

# The Influence of Alcohol and Drugs on Driving

Report on a WHO  
*Ad Hoc* Technical Group

Monaco  
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**AD HOC TECHNICAL GROUP ON  
THE INFLUENCE OF ALCOHOL AND  
DRUGS ON DRIVING**

*Monaco, 30 October – 2 November 1978*

## 1. INTRODUCTION

A resolution adopted by the twenty-sixth session of the WHO Regional Committee for Europe in 1976 requested the Regional Director to convene a consultative group to advise on the development of a medium-term programme on prevention of road traffic accidents. The Group recommended that, within that programme, priority be given to a study of the problem of alcohol and medical drugs as major risk factors in road traffic accidents.

For these reasons, the World Health Organization's Regional Office for Europe, in collaboration with the Government of the Principality of Monaco, convened a Technical Group on the Influence of Alcohol and Drugs on Driving, which met from 30 October to 2 November 1978.

The participants came from ten countries of the WHO European Region (Austria, Czechoslovakia, Finland, France, Federal Republic of Germany, Monaco, Poland, Sweden, Switzerland, United Kingdom), and from Canada and the United States. A list of participants is included as an annex. A variety of professions was represented: clinical physicians, forensic pathologists, pharmacologists, toxicologists, psychiatrists, psychologists, road safety experts and public health administrators. Mr Desmet, Government Counsellor for the Interior, welcomed participants on behalf of the Government of the Principality. Dr Boéri was elected Chairman of the meeting and Professor Fournier Rapporteur. In his opening statement, Dr Leo A. Kaprio, WHO Regional Director for Europe, thanked the Government of the Principality of Monaco for the interest it had displayed in the Regional Office's programme by inviting the Group to Monaco, before going on to recall that the effects of alcohol on road safety had already been the subject of major research that had laid the basic scientific groundwork for preparing preventive policies. Nonetheless, results were still not wholly satisfactory and the present situation required that the effort be continued.

Dr Kaprio noted that at present there were many hypotheses as to the real influence of drugs in increasing accident risks. Moreover, experiments

in the area were as costly as they were difficult to implement, and thus required active international cooperation.

Still, knowledge of the impact of medical drugs on behaviour and on the mental and physical abilities called upon in performing the various tasks involved in driving had increased considerably in recent years. Efforts should now be made to develop effective countermeasures. It was likewise important, in any research into the causes of accidents, not to treat the problems of alcohol and drugs in isolation but as part of a more general approach. In practice, since the problems merely reflected to some extent cultural or psychosocial ingredients in the make-up of the population, preventive activities should also be conducted at several levels.

Finally, he stressed that solution of many of the problems posed by alcohol and drugs required close cooperation between countries and greater collaboration at international level. One major step in that direction had just been taken by WHO and OECD, which were using certain major activities carried out by the latter to study the best ways of strengthening their respective programmes by increased collaboration.

## 2. GENERAL

Dr Romer, Regional Officer for Accident Prevention, then introduced the discussions, recalling the aims of the meeting, which were to review the present state of research and consider the latest developments in science, which might form the basis for specific recommendations in the spheres of legislation or research.

He also recalled that the Group formed part of a series of technical activities aimed at reviewing the chief problems encountered in the prevention of road traffic accidents and he noted that the recommendations emerging from the Group would be of additional interest since, at the same time as they were directed towards the governments of the European Region, for whom the problem was of major concern, they would also contribute to the development of the global programme of WHO, for which responsibility had been placed with the European Regional Office.

Reference had also been made to the Convention on Psychotropic Substances, 1971. Articles 3 and 10 of that Convention stressed the usefulness of regulations and recommendations requiring precautions and warnings to be indicated on the packaging and directions for use of psychotropic substances, and called for warning notices on the unfavourable side effects of certain medical drugs taken in combination with alcohol which make certain activities such as the driving of cars more dangerous than usual.

If the problem is treated as a whole, present studies on the links between traffic accidents and the consumption of alcohol and psychotropic substances run into certain difficulties, partly because of:

- imprecise understanding of driving: the way vehicles are used, outside agents affecting safety;
- wide variations in the national legislation of different countries on blood-alcohol levels considered acceptable for a driver;
- a wide range of variations in methods of study and prevention of the side effects of drugs, depending on whether there is actual legislation or simply recommendations on the use of psychotropic substances by drivers, or whether there are no specific indications on driving at all;
- a wide range of controls over drivers and attitudes towards them (penalties or experiments in re-education); and
- the vague nature of documentation on traffic accidents, even of the most serious type.

The incidence of accidents in a state of intoxication can only be understood from statistical patterns; this is why studies and research must be continued, so as to:

- identify medicines and drugs that alter driving behaviour, and study the effects of taking them in combination with alcohol;
- refine the methodology for biological and analytical studies that can be used at present, enhance knowledge of the subject, and facilitate decisions;
- improve epidemiological studies, showing the difficulties encountered;
- simplify decision making by studying the practical effect of various types of legislation on alcohol, drugs and driving, and psychosocial aspects of the problem.

### **3. REVIEW OF DRUGS WITH A KNOWN EFFECT ON DRIVING**

Those drugs with a proven effect on driving, in isolation or in combination with alcohol, directly or indirectly have an impact on the activity of the higher nervous system.

Psychotropic substances, the ones that seem to be most harmful in driving, are also the ones that have been most closely studied. However, it is important not to ignore the potential harm done by cough sedatives, anti-migraine preparations, muscle relaxants, antispasmodics, anti-Parkinsonism preparations and anti-convulsants — all of them liable to reduce vigilance — or that done by antihypertensives and antidiabetic drugs.

### 3.1 Hypnotics

Barbiturates play a major part in accidents: analyses indicate that recent intake of them is found in 9% of those suffering accidents, in 2.5% of car accidents (1), in 9.3% of traffic accidents (2), in 3% of accident victims in general (3), and in 2% of fatalities (4-6).

Experimentally, motor coordination is reduced by 0.3 g cyclobarbitol or 0.20 g secobarbital. For hearing and visual stimuli, reaction times are diminished after 0.30 g secobarbital, for example. Performance is reduced by 0.20 g secobarbital and 0.15 g amobarbital (7). Errors on a driving simulator register an upswing after 0.10 g secobarbital, 0.20 g butobarbital or 0.20 g phenobarbital (7-12). Another test was applied to 40 volunteer students treated for periods of 14 days with low doses of hypnotic drugs (13): amylobarbitol and flurazepam changed the results more than did methaqualone, diphenhydramine and glutethimide.

