Presentation of the research project
IMMORTAL

Impaired Motorists, Methods of Roadside Testing and Assessment for Licensing

IMMORTAL specifies a research programme concerning the accident risk associated with different forms of driver impairment and the identification of ‘tolerance levels’ applied to licensing assessment and roadside impairment testing (including drug screening).

Thus, IMMORTAL is focused on two societal needs that both contribute to quality of life, namely mobility and safety. IMMORTAL will provide added community value in terms of the generalisation of conclusions relevant to EU policy and standardisation of driver testing and assessment methods with respect to EEC directives.

The technical and scientific objectives of IMMORTAL are to:

• Investigate the influence of chronic and acute impairment factors on driving performance and accident risk;
• Recommend criteria (‘tolerance levels’) for high risk categories of impairment;
• Provide key information to support formulation of European policy on licensing assessment and roadside testing.

IMMORTAL shall result in a variety of exploitable results:

• The results will provide comprehensive knowledge concerning the influence of acute and chronic impairing factors that may be used in policy decisions.
• The results will support recommendations on how to (a) examine chronically impaired people seeking (re)licensing, and (b) assess driver for acute impairment (at roadside).

IMMORTAL started on 1 January 2002 and runs for three years. The workplan is structured in terms of ‘work packages’. The work packages are separated into administration, research, and policy functions:

• The administrative functions include project co-ordination, quality assurance, and dissemination/exploitation.
• The research work packages focus on chronic impairment from ageing, mental illness and disease, as well acute impairment from drugs, alcohol and medicines.
• The policy function will provide workshops on these and other impairment factors (i.e., fatigue, visual & perceptual deficiencies) and consider relevant countermeasures, including licensing and impairment testing.

The consortium comprises 10 partners from a range of European institutions. The multi-disciplinary expertise and critical mass of the consortium will ensure that the objectives are feasible and applicable to the European context. The partners are:

• School of Psychology, University of Leeds, UK – coordinator
• SWOV Institute for Road Safety Research, The Netherlands
• Board for Safety and Prevention (Kuratorium für Schutz und Sicherheit), Austria
The various tasks in the research work packages and the policy functions are listed below, indicating which tasks will be presented at the T2002 workshop.

**Research work package: Ageing, mental illness and medical diseases**

**Literature review of impairment and accident risk associated with ageing, illness and disease**
The task will provide an updated literature review and metaanalyses of health-related risk factors, partly based on research reports compiled for the Norwegian Traffic Safety Handbook. *(To be presented at the T2002 workshop)*

**Estimation of risk involvement of several medical disorders in road accidents**
A questionnaire-based study of self-reported health problems among crash-involved drivers will aim at suggesting health factors related to accident involvement. *(To be presented at the T2002 workshop)*

**Medical predictors at time of licensing for traffic violations and accidents**
The task will provide a prospective analysis of drivers attending Medical-Psychological Centres for obtaining/renewing a driving licence. The assessment of fitness to drive will aim at predicting licensing assessment and subsequent traffic violations and accidents. *(To be presented at the T2002 workshop)*

**Effects of depression and antidepressant therapy on driving performance**
The study will measure the effects of antidepressants and depression severity on cognition, psychomotor function and driving performance. Depressed outpatients will be studied during 6-8 weeks of subchronic drug treatment by means of laboratory performance tests and standardized actual driving tests, respectively. *(To be presented at the T2002 workshop)*

**Effects of diabetes on driving performance**
The study will describe the relations between physical disorder (diabetes) and psychic disability. The study will develop a list of risky factors in dependence on various conditions, as the age, gender, practice, severity of the illness, type of medication, lifestyle and adherence to medication on driving.
Protocol development for assessment of fitness-to-drive amongst categories of elderly driver
Whereas many countries do have licensing restrictions, the methods of testing used to determine the form of restriction are seldom standardised or validated. The study will consider road, simulator and computer-based methods of assessment of fitness-to-drive in terms of standardised protocols for specific categories of driver disability related to age. (To be presented at the T2002 workshop)

Assessment of fitness-to-drive amongst patients with learning difficulties
The study will assess methods used in fitness to drive evaluations of persons with learning difficulties. The study includes a detailed description of the developed assessment methods, experimental design, results and conclusions regarding the potential and feasibility of medical assessment, neuropsychological assessment, simulator assessment and on-road assessment.

