



GLOBAL
ROAD SAFETY
PARTNERSHIP

Improving Road Safety by Reducing Impaired Driving in Developing Countries: a Scoping Study

A Davis and A Quimby (TRL Limited, UK)

W Odero (Moi University, Kenya)

G Gururaj (National Institute of Mental Health and Neuro Sciences, India) and

M Hajar (National Institute of Public Health, Mexico)

**Unpublished Project Report
PR/INT/724/03**



GLOBAL
ROAD SAFETY
PARTNERSHIP



DFID Department For
International
Development

PROJECT REPORT PR/INT/724/03

Improving Road Safety by Reducing Impaired Driving in Developing Countries: A Scoping Study

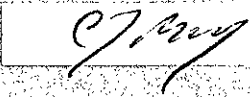
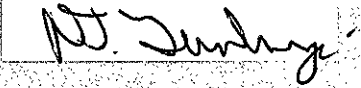
by

A Davis and A Quimby (TRL Limited, UK)

W Odero (Moi University, Kenya)

G Gururaj (National Institute of Mental Health and Neuro Sciences, India) and

M Hajar (National Institute of Public Health, Mexico)

Approvals	
Project Manager	
Quality Reviewed	

Copyright TRL Limited 2003

This study was funded by the UK's Department for International Development (DFID) and was managed on their behalf by the Global Road Safety Partnership (GRSP). It was carried out for the benefit of developing countries. It is an unpublished report and must not be referred to in any publication without the permission of the GRSP. Any views expressed are those of the authors and not necessarily those of either the GRSP or DFID.

Transport Research Foundation Group of Companies

The Transport Research Laboratory and TRL are trading names of TRL Limited, a member of the Transport Research Foundation Group of Companies.

TRL Limited. Registered in England, Number 3142272. Registered Office: Old Wokingham Road, Crowthorne, Berkshire, RG45 6AU, United Kingdom.

CONTENTS

LIST OF ACRONYMS	iv
EXECUTIVE SUMMARY	v
1 INTRODUCTION	1
2 SOME DRIVER IMPAIRMENT ISSUES	3
2.1 Introduction.....	3
2.2 Alcohol.....	3
2.3 Drugs.....	5
2.4 Fatigue.....	6
3 METHOD AND GEOGRAPHIC SCOPE OF REVIEW	7
4 IMPAIRED DRIVING IN AFRICA	9
4.1 Introduction.....	9
4.2 Scope of review.....	9
4.3 Method	10
4.4 Size of the Problem.....	11
4.4.1 Alcohol consumption patterns: historical and social perspectives	11
4.4.2 Epidemiological studies	14
4.4.3 Police accident statistics	18
4.4.4 Qualitative studies on impaired driving.....	19
4.5 Studies on psychotropic drugs and road traffic injuries.....	21
4.6 Effects of fatigue on driver impairment.....	22
4.7 Demographic and socio-economic profile of impaired drivers	23
4.8 Consequences of impaired driving.....	24
4.9 Current Prevention Strategies	25
4.9.1 Institutional organisational framework	25
4.9.2 Legislation and enforcement.....	26
4.9.3 Some country-specific enforcement activities.....	26
4.9.4 Control of alcoholic beverages	29
4.9.5 Promotion of responsible alcohol use	29
4.10 Suggested interventions	30
4.11 Useful contacts.....	30
5 IMPAIRED DRIVING IN SOUTH EAST ASIA	32
5.1 Introduction.....	32
5.2 Scope of review.....	32
5.3 Method	33
5.4 Road Traffic Injuries in SEAR	34
5.5 Alcohol use in SEAR countries	39
5.6 Illicit drug use in SEAR.....	43
5.7 Factors influencing alcohol and drug use within the population	44
5.8 Epidemiological analyses of alcohol/drug use and RTI risk	45
5.8.1 Thailand	45
5.8.2 Sri Lanka.....	47
5.8.3 Nepal	47
5.8.4 India	47
5.9 Some health, economic and psychological impact issues.....	51

5.10	Driver fatigue issues	52
5.11	Prevention polices in SEAR with a focus on drinking and driving	53
5.11.1	India	54
5.11.2	Thailand	55
5.11.3	Sri Lanka.....	56
5.11.4	Summary	56
5.12	Directions for future work	58
5.12.1	Research issues and interventions.....	58
5.12.2	Some policy proposals	59
5.13	Limitations of study	60
5.14	Summary and Conclusions	60
5.15	Useful Internet Sites.....	61
6	IMPAIRED DRIVING IN LATIN AMERICA AND CARIBBEAN COUNTRIES	70
6.1	Introduction.....	70
6.2	Scope of the review.....	70
6.3	Method	71
6.4	Studies on 'size' of alcohol impairment problem in RTI	72
6.4.1	Alcohol consumption patterns	73
6.4.2	Epidemiological studies.....	73
6.4.3	Qualitative studies on impaired driving.....	76
6.5	Studies on drugs and RTI.....	76
6.6	Studies on fatigue and RTI	77
6.7	Demographic and socio-economic profile of impaired drivers	77
6.8	Current prevention strategies	77
6.8.1	Road Safety Councils.....	77
6.8.2	Legislation and Enforcement	78
6.8.3	Some possible strategies to mitigate impairment issues	78
6.9	Discussion and suggestions for further research.....	84
6.10	Useful contacts.....	85
7	CONSULTATIONS WITH ROAD SAFETY ORGANISATIONS	88
8	IMPAIRED DRIVING AND COUNTERMEASURES IN DEVELOPED COUNTRIES	91
8.1	Introduction.....	91
8.2	Drink Driving.....	91
8.3	Drugs and Driving.....	94
8.4	Driving Fatigue	98
9	CURRENT ROAD SAFETY MEASURES	100
9.1	Social and Cultural Factors.....	100
9.2	Legislation Issues.....	104
9.3	Enforcement Issues	107
9.3.1	Alcohol enforcement.....	107
9.3.2	Drug enforcement	109
9.3.3	Fatigue enforcement.....	111
9.4	Effects of urbanisation and traffic density	111
10	LESSONS LEARNED AND 'GOOD PRACTICE' IN DEVELOPED COUNTRIES	113

10.1	Alcohol impairment	113
10.2	Drug impairment.....	115
10.3	Fatigue.....	116
10.4	Summary	117
11	DISCUSSION.....	118
12	SOME WIDER ISSUES, PROPOSALS FOR RESEARCH AND INTERVENTIONS.....	121
13	REFERENCES	125

LIST OF ACRONYMS

ARA	Association for Responsible use of Alcohol
BAC	Blood Alcohol Concentration
BrAC	Breath Alcohol Concentration
CADD	Campaign Against Drinking and Driving
DALY	Disability Adjusted Life Years
DFID	Department for International Development
DRT	Drug Recognition Training
DUI	Driving under the Influence
DUID	Driving under the Influence of Drugs
DVLA	Driver and Vehicle Licensing Agency
DWI	Driving while Impaired
ETSC	European Transport Safety Council
FIT	Field Impairment Testing
GDP	Gross Domestic Product
GRSP	Global Road Safety Partnership
HGV	Heavy Goods Vehicles
HRO	High Risk Offender
ICADTS	International Council on Alcohol, Drugs and Traffic Safety
ICAP	International Center for Alcohol Policies
IMMORTAL	Impaired Motorists, Methods of Roadside Testing and Assessment for Licensing
LAC	Latin America and the Caribbean
MADD	Mothers Against Drink Driving
NIAAA	National Institute on Alcohol Abuse and Alcoholism
NIDA	National Institute on Drug Abuse
NIMHANS	National Institute of Mental Health and Neuro Sciences
NRSC	National Road Safety Council
PLA	Participatory Learning and Action
RIA	Roadside Impairment Assessment
ROADSIP	Road Sector Investment Program
ROSITA	Roadside Testing Assessment
RTA	Road Traffic Accident
RTI	Road Traffic Injuries
RTIN	Road Traffic Injuries Network
SACENDU	South African Community Epidemiology Network on Drug Use
SAO	Social Aspects Organisations
SASPI	Society for Alcohol Related Social Policy Initiatives
SEAR	South East Asia Region
SERS	Surface Enhanced Raman Spectroscopy
SIA	Standard Impairment Assessment
SRVA	Sleep Related Vehicle Accident
TOR	Terms of Reference
VMS	Variable Message Signs
WHO	World Health Organization

EXECUTIVE SUMMARY

Purpose

- In order to understand more about the role of impaired driving in road accidents the Global Road Safety Partnership (GRSP), with the financial support of the UK's Department for International Development (DFID) recently awarded the Transport Research Laboratory (TRL) a research grant to conduct a small 'scoping study' on impaired driving – with particular reference to developing countries.
- The impairment of normal driver behaviour is generally regarded as 'a reduced ability to perform adequately the various elements of the driving task'. The cause of driver impairment (or resulting dangerous and erratic behaviour) may be the result of a number of factors such as alcohol consumption, drug ingestion, injury, infirmity, fatigue, the natural ageing process; or a combination of these factors.
- The focus of this study is on driver impairment caused by alcohol, illegal and medicinal drugs and fatigue, as these impairment factors were thought to be most relevant with regard to the problem of improving road safety in developing countries.
- This study aims to review existing knowledge about impaired driving – with special reference to developing countries. It was decided to invite a small number of 'local' specialists to conduct a series of regional reviews that covered a large proportion of developing countries around the world. It was anticipated that this approach would provide more valuable in-depth (and sometimes unpublished) information about a significant number of countries rather than having a strategy that might provide limited and unreliable information about all countries.

Background

- Drink driving, sometimes referred to as 'driving under the influence' (DUI) or 'driving while impaired' (DWI) is considered to be one of the most dangerous and anti-social behaviours linked to alcohol consumption, not least because it is recognised as being one of the leading cause of road traffic accident injuries and fatalities. Many countries agree on the need to establish regulations that prohibit impaired driving, and have set a maximum allowable blood alcohol concentration (BAC) level as a tool for both enforcement and prevention. BAC represents the amount of ethanol (ie alcohol) in a given amount of blood, noted as 'weight by volume', and measured as either grams of ethanol per 100 millilitres of blood (g/100 ml – used in the United States) or milligrams of ethanol per 100 millilitres of blood (mg/100 ml – used in Europe).
- The use of illegal or psychoactive substances and medicinal drugs whilst driving is a more recent cause for concern by safety practitioners, but nonetheless one that can result in a gross degradation in driver performance. The effect of drugs on road safety is rather more complex than that of alcohol, because impairment can be caused by such a huge range of prescription drugs, illegal or 'recreational' drugs, solvents, or stimulants used to counter fatigue. Hence, it is very difficult to

provide an objective enforcement 'benchmark' (as for drink driving enforcement) against which impairment caused by drugs can be measured.

- Driver fatigue has also been identified as a significant factor in road transport crashes, particularly amongst commercial drivers where as many as 40% of all accidents on UK trunk roads have been estimated as being sleep related.
- Fatigue, caused by overwork, excessive hours of driving, lack of rest and lack of nourishment, produces a state of reduced mental alertness which may include sleepiness or drowsiness.

Africa

- There have been few epidemiological studies conducted in Africa to examine the associations between the use of alcohol or drugs and driving. The majority of non-fatal injury studies have been conducted in South Africa. A series of hospital-based studies in Cape Town have consistently shown that between 26% and 31% of non-fatally injured drivers are intoxicated - that is they have BAC exceeding the legal limit of 0.08g/100ml. The proportion of alcohol impaired drivers in Africa ranges between 4% and 8%.
- In spite of the growing use of psychotropic (or behaviour altering) drugs worldwide, very few studies have been conducted in Africa to determine the extent of their association with the increasing burden of traffic crashes. Drug usage is common among injured patients presenting to hospitals in Africa. However, because of the high cost of conducting analyses and the technical sophistication required for the analysis, drug detection capacity is considerably limited.
- A small number of studies have documented the role of fatigue as a risk factor in motor vehicle crashes. Focus group discussions with commercial drivers in Ghana revealed that demands for increased returns by transport owners force drivers to over-speed and work when exhausted. In Kenya, another survey found that on average a matatu driver works very long hours – 14 hours a day for 7 days a week.
- Few countries in Africa have a legal limit for drivers stipulated in their traffic laws (eg Road Traffic Act); most of these are in Southern Africa. With the exception of South Africa, where the legal limit has recently been reduced to 0.05g/100ml, the rest have a legal limit of 0.08g/100ml. In the majority of countries, the Traffic Act is vague and does not specify the criterion BAC, nor does the law state the methods used in detecting alcohol or drugs, or mechanisms for enforcement.

South East Asia Region

- The countries in SEAR are currently responsible for around 35% of global RTI deaths. It is estimated that around 65% of the fatalities in developing countries involve pedestrians while 35% of the deaths are children (aged under 15).
- Although research suggests that between 30% and 50% of traffic accidents occurring in the South East Asia Region have an alcohol and drugs contributory factor no research appears to have been done that examines the impact on health,

social and economical aspects at either the individual or community levels. Although the economic impact has not been measured accurately the indications are that nearly 3% of GDP is wasted every year.

- In contrast to other parts of the world the governments within SEAR have not made any sincere attempts to reduce the problem. Every country of the region has a Motor Vehicles Act with “an active section” on alcohol and drugs combined with a “sleeping level” of implementation. The enforcement is often minimal, non-visible, not uniform, has low penalties and is muddled with political inadequacies and economic barriers. The lack of technology, dedicated teams, information systems, and casual ways of ‘only booking cases for economic gain’ compounds the problem further.
- Addressing the problem through relevant policies and programmes has not assumed importance in the region. Numerous political, social, economic, and technological factors are in operation in a complex money driven environment propelled by the alcohol industry, the motor vehicle industry and the liberalised economic policies of governments. The numerous success stories of the developed nations cannot be simply implanted and implemented in these countries and, as a result, tackling the problem will require innovative research.

