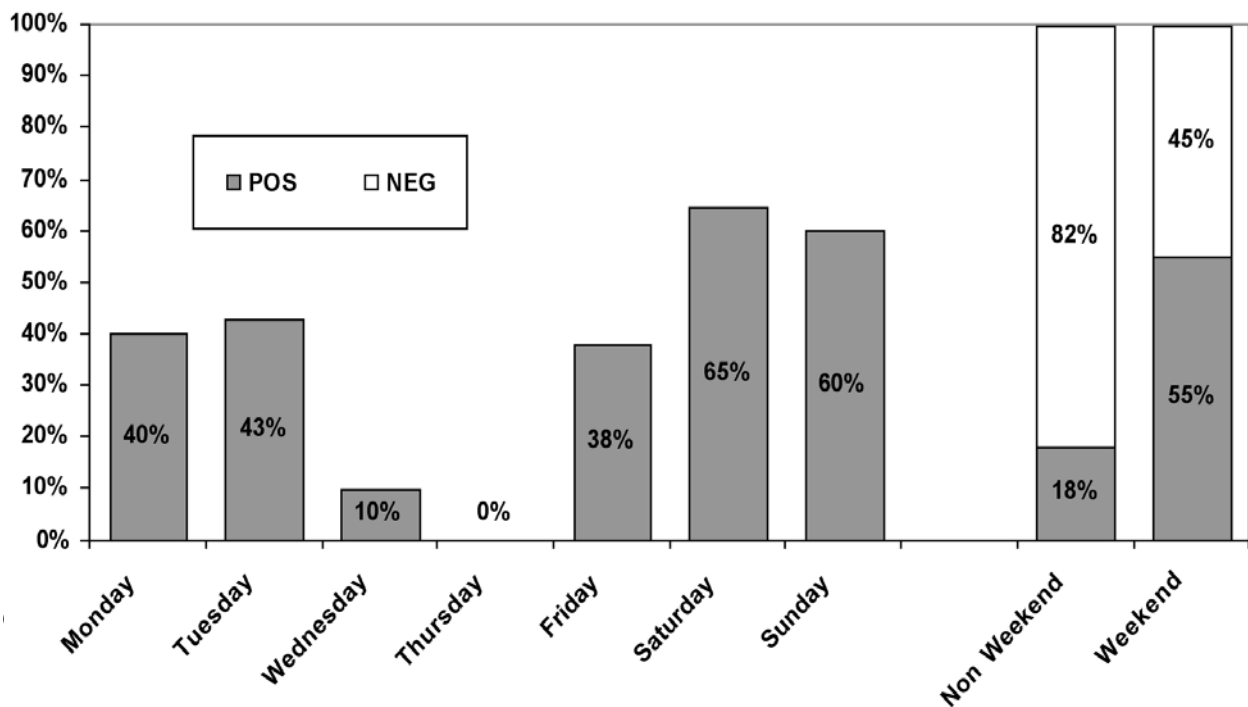


Fig. 3. Presence of alcohol and drugs according to role during the road traffic accident.