### 3.2 Tranquillizers

The effect of these is undeniable; for accidents requiring hospitalization, the diazepam content in the blood has been found positive in 2.59% of subjects in the USA (14,15) and in 11% in Denmark (16) and Norway (17).

Experimentally, results from vigilance tests are lower after absorption of tranquillizers (13,18-20). A dose of 5 mg of diazepam for 4 days is sufficient to reduce driving performance, reaction times, and motor coordination (21), but a single weak dose of 2 mg has no effect.

An additional factor comes into play to distort the results of studies on behaviour under the effect of tranquillizers; the subjects these are prescribed for are of a distinctive type in that they in any case have a high rate of traffic accidents (6, 20, 22). Moreover, as for the following categories, it is by no means certain that the results obtained on healthy volunteers are applicable to the particular type of subject who is prescribed such drugs.

### 3.3 Neuroleptics

Some authors consider that low doses reduce vigilance and the capacity to integrate information (23,24); 1 mg/kg of chlorpromazine or thioridazine is

enough to reduce the motor capacity of the wrists (25); 25 mg of promethazine or 10 mg/kg of fluphenazine reduces reaction speed and motor efficiency.

On the other hand, 50 mg of chlorpromazine was found to have no effect on some of the aspects of visual acuity studied. Fluphenazine apparently has no effect at low doses (26).

### 3.4 Analgesics

Even though the sedative effect of analgesics is not the main aspect of their action, their existence justifies a study in traffic medicine (27) since they figure largely in pharmaceutical specialities.

Vigilance, ability to memorize and reaction speeds taper off after absorption of fentanyl and lidocaine (19). The same effect does not appear at low doses, with methadone, for example.

For anaesthetizing drugs, delays of 24 to 48 hours before driving should be observed (28). At weak doses, thiopental and methohexital have no effect, although at stronger ones they reduce the results of psychological tests (29,30).

### 3.5 Antidepressants

Study of these substances is still comparatively little advanced, but shows a relative absence of effect on driving.

Imipramine, at 0.8 mg/kg, desimipramine and amitriptyline do not affect performance or motor activity (31). After prolonged periods of use lasting 14 days, amitriptyline and doxepin do not affect coordination, vigilance or decision-making abilities (32); clomipramine and nortriptyline (at 10, 20 or 25 mg/day for 14 days) have no effect on learning or the ability to memorize.

Imipramine does, however, affect the driver's judgement and evaluation of risks (33).

### 3.6 Anorexiant

Studies are few in number, but go to show that amphetamine reduces awareness, the ability to concentrate and skilfulness, and promotes nystagmus (10). Methylphenidate encourages risk-taking by giving drivers an exaggerated confidence in their own abilities.

### 3.7 Drugs and alcohol taken in association

The various experimental tests referred to above were carried out using drugs taken in isolation, whereas in practice drugs are often taken in combination with one another, with a risk of potentiation; ethyl alcohol often

potentiates the effect of drugs on driving. Moreover, the initial pathological state of the subjects for whom treatments are prescribed differs from the state of healthy subjects on whom experiments are performed and hampers extrapolation to real driving situations; epidemiological studies are infrequent but seem to show that there is a supplementary accident risk factor in psychiatric patients treated with psychotropic drugs (16,20,34). Experimental studies have been conducted on normal subjects, but would gain by being performed on pathological subjects. In addition, the very long-term alterations caused by prolonged periods of treatment, the risk of metabolic accumulation, and withdrawal symptoms interfere to complicate the data.

Interaction with *alcohol* has been demonstrated for stimulants and sedatives; their effects serve to reduce or potentiate those of alcohol.

*Stimulants* partially neutralize the effect of alcohol (35,36). Thus, methylamphetamine (37) at 9 mg neutralizes the effect of 0.5 g/kg of alcohol and reduces that of 1 g/kg on motor coordination, but does not correct blood-alcohol levels, nystagmus or disturbances in the sense of balance or critical judgement.

Caffeine has partial effects (38).

Imipramine, desimipramine and clomipramine diminish the effect of alcohol. On the other hand, amitriptyline, doxepin (31,32) and nortriptyline strengthen it.

*Sedatives* are much more often implicated. A synergic effect with alcohol, sometimes even a potentiating one, can be noted.

Such potentiation has been demonstrated for all the different hypnotics and sedatives (9-13,39); it leads to reduced vigilance, motor coordination and reaction speeds. The same is true for the tranquillizers (12,13,17,40,41) and for the neuroleptics (25,42).

All sedatives have a synergic effect with alcohol and often one of potentiation. This is a question of kinetic interference; in fact, the blood-alcohol curve remains unaltered by the drugs taken (43).

This is the reason why particular prudence must be observed in prescribing psychotropic drugs to drinkers or professional drivers. The first precaution is to display a warning of this interference factor on pharmaceutical packaging and notices, particularly for drugs available to the general public and purchased without medical advice. Warning about driving should be an automatic reflex for any physician prescribing psychotropic drugs, like safety precaution warnings for avoiding industrial injuries. Abstinence from alcohol is desirable during the first few days after psychotropic drugs have been prescribed, but then it may be progressively reintroduced.

Thus, it is an undeniable fact that medicines, especially psychotropic drugs, affect vigilance during driving, particularly when taken in combination with alcohol.

A number of questions remain to be discussed, including harmful effects on driving other than lowered vigilance. A number of drugs cause the type of

*therapeutic accident* which French law normally penalizes by a ban on driving, though medical contraindications to the issuing of driving licences may be due to the prescription of certain therapeutic substances.

The chief contraindication is hypotension which can set in during the first few days of adaptation after neuroleptics or sedatives have been prescribed. However, note should also be taken of the motor hypertonia caused by neuroleptics, the various types of hypoglycaemia caused by antibacterial sulfamides and the heart-beat disturbances caused by antidepressants.

Attention should also be paid to the case of patients who have undergone very prolonged treatment with psychotropic substances, such as epileptics treated for many years with barbiturates or Dilantin. Here the prescription of these drugs continues to have an anti-epileptic effect although its impact on the patient's vigilance diminishes progressively until, after a number of years of treatment, vigilance remains perfect for blood levels which would induce somnolence in patients taking barbiturates for the first time.