Latin America and Caribbean Region

- Countries such as Colombia, Argentina, Brazil, Chile, Costa Rica and Mexico all have an ‘institutional framework’ based on having a National Road Safety Council (NRSC) which are mandated to develop appropriate road safety interventions and to co-ordinate and monitor their implementation.
- Although only a few papers were found that considered the role of impairment caused by alcohol in road accidents in the Latin American and Caribbean countries region, it is very clear that alcohol plays a major role in contributing to the numbers of road accidents. There is a lack of information in many of the region’s countries. This may reflect the absence of any monitoring or research being conducted in these countries.
- In general terms the entire LAC region considers the alcohol (and driving) issue within the legislation related to RTI. One major problem is the lack of effective enforcement of such legislation; while a second problem is that although there is a law for impaired drivers there isn’t one for impaired pedestrians. Another serious issue in some LAC countries is the high percentage of ‘hit and run’ accidents. This situation is encouraged in Mexico, for example, because current legislation always judges them to be the guilty party in certain accidents irrespective of the circumstances. It is also widely believed that many such accidents occur because the driver may be drunk (or under the influence of drugs) and is afraid of the consequences of stopping and reporting the accident.

OECD Countries

- These developing country reviews were to be supplemented by information available from more developed countries - such as Europe, North America and

Australia – that might serve to provide benchmark (and ‘good practice’) information relevant to the study.

- A number of epidemiological studies have been undertaken to ascertain the correlation between road traffic accidents and blood alcohol concentration levels in developed countries. Among these include a study conducted in Toronto, Canada, in 1955, the ‘Grand Rapids’ study conducted in Michigan, USA between 1962-63, and more recently a study of crash risk conducted in Long Beach, California and Fort Lauderdale, Florida, in 2002.
- These contributions to knowledge of the relative risk of a crash produced by a driver's blood alcohol concentration have done much to emphasise the need for more stringent legislation and enforcement. The Grand Rapids study, for instance, was one of the earliest and largest studies of its kind and had a strong influence on impaired driving laws in the United States and abroad.
- Historically there has been less concern (and research) on the problems associated with drugs and driving. Partly this is a result of the more prevalent and transparent problems resulting from drinking and driving. Many developed countries can be viewed as ‘alcohol societies’ – rather than ‘drug cultures’ that can be said to exist in certain regions of the world; although often alcohol and drugs co-exist within societies and cultures.
- In most surveys reported in different European countries the prevalence of licit drug use falls in the range of 5-15%, and illicit drug use in the range of 1-5%. In the general (non-accident) driving population, cannabinoids are the most frequently detected illicit drug, with the use of opiates less frequently observed.
- Fatigue in commercial road transport is extremely commonplace, as commercial drivers are most vulnerable to the effects of fatigue. There is shown to be an increased risk of fatigue-related accidents at night (a risk factor ten times higher than daytime levels), an increased risk the greater the length of the working day, and with irregular working hours and shift patterns.
- The evidence suggests that a minor reduction of driving under the influence of alcohol and drugs would have a large effect on accident occurrence. There is wide agreement in the international scientific literature that increasing drivers’ perception of the risk of being detected for excess alcohol is a very important element in any package of measures to reduce alcohol related crashes. Police powers, procedures and the type of evidentiary equipment used all play a large part in determining the extent to which this objective can be reached.
- Social and cultural countermeasures have been shown to reduce the incidence of accidents caused by impairment. Yet, without effective legislation, raising awareness through publicity campaigns and education schemes remains a short-term resolution, by influencing people’s driving behaviour without the control of the legal system. Additionally, health education campaigns to ‘drink sensibly’ (or to drink less) will also have the added benefit of helping road safety.

Interventions

- Legislation for drink and drugged driving is variable from country to country. Virtually the only legislation that is consistent across countries is the setting of maximum blood alcohol concentration levels or breath alcohol content. Even then, BAC limits are not standardised across countries, with many (especially low and middle income countries) not applying BAC levels at all. The World Medical Association asserts that appropriate legal sanctions are a requisite of any national anti-drink or drug driving campaign for enforcing appropriate penalties on drivers that flout drink and drug driving laws.
- At present, there is insufficient information to support policy and the development of valid and standard protocols to evaluate driver impairment. The aim of the IMMORTAL (Impaired Motorists, Methods of Roadside Testing and Assessment for Licensing) research programme is to provide evidence to propose intervention methods for driver impairment, and support the future development of European policy governing driver impairment legislation.
- Without enforcement by local authorities and police forces, legislation against drink and drugged driving is virtually redundant, because unless offenders can be detected, and there is an effective deterrent, drink and drugged driving offences will continue to rise. Research indicates, that for drink driving at least, breath testing is the most effective means of both enforcing legislation and deterring potential or high-risk offenders.
- While developed countries have much to offer in terms of their experience it is not sensible to think that their 'solutions' (if such things exist) can simply be applied in developing countries without taking account of local circumstances. Each country is unique – and indeed some countries consist of different regions and ethnic populations that are very different from each other.
- Any long-term effective strategy to reduce impaired driving accidents in developing countries will need the support and encouragement of the government. In order to make politicians and policy makers support such activities it is necessary to persuade them about the 'true' size of the problem and provide convincing evidence about the social and economic cost of impairment issues. This type of information – together with objective assessments of what a variety of interventions would be likely to achieve could provide a very strong case in many developing countries for implementing countermeasures.

Improving Road Safety by Reducing Impaired Driving in Developing Countries: A Scoping Study

1 INTRODUCTION

It has been estimated that world-wide approaching 1 million people are killed in road crashes each year (Jacobs et al, 2000). In many countries the numbers of road crashes are increasing each year - and this is especially the case in developing countries. The World Health Organization (WHO) has recently estimated that by the year 2010 road accidents will be the third main cause of death and disability in the world after 'medical' conditions involving clinical depression and heart problems (WHO/Harvard University, 1996), putting it 'ahead' of respiratory infections, war and HIV. For every death resulting from a road accident there are many more serious injuries – some of which result in permanent disability. Research has shown that wage earners are more likely to be involved in road accidents than other groups of people (Ghee et al, 1997) which may mean that they can no longer work to support themselves or their families. It is estimated that around 70% of all road accidents occur in developing countries and, critically, while the number of accidents in developed countries is generally reducing, the numbers in developing countries is increasing sharply. It is estimated that road accidents around the world currently cost around US\$ 500 billion per year (Ghee et al, 1997) – a huge amount when it is recognised that methods of preventing many of these accidents are already known. Road accidents are therefore a major social and economic problem, especially in developing countries.

There are many reasons why road accidents happen - and these are frequently grouped into problems involving, either the vehicle, the road or the driver; although many accidents can have a number of such contributory factors. However, it is widely accepted that faulty road user behaviour is by far the main factor contributing to accidents (Treat, 1980).

There are numerous types of such dangerous driving behaviours. For example, *driving-too-fast*, *failing-to-'give way'* and *driving-while-drunk* are frequently quoted as being particularly important factors in causing accidents. However, linking single factors of this type to particular accidents fails to recognise the often-complex hierarchical interactions that may be involved. For example, the best predictors of accident liability can be variables such as age (or driving experience with which it is correlated, Maycock, 1991) for which it is difficult to legislate.

There are also other factors that need to be accounted for, relating to the outcome of a crash, such as whether the driver or passengers were wearing seatbelts and the quality of the emergency services and hospital treatment received.

In spite of such complexities it is generally accepted that driving/riding (and even walking) while drunk, driving while under the influence of drugs, or driving when fatigued or tired (eg 'falling asleep at the wheel') all represent very major road safety problems. All of these factors can be grouped together under the umbrella term of

‘impairment’. What is not known – or generally acknowledged – is the actual extent of such problems. While a considerable amount of relevant research has been done (typically in developed countries) the actual magnitude of problems still remains unclear; and even less is known about the situation in many developing countries.

In order to understand more about the role of impaired driving in road accidents the Global Road Safety Partnership (GRSP), with the financial support of the UK’s Department for International Development (DFID) recently awarded the Transport Research Laboratory (TRL) a research grant to conduct a small ‘scoping study’ on impaired driving – with particular reference to developing countries.

The terms of reference (ToR) for this study included the following outputs:

- A scoping study: based on a review of the literature and discussions with key partners, and including:
 - A synthesis of available information on the extent of impaired driving in a range of developing countries and their impact on the poor
 - A review of potential causes
 - A summary of existing good practice in both developed and developing countries and an evaluation of their feasibility in low and middle-income countries
- A statement of the case for further research, its objectives and likely application.

This report represents the outcome of this study. It concludes with a number of proposals for possible further research that it is judged are required to overcome important knowledge gaps about the actual size of the driver impairment problem and, perhaps more importantly, what steps are required to try and overcome the actual problem, especially with regards to the situation in developing countries.

2 SOME DRIVER IMPAIRMENT ISSUES

2.1 Introduction

The impairment of normal driver behaviour is generally regarded as ‘a reduced ability to perform adequately the various elements of the driving task’. The cause of driver impairment (or resulting dangerous and erratic behaviour) may be the result of a number of factors such as alcohol consumption, drug ingestion, injury, infirmity, fatigue, the natural ageing process; or a combination of these factors.

The focus of this scoping study is on driver impairment caused by alcohol, illegal and medicinal drugs and fatigue, as these impairment factors were thought to be most relevant with regard to the problem of improving road safety in developing countries.

It was recognised from the beginning that more information was likely to be available with regard to drinking and driving than with respect to drugs and fatigue. There has been a considerable amount of research linking the consumption of alcohol and impaired driving and, importantly, relatively simple ways of measuring alcohol consumption (eg breathalysers) have been developed. This is not the case for either drugs (of which there are many varieties) or fatigue, although in recent years both topics have attracted more attention and research.

2.2 Alcohol

It has been known for many years that alcohol is associated with an increased risk of injury and numerous reports have documented this relationship in a variety of ways (Cherpitel, 1993):

- Alcohol impairs judgement and increases the possibility of engaging in high-risk behaviour leading to an injury.
- It affects vision and then poses greater risks in identifying risks in the road environment.
- Because of its physiological effects, it poses difficulties in appropriate co-ordination, which is required in manoeuvring the vehicle, especially in poor conditions of developing countries by affecting the psychomotor performance so that responses are inadequate or inappropriate to a crisis situation.
- Literature indicates that the amount of injury sustained from a given traumatic impact is higher under alcohol influence (Anderson, 1986; Waller et al, 1986).
- Long term consumption of alcohol increases fragility of bones, thus increasing vulnerability to injury and impending recovery (Hernandez-Avila et al, 1991).

Drink driving, sometimes referred to as ‘driving under the influence’ (DUI) or ‘driving while impaired’ (DWI) is considered to be one of the most dangerous and anti-social behaviours linked to alcohol consumption, not least because it is recognised as being one of the leading cause of road traffic accident injuries and fatalities. Many countries agree on the need to establish regulations that prohibit impaired driving, and have set a

maximum allowable blood alcohol concentration (BAC) level as a tool for both enforcement and prevention (ICAP, 2002). BAC represents the amount of ethanol (ie alcohol) in a given amount of blood, noted as 'weight by volume', and measured as either grams of ethanol per 100 millilitres of blood (g/100 ml – used in the United States) or milligrams of ethanol per 100 millilitres of blood (mg/100 ml – used in Europe).

The most common (as well as fastest and cheapest) method of determining BAC is by measuring the alcohol in an exhaled sample of breath ('breath alcohol', or BrAC), or measuring other bodily fluids such as urine. In countries where drink driving legislation exists, BAC levels range from 100 mg/100 ml (eg in the United States) to 0 mg/100 ml, a 'zero' limit, (eg in Armenia, Czech Republic, Hungary, Romania), with 50 mg/100 ml being the most common BAC that has been adopted in nearly 30 countries. Drivers whose BAC exceeds the legal permissible limit of a particular country are considered to be 'impaired', and hence subject to a reduced ability to perform adequately the various elements of the driving task, including perception of hazards, judgement of distance and speed, and reaction times (PoV, 1996). The use of breath testing and blood/urine samples for enforcement of drink driving legislation is discussed in more detail in Section 8.2 of this report.

Alcohol by any standard definition is a drug and can be classified under sedatives, tranquillisers, hypnotics or anaesthetic depending on the quantity consumed. Alcohol has a clear and profound effect on the central nervous system. Alcohol has different effects at different levels of blood alcohol levels. At 0.05% BAC (ie. 50mg/100ml), thought, judgement and restraints are disrupted. Voluntary motor action gets diminished at 0.1% BAC. At 0.2% the motor functions of brain are depressed and emotions and behaviour are affected to a great level. The person will be commonly confused or stuporous at 0.3% levels and will definitely be semi-comatose at 0.4-0.5% levels.

While there could be varied effects of alcohol, it has generally a gradual anaesthetic effect by depressing the central nervous system. As a result, perceptions are blunted and quick performances are delayed. The reaction time to sensation of light, touch and hearing are impaired thus increasing the reaction time in a crisis situation.

With the realisation that drinking and driving is dangerous, developed nations have concluded (at present) that it is hazardous to society and have made this behaviour unacceptable and a serious criminal offence. The victims of drunk driving are not only themselves, but also their co-passengers and others on the road. Norway was the first country to introduce the first (per se) law in 1936 (Voas and Lacey, 1990). A per se law is a law, which makes it an offence by itself, to drive with a blood alcohol content above a certain limit (which is the legal limit). The Norwegians set their legal limit at 50mg/100ml. This led to the promulgation of adopting blood alcohol content (BAC) levels in many countries during the last three decades. However, several questions have been raised about the appropriateness of the limits as there are many biological and other variations. In recent years it has become clear that effects of alcohol manifest soon after the first drink at a BAC level of 20mg and lower. The risk of collision is found to increase at BAC levels of 50mg. A recent observation has been that lowering of BAC

levels have resulted in significant reductions (Shults et al, 2001). Thus if a country lowers its levels from 80mg to 50mg, a definite reduction is known to occur (Mann et al, 2002).

The excessive consumption of alcohol is widely considered to be a major social problem. The ICAP (International Center for Alcohol Policies) Series on Alcohol in Society provide invaluable information on global drinking behaviour and the impact of alcohol consumption on society with respect to cultural, religious and media influences. In 'Drinking Patterns and their Consequences', Single and Leino (1998) explain that alcohol epidemiology has focused mainly on levels of drinking, with research on individuals measuring alcohol consumption in terms of quantity-frequency scales of average consumption, and research at the societal level focusing on mean per capita consumption. They advocate that greater attention be given to drinking patterns, since the temporal rhythm of drinking patterns has significant impacts on alcohol related problems, quite apart from the impact of drinking levels.