Research work package: Alcohol, drugs and medicines

Review of impairment and accident risk for alcohol, drugs and medicines
The task will provide an introduction into the problem of drugged drivers and the impact of different substances on driving performance. The review includes recent results of scientific research on this topic and possibilities of detection of drugged drivers and driver assessment.

Survey and epidemiological evidence of impairment and accident risk for alcohol, drugs and medicines
Roadside surveys will be carried out in three countries (Norway, Netherlands, UK). The results will give an indication of the prevalence of substances in drivers. The comparison of incidence rates from fatal and baseline cases should suggest risk factors for different substance categories. Where possible, tolerance levels will be specified from analyses of dose-equivalent effects. (To be presented at the T2002 workshop)

Qualitative analysis of accident causation factors from alcohol, drugs and medicines
The task will provide a qualitative analysis of accident causal factors related to impaired drivers. Anonymous in-depth interviews of the parties in such accidents will be carried out in cooperation with physicians at selected hospitals. (To be presented at the T2002 workshop)

Driver impairment, accident risk and tolerance levels from consumption of drugs
The task will assess the effects of MDMA on actual driving performance, cognition and psychomotor function of recreational MDMA users as a function of dose and time after dosing. The study will be designed to assess the effects of MDMA with and without a social dose of alcohol. (To be presented at the T2002 workshop)

Driver impairment, accident risk and tolerance levels from consumption of remedy medicines
The task will assess the effect of flu medications on driving and cognitive performance in conjunction with fatigue. The study will summarise the extent of safety risk from these types of drug impairment.
**Work package: Policy functions**

This work package will identify relevant information to support policy by operating topic workshops to include researchers and policy makers from the European countries and representatives from related projects. Four workshops will be carried out with the following topics:

1. Vision and perceptual deficiencies as a risk factor in traffic safety
2. Fatigue as a risk factor in traffic safety
4. Cost benefit analyses of countermeasures to prevent driving while impaired and impairment-related accidents

More information on [IMMORTAL](http://www.immortal.or.at) can be found on the web site [www.immortal.or.at](http://www.immortal.or.at).
Estimating Accident Risks Associated with Ageing, Illness and Disease

Truls Vaa, Research Psychologist

Institute of Transport Economics (TØI), Postbox 6110 – Etterstad, N-0602 Oslo, Norway
Tel: + 47 2257 3800, Fax: + 47 2257 0290, E-mail: truls.vaa@toi.no

Introduction
This presentation describes the tasks R1.1 and R1.2 in the EC-project IMMORTAL. Task R1.1 is a literature review of impairment and accident risk associated with ageing, illness and disease. Task R1.2 is labeled “Estimation of risk involvement of several medical disorders in road accidents”.

Objective
The general objective of both tasks is more or less the same, i.e. to assess relative risks associated with certain states or conditions of drivers. More specifically, R1.1 will focus on health-related risk factors, medical conditions, illnesses and diseases, physical or perceptual impairment, i.e. to the extent such conditions have been reported in scientific literature. R1.2 will assess relative risks associated with self-reported medical conditions, health complaints and medicine consumption.

Method
Several factors may preclude precise estimations of the accident risk associated with certain medical, psychological, or physical conditions. As a rule little is known about the health condition of accident-involved drivers, since such data are not included in accident databases. Second, even if special investigations may provide data on accident involvement for some disease groups, exposure estimates may not be available. Together, tasks R1.1 and R1.2 offer two approaches aiming at calculating relative accident risks.

R1.1 will use meta-analysis to calculate relative risks for groups of drivers who have certain characteristics related to health, impairment, medical or drug abuse, and compare the risk for drivers with the characteristic to drivers without. The task will provide updated results from meta-analyses of health-related risk factors, partly based on research reports compiled for the Norwegian Traffic Safety Handbook. Some examples will be presented.