### **3.8 Limits to the study**

Is it possible to look forward to perfect knowledge of the interaction between drugs and alcohol in driving?

For the present, there is no clear-cut answer. The best clinical pharmacology studies carried out in properly supervised conditions have certainly provided important information on bioavailability, pharmacokinetics and the dose/effect ratio, but matters stand very differently for random field studies carried out in imprecisely monitored conditions.

Alcohol metabolism, a reaction of zero magnitude, lends itself particularly easily to certain types of extrapolation. Pharmacological side effects are as well known as possible, but one cannot very well expect the same to be true for organic products with metabolism rates that vary widely and whose content in the blood does not reflect the true cerebral state, even though, for the simple case of swiftly absorbed and swiftly eliminated substances, a certain parallel may exist between blood levels and tested effects.

## **4. PROSPECTIVE STUDIES ON BEHAVIOUR INDICATORS, CLASSES OF PSYCHOTROPIC SUBSTANCES AND DRUGS INTERACTING WITH ALCOHOL TO AFFECT DRIVING**

### **4.1 Alcohol alone**

Studies in human neuropharmacology can identify the dominant effect and side effects of alcohol by identifying the amount that acts on man,

through tests specifically designed for use in driving safety. For research programmes on the alteration of responses or behaviour as complex situations evolve, special methods are required. Some of these have shown remarkable sensitivity to alcohol absorption, with regular variations in results for blood-alcohol levels of about 150 mg/l.

The results indicate that no blood-alcohol level can be considered as recommendable, under the criteria applying in human pharmacology.

## **4.2 Psychotropic substances**

The National Institute of Drug Abuse and the Department of Transportation in the United States have initiated a programme to examine drugs for possible impairment of driving. Eight drugs are being studied at four dose levels, each over a 24-hour period after a single acute dose: diazepam, chlordiazepoxide, flurazepam, secobarbital, methaqualone, codeine, diphenhydramine and marihuana. Behaviours examined include visual search, signal detection, tracking, dual task performance under divided attention and information processing. Pharmacokinetic data based on repeated examination of blood, urine and saliva specimens permit correlation with changes in behaviour over time.

A concurrent study is examining the degree of impairment for each drug in relation to each behavioural variable, including a measurement of performance in a complex driving simulator, to establish task validity. A study has been made of several of these drugs in interaction with alcohol and has demonstrated increased driving-related impairment. The information will provide the basis for drug control and other programmes against the dangers involved in driving under the effects of impairing drugs. In particular, the public should be informed of such effects by prescribing physicians, as well as directly where they are used without medical prescriptions (self-medication, illegal drugs).

# **5. BIOLOGICAL AND ANALYTICAL STUDIES**

## **5.1 Toxicological analysis methods**

Rapid and reliable analytical methods should be prepared, while it should be noted that the accuracy and reliability of the measurements can vary according to whether it is a simple method of tracing that is needed or results that it might be possible to use as reference levels in preventive legislation. So far, no such provision appears in any national laws.

### 5.1.1 *Selection of a method*

The choice of any technique for toxicological analysis is governed by several factors such as rapidity, sensitivity, and precision. Furthermore, preference is to be given to a technique which does not need extraction of the suspected substance under study or which makes the use of a single standard possible, such as phenobarbital for the determination of any barbiturate.

The progressive increase in the number of drugs since the Second World War and their regular use and abuse were accompanied by improvements in photometric instrumentation that greatly increased the sensitivity of analysis (ultraviolet spectrophotometry) and specificity of identification (infrared photometry). At the same time, separation techniques utilizing the various methods of chromatography were effectively exploited, as were other approaches such as counter-current distribution and paper electrophoresis. More recently, the application of gas chromatography, atomic absorption spectrophotometry, and mass spectrometry to analytical toxicology has increased the potential for toxicological analyses.

There is no doubt that mechanization of toxicological analyses in large hospitals or regional laboratories would improve service materially in terms of number, accuracy, performance and regular availability of tests. For the smaller hospitals at the periphery, several simpler methods for the determination of blood-alcohol rates are available.

The development of simple kits (e.g., Toxipak for salicylate) to measure the most common drugs should be given a high priority. A minimum amount of time should be required for sample preparation and results must be obtained rapidly. The methods employed in reagent kits should be capable of determining the class of the compound, but not necessarily its actual identity. Such kits should be available in all hospitals far from the large centres with extensive toxicological facilities.

### 5.1.2 *Difficulties involved*

The first difficulty encountered by toxicological analysis is the multiplicity of drugs having a real or potential effect on driving capacity: analgesics, narcotics, hallucinogens, antidepressants, antidiabetics, anti-epileptics, antihistamines, antispasmodics, anticholinergics, antihypertensives, tranquilizers, hypnotics, sedatives, cough sedatives, muscle relaxants, neuroleptics, anti-Parkinsonism and anti-obesity preparations as well as preparations to combat migraine, psychostimulants and local ophthalmologicals such as those for mydriasis and glaucoma. Nearly 300 substances have been listed by an expert group of physicians of the Nordic Council of Medicine. A short list of the most common 60 drugs is generally accepted by toxicological laboratories.

Other difficulties include the following:

- the metabolic changes occurring with many of the drugs necessitate a search for metabolites in the urine;
- blood sampling of persons who have died as a result of traffic accidents is sometimes difficult due to absence of legal provisions;
- the ideal battery of tests to measure impairment of function in relation to dosage has still to be developed.

### 5.1.3 *Organization of services*

A central data bank of toxicological information should be established at national level to give advice on all the characteristics and methods of analysis of different drugs. National toxicological laboratories should be provided with expert staff and adequate equipment to identify and interpret the action of toxic agents. This organization would make for uniformity of analytical procedures that would ultimately improve the quality of work.

## 5.2 **Determination of doses liable to affect driving**

These data may be obtained through random epidemiological studies comparable to those used to establish patently dangerous blood-alcohol levels independently of studies on the incidence of fatal accidents. Thus, 1.5 g/l level of blood ethanol has been established under different bodies of national legislation as a reference level for a state of intoxication. This is now considered to be three times higher than the level where there is an unquestionable increase in the number of accidents (0.5 g/l). It could also be true for psychotropic drugs in cases where their effect, although not enough to induce a state of inebriation or confusion such as a strong dose would produce, already impairs driving capacity in ways that might be dangerous.