There now exist a number of organisations dedicated to increase the understanding of alcohol and the consequences of its misuse, including the International Center for Alcohol Policies, the Institute for Alcohol Studies the Portman Group, and Eurocare – Advocacy for the Prevention of Alcohol Related Harm in Europe. Yet, for drink driving, despite there being global recognition of the scale of the problem, and in most cases, associated legislation to minimise alcohol related driving accidents, it remains a pandemic that legislation and enforcement have, thus far, been unable to curtail.

2.3 Drugs

While the mechanism of alcohol influence is clearly known, much less is known about illicit drugs. Studies have reported inconsistent results even in developed countries while nothing is known from developing areas, where usage of illicit drugs are high. It has been reported that drugs generally affect judgement, psychomotor performance and balancing aspects. Reports indicate that alcohol has much more deleterious effects. It is highly debated whether licit drugs given for certain medical conditions (eg epilepsy, cardiovascular disease, mental health states) would decrease risks, as drivers would perform less well in the absence of these drugs.

The use of illegal or psychoactive substances and medicinal drugs whilst driving is a more recent cause for concern by safety practitioners, but nonetheless one that can result in a gross degradation in driver performance. The effect of drugs on road safety is rather more complex than that of alcohol, because impairment can be caused by such a huge range of prescription drugs, illegal or recreational drugs, solvents, or stimulants used to counter fatigue. Hence, it is very difficult to provide an objective enforcement 'benchmark' (as for drink driving enforcement) against which impairment caused by drugs can be measured. To a large extent this state of affairs is caused by the lack of suitable test equipment (such as the breathalyser) that can detect drug use and level of resulting impairment, although such tools are now becoming more available (although tend to detect recent use of particular drugs rather than the current level of 'intoxication' or impairment). Furthermore, a combination of drug and alcohol use can accentuate

impairment, although the effects of all the possible combinations and doses have not yet been fully explored.

In addition, some medicinal drugs have been found in a few circumstances to improve driver performance, whereby diabetics, depressives and epileptics may prove to be safer drivers with medication than without treatment (Starmer and Mascord, 1994). In fact, there is an increasing tendency for commercial drivers in the West, but more specifically in developing countries where legislation for driving time is non-existent, to consume licit or illicit drugs in an effort to counter fatigue whilst driving, allowing them to drive for longer periods to maximise their income.

The problem of being under the influence of drugs (whether legal or illegal) is becoming increasingly visible, yet the cause and effects of drug induced impairment is still open to debate, particularly with regard to legislation and enforcement issues. Typically, there are three types of studies: epidemiological, pharmaco-epidemiological and experimental studies that have helped 'demystify' the influence of drugs on driving performance. Section 8.3 describes the way in which these studies have analysed specific cause and effects of different drugs on driving behaviour.

2.4 Fatigue

In addition to alcohol impairment and speeding, which are both considered to be major causes of road traffic accidents, driver fatigue has now been identified as a significant factor in road transport crashes, particularly amongst commercial drivers where as many as 40% of all accidents have been estimated as being sleep related. According to the European Transport Safety Council (ETSC, 2001), driver fatigue is responsible for 20% of commercial road transport crashes, especially on long journeys on trunk roads and motorways. Fatigue, caused by overwork, excessive hours of driving, lack of rest and lack of nourishment, produces a state of reduced mental alertness which may include sleepiness or drowsiness. Fatigue, attributed to drowsiness, is the cause of around 300 deaths per year in the UK, typically when the driver has fallen asleep at the wheel (DETR, 2000). Fatigue is shown to be most prolific amongst long distance heavy goods vehicle drivers (Maycock, 1995), but is also prevalent amongst men aged 30 years and under, skilled manual workers and shift workers (Sexton et al, 2002).

It is especially difficult to counteract driver fatigue, and in particular sleepiness, which is caused by neurobiological processes that determine the cycle of sleep and wakefulness. Hence, legislation and enforcement regulations are difficult to implement, since, unlike drink driving and drugged driving, driving whilst fatigued is not against the law or easily enforceable. Section 9.1 examines ways in which social and cultural factors can be used as a counter-measure to be used in the prevention of sleep-related vehicle accidents.

3 METHOD AND GEOGRAPHIC SCOPE OF REVIEW

This study aims to review existing knowledge about ‘impaired driving’ – with special reference to developing countries. Given the very limited time and resources available this represented a sizeable challenge for a variety of reasons. Firstly, it was suspected that there might be a considerable amount of relevant information that was unpublished (so called ‘grey’ literature). Secondly, there was a problem of language - with not all publications being readily available in English. Thirdly, there was the problem of definition (or semantics) with different countries having a different meaning (or at least understanding) associated with words such as drug, alcohol, drunk, accident, casualty and enforcement. For example, some people, even in European countries, do not consider that drinking beer is consuming alcohol, while in some cultures the use of certain drugs (eg caffeine) is so widespread that it is accepted (and normal) behaviour.

To try and overcome some of these issues – and to take advantage of existing local expertise and experience – it was decided to invite a number of ‘local’ specialists to independently conduct a series of regional reviews that together would cover a high proportion of developing countries around the world. It was anticipated that this approach would provide more valuable in-depth information about a significant number of countries rather than having a strategy that might provide limited and unreliable information about ‘all’ countries. The number of these reviews was limited by financial constraints, the lack of known suitable practitioners and language problems. One consequence of this was that it was not possible to include countries of the Central and Eastern European in the review; a limitation that is recognised and regretted since such ‘transitional’ countries, although often lacking the infrastructure to address road safety, can serve to provide guidance to both developed and developing countries.

Three ‘regional’ reviews were undertaken that covered countries in:

- Africa,
- South East Asia (SEAR) and
- Latin America and the Caribbean. (LAC).

However, it proved impossible to find relevant information about all the countries in each of these regions. The countries for which information was found are given in each of the regional reviews that are presented in the next 3 sections (Sections 4 – 6). Note that the BAC unit of measurement differs in the reviews. Studies in Africa and Latin America use g/100ml (eg 0.05g/100ml) while in SEAR it is represented as a percent (eg 0.05%) or as mg per 100ml. Also, each of the regional reviews contains its own list of useful internet sites, useful contacts and/or ‘grey’ literature references. While the format of each of the regional reviews was intended to be similar, and individual reviewers were given a structure to follow, this did not turn out to be possible. For example, one of the reviews (from SEAR) contained additional information (eg on the increase in the numbers of vehicles in the region, alcohol consumption figures and ‘general’ accident information) that was retained as it was considered to provided useful ‘background’ information relevant to the road safety and impairment problems. This review also contains additional

information on aspects such as the physiological and psychological effects of alcohol and drugs which were also retained since they have a bearing on resolving the problem of road safety.

It should be noted that the words 'crash' and 'accident' are both used throughout this report to describe the unintentional collision involving at least one vehicle. While there is growing support for the use of the word 'crash', individual contributors were allowed their preferred terminology.

These 'developing country reviews' were to be supplemented by information available from more developed countries - such as Europe, North America and Australia – that might serve to provide benchmark (and 'good practice') information relevant to the study.

The second method employed for this review was to conduct an informal consultation exercise by means of a short 'ad hoc' e-mail survey of known (or interested) practitioners and institutions. While it was always recognised that this survey would produce limited information – in terms of the countries, or individuals, that might respond, and the subjective nature of the information provided – it was conducted to both provide background information, and to try and identify key individuals and institutions that might be of value for future activities. Section 7 describes the consultation process and results obtained.

4 IMPAIRED DRIVING IN AFRICA

(by W Odero)

4.1 Introduction

Road traffic crashes are a major cause of fatality and serious injuries world-wide, especially in developing countries. In many African countries, the number of deaths from road crashes increased by over 350% between 1968 and the 1990s (Oluwusanmi, 1993; Dhliwayo, 1997), with the highest increases being observed in East African countries. In contrast to this, in developed countries (eg Western Europe, North America, Japan, Australia and New Zealand) road fatalities declined over this period by over 20% (Ross et al, 1991). Although Africa has only 4% of the world's vehicles, it is responsible for 10% of all road fatalities world-wide; while the developed world with 60% of all registered vehicles contributes only 14% of all road deaths (Jacobs et al, 2002). The rates of road accident fatalities per 10,000 vehicles (a frequently used index of a country's 'road traffic risk') are also significantly higher in African countries than in high-income nations, sometimes by a factor of 30-60. In particular, Ethiopia, Kenya and Uganda have the highest rates that are in excess of 60 per 10,000 registered vehicles (Assum, 1997; Odero et al, 1997).

Driver behaviour (sometimes in combination with poor road infrastructure and vehicle factors) is widely recognised as the main cause of road traffic crashes and is generally judged to be a contributory factor in over 80% of all accidents. Although there are many different kinds of dangerous behaviours, alcohol intoxication ('drunken driving') is known to adversely affect driving tasks, and is recognised as a major risk factor in motor vehicle crashes (Borkenstein et al, 1964; Baker et al, 1992). Consequently, effective interventions to reduce alcohol-impaired driving have been introduced in all developed countries as part of the broader road safety effort. These interventions have contributed to the overall decline in road traffic injuries and fatalities in these countries (Lund, 1991; Shults et al, 2002). In Africa, despite the huge burden of road traffic crashes, the extent of alcohol-involvement in the road traffic injuries and deaths is still unclear, and there is little information on effective interventions for reducing impaired driving in the continent. Other impairment factors, such as drugs and fatigue, are also widely recognised as being important road safety problems.

4.2 Scope of review

The purpose of this study was twofold:

- 1) To undertake an extensive review of the literature and summarise existing information on the causes and consequences of impaired driving resulting from the use of both alcohol and other psychoactive substances in Africa; and
- 2) To evaluate the scope for further research which could assist in the formulation of interventions for reducing impaired driving.

The study examined data from a wide variety of sources that presented information on the following aspects of impaired driving:

- 1) Proportions of road traffic crashes, injuries and deaths due to impaired driving
- 2) The demographic and socio-economic profile of drivers and pedestrians impaired by alcohol or psychoactive drugs
- 3) Patterns of alcohol consumption and drug use, including type of beverages and drugs used; and the social contexts of drinking and driving
- 4) Travel patterns of impaired drivers and pedestrians
- 5) Interventions for reducing impaired driving
- 6) Gaps in existing knowledge and suggestions for further research.

This review was intended to cover all African countries. However, it found that relevant data on alcohol and drug impairment was available from only 15 countries that were located mainly in 3 sub-regions of the continent (see Table 4.1). In spite of the efforts made to identify all the available literature in the short time available, a number of problems were encountered, for example, getting information from non-English publications.

Table 4.1: List of countries identified with studies on impaired driving

Sub-region	Country
I. East Africa	Kenya Tanzania Uganda
II. West Africa	Benin Cameroon Ghana Nigeria
III. Southern Africa	Botswana Lesotho Malawi South Africa Zambia Zimbabwe Swaziland
IV. Central Africa	Benin
V. North Africa	Morocco

4.3 Method

Relevant studies were identified through a systematic search of published and unpublished literature on alcohol, drugs, impairment and road traffic crashes (in Africa) from 1966.

This included searching:

- OVID-MEDLINE and PubMed databases. Here, articles were identified using key search terms such as: “alcohol or drugs or accidents or injuries or trauma” and “alcohol or drugs or driving”. African countries were identified by using “Africa” as the key term, which were then automatically ‘exploded’ into regions and constituent countries. Titles and abstracts identified using the above search terms were then reviewed and those with data on alcohol or drugs were selected. Full papers of the selected articles were sought from various libraries both in Kenya and elsewhere (eg. Medical Research Centre, Cape Town, South Africa; Indiana University School of Medicine, USA). When available, relevant articles were obtained from the Internet.
- General Internet searches (eg. Google) applying similar search terms and article selection procedures as for OVID-MEDLINE.
- Books, conference proceedings, unpublished reports on the subject, including academic theses, research and project reports, and newsletters were sought from individuals, institutions and organisations identified from a variety of sources, including the internet, WHO, RTI-networks; as well as personal contacts.
- ‘Snowballing’ search – so that relevant references cited in the papers and books selected through the above methods were also located and reviewed.

It should be noted that the review focused primarily on literature published in English.

4.4 Size of the Problem

The extent of impaired driving is generally poorly documented in developing countries. A number of reports (eg. WHO, World Bank, TRL) acknowledge a lack of sufficient evidence on whether impaired driving is a significant road safety problem in specific developing countries, such as those in Africa. A previous review of literature on alcohol-related road traffic injuries in developing countries undertaken by Odero et al (1997) found inconclusive evidence and suggested further studies. This present study represents a further effort to seek more comprehensive and up to date data on the extent of alcohol and drug impaired driving in African countries.

4.4.1 Alcohol consumption patterns: historical and social perspectives

The involvement of alcohol in road accidents is likely to be strongly influenced by drinking behaviour. Existing reviews of the literature provide summaries of the patterns of alcohol use and its effects in the general population in a number of developing societies, including Africa (Room et al, 2002; Maula et al, 1990; Harworth, 1989; Acuda, 1985). There is evidence from ethnographic studies, which indicate that alcohol was an integral part of the traditional African life-style before the arrival of Europeans. Historically, traditional African brews, made from a variety of plants, mainly sorghum, maize, wheat, millet, cassava, banana and palm trees, played an important role in various social and cultural activities, and was not meant for trade (Acuda, 1985). In Uganda, for instance, alcohol was consumed by elders at meetings, during the settlement of disputes,

in negotiation for a bride price and in all sorts of celebrations (Mushanga, 1976). However, the arrival of Europeans in the continent, bringing with them European types of alcohol, such as rum, gin, whisky and brandy, as commodities of trade, resulted in the use of these exotic alcoholic drinks gradually became more common (Pan, 1975). Subsequently, a shift from the traditional brews to European ('modern') drinks occurred – with many people resorting to drinking bottled beers and spirits in bars or taverns. The traditional use of alcohol for socialisation and celebrations has gradually changed over the years, and alcohol is now produced largely for commercial rather than for social purposes.