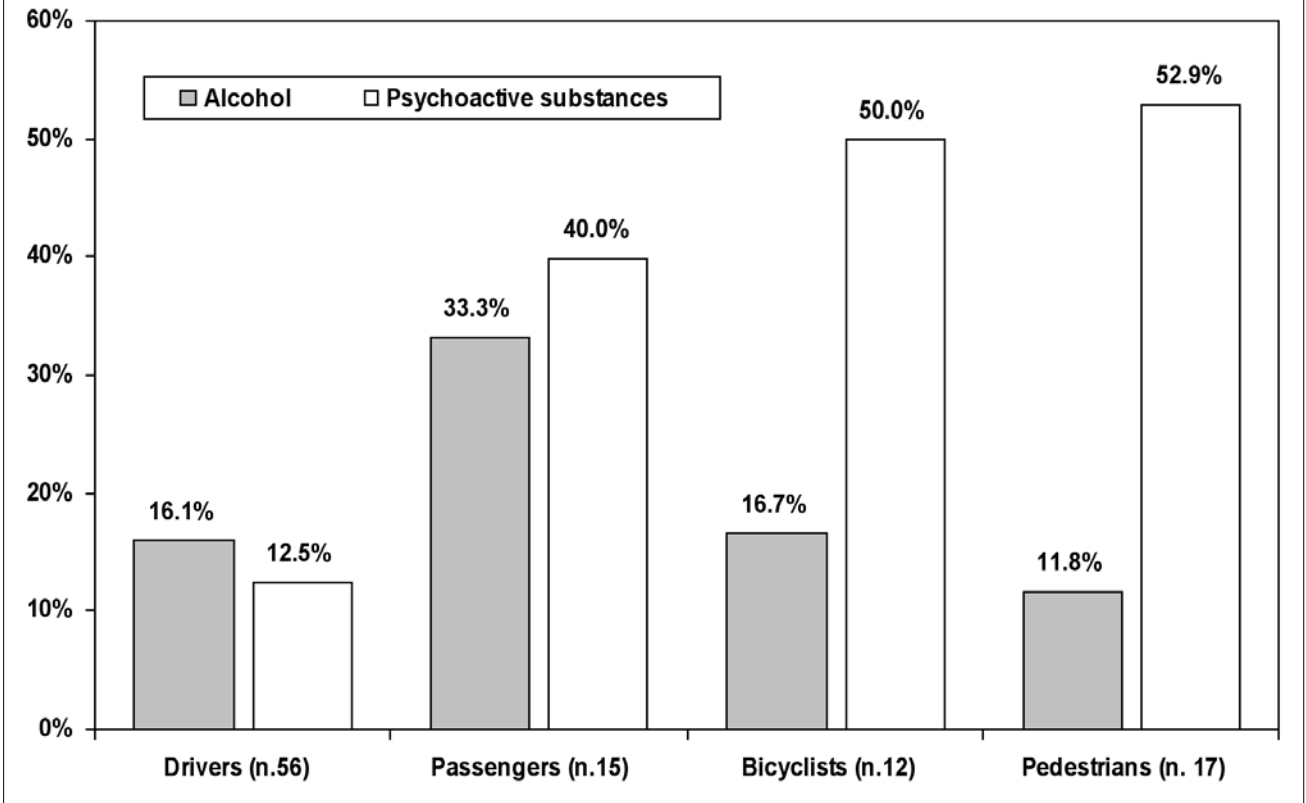
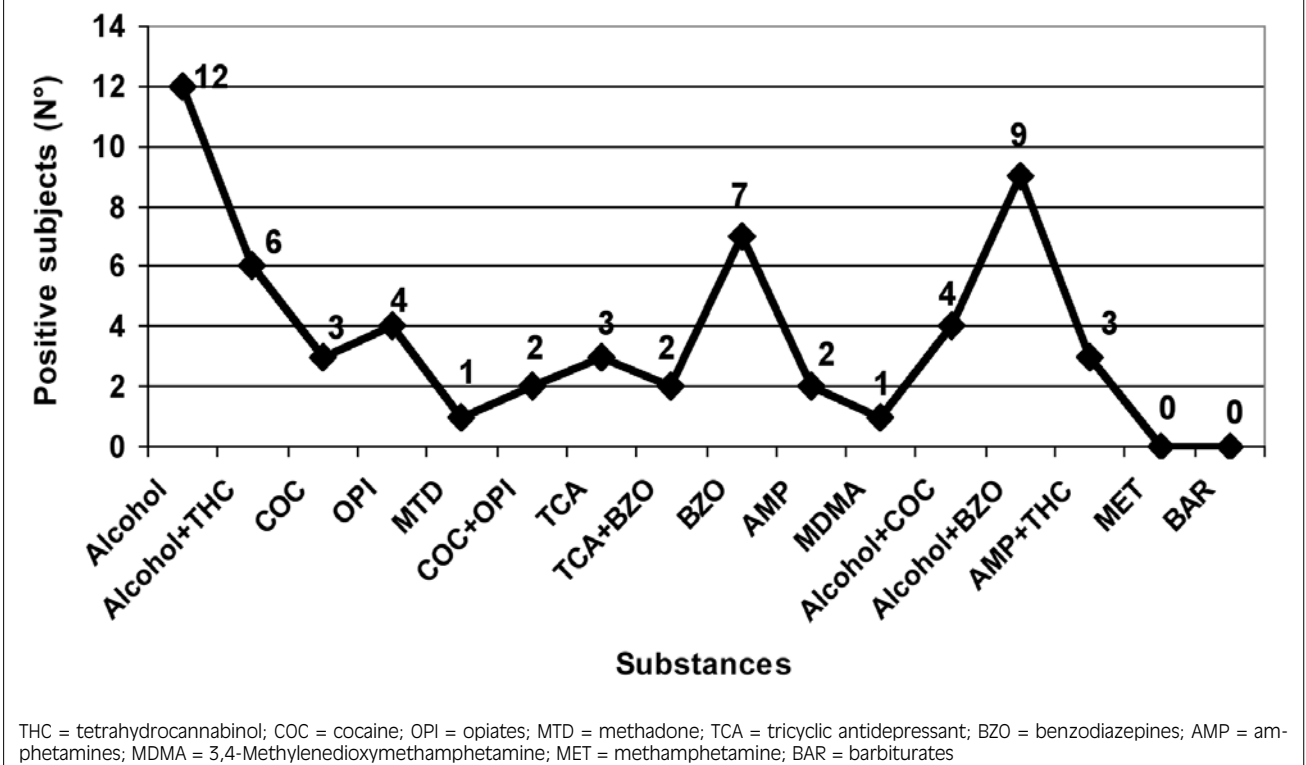


Fig. 4. Positivity to alcohol and psychoactive substances abuse in subjects involved in road traffic accidents.



as very probably positive. On the other hand it is possible to obtain a false negative result as there is not yet enough of substance in the urine. So on-site testing can be used for medical purposes, but cannot be used as the only method if a positive result may cause sanctions. This rapid urine test may give the medical personnel of an Emergency Department a preliminary easy and fast response which enables a faster diagnostic guideline, to avoid therapeutic faults such dangerous pharmaceutical association may induce, to inform the anaesthetist in case of urgent surgical intervention. It is an aid to anaesthesiologists, given the high frequency of patients

with drug abuse history who are admitted to intensive care units and who undergo anaesthesia for emergency surgery [35-40].

This paper reports a preliminary study to evaluate the presence of the use of psychotropic substances in road traumatized subjects admitted to an Emergency Department. To further our knowledge of the distribution of the phenomena and the correlations with dangerous events, further studies are advisable with an increase of number of patients, in a wider temporal range (12 month), including control subjects (with traumas not due to RTA), and using confirmation tests.

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