At this stage of the study, variations in pharmacological effects will appear depending on the individuals, their lifestyles, their sensitivity and tolerance, and their physical state, but this is also true of alcohol, and everything tends to indicate that the degree of uncertainty bound up with the individual differences is not of interest to the law maker since it is his task to reduce road deaths by bringing pressure to bear on the most dangerous drivers, the very ones whose sensitivity to alcohol and drugs is greatest.

Research already carried out gives serious grounds for hope in this area, provided that too much trust is not placed in immediate results that would be valid for all psychoactive substances.

### 5.3 Relevance of the variables studied

Our current knowledge of the effects of drugs on driving ability rests primarily on experimental laboratory or simulator studies. These studies have the usual advantages of experiments involving administration of known doses of drugs and the ability to follow behavioural changes as a function of drug levels, either as administered or as found in blood and urine. The prime difficulty with the studies has been the frequent use of behaviours as response variables which have poorly identified or questionable relevance to driving.

Among variables often seen in the studies are digit symbol substitution, simple reaction time, visual acuity, flicker fusion, nystagmus, accommodation, visual field, oculomotor balance and mood or subjective effects. These variables are of value in a complete behavioural definition of the effects of the drugs. However, they are not variables that recent research literature suggests are of importance in man-machine interactions. The literature on performance in relation to human factors, engineering, and skills is in agreement with findings on accident causation from on-site driving accident investigation teams, i.e. it identifies the key behavioural factors in accident causation as primarily perceptual and decision-making errors (both in the general areas of information processing) with motor control as a third factor. Simple sensory factors, such as visual acuity or simple reaction time, fail to show significant correlations with accident causation.

Findings in examining the effects of drugs on non-relevant variables are likely to lead to incorrect conclusions suggesting a lack of effects of the drugs on driving abilities, since simple behavioural functions are often more resistant to drug effects than the complex behavioural processes involved in perception, information processing and decision making. Behavioural variables which human factors research suggests as germane include attention, vigilance, division of attention, information load capacity, rate of information processing, tracking ability and risk taking.

Unfortunately, there are few studies examining drug effects on the latter group of variables. Only alcohol and marijuana appear to have been examined adequately with reference to driving behaviours, generally only during peak time of drug action. Examination of the literature on a wide range of psychoactive drugs reveals sparse and incomplete study of driving behaviours. Reviews conducted under the auspices of OECD and those sponsored by the National Institute of Drug Abuse and the National Highway Traffic Safety Administration in the United States agree that alcohol and marijuana significantly impair a wide range of driving-related behaviours. Sparse but relevant evidence on similar impairment appears to exist for some barbiturates and tranquilizers. Evidence on other drug categories involves sampling such a small number of behaviours with so few drug samples that conclusions appear premature.

It should be noted that, even within a given category of drugs such as minor tranquillizers, major differences exist in the extent and duration of driving skills' impairment.

Furthermore, with alcohol alone the complex techniques incorporated in reference works have revealed already considerable disturbances for blood levels of 0.2 g/l without it being possible to establish a sure correlation between this level of blood-alcohol and driving risks.

At such a level of sensitivity, any nutritional alteration, a relative hypoglycaemia, an alteration in calcium level, or even simple and spontaneous chronobiological behaviour variations might nullify an enormous range of experimental work.

#### **5.4 Connections between active dose and behaviour**

When proposing comparable limits for drugs and other medicine, lawmakers in every nation will tend to refer to the ceilings laid down for blood-alcohol levels. If the level chosen is high there will be a risk of very dangerous combinations of alcohol and drugs. If the level chosen is very low or zero, it would be tantamount to imposing a ban on drivers who had taken any medical preparation whatsoever.

Since many drugs have socially useful functions, it appears important to examine each drug individually rather than to determine the effects on driving on the basis of a drug's membership of a particular category.

The extent of drug impairment found is sufficient to suggest the need for systematic examination of the entire range of psychotropic drugs with relevant behavioural measures. Skill impairment represents not only a public health menace in driving but also a hazard in other man-machine interactions as in industry, recreation, and even our modern home environments.

A comprehensive programme of experimental studies on drugs and driving should take account of all factors, in particular:

- (1) Studies should include a variety of drug doses that corresponds to the range of usual dose levels.

- (2) Acute dosage studies should be followed by chronic dosage studies. Many psychoactive drugs have active metabolites that accumulate to large levels over periods of weeks. Moreover, this approach permits analysis of the role of tolerance, an important factor in psychoactive drugs. For example, in examining methadone, no impairment was found after six months of use.

- (3) After a single acute dose, it is important to test repeatedly over a certain period of time to ensure that the duration of drug action is known. Thus, with marihuana, behavioural impairment is found

for 4-6 hours after a single dose, despite disappearance of the subject's euphoria and return of pulse levels to normal within an hour.

(4) It is important to determine combined alcohol-drug effects by referring to levels considered as impairing driving ability.

## 6. EPIDEMIOLOGY

### 6.1 Present state of knowledge

Our current knowledge regarding drugs and driving is regrettably limited. In particular, epidemiological research in this area is incomplete. For example, there is nothing comparable to the Borkenstein study which produced estimates of accident probability as a function of blood levels and which illuminated the role of such co-variables as age, driving experience, drinking experience, sex and other social factors. These results were the product of relatively complete sampling of all accident-involved drivers in the study timespan, with determination of their blood-alcohol levels and a comparison with the blood-alcohol level of an adequate control group of drivers passing the accident scene at similar times. This task was rendered feasible by the cooperation of drivers requested to give breath samples.

Attempts to perform similar studies on drugs and driving have been hindered severely by difficulty in getting cooperation from accident-involved drivers and controls in supplying body fluid specimens, and by the technical difficulty and expense involved in performing scientifically accurate quantitative blood-drug analyses. Perhaps these difficulties account for the rather large variability in the reported presence of drugs in accident-involved drivers or in drivers arrested for impaired driving.

### 6.2 Methods

Epidemiological classification of driving accident cases presupposes a preliminary evaluation of drugs. The mere questioning of drivers is invalid because their financial and civil, not to say penal, liabilities in cases of accident mean that no value at all may be attached to the truth of their statements.