Because of this commercialisation, numerous types of 'home made' alcoholic drinks, some illicit, are increasingly being produced and made readily available at low cost in a number of African countries. A variety of such alcoholic beverages, known by a wide variety of local names (some of which are given below), exist in different countries. In Nigeria, the common alcoholic beverages are palm wine (*burukutu*), locally distilled palm wine (*ogogoro*), beer, spirits and wine (Ebie, 1990); while in Cameroon, millet-based traditional brews, palm wine, beer and spirits are widely consumed (Yguel, 1990). In Tanzania, the types of alcohol available include beer (*pombe*), palm wine (*tembo*), banana beer (*mbege*), and illicit distilled spirits (*gongo*) - (Maula, 1990). In Kenya fermented local brews (*busaa*) and locally distilled illicit spirits (*chang'aa*) are commonly consumed in rural areas (Silberschmidt, 1990). *Chang'aa* with a high concentration of pure alcohol of up to 60%-70% is easily available and inexpensive. A study by Mwaniki (1982) in Nairobi, Kenya, showed that the production and sale of illicit distilled alcohol (*chang'aa*) is a thriving business and a frequent source of income for women living in low-income slum areas.

A number of qualitative studies that have examined alcohol consumption patterns in Africa report variable findings. A population survey of 109 selected adults in a rural community in Nigeria undertaken in the 1970s showed that 8.3% of the subjects were alcoholics (Odejide et al, 1977). In Kenya, a survey of 200 heads of households in a rural district found a very high prevalence of alcoholism: 27% of the men and 24% of the females were classified as alcoholics based on the WHO definition (Bittah et al, 1979). Another hospital-based survey in Kenya by Nielsen and colleagues (1988) showed that 54% of males and 25% of females attending an outpatient clinic were alcoholics. Acuda (1990) further reported findings of a multi-centre WHO Collaborative study designed to develop a screening instrument for detecting problem drinkers among patients attending hospitals. The study showed that Kenyan and Zimbabwean patients had the highest levels of alcohol consumption, with an average daily consumption of 97grams – compared to 30 grams in five other countries. In South Africa, the Demographic Health Survey in 1998 found that of the current consumers of alcohol, almost a third drank in excess of recommended 'risk' levels over weekends. The highest level of heavy drinking was reported among males aged 35-44 and females aged 45-54 years with low levels of education, living in non-urban settlements (Van Heerden and Parry, 2001).

Other data from the alcohol and drug use surveillance studies conducted by the South African Community Epidemiology Network on Drug Use (SACENDU) between 1997

and 2000, showed the widespread misuse of alcohol in the general population, especially among men. Very high drinking levels were also found among high school students, with 53.3% of grade 11 male students in Durban and 36.5% of a similar age group in Cape Town reporting heavy drinking episodes (Parry et al, 2002).

Another method that has been used in estimating levels of alcohol use in specific communities or sub-populations is to determine the proportion of people who do not drink at all (ie. 'abstainers'). Several population-based studies on abstinence in Sub-Saharan Africa, reviewed by Partanen (1990), provide some evidence on the prevalence of abstinence and characteristics of such abstainers – see Table 4.2. This shows that in all the studies, higher proportions of women than men are abstainers. Data from Tanzania (Njelekela, 1978) further indicate that those under 20 years, and over 50 years of age had the highest prevalence of abstinence. In Uganda, abstinence among the Baganda tribe was generally rare, but was found to be higher among the Muslims (Mushanga, 1976). In Morocco, a predominantly Muslim state, a survey of medical students found the prevalence of alcohol use to be very low: less than 1% of the respondents (n=595) were found to be regular users (Touhami, 1990). These findings are supported by recent estimates of drinking patterns in the WHO sub-regions showing that most Islamic states have a higher prevalence of abstainers compared to predominantly non-Islamic countries (Room et al, 2001).

According to Room and colleagues (2001) the most widespread prohibitions in the world on alcohol consumption are religious in nature. Except for Christianity, most major global religions regard the drinking of alcoholic beverages as incompatible with leading a holy life. In Islam, abstaining from alcohol is an obligation of all adherents. In northern Nigeria, between 1999 and 2001, twelve states adopted Muslim *sharia* law, which involves alcohol prohibition. In the last two centuries, many strands of Christianity have also acquired abstinence of their adherents. Religion, thus, seems to offer a potential but unexplored strategy for reducing alcohol-related problems such as impaired driving.

Alcohol consumption is, thus, common in African society, but there is considerable variability in drinking patterns between countries. This implies that the magnitude of the consequences of drinking alcohol and the associated effects and problems will differ from country to country, and even within different regions in the same country.

Table 4.2: Proportions of abstainers in selected African countries

Country, sample population	Proportion (%)	
	Men	Women
Zimbabwe, African population in Harare, 1970	36	80
Zimbabwe, African population in Bulawayo, 1970	47	82
Tanzania, adult rural population in Iringa district, 1978	14	21
Nigeria, rural community	26	45
Kenya, slum area of Nairobi, 1985	27	54
Zambia, low-income townships in Lusaka, 1981	29	40
Zambia, general population:		
- low-income urban community	41	77
- sub-urban community	56	71
- rural community	34	70

Source: Partanen J (1990). Abstinence in Africa. In: Alcohol in developing countries. *Proceedings from a meeting, August 10-12, 1988, Oslo. NAD Publication No. 18, Helsinki, p72.*

4.4.2 Epidemiological studies

There have been few epidemiological studies conducted in Africa to examine the associations between the use of alcohol or drugs and driving. Of the 22 articles and reports identified by this review, 14 studies assessed non-fatal accident victims for alcohol or drugs (see Tables 4.3 and 4.4), five studies examined fatally injured road accident victims (Table 4.5), and three studies conducted a roadside survey of drivers for evidence of alcohol impairment (Table 4.6).

a) Non-fatal injury studies

The majority of non-fatal injury studies have been conducted in South Africa (Table 4.3). A series of hospital-based studies in Cape Town have consistently shown that between 26% and 31% of non-fatally injured drivers are intoxicated - that is they have BAC exceeding the legal limit of 0.08g/100ml (Peden et al, 2001,1996; Cape Town City Traffic Department, 1993; Kralingen, 1991; Myers, 1977). A multi-centre sentinel surveillance of alcohol and drug abuse undertaken in three cities – Cape Town, Durban and Port Elizabeth - over a 2-year period (1999-2000), showed the level and trends of alcohol-related road traffic injuries in the different regions of South Africa (Peden et al, 2001). In Cape Town, for example, the proportion of non-fatal traffic involved patients (for all road users) with a positive BAC test increased from 32.7% to 42.5% between 1999 and 2000, while it declined in both Durban and Port Elizabeth over the same period though the levels still remained high (Table 4.4). Considerable variations in proportions of alcohol positive subjects were observed across the cities, with Port Elizabeth having the highest alcohol prevalence of 72.5% and 52.8% in 1999 and 2000, respectively. However, the total numbers of subjects tested for alcohol were very small in some of the studies, which may explain the high variability for some of the results.

Table 4.3: Alcohol use in non-fatal road accident victims

Country (1 st author, year)	Road-user	Sample size	% +ve for alcohol	BAC Legal Limit for drivers	% Impaired /above Legal Limit	Method of detection
S. Africa (Peden, 2000)	Driver Pedestrian Passenger	44 14 123	50.4 50.7 33.0	0.05g/100ml	31.8	Breath test (Lion Alcolmeter)
S. Africa (Peden, 1996)	Pedestrians	196	61.2	0.08g/100ml	58.7	Blood analysis*
S. Africa (Van Kralingen, 1991)	Driver	285	37.5	0.08g/100ml	29.1	Blood analysis
S. Africa (Hedden, 1994)	All-drivers, Passengers pedestrians	530		0.08g/100ml	51.7	Breath test – Lion Alcolmeter
S. Africa (Myers, 1977)	Driver Pedestrian Passenger	70 21 24	37.1 28.6 37.5	0.08g/100ml	31.0 23.8 33.3	Blood analysis
Kenya (Odero, 1998)	Driver Pedestrian Passenger Pedal cyclist	25 30 106 24	60.0 33.3 16.0 8.3	None	40.0 [†] 20.2 5.7 4.2	Blood analysis & Breath test
Tanzania (Mbaruku, 1980)	All road users	230	13.0	0.08g/100ml	-	Smell of alcohol on breath
Uganda (Andrews, 1999)	Occupants Pedestrians	115 153	5.2 17.0	-		Smell of alcohol on breath
Nigeria (Aguwa, 1982)	Drivers (all male)	32	88.0	None	56.0	Blood analysis
Nigeria (Asogwa, 1980)	Drivers	555	7.7 12.2 (kola nut)	-	-	Self-report (interview)
Benin (Bouramia, 1992)	All road users	796	1.0	None	-	Smell of alcohol on breath

[†]BAC \geq 0.05g/100ml; [‡]BAC \geq 0.10g/100ml; * By gas chromatography

In Kenya, 40% of the 25 injured drivers treated in hospital emergency departments in Eldoret were found to have a BAC exceeding 0.05g/100ml (Odero, 1998). Similarly, in Anambra State, Nigeria, Aguwa and colleagues (1982) found 56% of accident-involved drivers to have high BAC levels in excess of 0.10g/100ml. All the above studies used either blood analysis (by gas chromatography) or breath-tests (using hand-held

Alcoholmeters) techniques to measure, or estimate, BAC levels. Other studies in Nigeria, Tanzania and Uganda which used subjective criteria for evaluating subjects for alcohol impairment (such as the smell of alcohol on the breath and self-reported drinking), in contrast found very low proportions to be impaired, ranging between 5.2% and 13%.

Table 4.4: Time trends in proportion of alcohol positive road traffic injuries in three South African cities

City	% BAC positive (sample size)*	
	1999	2000
Cape Town	32.7% (17)	42.5% (17)
Durban	41.0% (16)	19.6% (10)
Port Elizabeth	72.6% (45)	54.8% (17)

* includes all road users

b) Fatality studies

Five studies, summarised in Table 4.5, were found that reported alcohol prevalence in fatal road crash victims; all of which, except one, were conducted in South Africa. For drivers, the proportions with a BAC above the legal limit of 0.08g/100ml, ranged from

Table 4.5: Alcohol use in fatal accident studies

Country (1 st author, year)	Road-user (N)	Sample size	% +ve for alcohol	BAC [†] Legal Limit for drivers	% Impaired /above Legal Limit
S. Africa (Lerer, 1995)	Drivers	-	-	0.08g/100ml	53.8*
S. Africa (Cape Town Traffic Dept, 1993)	Drivers	38	52.6	0.08g/100ml	47.3
	Pedestrians	120	75.8		72.5
S. Africa (National Trauma Research Programme, 1990)	Pedestrians	-	67.0	0.08g/100ml	60.2
S. Africa (Fosseus, 1983)	Motorcyclists	48	61.3	0.08/100ml	42.0*
Zambia (Patel, 1977)	Drivers	33	30.3	0.08g/100ml	27.2
	Pedestrians	109	32.1		32.1
	Passengers	61	14.7		14.7
	Pedal cyclists	12	33.3		33.3

[†] Determined by analysis of blood samples using gas chromatography

*cut-off BAC level = 0.10g/100ml

27% in Lusaka, Zambia, to 70% in Cape Town; while between 30% and 72% of pedestrians killed were intoxicated. One study which evaluated motorcyclists using a

BAC cut-off level of 0.10g/100ml found 42% to be impaired (Fosseus, 1983). Overall, these studies show that proportions of alcohol impaired drivers and pedestrians in post-mortem studies are considerably higher than in non-fatal cases. It should also be noted that relatively few subjects were evaluated for alcohol in each of these studies. However, there was consistency in the method of blood alcohol analysis (eg. by gas chromatography) across the studies.

c) Non crash-involved drivers

Only three studies were found that conducted roadside surveys to investigate the prevalence of alcohol impaired driving among randomly selected drivers for this review. These surveys were conducted in Ghana, Kenya and South Africa (see Table 4.6).

Mock and colleagues (1998) breathalysed 722 drivers stopped by the roadside in Accra; 21% of the drivers had detectable BAC, while 7.3% had BAC in excess of 0.08/100ml. None of the 8 female drivers tested had a positive BAC. A higher proportion of middle-aged drivers of ages 30-49 years (9.1%) and illiterate drivers (11.1%) were found to be impaired; similarly, a greater proportion of drivers of private vehicles (9.8%) than those of commercial vehicles (6.4%) had BAC levels above 0.08g/100ml. Of the commercial vehicles, taxi drivers had the highest rate of impaired driving (10.3%). Truck and large bus drivers also had high rates of 9.9% and 8.1% respectively.

In Kenya, of the 479 drivers who were breath-tested during a roadside survey conducted by Odero and Zwi (1997), 19.9% were positive for alcohol, 8.3% had BAC in excess of 0.05g/100ml, and 4% exceeded the BAC level of 0.08g/100ml. All intoxicated drivers were male, and aged 25 years and above. Only one of the 8 female drivers had a positive test. As in the Ghana study, the prevalence of alcohol impaired driving was higher among private motorists (12.1%) than in commercial drivers (4.1%). Although given the high passenger occupancy of the buses, even these rates of impairment place a large number of passengers at risk.

In South Africa, a series of roadside surveys carried out by De Jager (1988) between 1981 and 1985 found that, on average, 7% of drivers and 16% of pedestrians randomly selected from traffic and breath-tested had BAC levels above the legal limit of 0.08g/100ml.

Additionally, two other population-based driver surveys, conducted in South Africa and Nigeria using self-report questionnaires, provide additional evidence on the prevalence of drunk driving. Flisher and colleagues (1993) examined risk-taking behaviours among high school students in the Cape Peninsula region using a self-administered questionnaire. This study identified impaired driving as one of the major factors for risk-taking behaviour. Of the 7,340 students surveyed, 8% reported having driven under the influence of alcohol or cannabis. In Nigeria, Asogwa (1980) in a survey of randomly selected drivers in different parts of the country it was found that 7.7% had drunk alcohol and 12.2% had consumed kola nut.