In R1.2, self-reported health problems among accident-involved drivers is collected and combined with knowledge of their being at fault or not at fault for the accident. This information makes it possible to use the method of “induced exposure” to estimate relative accident risk for the reported conditions. The assumption behind this approach is that the prevalence of a given condition among not-at-fault drivers reflects the prevalence in the driving population at large. It is
proposed to use insurance company files to select drivers who have recently reported a crash, and classify them as at fault or not at fault. A questionnaire will be administered, containing questions about various health problems. The questionnaire will be sent to about 5000 drivers.

Several of the candidates listed in the Technical Annex (TA) of the IMMORTAL project are stated broadly as “chronic and acute impairment factors”; “chronic impairment from aging; mental illness and disease”; “acute impairment from drugs, alcohol and medicine”; “fatigue”; “visual and perceptual deficiencies”. Naturally, such states have to be restated and specified in the questionnaire. Some conditions are, however, specified in the TA: Sight, hearing, locomotive disability, cardiovascular diseases, diabetes mellitus, (clinical) depression, AD/HD, and “the flu”. Other diseases and conditions hypothesized to contribute to an elevated accident risk will be added to this list.

**Expected results**
To the extent that a given condition is more frequent among at-fault drivers than not-at-fault drivers, it indicates increased accident risk. It is expected that the tasks R1.1 and R1.2 both will give relative risk levels of certain conditions compared to drivers without a given condition.
Medical Predictors at Time of Licensing for Traffic Violations and Accidents

Javier Alvarez and M. Carmen del Rio

Drugs and Alcohol Research Group, Department of Pharmacology and Therapeutics, Faculty of Medicine, University of Valladolid, Valladolid, Spain. alvarez@med.uva.es and delrio@med.uva.es

Introduction
Scientific evidence suggests that one of the many factors causing traffic accidents is drivers’ medical condition. In many cases medical conditions will last for an extended period of time, in some cases for the rest of the drivers’ life. It is important to note that people with medical conditions need pharmacological treatment. Sometimes the medication prescribed may have an effect on the psychomotor performance, but also the illness itself can impair fitness to drive and the consequences for driving of not taking the medication can be worse (1). Various earlier studies have analysed these aspects (2-4).

Current European legislation does not permit the issuing or renewal of driving licences for those who do not possess adequate driving ability. Council Directive 91/439/CEE, on driving licences, establishes in Annex III, the minimum standards of physical and mental fitness for driving a power-driven vehicle. In practice, various types of illness and disease, including the effect of medical treatment can affect fitness to drive. Member states implement this regulation differently. For example, Spanish legislation establishes that to obtain a driving licence, or to renew it (every ten years up to 45, every 5 years between 46 and 70 and every 2 years from 70 onwards), a medical-psychological examination, carried out in specific ‘Medical Driving Test Centres’, is obligatory. In these Medical Driving Test Centres, medical, eyesight and psychological tests are carried out with a view to assessing fitness to drive in accordance with Spanish legislation (Royal Decree 772/1997).

Objectives
Prospective analysis of the Medical Psychological assessment of fitness to drive and accident risk in drivers obtaining or renewing their license is carried out to evaluate the likelihood of subsequent traffic violations and accidents.

Methods
Full interviews (medical, ophthalmologic and psychological assessment) are planned for 4000 drivers attending Medical Psychological Centres. Between 5-10% of those assessed are expected to be fit-with-restrictions [that is have some medical disorder, psychological disorder or...
ophthalmologic disorder following CD 91/439] that oblige drivers to renew their licence after a shorter period of time. Follow up after 1 year to assess involvement in traffic violations and accidents.

**Expected results**

The existing problems related to illness, disease, medication and driving. We expect to obtain relevant information on the role of illness, disease and medication on accident risk and evaluation of fitness to drive. A workshop on the use and usability of CD 91/439 on driver licensing is also planned.

**References**


Effects of Depression and Antidepressant Therapy on Driving Performance

Jan Ramaekers and Jeroen Schmiit

Brain-Behaviour Center, University of Maastricht, The Netherlands
E-mail: J.Ramaekers@PSYCHOLOGY.unimaas.nl

Objectives
We will assess driver ability of outpatients with a major depressive disorder.