A decision has to be made to use blood sampling, despite all the handicaps this involves. The first handicap lies in the very nature of the investigation, carried out without knowing the drug ingested: analysis methods are long and costly since a variety of chemical groups must be tested in succession; they are liable to be incomplete and to yield falsely negative results; finally,

they call for hospital equipment and the right kind of toxicological teams if one wants to avoid having to send on biological samples to larger hospitals. However, the fact that the forensic implications require formal sampling means that, in practice, preference is given to passing on samples to regional laboratories that provide valid results rather than to carrying them out on the spot with less precise toxicological kits.

This sampling of drugs not only permits better appreciation of risk factors and lays the groundwork for medical and legal prevention, but has the parallel advantage, useful for the treatment of the wounded, that, faced with a disturbance in lucidity, it becomes possible to identify what is due to the drugs taken and what is due to cranial trauma. Conversely, a cause of error in analysis can be the state of the injured party; traumatic haemorrhaging, reduced or increased blood plasma levels as a result of treatment may distort levels of the drug present in the blood and urine.

Such analyses make it possible to recognize the part played by drugs among the various other accident factors involved: the driver's own pathological state, mechanical failure, weather conditions at the time of the accident. Such investigations are more valuable when analysis of psychotropic drugs in the blood can be carried out at the same time in a control group of drivers not involved in the accident but passing the site of the accident on the same day and at the same hour (this being important in order to eliminate the weather factor); this kind of control was carried out for alcohol by Borkenstein in the Grand Rapids experiment.

Sampling and analysis techniques must be strict: sampling of non-anticoagulated blood, of urine, even of stomach contents. Analytical methods must use a variety of techniques depending on the type of drug, locally available resources and the desired degree of accuracy. Epidemiological studies for the detection and prevention of disturbances in vigilance demand less accuracy than analyses required for subsequent legal enquiry.

A prospective study on accident rates among patients undergoing out-patient treatment with psychotropic drugs has yet to be carried out. This would require the collaboration of drivers, and also of psychiatrists to select the subjects: the drivers would all have to be volunteers so as to guarantee their reliability; in addition, prescribing physicians and drivers would have to receive formal assurances releasing them from legal responsibility in the case of accident. The difficulty of putting into practice all these conditions explains why such a study, although it is the most effective, does not seem to have been carried out so far.

### **6.3 Recommendations**

The Group recommended continuation of comparative studies of results and the development of epidemiological research on the following points:

- evaluation of subjects at risk, through representative sampling of traffic;
- an accident census of all fatal traffic accidents and, so far as is possible nationally, investigation into individual supplementary elements, in particular the allocation of responsibilities;
- specific study of causative factors of accidents (alcohol, drugs);
- coordination and synthesis of data collected from emergency services, police, road safety and forensic medicine sources.

Apart from the one on marihuana, epidemiological studies demonstrating the effect of a single product are few and to be treated with care. This means that proper weight should be given to preliminary clinical pharmacology studies to provide information for practitioners and drug surveillance centres.

## **7. MONITORING THE EFFECT OF LEGISLATION**

The imposition of legal blood-alcohol levels (between 0 and 1.20 g/l) does not eliminate all accidents. The determining factor in improving road safety by utilizing blood-alcohol levels is the frequency and strictness of controls.

It is also possible to intervene by generally strengthening the legislation against alcohol so as to reduce the overall consumption, which is still on the increase or remains at a high level in a number of countries.

Present-day detailed legislation is of very recent origin, which explains the absence or scarcity of information and the need to continue studies for several more years before satisfactory results can be obtained.

### **7.1 Alcohol and road traffic accident prevention: comparison of results obtained and control procedures in present use in the various countries**

The techniques proposed are limited to studies of breath and blood-alcohol levels.

Despite the difficulties of analysis resulting from the simultaneous introduction of road safety measures such as the wearing of seat belts and the imposition of maximum speed limits, it has proved possible to isolate blood-alcohol levels as an independent factor in the frequency and seriousness of accidents on the public highway.

The following points were stressed.

The positive results obtained in countries carrying out alcohol absorption tests of sufficient frequency and without drivers being able to predict them (random tracing) have confirmed the link between alcohol intake and road safety. The correlation between alcohol intake, even where this is minimal and incapable of causing clinically discernible disturbances, and erratic behaviour in driving can be demonstrated in terms of the probable incidence of road traffic accidents. Statistical increases of the latter under the effect of alcohol levels in the blood can be predicted (multiplying the incidence by two) for rates of the order of 0.5 g/l. The rate of 0.8 g/l is one at which a still greater probability of increase in the frequency of accidents arises. However the 0.5 g/l level should be recommended, as being closest in line with data available at present, since it is at this level that there is already a clear decrease in driving safety.

Penalties and their consequences on those who drive under the influence of alcohol vary from one country to another. The probability of being subjected to test, even in the strictest countries in this respect, remains low.

Given these limitations, prevention methods must involve an educational effort, particularly the repetition of information and verification to see that it is understood by the population it concerns, through roadside surveys of drivers for example.

Preventive measures must also include measurement of ethyl alcohol rates in breath, which makes it possible to identify individuals who should undergo further tests (such as the measurement of ethanolamine), or possibly be penalized.

All these checks have certain limitations that are apparent from the on-the-spot roadside enquiries. In a study by Got (44), the accidents studied were broken down as shown on p. 17.