From the above results, it can be concluded that - at a cut-off BAC level of 0.08g/100ml - the proportion of alcohol impaired drivers in Africa ranges between 4% and 8%, which is more than four times higher than reported in the UK following a series of week-end evening roadside surveys which found rates of between 1.0 - 1.7% (Sabey et al, 1988; Everest et al, 1990).

Table 4.6: Roadside surveys of non-accident involved drivers

Country (First author, year)	Driver characteristics	Sample size	% +ve for alcohol	% impaired (BAC \geq 0.08g/100ml)
Ghana (Mock, 1998)	All drivers	722	20.6	7.3
	<i>Sex</i>			
	Male	714	-	7.4
	Female	8	-	0.0
	<i>Age</i>			
	<30 years	202	-	5.0
	30-49 years	475	-	9.1
	\geq 50 years	45	-	0.0
	<i>Vehicle type</i>			
Private vehicles	194	-	9.8	
Commercial	528	-	6.4	
Kenya (Odero, 1997)	All drivers	479	19.9	8.3
	<i>Sex</i>			
	Male	471	20.0	8.5
	Female	8	12.5	0.0
	<i>Age</i>			
	<25 years	28	15.4	3.8
	25-34 years	176	21.3	9.4
	35-44 years	174	18.2	8.2
	45-54 years	74	23.5	10.3
	\geq 55 years	12	18.2	0.0
<i>Vehicle type</i>				
Private	271	23.7	12.1	
Commercial	208	15.5	4.1	
S. Africa (De Jager, 1988)	Drivers	18352	-	7.0
	Pedestrians	7643	-	16.0

4.4.3 Police accident statistics

Police departments remain the main regular source of official data on traffic crashes in many countries and several studies were identified that reviewed police records in order to provide some indication of the magnitude of alcohol-related road traffic crashes and fatalities. Odero et al (1997) in an extensive search of literature in developing countries

identified 13 studies in Africa reporting alcohol impairment in non-fatal drivers with half of the studies using data derived from police accident records. In all the studies, the method of assessment of alcohol-involvement was subjective - either by the smell of alcohol on the breath or the demeanour of the subject. The proportion of drivers reported as being under the influence of alcohol was generally very low; and varied from just 0.16% in Nigeria (Aganga, 1983) to 3.2% in Zimbabwe (Zwi et al., 1993). The following studies are illustrative of these studies.

A study by the Norwegian Centre for Transport Research (Vaaje, 1987), based on police data, found very low prevalence rates of drunken driving in a number of Southern African countries:

- In Swaziland, for instance, only 2.8% drivers of the 2,696 accidents reported by the police in 1983 were judged to be under the influence of alcohol – with the legal BAC level of 0.15g/100ml. Similarly, a review of the Swaziland police statistics over a 10-year period by Haworth (1989) found that drunken drivers were indicated as the primary cause in only 4.3% of all road crashes.
- In Zambia, police statistics in the 1980s showed that drunken driving was not a serious problem as only 0.6% of the drivers involved in 5,338 accidents were classified as “driving under the influence of drugs and drinks”.
- In Botswana, a report by the National Road Safety Committee (1984) indicated that only 8% of the 2,648 accidents in 1981 involved intoxicated drivers; and a review of the 1980 transport statistics by Finlay and Jones (1984) showed similar findings - only 6.8% of all traffic accidents involved intoxicated drivers.
- In Zimbabwe, the proportion of road accidents reportedly caused by drunken drivers in the years 1981-1983 increased slightly from 3.5% to 4.9% (Haworth, 1989).
- In Tanzania, police accident records indicated an increase in alcohol-related crashes from 2.2% in 1981 to 8% in 1986 (Kilonzo, 1990). However, according to judicial determination of road fatalities in the capital city Dar-es-Salaam, alcohol was found to be responsible for a much higher proportion – up to a third (34%) of 221 fatalities reported in 1986, based on forensic analysis of blood samples, although no cut-off reference to the BAC level employed was stated.

Although police accident reports may provide an indication of whether alcohol was involved, assessment of alcohol impairment is typically inaccurate. Compared to epidemiological alcohol studies, there is considerable underreporting of alcohol involvement of injured drivers by the police department. Similar findings have been documented in numerous studies conducted in the U.S.

4.4.4 Qualitative studies on impaired driving

Qualitative studies can provide valuable contextual understanding on the knowledge, beliefs and practices of individuals, or groups, on drinking and driving that can be useful in developing effective interventions. This review found only three studies using focus group discussions and interviews with key stakeholders to examine the knowledge and attitudes of participants with regard to alcohol and driving. These were studies conducted in Ghana (Asiamah et al, 2002) and Kenya (Nantulya et al, 2001; Odero, 1997).

In the Ghana study, focus group discussions were held with 43 commercial drivers in groups of 7-10; all were men. Alcohol and drug use were identified by all the groups as major causes of crashes, and perceived to increase the risk of crashes by changing driver behaviour.

The following quotes are illustrative of those obtained:

- *“drinking gives the driver false courage”;*
- *“drinking affects one’s sense of judgement”;*
- *“the drunk driver is always prone to over-speeding”;*
- *“the drunk driver overtakes other vehicles unnecessarily”.*

Despite this knowledge of the effect of alcohol and their positive attitude towards safety, commercial drivers did not seem to put into practice what they knew. They reported consuming alcohol for a variety of reasons, including peer pressure, compliance with social practices such as funerals and other social gatherings that require all members to be *“on the same level of intoxication”*. Other drivers drank for medicinal purposes – *“we use the local spirit to prepare herbal concoctions which is taken twice daily”*; some are addicted – *“some drivers do not feel okay in the absence of alcohol”*; and others especially bus drivers, drink to stay awake while driving – *“drinking makes some of us alert behind the steering wheel”*. However, the respondents also reported that drinking and driving is not practised by lorry drivers who were Muslims.

In Kenya, Odero (1997) conducted 12 key informant interviews and 3 focus group discussions with respondents, representing diverse stakeholders in road safety work, to assess their perceptions and attitudes to drunk driving. The respondents comprised road crash victims, drivers of public service vehicles, traffic police, doctors, nurses, lawyers, senior insurance personnel, and representatives of road safety organisations. Most of the respondents felt that human factors are the most frequent cause of crashes; of which speeding, driving under the influence of alcohol and disregarding traffic rules were the most common. The following citations from the interviews are illustrative of the perceived frequency and circumstances of impaired driving:

- *“driving under the influence of alcohol is very common here, most drivers involved in accidents at night are usually drunk”;*
- *“drunken driving is common at night, during week-ends, especially if it falls at month-end when they have money, and during public holidays”;*
- *“I was involved in an accident on Christmas Eve; the driver was quite drunk and was over-speeding”.*
- *“doctors don’t do blood alcohol tests, we used to take blood samples of drivers involved in accidents for analysis long time ago, but these days nobody is keen in doing this”.*

In another study reported by Nantulya et al (2001), 10% of the 213 road crash victims interviewed said that the driver was under the influence of alcohol at the time of the

crash. The respondents perceived speeding to be the most frequent cause of accidents, followed by overloading of vehicles and drink driving.

These studies clearly indicate the level of awareness of respondents on the risks associated with drinking and driving. Although the data are subjective in nature and are likely to underestimate the extent of the problem, they do provide useful insights into public perceptions about drink driving that will be useful to build upon for the development of effective anti-drink driving campaigns.

4.5 Studies on psychotropic drugs and road traffic injuries

In spite of the growing use of psychotropic (or behaviour altering) drugs world-wide, very few studies have been conducted in Africa to determine the extent of their association with the increasing burden of traffic crashes. The South African Community Epidemiology Network on Alcohol, Tobacco and Other Drug Use (SACENDU) is perhaps the only organisation purposely established to monitor the extent of, and trends in drug abuse in sentinel sites in the country. A recent surveillance study on substance abuse by SACENDU provided strong evidence on the prevalence of both alcohol and illicit drugs among trauma patients treated at specific hospitals in three South African cities (Peden et al, 2001; Peden et al, 2002).

The SACENDU study enrolled a total of 1,354 trauma patients arriving at hospitals in Cape Town, Port Elizabeth and Durban over a period of two years (1999-2000). Of these, 281 (20.8%) had been injured in traffic crashes. Illicit drug usage was assessed by three methods: self-report, urine analysis using a multi-drug kit, and immuno-assay analysis of urine samples for cannabis and methaqualone. The results indicated that 51% of pedestrians (n=114), 35.5% of drivers (n=44) and 23.2% of passengers (n=123) had used a drug prior to being injured. The most commonly identified drugs in all trauma patients tested were cannabis (used by 32.5%), methaqualone (14.5%), mandrax, known locally as "white pipe" (11.6%), cocaine (4.2%) and amphetamines (0.6%) - (see Table 4.7). The study found a slight decline in the usage of cannabis and methaqualone over the two years. Methaqualone usage was found to be more common in Cape Town than in the other two cities. Men were two and a half times more likely to use a drug than women. Significantly, a greater proportion of patients who had used any psychotropic drug were admitted to hospital than those who had not (43% vs. 33.7%).

Other studies show that in Cape Town, 40% of all trauma patients (including road crash victims) had used at least one illicit drug in the recent past (Peden et al., 1997). The most commonly abused drugs were cannabis or a combination of cannabis and Mandrax/'white pipe'. The use of "white pipe" was, however, confined almost exclusively to patients injured as a result of interpersonal violence. In Durban, a survey by Hedden et al (1994) of 530 patients with road traffic injuries presenting to Addington Hospital, reported that 35.1% tested positive for marijuana (identified by urine test), and 18.5% were positive for both marijuana and alcohol (BAC>0.08m/100ml).

Two earlier studies conducted in Nigeria further provide some evidence of drug impairment among drivers. Asogwa (1980) administered questionnaires to randomly selected drivers at ten sites countrywide to assess the role of human factors in the causation of road crashes. Of the 555 drivers surveyed, 1.6% admitted drug use (typically smoked 'hemp'), 7.7% drank alcohol and 12.2% consumed kola nut. In another survey, a questionnaire was administered to 50 crash-involved drivers at four hospitals in Kaduna metropolis (Obembe et al, 1988). The results showed that 20.5% had a history of drug abuse (mostly cannabis and *kwaya*) and 9.5% were alcohol intoxicated (mainly with local brews); all were male.

These studies, though few in number and sometimes in terms of the numbers involved, illustrate that – as with alcohol - drug usage is common among injured patients presenting to hospitals in Africa. However, because of the high cost of conducting analyses and the technical sophistication required for the analysis, drug detection capacity is considerably limited.

Table 4.7: Prevalence of illicit drugs usage (by urine analysis) in injured patients* in South Africa

Drug	1999 % (n)	2000 % (n)	Total % (n)
Cannabis	36.2% (220)	28.4% (156)	32.5% (376)
Methaqualone	15.9% (96)	13.1% (72)	14.5% (168)
Mandrax – “White pipe” (cannabis + methaqualone)	12.9% (92)	10.1% (65)	11.6% (157)
Cocaine	1.8% (11)	6.9% (38)	4.2% (49)
Amphetamine	0.0% (0)	0.6% (3)	0.6% (3)
Methamphetamine	0.2% (1)	0.4% (2)	0.3% (3)

* Patients with injuries from all causes

4.6 Effects of fatigue on driver impairment

It is generally thought that driver ‘fatigue’ is more of a safety problem for professional or commercial drivers (e.g. public transport or lorries) than private drivers, since they typically drive further and for longer periods of time. Also, since it is poorer people who tend to use (often unsafe) public transport this raises the ‘poverty issue’ within the context of impairment. Both these issues will be considered briefly here.

A small number of studies have documented the role of fatigue as a risk factor in motor vehicle crashes. Focus group discussions with commercial drivers in Ghana revealed that demands for increased returns by transport owners force drivers to over-speed and work when exhausted (Mock et al, 1998). In Kenya, another survey found that on average a *matatu* driver works for very long hours - 7 days a week for 14 hours a day (Kapila et al, 1982).

Findings from focus group discussions with *matatu* drivers, conducted by Nantulya et al (2001) have illustrated their working conditions.

In the discussions, *matatu* drivers stated that it was not unusual for them to work for 17 hours per day, often starting from as early as 5 am in the morning and continuing until 10pm at night. A *matatu* driver could cover over 200 kilometres per day on a town run. Most of them admitted that it was not good for them to be on the road for long hours, but they had to do this to survive – “*To survive, one has to be on the road for long hours, which means little sleep and no time to attend to other needs.*”. To fight fatigue, some of the drivers admitted using drugs such as *miraa* (an amphetamine-like local herb) that often led to substance abuse. *Miraa* chewing was also reported to be common among bus and long distance truck drivers.

Public transport systems are generally poorly developed in most countries in Africa. Both conventional buses and other vehicle types (eg. minibuses, taxis, converted pick-up trucks, motorcycles), known by different names (such as *matatus* in Kenya, *donfo* in Nigeria, *troto* in Ghana), are used widely for passenger transport (Simon, 1996). These vehicles are often poorly maintained, overloaded, and driven recklessly and at high speeds resulting in high crash rates. Unconventional vehicles are often the main means of transport for low-income people both in cities and rural areas, because of their lower fares, availability and convenient routes. A study in Nairobi, Kenya by Kapila and colleagues (1982) found that poorer residents without any education were more likely to walk (27%) or use public transport (55%) than those with secondary school or higher level of education who travelled mainly in private cars (81%). The poorer populations who cannot afford to own their vehicles are therefore more likely to walk or ride *matatus* - the more dangerous form of transportation. Several studies have documented pedestrians and passengers as the most vulnerable road-users (Nantulya et al, 2001; Odero et al, 1997). For example, in an analysis of the data recorded for 13,000 road deaths in Kenya for the period 1992 -1996, Nantulya and colleagues showed that pedestrians (42%) and passengers (38%) accounted for the majority of those killed in crashes.