Outpatients will be included if their symptom severity is associated with a score 17 on the 17-item Hamilton Depression rating Scale (HAM-D). Parallel groups of depressed patients will be treated with a SSRI\textsuperscript{1}-type antidepressant (N=24) or a TCA\textsuperscript{2} (N=24), double-blind, for 6-8 weeks. Therapeutic effects will be assessed using conventional rating scales (HAM-D, MADRS).

Method
Actual driving performance will be assessed in the week prior to therapy and at 1, 3 and 6-8 weeks after treatment, using standardised, actual driving tests, as well as laboratory tasks. Blood samples will be taken at each time of testing for determining the blood plasma concentration of medication.

Beneficial effects of successful antidepressant therapy on driving performance will be inferred from an improvement in the patients driving performance relative to baseline.

Impairing antidepressant effects on actual driving performance will be inferred from a decrement in driving performance during antidepressant therapy as compared to baseline performance.

Efficacy and driving variables will be evaluated by a repeated measures analysis of variance to test the effects of the factor treatment, Time of treatment and their interaction. A multiple regression analysis will be conducted to determine which of the factors above independently correlates with driving performance.

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\textsuperscript{1} Specific Serotonergic Reuptake Inhibitors

\textsuperscript{2} Tricyclic Antidepressants
**Experimental Methodology of Driving Performance Assessment**

Patients will be driving an instrumented car, accompanied by a licensed driving instructor, preferably in open road traffic. Driving tests will be carried out pertaining to straight road driving (mean and standard deviation of lateral position and speed), car-following (headway distance, time-to-collision, brake reaction time), city driving (behavioural observation) and implicit navigational memory (route recognition test).
Developing Protocols for Assessing of Fitness to Drive in Dementia and Arthritis

Dr Liliana Read

Institute for Transport Studies, University of Leeds, UK
Email: lread@its.leeds.ac.uk

Background
Fitness to drive decisions are largely based on assessing performance on a series of laboratory tests and/or a road test. Many researchers have attempted to develop laboratory tests with the power to predict on-road driving performance (Marottoli et al, 1994; Marottoli et al, 1998; Hunter-Zaworski, 1990; Hunt et al, 1993; Janke & Hersch, 1997). Although some such laboratory tests have been identified for specific disease categories, they are used at present either exclusively by researchers or inconsistently in clinical practice.

Objectives
This part of the IMMORTAL research program first aims to group together tests shown to predict driving performance for cognitive impairment only (dementia) and physical impairment only (arthritis) groups. Second, it aims to assess the predictive power of these groups of tests, leading to the development of testing protocols for these driver groups.

Methods
Both driving simulator and on-road driving performance will be used to provide the criterion to ensure that standardisation of traffic conditions and the behaviour in critical traffic situations are also examined. A group of 50 drivers from each disease group will complete the test battery and will drive either the simulated or the real road standard route.

We will then examine the predictive power of each test and the change in predictive power obtained by adding extra tests. The outcome will be to create an optimal laboratory test protocol.

Results
At present, we are setting up the data collection procedure. The results of this study will be available in early 2004.

Discussion
Many groups of drivers affected by medical conditions have both physical and cognitive impairments (Parkinson’s disease, stroke and so on), which makes the assessment of fitness to drive difficult. Having a testing protocol for cognitive-only and physical-only impairments may be the first step in developing protocols for conditions with physical-and-cognitive components.
Estimating the Relative Injury Risk of Drink and Drug-Driving in the Netherlands by Means of a Case-Control Study

René Mathijssen, researcher

SWOV Institute for Road Safety Research, PO Box 1090, 2260 BB Leidschendam, The Netherlands
E-mail: rene.mathijssen@swov.nl

Background
Within the framework of the EU IMMORTAL project, SWOV in January 2002 started a prospective case-control study, aimed at estimating the relative injury risk of drink- and drug-driving in the Netherlands.

In the past, several observational studies tried to find a causal relationship between the use of drugs other than alcohol on the one hand, and road accidents on the other. However, epidemiological studies including a proper control group are still lacking.

Objectives
The study is aimed at estimating the relative injury risk of drink- and drug-driving by comparing the prevalence of various licit and illicit drugs in injured motorists with their prevalence in a representative sample of non-injured motorists. The latter sample is taken from the same population the injured motorists emanate from. Substances included in the study are: alcohol, benzodiazepines, tricyclic antidepressants, opioids, methadone, amphetamines, cannabinoids, and cocaine.