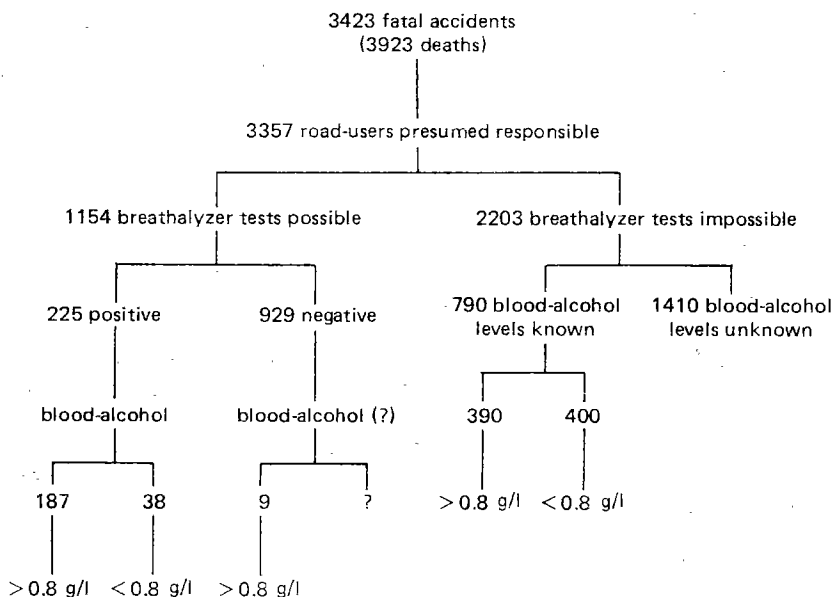
The French law of 9 July 1970, making provision for an investigation of the degree of alcohol intake by means of a breathalyzer test, and a blood sample in cases where the test proves positive or impossible to carry out, was properly applied on 1935 occasions (57.3%). In the other cases, blood-alcohol levels were not established, normally because the physician required to obtain the blood samples declared that it was impossible on a corpse, or contraindicated in the case of a seriously injured victim.

The proportion of those responsible for fatal accidents under the influence of alcohol differed widely from the group it was possible to carry out the breathalyzer tests on to the one that underwent blood sampling alone.

Two hundred and twenty-five breathalyzer tests (19.5%) proved positive. Some of these (38) were subsequently not confirmed through blood sampling because of false positive readings and particularly because the delay between the breathalyzer test and blood sampling made it possible for the blood-alcohol levels to fall back below legal limits.

In 21 cases, the blood-alcohol level was not clearly established although the breathalyzer test had been positive. Conversely, a certain number of

Results of a study in France  
(1-30 June 1977 throughout the highway network)



negative breathalyzer tests were followed by blood tests and on 9 occasions the results of the latter gave readings above the legal limits.

In the group investigated by blood sample alone, 390 blood-alcohol levels (49.4%) proved higher than the legal limit. This high rate was not surprising, and the circumstances of the accidents were not the same as those in the preceding group.

Applying this level of 49.4% to the whole of the group that could not be studied by breathalyzer tests and associating it with positive breathalyzer tests confirmed through blood sampling, we obtain a level of 37.7%, a minimum figure for those responsible for fatal accidents under the influence of alcohol. The extension of the 49.4% rate to the whole of the group is valid because the taking or non-taking of blood samples depends on the goodwill of the physician concerned and not on the characteristics of the accident. If we did not proceed in this manner it would be equivalent to estimating alcohol consumption per inhabitant by taking account of all women and children and only keeping that third of the male population

which has highest consumption. It is essential to give the proper weight to the group that it was not possible to explore in its entirety.

To obtain a result closer to reality, other corrections of errors should also be introduced, all of them helping to increase the values obtained. They relate to:

- cases where blood-alcohol levels fall back below the legal limit as a result of the interval in time between the accident and the blood sampling;
- false negative breathalyzer tests;
- interpretation of results in certain laboratories where there is a “statistical” shortfall in the blood-alcohol level between 0.80 g/l and 1 g/l (these results then appear in the range 0.60–0.80 g/l).

The different corrections cannot be precisely quantified but may result in the proportion of those responsible for accidents under the influence of alcohol being raised by between 3% and 10%. The two most important factors are delays between accident and blood sampling and, most important of all, false negative results from breathalyzer tests. It is very easy to appreciate the role of alcohol absorption as a driving hazard for high blood-alcohol rates, but very difficult for low rates.

Freudenberg gives the following risk multipliers:

- for 1.5 g/l  $\times$  16
- for 0.8 g/l  $\times$  4

Got obtained a comparable ratio and confirmed the frequency of incidence of fatal accidents in the group experiencing the effect of high or very high blood-alcohol levels.

## 7.2 Proposals

It would be of value:

- to compare data from countries with relatively flexible legislation such as France (0.8 g/l, lower levels allowed), and those such as Czechoslovakia where drivers are banned from consuming alcohol;
- to compare consumption patterns and the effects of different alcoholic drinks and drugs; for example, a considerable increase in the consumption of wine and stronger alcoholic drinks during the 1970s in England and a high consumption of stronger alcohols in Poland (65% of total consumption) can be noted;

- to make a comparative study of the frequency of effective controls in the different countries where provisions for these exist under the law, and in different groups of drivers;
- to study the impact of attitudes and social, administrative and legislative decisions related to the consumption of alcohol, medicines and drugs.

## **8. PSYCHOSOCIAL FACTORS IN THE CONSUMPTION OF ALCOHOL, AND MEDICAL AND ILLICIT DRUGS**

### **8.1 Present state of knowledge**

First of all, it was stressed that the consumption of alcoholic beverages depended to a large extent on the supply and general accessibility, as well as on the price factor.

Among other possible influences were mentioned the general attitude in society towards alcohol, the mostly poor image of teetotalism, the existence of contradictions in society, the lack of clear and positive beliefs in society, increasing anonymity and rigid administration of daily life, socioeconomic conditions, the effects of alienation in the broadest sense, and the search for pleasure.

Thus, certain expectations concerning drinking and driving might not be justified as long as, on the one hand, the advertising industry supports certain consumption habits and, on the other hand, possession of a car continues to be the norm in society.

A scientifically shown probability seems to indicate that a behaviour change can more easily be achieved by influencing the (social) environment than by making an impact on the individual (in social isolation). It is therefore important to examine the roots of a given behaviour not only in the structure and dynamics of the personality, but also in those of the social environment and, in the last resort, in those of society in general, and to know what alcohol means to an individual and to certain groups in certain specific social situations.

It was further noted that alcoholism and drunken driving were not identical and that a distinction must be made, for example, between social or moderate drinkers, problem drinkers, and alcoholics.

Scientific investigations have failed to reveal a particular personality structure for "the drinker". However, in reviewing the relevant literature, it seems rather probable that persons with an instability and certain weak points in their personality structure are more inclined to consume alcohol or drugs,

and they are more likely to have difficulties with themselves or with others. Some relevant personal characteristics, including certain family patterns, were referred to in brief.

Review of the literature also indicates certain correlations between the frequency and amount of the consumption of alcohol and traffic delinquency, drunken drivers showing in their personal life history as a group an amount of former delinquency more similar to that of general criminals than to that of normal drivers.