Economic factors and lack of laws regulating the unconventional public transport sector is also thought to contribute to the increased risk of motor vehicle crashes. As an example, *matatu* drivers in Kenya have set daily targets of revenue to be handed to vehicle owners, and any amounts in excess of this target are retained by the drivers and co-workers. This provides a powerful incentive for reckless driving, speeding and overloading – as drivers try to maximise their daily earnings.

4.7 Demographic and socio-economic profile of impaired drivers

Only a small number of the studies were identified that provided alcohol and drug impairment data disaggregated by age, sex and other socio-economic parameters (see Table 4.8).

Table 4.8: Alcohol impairment by sex

Country (Author, Year)	BAC cut-off level	Sex (n), % impaired	Subjects
Ghana (Mock, 1998)	0.08g/100ml	Male (714): 8.3% Female (8): 0.0%	Non-accident involved drivers
Kenya (Odero, 1997)	0.05g/100ml	Male (25): 40.0% Female (2): 0.0%	Non-fatal drivers treated in hospitals
Nigeria (Obembe, 1988)	Self-report	All male (50): 9.5%	Non-accident involved drivers
Tanzania (Mbaruku, 1980)	Any amount – detected by odour of alcohol	Male (26): 10.8% Female (4): 1.6%	Non-fatal casualties (all road users) treated in a hospital.
Zambia (Patel, 1977)	0.08g/100ml	All male (33): 30.3%	Fatally injured drivers

Table 4.8 shows that the key groups at risk for alcohol and drug impaired driving in African countries are:

- Males – who are predominantly more involved in alcohol and drug impaired driving than females. This reflects the existing gender differences in alcohol consumption patterns in African society that have been documented in several ethnographic studies;
- Adult males of ages 30-49 years are more likely to drive while intoxicated than those younger or older than this age bracket;
- Non-Muslim drivers have a higher prevalence of alcohol impairment than those who are Muslims (who are predominantly ‘abstainers’);
- Operators of private vehicles are more likely to be under the influence of alcohol than drivers of commercial vehicles (eg. buses, taxis and trucks), but the risk caused by alcohol impaired commercial drivers is greater due to the high passenger load of these vehicles, and the large distances covered;
- Drivers with low education (or who are illiterate) are more likely to report driving while impaired than those with college or university level education;
- People driving along routes/streets leading to or from popular drinking places (eg. taverns, bars, night clubs) are more likely to be impaired than those on other road locations;
- Driving in the evenings, at night and over weekends is associated with a high prevalence of alcohol impairment.

4.8 Consequences of impaired driving

In spite of the growing problem of impaired driving in Africa, this review failed to identify any publications containing specific information quantifying the economic and social consequences of alcohol-related crashes. An extensive review of estimates of the total costs of road traffic crashes in Africa by Jacobs et al (2000) provide some costing data (as a proportion of GNP) ranging from 0.8-0.9% in Ethiopia, 1% in South Africa,

2% in Nigeria, 2.7% in Botswana, to a high of 5% in Kenya. A recent study by Nantulya et al (2001) in Kenya further showed that between 26% and 52% of the total earnings from the road transport sector were lost in 1996 due to road crashes. In Zambia, a study financed by the Road Sector Investment Program (ROADSIP) in 1997 reported an annual cost of Kwacha 90 billion or US\$ 78 million, equivalent of 2.3% of GNP (ROADSIP, 1998). Given the general high prevalence of impaired driving (in countries where data is available), it is likely that a very substantial proportion of these costs could be attributed to alcohol.

There is obviously a dearth of information on socio-economic consequences of alcohol-related road crashes in Africa. Limited information from a multi-country DFID sponsored project in Ghana, Swaziland and Zimbabwe, based on hospital and insurance surveys, indicates that most road crash victims are married with dependants, and are the sole earners in the family, reflecting the negative impact of road crashes on the households (cited in Jacobs et al, 2000).

More case studies applying context specific methodologies are needed to elucidate the magnitude of both economic and social consequences of alcohol-related crashes in Africa.

4.9 Current Prevention Strategies

Alcohol intoxication is widespread and recognised to play a major role in road traffic crashes, though the magnitude varies between countries. Sufficient epidemiological evidence on actual blood alcohol concentration levels was available in only four countries: South Africa, Kenya, Nigeria and Ghana.

Ongoing initiatives to address the problem of alcohol and road traffic crashes in Africa can be summarised (and grouped) under a number of possible initiatives.

4.9.1 Institutional organisational framework

Many countries in Africa have an institutional framework in the form of National Road Safety Councils (NRSC) mandated to develop appropriate road safety interventions, co-ordinate and monitor their implementation. The Councils, established in a number of countries since 1972, consist of representatives of various key stakeholders including government ministries (public works, transport and communications, health, internal security, education and finance) and non-governmental organisations. Assum (1997) in a review of the road safety situation in five African countries highlighted the strengths and weaknesses of the existing road safety programmes. The main strengths are the existence of basic traffic legislation and a lead organisation to co-ordinate road safety work. However, effective implementation of road safety measures is problematic in many of the countries. The main constraints are:

- Lack of political concern and priority in road safety
- Inadequate feedback to decision makers due to poor systems of collection and recording data on the magnitude of risk factors and consequences of road crashes

- Lack of resources
- Inadequate funding for road safety work
- Widespread corruption and weak law enforcement
- Lack of authority and inadequate resource allocation to the Road Safety Councils

4.9.2 Legislation and enforcement

Legislation against drink driving normally defines certain behaviours influenced by alcohol as illegal, and also stipulates methods of detection and punishment for such behaviours. Two methods can be used in defining impairment: 1) a verbal description based on observations by a witness (eg. erratic driving), and presence of other evidence (e.g. smell of alcohol on the breath); and 2) a definition based on a legal BAC limit. Evidence based on a verbal description and supported by information on BAC is often more powerful.

Few countries in Africa have a legal limit for drivers stipulated in their traffic laws (eg Road Traffic Act); most of these are in Southern Africa (see Table 4.9). With the exception of South Africa, where the legal limit has recently been reduced to 0.05g/100ml, the rest have a legal limit of 0.08g/100ml, with the exception of Uganda which has a limit of 0.15g/100ml. In the majority of countries, the Traffic Act is vague and does not specify the criterion BAC, nor does the law state the methods used in detecting alcohol or drugs, or mechanisms for enforcement.

Table 4.9: African countries with a legal BAC limit

Country	Author, year	Legal Limit in g/100ml
Botswana	NRSC, 1984	0.08
Lesotho	Vaaje, 1987	0.08
South Africa	Myers, 1977; van de Spuy, 1989; Van Kralingen, 1991	0.08
South Africa	Peden, 2000	0.05
Swaziland	Vaaje, 1987	0.08
Tanzania	Vaaje, 1987	0.08
Uganda	Aidria-Ezati, 1996	0.15
Zambia	Patel, 1977	0.08
Zimbabwe	Kobus, 1980	0.08

4.9.3 Some country-specific enforcement activities

Botswana:

Intervention measures for drunken driving are reported to be strictly enforced in Botswana. The measures include publicity, drink drive campaigns and random roadside checks of drivers for alcohol by the police using breathalysers. These activities are

thought to have contributed to the dramatic decline in road deaths experienced between 1996 and 1997 (Department of Road Transport Safety, 1997).

Ghana:

Ghana still retains the 1952 British Colonial Statutes which merely states that no one is allowed to operate a motor vehicle if they are so impaired by alcohol as to not be able to drive safely (Mock et al, 1998). There is no prescribed legal limit of blood alcohol concentration, hence no emphasis on enforcement of anti-drunk driving law. The Motor Transport Traffic Unit of the Police Service has a limited number of breathalysers used for screening intoxicated drivers involved in crashes. However, the high cost of the devices (with an average cost per unit of \$500) limits the ability to provide these to all police units in the country.

Kenya:

Section 44 of the Traffic Act in Kenya states that *“any person who, when driving or attempting to drive or when in charge of a motor vehicle on road or other public place is under the influence of alcohol or drug to such extent as to be incapable of having proper control of the vehicle shall be guilty of an offence and liable to a fine not exceeding K shillings 10,000 or imprisonment of a term not exceeding 18 months or both fine and imprisonment.”* (Laws of Kenya, Cap 403). It neither defines the legal limit of blood alcohol concentration, nor does it specify procedures for detection, resulting in low detection. In addition, lack of equipment, patrol vehicles, personnel and established procedures for surveillance of drink driving by the traffic police contribute to poor enforcement of the legislation. Although a hospital-based study in Eldoret showed the reliability of breathalysers in providing reliable and valid estimates of blood alcohol concentrations in injured patients attending emergency departments (Odero et al, 1999), the use of breathalysers by the police has not been sanctioned by law. The courts do not accept evidence of BAC levels based on breathalyser readings for prosecution of suspected drunk drivers, even if the breath test was administered by a physician.

Malawi:

In Malawi, the law simply states that *“any person who when driving or attempting to drive a motor vehicle on a road is under the influence of intoxicating liquor or drugs to such an extent as to be incapable of having proper control of such a vehicle, shall be liable to a fine of 100 pounds and in the case of a second or subsequent conviction to a fine of 200 pounds and to imprisonment for twelve months”*. No information was available on enforcement of the law.

Nigeria:

Nigeria, with 6,185 fatalities in 1995, has the second highest number of annual road deaths in Africa (Jacobs et al, 2000). A three tier Federal Road Safety Commission established in 1998 is responsible for enforcement of basic road safety legislation. However, no information on the existence of legislation regarding a BAC limit was obtained in this study.

South Africa:

In South Africa, the role of alcohol and drug abuse has been well documented, and the Road Traffic Act is fairly precise with regard to definition and determination of impaired driving. The law states that *“it is an offence to drive a vehicle on a public road or occupy a driver’s seat of a motor vehicle with its engine running while the person under the wheel is: a) under the influence of intoxicating liquor or having a narcotic effect; or; b) has a concentration of alcohol in the blood of 0.05g or more per 100ml of blood. Any person behind the wheel whose BAC level is 0.05g/100ml or greater is regarded by the law as being incapable of driving a vehicle, and is liable for prosecution”*.

Enforcement, however, is still problematic since breath test results are not accepted as evidence in court, but are used only as a screening test by traffic officers. To ascertain the BAC level, a specimen of the driver’s blood is taken within 2 hours of the alleged offence by either a medical officer or a registered nurse then submitted to a state laboratory for analysis. Before the court can consider the results of the blood analysis, the prosecution must prove that the analysis was made by an expert and that the specimen analysed was that of the accused. (see Website: <http://www.legalcity.co.za>)

The “Drive Alive” national road safety campaign targeting drivers, pedestrians and passengers, include five key areas: drinking and driving, speeding, jay walking, visibility, and alighting and crossing are also increasingly being advocated in South Africa. Publicity materials on these issues are widely distributed to community level by the Department of Transport.

Tanzania:

In Tanzania the Road Traffic Act prescribes two BAC levels: 0.08g/100ml and 0.15g/100ml. These levels are used for imposing graduated penalties on offenders. The penalty for drunk drivers with BAC level between 0.08 and 0.15 is less than for more intoxicated drivers with BAC levels greater than 0.15g/100ml. The drink driving law is generally not strictly enforced. More often, blood alcohol tests are only taken after a driver has been involved in a crash or on suspicious driving behaviour. As in the case of South Africa, the law authorises only blood tests, and a medical doctor has to take the blood and send for analysis at a central laboratory. Breath tests are not authorised by law, and therefore it is not legal to ask a driver to participate in a breath test (Vaaje, 1987).

Uganda:

At the Mulago hospital in Uganda a study by Aidria-Ezati (1996) found that road crash victims accounted for 20-25% of surgical emergency admissions in 1995. Although alcohol intoxication is believed to play a major role in road injury, there are no mechanisms for enforcing the existing blood alcohol legal limit of 0.15g/100ml (Andrews et al, 1999)

Zambia:

Although a legal BAC (of 0.08g/100ml) exists in Zambia, there is no provision for using breathalysers in the current traffic legislation. The traffic police have no objective means of detecting drunk drivers, other than through observation of driving performance. A

charge of careless driving is the conviction often used in arresting suspected drunk drivers (ROADSIP, 1998).

The above examples highlight the fact that enforcement of drink driving law is generally problematic and ineffective in nearly all the countries in Africa. There are several reasons for this lack of enforcement; these include:

- Lack of means (eg breathalysers) by the traffic police to routinely monitor drivers' blood alcohol levels, even in countries where a legal limit exists
- There is no legal requirement for the police to do random breath-tests of non-accident involved drivers
- The traffic police are not adequately trained to administer alcohol tests
- The legal procedure for obtaining blood tests is cumbersome as the (few and overworked) doctors do not consider blood alcohol tests a priority in patient care
- Laboratory facilities for blood alcohol analysis are not available at the hospitals
- Low conviction rates for those arrested for drunk driving, in relation to the extent of the problem, may be a disincentive to the traffic police
- The general lack of enforcement of laws to control the production and sale of alcohol and psychotropic drugs in most countries.

4.9.4 Control of alcoholic beverages

Regulations governing alcohol availability come in a variety of forms. These include:

- Controls on production, sale, price, advertising and other promotion activities
- Restrictions on persons authorised to sell alcoholic beverages through liquor licensing
- Regulation of the conditions of sale of alcohol such as hours and days of sale, minimum age of customers, and prohibition of serving a customer who is already intoxicated
- Restrictions on the buyer or consumer.

These measures have been successfully applied for many years in North America and Western Europe, especially in the Nordic countries (Room et al, 2001). However, in Africa, because of the widespread production and availability of traditional brews and illicit distilled drinks, attempts to introduce such policies have not been effective. In Zimbabwe, for example, an attempt to raise taxes on beer in 1995 led to a fall in state tax revenue as many consumers shifted to cheaper home-made alcoholic drinks, forcing the government to rescind the beer tax (Jernigan, 1999). The lack of enforcement of laws regulating the production and sale of alcohol has been shown to be the major problem in many African countries (Bryceson, 2003).

4.9.5 Promotion of responsible alcohol use

The Association for Responsible Use of Alcohol (ARA), established by the South African liquor alcohol industry in 1986 to promote the responsible use of alcohol, is perhaps the only advocacy group formed by large alcohol producing companies in Africa (see <http://www.ara.co.za>).