Methods
Cases are injured motorists admitted to the Regional Trauma Unit of St. Elisabeth Hospital, Tilburg. Demographic and trauma related data is collected from hospital and ambulance records. Urine and/or blood specimens are collected on admission.

Controls are drawn at random from moving traffic on a representative sample of main roads in the Tilburg police district. Sampling is conducted by researchers, in close collaboration with the Tilburg police, covering different days of the week and times of the day. Respondents are interviewed and asked for a urine specimen. If no urine specimen can be obtained, a blood specimen is requested. All blood and urine samples of both cases and controls are tested for the above-mentioned drugs. Positive screening results for benzodiazepines, amphetamines and opiates will be confirmed using GC-MS.

Odds ratios are determined with a logistic regression model.
Expected results
Based on the results of a feasibility study conducted in 2000/2001, it is expected that approx. 500 evaluable cases and 3,000 controls may be included in the study.
Objectives
The objectives of this study are to show whether motorists using one or more of the 7 drug groups mentioned in the work package 4.2 of the IMMORTAL Technical Annex have higher accident risk than drivers not using these drugs and to as far as possible quantify this risk. The drug groups which will be studied are as follows: benzodiazepines, opiates, amphetamines, ecstasy, cannabis, cocaine and alcohol.

Method
The study will be carried out as a case/control study, where the prevalence of the substances among injured drivers (a Hospital Sample) and normal drivers (a Roadside Sample) will be compared, and the relative risk of each substance and some combinations of substances will be estimated.

For the Hospital Sample Saliva or Blood samples (in particular circumstances of injury) from 500 injured motorists will be collected at the Accident & Emergency Departments of at least 2 hospitals. For the Roadside Sample, Saliva samples will be collected from 750 randomly selected drivers. These roadside control samples will be collected from (non-accident involved) drivers at accident sites within the catchment area of the hospital and the same times of day as the accident sample. It is not proposed to collect any blood samples from ordinary drivers in the UK.

Ordinary drivers will be stopped by the police as part of a routine control and asked to supply a saliva sample. This sample will be collected by a TRL interviewer. The identity of the drivers will not be registered, and the police will not receive information on the results for each driver. In cases where the police have other reasons for suspicion as to impairment of any kind, the police will follow their normal routines, which means that a breath test will be taken and the driver will be transferred to the police station for a blood sample. If the survey method is to be truly representative drivers suspected of taking drugs should have a forensic sample taken and the results of this should be included anonymously in the survey results.

The Department of Forensic Toxicology, Glasgow University (Dr John Oliver) will analyse the saliva, and any blood samples collected, from both the roadside and the hospital sources. This
will consist of initial screening followed by full confirmatory GC/MS analysis of all positive samples.

A pilot study of up to 20 injured drivers and 30 ordinary drivers will be carried out as soon as the necessary arrangements have been made with the Police and Hospital Authorities.

**Hypothesis / Expected Results**
The hypothesis is that, if the presence of any of the drugs being considered in the study impairs driving this will increase accident risk and mean that the incidence of a drug/drugs in the injured sample will be higher than in the roadside control sample. The ratio of the incidence of each drug; injury sample incidence/roadside sample incidence will give the relative injury risk for each drug.

Incidence only will assessed, not concentration, but concentration will need to be above a minimum threshold.

The results will be presented as relative risks for each drug and drug combination. Severity of injury risk may also be assessed by drug type.
Drugs and Medicines as Accident Causation Factors

Inger Marie Bernhoft, Senior Research Scientist

Danish Transport Research Institute, 2800 Kgs. Lyngby, Denmark
E-mail: imb@dtf.dk

Objectives
The objectives of this task are:

1. to demonstrate that drug impairment causes or contributes to traffic accidents;
2. to get information on which kind of drugs are dominant in accident involved drivers;
3. to get information on drivers’ attitudes to driving under the influence of drugs and medicines, alone or in combination with alcohol.

Method
Motor vehicle drivers impaired by licit and illicit drugs, alone or in combination with alcohol who were brought in to two selected hospitals after a traffic accident will be asked to take part in qualitative interviews. The survey will be carried out in co-operation with physicians from the emergency wards at Odense University Hospital and Aarhus Municipality Hospital.