The discussion also dealt with the role of some sociological variables such as sex and age, social class, occupational groups, regional differences, etc. Particular emphasis was laid on prognostic considerations (e.g., previous delinquency, social decline, frequency of change of occupation, absenteeism, family circumstances, divorce, general history of drunkenness, frequency of drunken driving, occupational temptation to drink, regularity of consumption, solitary drinking habits, consumption of different kinds of alcohol, morning drinking, unreal estimate of ability to drink, lack of involvement in leisure activities, financial difficulties, difficulties with parents, teachers; etc.).

In conclusion, the importance of a systematic approach was stressed and some examples were given.

## 8.2 Conclusions and recommendations

The late treatment of high-risk groups does not seem to be a proper medico-social approach. It is essential to intervene much earlier, if possible before habits are established which modify psychosocial reactions to any great extent.

In this spirit, it was recommended to make provision as early as possible for medical, legal and social intervention tailored to suit the different types of driver and consumption of alcohol, and to use general educational possibilities as far as possible by methods bringing into play personal participation (education of children, discussion of practical situations, organization of education for first offenders). The methods of control and penalties available to the authorities should be clearly explained to the general public.

## 9. SUMMARY OF RECOMMENDATIONS

The Technical Group on the Influence of Alcohol and Drugs on Driving recommended:

1. *An intensification of research on the alcoholic condition of car drivers.* Techniques for random tests on the road have proved of value and it is recommended that they be increased.

2. *The implementation of preventive methods requiring educational efforts*, repetition of information and checks on whether it has been understood by the community concerned.

3. *The promotion of clinical pharmacological studies* to identify certain adverse effects of alcohol and drugs by means of appropriate tests whose value has been demonstrated for blood-alcohol levels as low as 0.2 g/l. With regard to medicaments and illicit drugs, priority should be given to pharmacological studies designed for objective information of practitioners and of pharmacotoxicological monitoring centres in the case of preparations which have a psychotropic effect.

4. *The development of national guidelines on safe driving and drugs*, such guidelines being intended initially for prescribing physicians and road safety authorities.

5. *Coordinated epidemiological studies* which should permit a comparison of national results. These studies would, in the first place, relate to techniques for sampling driver populations and recording all fatal accidents, and would include study of the responsibility of drivers and their physical state, using representative samples of road traffic accident victims.

6. *Medical, legal and social measures* among drivers, at as early a stage as possible, in conjunction with general education of children before the age of driving, using personal participation, and aimed at proper understanding of legislation against alcoholism.

7. *The development and application of techniques for determining the blood levels* of the main psychotropic substances commonly employed in the Member States, using specific and inexpensive methods.

8. The maintenance of a *very firm regulatory and legal position* in combating the use of drugs and alcohol in association with driving. There is an appreciable increase in the frequency of road traffic accidents at the level of 0.5 g/l, recommended as the prescribed limit for drivers.

9. *The intensification of international cooperation*, in particular between WHO and the intergovernmental organizations concerned (ECE, OECD, CMEA, Council of Europe) and certain nongovernmental organizations. In this regard, the Technical Group took note of the particularly thorough work carried out by OECD, and endorsed the recommendations of its latest report on the subject (45).

## REFERENCES<sup>a</sup>

1. Turk, F. et al. Involvement of alcohol, carbon monoxide and other drugs in traffic fatalities. In: Israelstam, S. & Lambert, S., ed. *Proceedings of the Sixth International Conference on Alcohol, Drugs and Traffic Safety, Toronto, 8-13 September 1974*. Toronto, Addiction Research Foundation of Ontario, 1975, pp. 597-606.
2. Briglia, R.J. *Toxicological screening programme of coroners' cases in Sacramento County*. Sacramento, California, Sacramento County Coroner's Office, 1966, p.14.
3. Sunshine, I. et al. Drugs and carbon monoxide in fatal accidents. *Post-graduate medicine*, 43: 152-155 (1968).
4. Perrine, M.W. Alcohol, drugs and driving: relative priorities for basic and applied research. In: Israelstam, S. & Lambert, S., ed. *Proceedings of the Sixth International Conference on Alcohol, Drugs and Traffic Safety, Toronto, 8-13 September 1974*. Toronto, Addiction Research Foundation of Ontario, 1975, pp. 107-128.
5. Perrine, M.W. et al. *Alcohol and highway safety: behavioral and medical aspects*. US Department of Transportation, NHTSA Technical Report, DOT-HS-800-599, 1971.
6. Nicholas, J.L. *Drug use and highway safety. A review of the literature*. Prepared for US Department of Transportation. Stevens Point, Wisconsin, University of Wisconsin, 1971, p. 110.
7. Betts, T.A. et al. Effects of four commonly-used tranquillizers on low-speed driving performance tests. *British medical journal*, 4: 580-584 (1972).
8. Loomis, T.A. Effects of alcohol on persons using tranquilizers. In: Harvard, J.D.J., ed. *Alcohol and road traffic. Proceedings of Third International Conference on Alcohol and Road Traffic, London, September 1962*. British Medical Association, 1963, pp. 1-4.
9. Doenicke, A. von. Beeinträchtigung der Verkehrssicherheit durch Barbiturat-Medikation und durch die Kombination Barbiturat-Alkohol. *Arzneimittel-Forschung*, 12: 1050-1054 (1962).
10. Schroeder, D.M. et al. Effects of secobarbital and d-amphetamine on tracking performance during angular acceleration. *Ergonomics*, 17: 613-621 (1974).
11. Schroeder, S.R. et al. Combined effects of alcohol with methapyrilene and chlordiazepoxide on driver eye movements and errors. *Journal of safety research*, 6(2): 89-93 (1974).

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<sup>a</sup> A more exhaustive bibliography has been compiled in a separate document and is available on request.