ARA plays a major role in co-ordinating activities, which counter and reduce the abuse of alcohol. Its main efforts are directed at self-regulation of the member alcohol producers to strict compliance with alcohol advertising, packaging and promotion code, and conducting campaigns and education programmes in schools and in the media on responsible drinking. It also supports research on alcohol use, which can assist in the development of public policy for prevention of alcohol-related problems.

4.10 Suggested interventions

Since alcohol consumption is strongly embedded in the African society, there is a need to develop intervention strategies that address the broader social, cultural, economic and political environments in which drinking of alcohol occurs. Examples of such strategies might include:

- Locating popular drinking outlets (eg taverns, bars) closer to residential areas to reduce the need to travel for a drink (although this might create other problems and might not be popular with resident groups)
- Improving public transport and making it available at night until after the bars close to discourage use of personal cars after drinking; especially where the drinking occurs far from home
- Prohibiting the sale of alcohol on commercial premises, such as stop shops and petrol stations, along the highways
- Modifying the drinking environment through server training programmes – eg training those selling alcohol to refuse selling to customers already intoxicated, preventing those who have had too much to drink from driving
- Introducing ‘designated driver’ programmes that encourage one person in a drinking group to stay sober and take responsibility for driving others
- Prohibiting advertising of alcoholic drinks in the media and sports, including sponsorship of sports activities by the alcohol industry
- Reviewing the legal system to deal more quickly and effectively with drunk drivers
- Increasingly involving various social and religious organisations (Christians, Muslims), mutual-help interest groups such as Alcoholics Anonymous (AA), women’s movements and other community advocacy groups (similar to Mothers Against Drunk Driving, MADD, in the USA) in changing individual drinking habits and prohibiting the harmful use of alcoholic drinks.

However, if such interventions are to succeed they need to be fully researched, evaluated and monitored. This research would be needed to explore the potential for implementation and effectiveness of the various strategies within both the African context and individual countries.

4.11 Useful contacts

- Charles Parry, Director, Alcohol and Drug Abuse Research Group, Medical Research Council, South Africa.

- Richard Matzopoulos, National Trauma Research Programme, Medical Research Council, Tygerberg, South Africa
- Mohamed Seedat, South African Community Epidemiology Network on Drug Use (SACENDU), Johannesburg, South Africa
- Margie Peden, Lead Person, Department of Violence and Injury Prevention, WHO, Geneva
- Melecki Khayesi, Department of Violence and Injury Prevention, WHO, Geneva
- Wilson Odero, School of Public Health, Moi University, Eldoret, Kenya
- David Njoroge, Director General, Automobile Association of Kenya, Nairobi, Kenya
- Vinand Nantulya, Harvard Center for Population and Development Studies, Harvard School of Public Health, MA, USA
- Olive Kobusingye, Director, Trauma Center, Mulago Hospital, Kampala, Uganda
- Charles Mock, University of Washington, Seattle, WA, USA

5 IMPAIRED DRIVING IN SOUTH EAST ASIA

(by G Gururaj)

5.1 Introduction

The South East Asia Region (SEAR) contains 25% of the world's population (WHO, 1999a) and 5% of the land area (UN, 1996a). It accommodates nearly 1.5 billion people with three countries (India, Indonesia, and Bangladesh) accounting for 85% of the total population of the region.

The SEAR (based on the WHO classification) consists of ten countries: Bangladesh, Bhutan, DPR Korea, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka and Thailand. These countries are currently undergoing very rapid social, economic and technological changes that are bringing about many significant improvements (in terms of personal wealth, health and education) – although such improvements are not evenly spread across, or even within, countries. They are typically experiencing rapid industrialisation, motorization and urbanisation; it is expected that by 2030, nearly 40-60% of the region's population will be living in urban areas, and that by 2015, six of the world's 'mega cities' will be in the region (UN, 1996). While these developments have brought many benefits they have also created new problems. One such problem is the dramatic increase in the numbers of road accidents being experienced within the region, such that road traffic injuries (RTIs) are now widely acknowledged as a serious public health problem in these countries (Gururaj, 1995).

Every year nearly 200,000 people are killed and 2,000,000 are injured on the roads in the SEAR, although under-reporting of traffic accidents (estimated to vary from between 10 - 50% in the region) often disguises the true seriousness of the problem. It is estimated that traffic accidents result in between a 1 - 3% loss of GDP in these societies.

Among the many causes of RTIs in the region 'impaired' driving - due to the use of alcohol and drugs - has been recognised as a major contributory factor, due in part to the ever expanding alcohol industry, rapidly increasing motorization and the changing values and life styles of people.

The limited data available from the region suggests that nearly 30 - 50% of crashes occur during night times and that between one-fifth and one-third of accident deaths and injuries are attributable to alcohol intoxication effects at the time of injury. Although similar information on the role of drugs and fatigue in road accidents is not known, both are thought to be significant factors in road accidents - and the consumption of drugs is known, as elsewhere, to be on the increase in the region.

5.2 Scope of review

This review considers the information available about the impairment problem in SEAR countries and focuses on:

1. The pattern of alcohol/drug production, distribution and epidemiology

2. Road traffic crashes, injuries and deaths due to impaired driving resulting from the use of alcohol and other psychoactive drugs (both legal and illegal).
3. The profile of road users involved in alcohol/ drugs related crashes
4. Existing interventions for reducing the problem
5. Existing gaps in implementation efforts and directions for future countermeasures.

5.3 Method

The policy adopted for this review was to collect relevant information from all available sources - both published and unpublished. This policy means that material is included that was obtained from the Internet as well as 'personal communications' with various researchers and practitioners. Although limited time was available a concerted effort was made to identify the different 'dimensions' of the problem; and consider both the growing concerns and (sometimes) half-hearted attempts of governments in tackling the problem.

However, a major limitation was the non-availability of information from some of the SEAR countries and the apparent absence of proven and evaluated interventions in this area. In addition the review was mainly limited to published reports available in the English language journals.

An extensive search of internet databases like MEDLINE and PUBMED was conducted using different key words (eg drinking, driving, alcohol, drugs, laws, programme, policy, motorization, South East Asia, individual countries). These Internet searches were extended using several search engines (eg Google, Altavista). Particular searches focused on particular sites, such as: National Institute on Alcohol Abuse and Alcoholism (NIAAA) and National Institute on Drug Abuse (NIDA), USA; Asian Institute of Alcohol Studies; and 'Drug' library networks. Visits were also made to several libraries.

In addition contact was made and information exchanged with noted researchers in the region. Discussions were also held with key stakeholders in the city of Bangalore such as: the police, transport, excise, non-governmental organisations, research colleagues at National Institute of Mental Health And Neuro Sciences (NIMHANS) and others. The review also involved examining relevant conference proceedings of world bodies and local organisations (eg proceedings of World Conferences, Injury Prevention meetings), official published data from local and national bodies, annual reports of various departments (eg police, health and transport), and assorted organisations. As well as obtaining official publications, available 'grey literature' was also reviewed extensively. The available information has been pooled, classified and synthesised to consider each of the issues to be covered.

This process resulted in obtaining information mainly from 6 countries within SEAR. These were: India, Bangladesh, Thailand, Indonesia, Sri Lanka and Nepal. However, the review also examines the problems of other countries in the Asian region wherever information was available.

The review concludes by raising a number of issues, which are considered vital from a research, policy, programme perspective to address the growing problem in South East Asia.

5.4 Road Traffic Injuries in SEAR

In order to provide a background to the road safety impairment issue a short review of the general road accident situation within SEAR is provided here.

Jacobs et al (2000) estimated that nearly 750,000 to 880,000 people were killed on the world's roads during 1999, with 85% having occurred in developing and transitional societies and nearly half occurring in the Asia Pacific Region. Importantly, while the situation is actually improving in developed countries it is rapidly worsening in developing countries. For example, between 1970 and 1990, there was a 30% decrease in road accidents in developed countries, while there was an increase of 200 - 300 % in Asian and African countries (Soderlund, 1995). In part this is the result of the present growth rate in vehicles (around 15 - 18% per annum in some countries; and over 250% in Thailand and 700% in DPR Korea over the 10 years between 1982-92). As a result it is likely that the numbers of road accidents will continue to grow in SEAR countries (Ross, 1998) unless the problem receives urgent attention.

In a recent review by Ghee et al (1997) the global cost of RTIs was estimated to be US \$230 billion per annum with cost to developing countries around US \$36 billion. In India alone, recent costs are estimated to be Rs 550 billion (Mohan, 2002).

The countries in SEAR are currently responsible for around 35% of global RTI deaths. It is estimated that around 65% of the fatalities in developing countries involve pedestrians while 35% of the deaths are children (aged under 15). In general within the region accident rates for men are 3 times higher than for women. If demographic variation and epidemiological fallacies are strictly accounted for, the highest number of deaths (70%) occur for those aged under 45. Among young adults (15 - 44 years), RTIs were the second leading cause of death (21.7 deaths per 100,000); and they were the third major cause in children under 4 years of age (13.7 deaths per 100,000).

Road accident fatality rates per 10,000 licensed vehicles are 30, 82, 77, 16, 12 and 11 for India, Nepal, Bangladesh, Sri Lanka, Thailand and Indonesia, respectively (in contrast to a figure of less than 2 in Australia), while the fatality index for countries mentioned above are 18, 68, 48, 14, 25 and 23, respectively (Ghee et al, 1997; Aeron-Thomas, 2000).

Many of these calculations are based on information available from the police department of the respective countries. However, recently, it has been acknowledged that there is significant under reporting of RTIs in developing countries due to inaccurate systems and lack of research. A recent TRL study (Aeron-Thomas, 2000) estimated the underreporting to be 3 - 12% in Dhaka, 17 - 33% in Hanoi and 24 - 53% in Bangalore based on comparison of hospital records with police records. Similarly, underreporting in other

countries of SEAR are 60 - 70% in Sri Lanka and Nepal. Significant underreporting occurred with regard to children, women, night time accidents, pedestrians and bicyclists and during weekends (Gururaj, 2000).

Similarly, the region accounts for the highest number of disability-adjusted life years (DALYs)¹ lost due to RTIs. Around 60% of DALYs lost occur among adults in the age groups of 15 - 44 years. In 1998 WHO reported that road traffic injuries (RTIs) were the 7th most frequent cause of death and the 8th most frequent cause of DALYs in the SEAR.

In Bangladesh road accidents have been increasing significantly in recent years, in part a result of vehicles registrations (per 10,000 population) having increased from 5.9 in 1971 to 42 in 1990. Of the nearly 500,000 vehicles in Bangladesh, 46% are motorcycles, 14% are cars, 12% trucks, 12% three wheelers, 9% buses and 7% of other categories. The capital city of Dhaka accounts for nearly 40% of all motorised vehicles and 50% of all accidents. From 1,597 road accident deaths recorded in 1994, the number has doubled to 3,314 in 1999. The percentage of deaths in reported accidents has increased from 36% in 1994 to 48% in 1999. The fatality rate due to road traffic injuries is 70 per 10,000 vehicles - 25 times higher than for any developed country (Khan, 1997). Most of the injuries fall within the 21 - 35 years age group - and 80% are men. During 1998, nearly 60% of those killed on roads were pedestrians. It has been estimated that nearly 50% of all accidents go unreported (Aeron-Thomas, 2000). Within the Dhaka metropolitan area in 1996, 30% of traffic fatalities were motorcyclists, 22% pedestrians, 20% car occupants, 18% rickshaw occupants and 5% were bicyclists.

In India over the last 20 years the number of road accidents has increased by an average of nearly 13% each year (see Table 5.1). In 1998 deaths per 1,000 vehicles and 100,000 population were 2 and 8. Accident rates vary markedly across different major cities with between 21 - 70 (per 100,000 population) being killed each year. During 1999, 82,000 people were killed and 272,000 were injured according to official figures. Four times as many males are killed as females and the proportions of deaths for different age groups were: <14 years (9%), 15 - 29 years (29%), 30 - 44 years (34%), 45 - 59 years (21%) and 60+ (8%) (Ministry of Surface Transport, 1998; Sarin, 2000). The main category of road deaths were the occupants of heavy vehicles (including buses) who made up 43% of all fatalities, whilst pedestrians, two-wheeler riders and cyclists constituted 10%, 11% and 4% respectively, although these 'official' figures are somewhat different with hospital and focused studies (Gururaj, 1993b, 1993c, 2000b; Maheshwari, 1989; Mohan, 1991; Mishra, 1984; Mohan and Bawa, 1985). The emerging pattern of road accidents in the country reveals that the 23 metropolitan cities of India account for 15% of road fatalities, with the first generation and second-generation cities contributing to the majority of injuries and deaths. However, distant more rural areas are not far behind in catching up with road accident numbers. Data from the rural Vellore area reveals that nearly 30 - 60 persons are killed every month and an average of 180 persons are injured in the district. The figures reveal that heavy vehicles like buses and trucks were responsible for nearly

¹ DALYs express years of life lost to premature death and also years lived with a disability, adjusted for the severity of the disability.

60% of injuries and deaths, with motorcyclists constituting 20 - 25%. The figures for the last available year show that no cyclists were injured or killed – suggesting that such injuries are often underreported. Although increased congestion will result in average traffic speeds dropping in major cities, as motorization expands in second and third generation cities and districts, the number of accidents recorded each year will continue to increase (Philip, 1998).

It is not only the numbers of traffic fatalities that should constitute a major concern in India. Recently, a review of several population based surveys revealed that for every single RTI death, nearly 25 - 30 people are hospitalised and 50 - 100 sustain minor injuries – although under reporting is likely to be far higher for less serious injuries than for fatalities where under reporting is around 5-10% (Gururaj, 2000a, 2001). Using the epidemiological evidence from India and a number of other countries, a conservative estimate indicated the ratio between deaths, hospitalisation and minor injuries to be 1:15:70. Making provisions for under reporting from previous studies, it is estimated that India would have experienced 85,000 deaths, 1.2 million hospitalisations and 6 million minor injuries. A number of factors linked to behaviour among policy makers, professionals, politicians, public and press have been incriminated and linked to the neglect of road traffic injuries in the Indian region (Gururaj, 1997, 2000d; Mohan, 1992, 1984). Table 5.1 provides figures for the increasing incidence of road traffic accidents (and vehicle ownership) in India from 1981-1998.