For a period of about one year, all such motor vehicle drivers will be asked to give their consent to taking part in the project. Motor vehicle drivers include drivers of cars, motorcycles and 45km-mopeds.

Taking part in the project includes giving a sample (blood or saliva) in order to test whether the injured person was impaired at the time of the accident. Those who are found impaired will subsequently be asked to take part in an anonymous in-depth interview.

The analysis is planned to include a test of the following substances: Codein, other opiates, amphetamines, methamphetamines, incl. ecstasy, cannabis (THC and methabolyser), cocain (cocain and methabolyser) and benzodiazepines. It is the intention to test for alcohol as well, but persons will only be asked to take part in an interview in case they were found impaired by at least one type of the above mentioned substances.

Data collection
Protocols have been sent to the local medical ethics commission in order to obtain a permission to conduct the study. The protocols include among others written information about the project that must be handed out to all potential participants in the project. Each patient must sign a written consent prior to analysis of the sample. The protocol includes also a detailed interview guide.
A pilot will be carried out in order to test the plan for co-operation with the hospitals and the practicability of the interview guide.

**Expected results**

It is estimated that a total of about 800 injured motor vehicle drivers will be brought in to the two hospitals during a one year period, resulting in a number of about 50 drivers who were found impaired and subsequently willing to take part in a qualitative interview.

The in-depth interview will deal with the trip that resulted in the accident and the person’s perception of the accident situation. Furthermore, the interview will deal with the person’s physical and mental condition at the time of accident, including knowledge of which drugs influence the driving ability.

Based on each of the interviews an assessment will be made in order to determine, whether the impairment may have been a contributing accident causation factor.
Effects of MDMA (Ecstasy) on Driving Performance and Cognition

Jan Ramaekers, Senior Research Scientist

Brain-Behaviour Center, University of Maastricht, The Netherlands
E-mail: J.Ramaekers@PSYCHOLOGY.unimaas.nl

Objectives
The objectives of this task are:

- To assess the acute effects of stimulant drugs on actual driving and cognition;
- To establish the effects of stimulant drugs on actual driving and cognition during the withdrawal phase;
- To establish the practical relevance of the drug effects with those induced by an amount of alcohol sufficient to raise blood-alcohol concentration (BAC) to the legal limit (i.e. 0.5 promille). Possibly, the behavioural effects will be linked to blood levels of the drug.

Method
Recreational users of stimulant drugs will be recruited for participation in the experimental studies. After drug administration, subjects will operate an instrumented car, accompanied by a licensed driving instructor, preferably in open road traffic. Driving test to be conducted include a Road Tracking Test (dependant measures: standard deviation of lateral position and speed), a Car-Following Test (dependant measures: headway, time-to-collision, time to speed adaptation and brake reaction time) and possibly a City Driving Test (behavioural observation, anticipation traffic). Additional cognitive and psychomotor tests will be administered to assess isolated psychological functions relevant for day-to-day operations such as driving.

Data collection
The preparation phase includes recruitment of users, establishment of contact with legal authorities, analytical laboratories and protocol submission to the medical ethics committee.

The task comprises two studies.

Study 1: Acute and withdrawal effects of MDMA 75mg, methylphenidate 20mg and placebo on cognition and actual driving performance

Study 2: The effects of MDMA 75mg, dexamphetamine 20mg with an without alcohol on cognition and actual driving performance: a drug-alcohol interaction study.
Data collection Study 1: Driving tests under the influence of MDMA and methylphenidate will be conducted according to a double-blind, placebo controlled, cross-over design in 18 recreational users of MDMA. All subjects should have held a valid driver’s licence for at least 3 yrs and their driving experience should > 5000 km/y. All subjects will perform a dress rehearsal of the entire procedure to prevent carry-over effects. Driving test and laboratory tests will be conducted between 2-6 hrs and 26-32 hrs post drug.

Data collection Study 2: Driving tests under the influence of MDMA, dexamphetamine with and without alcohol will be conducted according to a double-blind, placebo controlled, cross-over design in 18-24 recreational users of MDMA.