12. Kielholz, P.L. et al. Fahrversuche zur Frage der Beeinträchtigung der Verkehrstüchtigkeit durch Alkohol, Tranquilizer und Hypnotika. *Deutsche medizinische Wochenschrift*, **94**: 301-306 (1969).
13. Saario, I. & Linnoila, M. Effect of subacute treatment with hypnotics, alone or in combination with alcohol, on psychomotor skills related to driving. *Acta pharmacologica et toxicologica*, **38**: 382-392 (1976).
14. Woodhouse, E.J. *The incidence of drugs in fatally injured drivers*. US Department of Transportation, DOT-HS-119-1-627. Washington, DC, 1974.
15. Woodhouse, E.J. et al. The incidence of drugs in fatally injured drivers. Final report. *Journal of safety research*, **6**(1): 42 (1974).
16. Bo, O. et al. Ethanol and diazepam as causative agents in road traffic accidents. In: Israelstam S. & Lambert, S., ed. *Proceedings of the Sixth International Conference on Alcohol, Drugs and Traffic Safety*. Toronto, 8-13 September 1974. Toronto, Addiction Research Foundation of Ontario, 1975, pp. 439-448.
17. Haffner, J.F. et al. Alcohol and drug consumption as causal factors in road traffic accidents in Norway. *Journal of traffic medicine*, **2**: 52-56 (1974).
18. Hindmarch, I. Laboratory investigation of effect of acute doses of nimifensine on a simulated aspect of night-time car driving performance. *British journal of clinical pharmacology*, **4**: 175-178 (1977).
19. Legg, N.J. et al. Effects of tranquillizers and hypnotics on driving. *British medical journal*, **417** (1973).
20. Linnoila, M. et al. Effect of treatment with diazepam or lithium and alcohol on psychomotor skills related to driving. *European journal of clinical pharmacology (Berlin)*, **7**(5): 337-342 (1974).
21. Bernheim, J. & Michiels, W. Effets psycho-physiques du diazepam (Valium) et d'une faible dose d'alcool chez l'homme. *Schweizerische medizinische Wochenschrift*, **103**: 863-870 (1973).
22. Nicholas, J.L. *Drug use and highway safety: a review of the literature*. DOT-HS-0-800-580, US Department of Transportation. National Highway Traffic Safety Administration, Washington, DC, 1971.
23. Linnoila, M. Effect of drugs and alcohol on psychomotor skills related to driving. *Annals of clinical research*, **7**: 6-18 (1974).
24. Linnoila, M. & Mattila, M.J. Drug interaction on driving skills as evaluated by laboratory tests and by driving simulator. *Pharmakopsychiatrie*, **6**: 127-132 (1973).
25. Milner, G. & Landauer, A. Alcohol, thioridazine and chlorpromazine effects on skills related to driving behaviour. *British journal of psychiatry*, **118**: 351-352 (1971).
26. Dorsch, W. & von Hebenstreit, B. Die Wirkung eines Fluphenazin-Dihydrochlorids auf die Fahrtüchtigkeit. *Arzneimittel-Forschung*, **12**: 1074 (1962).

27. **Klebelsberg, D. von.** Prüfung eines Analgetikums hinsichtlich Beeinflussung der Fahrtüchtigkeit. *Verkehrssicherheit*, 7: 131-136 (1961).
28. **Harvard, J.D.** Survey on driver behavior, alcohol and drugs. *Pharmakopsychiatrie*, 6: 67 (1973).
29. **Haas, E. et al.** Vergleichende elektronystagmographische und psychophysische Untersuchungen nach intravenösen Kurznarkosen mit Thiopental, Methohexital und Phenoxy-Essigsäure-Amid. *Anaesthesist*, 12: 346 (1963).
30. **Korttila, K. et al.** Recovery and simulated driving after intravenous anesthesia with thiopental, methohexital, propanidid or alphadione. *Anesthesiology*, 43: 283-291 (1975).
31. **Patmann, J. et al.** The combined effect of alcohol and amitriptyline on skills similar to motor-car driving. *Medical journal of Australia* (1969).
32. **Seppälä, K. et al.** The effect of tricyclic antidepressants and alcohol on psychomotor skills related to driving. *Clinical pharmacology and therapeutics*, 17: 515-522 (1975).
33. **Clayton, A.B. et al.** The effects of two antidepressants, imipramine and viloxazine, upon driving performance. *Psychopharmacology*, 55: 9-12 (1977).
34. **Eelkema, R.C. et al.** A statistical study on the relationship between mental illness and traffic accidents—a pilot study. *American journal of public health and the nation's health*, 60: 459-461 (1970).
35. **Hugues, F.W. & Forney, R.B.** Comparative effect of three antihistaminics and ethanol on mental and motor performance. *Clinical pharmacology and therapeutics*, 5: 414-421 (1964).
36. **Strassman, H.E. et al.** Metronidazole effects on social drinkers. *Quarterly journal of studies on alcohol*, 31: 394 (1970).
37. **Rutenfranz, J. & Jansen, G.** The compensation of the alcohol effect by caffeine and pervitin in a psychomotor performance. *Internationale Zeitschrift für angewandte Physiologie einschliesslich Arbeitsphysiologie*, 18: 62-81 (1959).
38. **Klebelsberg, D. von.** Unterschiedliche Auswirkungen einer Blutalkoholkonzentration von 1,0 Promille bei einzelnen psychischen Komponenten der Fahrtüchtigkeit. *Zeitschrift für experimentelle und angewandte Psychologie*, 9: 1-11 (1962).
39. **Sharma, S.** Barbiturates and driving. *Accident analysis and prevention*, 8: 27-31 (1976).
40. **Mørland, J. et al.** Combined effects of diazepam and ethanol on mental and psychomotor functions. *Acta pharmacologica et toxicologica*, 34: 5-15 (1974).
41. **Staak, M. et al.** Studies on the effects of alcohol and oxazepam on behavior in traffic. *Beiträge zur gerichtlichen Medizin*, 34: 91-96 (1976).

42. **Seppälä, T. et al.** Two weeks' treatment with chlorpromazine, thioridazin, sulpiride or bromazepam: actions and interactions with alcohol on psychomotor skills related to driving. *Modern problems of pharmacology*, **11**: 85-90 (1976).
43. **Seidel, G. & Soehring, K.** Zur Frage der Änderung der Blutalkoholwerte durch Medikamente. *Arzneimittel-Forschung*, **15**: 472-474 (1964).
44. **Got, C.** Alcool et accidents. In: *Bulletin du Haut Comité d'Etude et d'Information sur l'Alcoolisme*, **131**, 4ème trimestre, 1977.
45. **OECD.** *Nouvelles recherches sur le rôle de l'alcool et des médicaments dans les accidents de la route.* Recherche routière series, Paris, 1978.

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