Table 5.1: Vehicle ownership, total accidents, deaths and injured, India 1981-1998

Year	Vehicle ownership/1,000	Total accidents (in thousand)	Deaths (in thousand)	Injured (in thousand)
1981	7.9	161.2	28	114
1985	11.9	207.0	39	163
1991	25.3	294.0	57	255
1992	27.3	276.4	60	257
1993	29.0	286.0	61	287
1994	30.8	315.7	64	311
1995	33.1	348.9	71	347
1996	35.9	355.1	72	361
1997	39.3	365.1	75	366
1998	-	380.05	80	379

Source: Ministry of surface transport: Motor vehicle statistics and road accidents in India.

In Indonesia information provided by the police reveals that motorization has been growing phenomenally. From nearly 7 million vehicles in 1987, the number had risen to 16 million by 1997, an increase of around 250%. (www.bps.go.id). In 1997 passenger cars, buses, trucks and motorcycles constituted 16%, 4%, 10% and 70%, respectively of the country's vehicle fleet. The number of road accidents has, on average, been 34,000 per year for the period from 1994 - 97. In 1997, of nearly 35,000 road traffic accidents, 28% were severe injuries, 36% were moderately severe injuries and 35% (n=12,308) were deaths. The accident rate per 100,000 population was 11.2, with death rates of 6 per

100,000 population. Hospital data indicate that nearly 64% of all traffic accidents involved motorcyclists, while 33% of all trauma patients attending emergency departments were motorcyclists (Achwan and Ruditso, 1999). Even on low volume roads of Indonesia motorcyclists constituted 25% of fatalities and 15% of casualties; with truck occupants making up 14% of the fatalities.

In Myanmar road traffic accidents are recognised as an important 'disease' and are seen as being a national priority. A total of 378,732 vehicles were registered in 1997 – 98; with 47% being passenger vehicles, 33% motor cycles and 20% commercial vehicles. In the same year in Yangon City 66% of registrations were for passenger vehicles while 27% were for motorcycles. National data on road accidents is not available although data is available for Yangon and Mandalay. Accident rates in Mandalay are twice those found for Yangon city. (YGH Statistical Report, 1998; Department of Health Planning, Myanmar, 1998).

In Nepal, the number of registered vehicles increased from 17,548 in 1988/89 to 190,672 in 1993/94 and to 237,163 in 1998/99 and road accidents are a major cause of injuries. Just over 900 people died in road accidents in 1996, an increase of 50% over 5 years. Accident figures reveal that pedestrians are the victims in most fatal accidents, and that 65% of such victims are children and young adults. Nearly half (44%) of all recorded accidents occur during the night time - with trucks accounting for 45% of highway accidents (Jha et al, 1997).

In an epidemiological study of 567 road traffic injuries at B.P. Koirala Institute of Health Sciences in 1995-96, male to female ratio was 3:1. The highest number of individuals was in <30 years age group (55%), with 10% being <10 years.

Another epidemiological study during 1997-98 undertaken on 870 road accident persons revealed that pedestrians (30%) drivers (25%) and occupants (46%) were the major affected groups.

Bicyclists (38%), motorcyclists (32%) and bus drivers (12%) were the major categories of road users. Bus occupants were the major group involved in minor to moderate injuries to the extent of 50%, followed by truck occupants (15%) and motorcycle occupants (13%) (Jha et al, 1997).

In Sri Lanka the free enterprise and open market economy of the last 2 decades has taken place alongside rapidly increasing motorization and mobility. By 1997, the country had a total of 1,407,532 vehicles, with three-quarters of these vehicles being added to the country's stock during the period 1981-1997. From 23 vehicles per 1,000 population in 1980, the figure has increased to 75 per 1,000 in 1997 (www.lk/national/census; Rathnayake, 1998; Goonawardhane, 1998). In the past 17 years, vehicle numbers have increased four-fold, and accidents have doubled producing an increase in casualties and fatalities. Changes in vehicular patterns indicate that personalised modes of transport like two wheelers increased from 24% to 54% in 16 years. Pedestrians (40-50%), passengers in vehicles (20-28%) and motorcycle riders (13 - 18%) are the major road user groups injured and killed over this period of time. An examination of road accident details

reveals that males aged between 20 - 39 years of age more likely to be either injured or killed in accidents.

Thailand in 1999 had nearly 15 million vehicles on its roads with 60% being motorcycles and 30% being motorcars (www.nso.go.th). During 1998, it is estimated that there were nearly 16,000 motor vehicle deaths, with four times as many men as women being involved. High risk behaviours identified in these accidents included 57.6% did not use safety belts, 44% of motorcyclists did not use helmets, 11.3% were driving at high speeds and 14% were under the influence of alcohol (Panichaphongse et al, 1995). Of the vehicles involved in road accidents during 1998 and 1999, motorcyclists comprised nearly 1/3 of accidents, followed by cars and pickup trucks (30% and 18% in 1998, 28% and 19% in 1999, respectively).

- A study by SweRoad (SweRoad, 1997) showed that while official reports cover 80% of accident deaths that occur in hospitals they only covered 10% of injuries. Also, In Thailand 3 times as many motorcyclists are killed compared with other road users. Nearly 8 out of 10 people killed are male with the 20 - 24 years age group being most involved (42 per 100,000 population), followed by the 15 - 19 and 25 - 29 age groups with corresponding figures of 38 and 30 (per 100,000) respectively.
- A study conducted in the Khon Kaen Hospital trauma registry, in Thailand, revealed that traffic accidents had increased from nearly 20% in 1989 to 30% in 1996 in emergency departments (Sri Wi Wat et al, 1999). The number of people with such injuries increased steadily from the 1980's to 1994 but started declining from 1995 onwards. The injury rate declined from 1,554 per 100,000 population in 1995 to 1,199 during 1999 with corresponding RTA rates falling from 56 to 28. In the Khon Kaen province motorcycles were involved in nearly 80% of all road accidents, with 3 times as many men as females being involved. The highest proportion (58%) of road accidents occurred in the 20 - 39 year age group (Trauma Centre Bulletin 1996, 1997).
- In recent years Thailand has introduced a number of road safety interventions that include compulsory helmet and seat-belt use, drink driving measures and speed control laws. Although accident prevention policies have been in place since 1987 their implementation has not been uniform across the country (National Safety Council, Thailand, 1997). Thailand has set a goal of reducing accidents to less than 50 per 100,000 population as part of their current national plan (Panichaphongse et al, 1995).
- It was estimated that in Thailand the cost of road accidents was 69,656 million Baht or \$2,800 million (SweRoad, 1997; Padmasiriwat, 1994).

However, traffic injury related deaths are only the 'tip of the iceberg'. For every death, nearly 30-50 are hospitalised and 50-100 receive care in emergency care departments. The precise numbers of these are not known, as not all injuries are included in health information systems. Further, a lack of co-ordination among injury data collection agencies and non-inclusion of injury-hospitalised data makes it difficult to arrive at objective conclusions.

In summary, several studies in the SEAR region have found that pedestrians, motorised two wheeler drivers and passengers and cyclists were more likely to be killed and injured in traffic accidents – indicating their greater vulnerability in road traffic injuries.

However, many of the national reports do not reflect this trend and indicate that heavy vehicle drivers and occupants are at greater risk. This variation should be considered seriously, emphasising the fact that road safety policies and programmes need to focus on these vulnerable road users.

A major impact after a death or severe or moderate injury is the significant change in quality of life of the person involved and their families over a period of time. An incapacitating injury can lead the person to alcohol usage, suicides, depression, behavioural and personality problem, apart from problems in mobility, communication, cognitive abilities and quality of life. All dimensions of physical, social, mental and spiritual aspects of health are affected by injuries either temporarily or permanently. The impact, burden and loss from injuries have not been examined quantitatively and qualitatively in South East Asia Region. If the research was conducted to provide this kind of information it might be influential in bringing about a recognition of the extent – and trend – of the problem.

5.5 Alcohol use in SEAR countries

This particular review also identified a considerable amount of general information about alcohol use in the region. Although not directly relevant to the impaired driving problem it has been retained since it provides valuable background information about the national and social context of road safety. The impaired driving problem within a society is influenced to a great extent by the drinking (and drug use) patterns within that society; and excessive alcohol consumption results in many problems other than road safety. Any road safety initiative needs to take account of the total ‘environment’ in which the problem exists.

According to the ‘Global burden of disease’ study supported by the WHO and the World Bank, alcohol has been a major risk factor for traumatic outcomes that kill or disable individuals at a relatively young age, resulting in both the loss of many years of life, and years of disability. It has been estimated that ‘alcohol’ contributes to nearly 1.8 million global deaths (3.2% of total deaths) each year, 19,287,000 years of life lost (2.1% of the total), 25,400,000 years of life disabled (6.0% of total) and 58.3 million DALYs (4.0 % of the total). Alcohol was the 8th leading ‘risk factor’ considered. The report concludes that even though consumption of alcohol has fallen steadily in most developed countries

Table 5.2: Trends in recorded per capita consumption of pure alcohol, (Litres) per adult 15 year of age and above in SEAR

	1970-72	1994-96	% change
China	1.03	5.17	401.94
Thailand	1.93	8.37	333.68
Philippines	2.44	6.94	184.43
Pakistan	0.05	0.13	160.00
India	0.45	0.93	106.67
Malaysia	0.45	0.89	97.78
Indonesia	0.07	0.11	57.14
Japan	6.1	7.88	29.18
Vietnam	0.93	1.2	28.41
DPR Korea	3.89	3.07	21.08
Sri Lanka	0.26	0.2	23.08
Myanmar	0.36	0.21	41.67

Source: Global Report on Alcohol, WHO 1999

Table 5.3: Recorded per capita consumption of pure alcohol (litres) per adult 15 years of age and above in 1996

	Total	Beer	Spirits	Wine
Thailand	8.64	0.88	7.73	0.02
DPR Korea	2.56	0.19	2.37	-
Philippines	6.77	1.51	5.25	0.01
China	5.39	0.95	4.38	0.06
Singapore	2.10	1.33	0.65	0.12
Maldives	2.08	0.60	1.22	0.26
Vietnam	1.21	0.38	0.83	-
India	0.99	0.04	0.95	0.00
Malaysia	0.87	0.76	0.10	0.01
Sri Lanka	0.21	0.06	0.15	0.00
Myanmar	0.21	0.05	0.16	-
Indonesia	0.13	0.06	0.07	0.00

Source: Global Report on Alcohol, WHO 1999

since 1980, it has risen quickly in all developing countries (Murray and Lopez, 1996a, 1996b; WHO, 2002). These trends are illustrated in Tables 5.2 and 5.3.

Alcohol production and consumption has existed for more than 5,000 years. It is now a major global commodity that brings in significant profits for producers; as well as large tax revenues for many governments. In the last 30 years, the total global production of alcohol has increased by nearly 60%, from 1,200 (thousands) of hectolitres of pure alcohol to 1,900 hectolitres. Alongside this commercialisation of alcohol there are many communities, especially in poorer areas, that still produce home made beverages; some of which are used as part for long standing social and cultural customs.

For example, ancient texts in India - traditionally seen as a 'dry' or abstinent culture - mention the use of intoxicating beverages such as 'soma and sura' dating back to the vedic periods of (2000-800 BC); and even the great Indian epics make numerous references to drinking patterns - although the same texts and scriptures refer to alcohol usage as being forbidden sins (Ranganathan, 1994). However, alcohol became associated with the Indian way of life during the presence of British and colonial powers (Wig, 1994). Hence, Indian society's attitude to alcohol has been an ambivalent one throughout history. The country has predominantly imported liquor, Indian made 'foreign' liquor (eg whiskey, brandy) and illicitly brewed liquor, of which more than 200 varieties are known to exist across the country. In 1976, India produced 169 million litres of absolute alcohol, which had increased to 208 million litres by 1981 and 459 million litres in 1991 - the last two figures representing an increase of 120% in ten years (Kumar and Dubey, 1991). Figures are not available for corresponding 'home made' manufacture, although it is reported that illicit and illegal alcohol is on the increase in a vast majority of district and rural areas and that illicit consumption is estimated to be around 50% of recorded consumption.

It is calculated that the adult per capita consumption of alcohol in India has increased from 0.4 litres of absolute alcohol in 1970 to 1 litre during 1996. The Indian beer industry is growing at a rate of 17% annually. The total revenue from alcohol was approximately 180,000 million rupees (US \$5 billion) in 1995-96.

Recent studies of alcohol use within the general population - measuring either 'current users', 'ever used' and 'never users' (Varma et al, 1980), or 'normal drinkers', 'daily users', 'monthly users' and 'life time users' (Sethi and Trivedi, 1979) suggests that between 20 and 50% of Indians consume alcohol to some degree (Varma et al, 1980; Sethi and Trivedi, 1979; Lal and Singh, 1978; Ponnudurai et al, 1991; Chakravarthy, 1990; Mathrubootham, 1989 and Bang and Bang, 1991).

The increasing use of alcohol across the country has led to increases in hospital admissions for alcohol related mental health problems (eg 25% of admissions in Chennai, Palniappan and Soundarrajan, 1994; 20% in Bangalore, Isaac, 1990; and nearly 50% of admitted patients in Goa (Hegde, 1994). However, it should be recognised that differences between these studies make direct comparisons problematic.

Information from other SEAR countries suggests:

- Bangladesh, being a predominately Muslim country has no formal alcohol industry, but 'house production' is frequently found and significant usage of alcohol has been noticed in poorer families and in rural area.
- DPR Korea produces alcohol within the country and imports some alcoholic beverages from outside. The adult per capita consumption is estimated to be nearly 3 litres of absolute alcohol during 1996.
- From Nepal, it is reported that alcohol consumption among men is increasing, while it is not a social practice among women. Men consume both locally available and imported products. The adult per capita consumption of beer and spirits was 2.5 litres of pure alcohol during 1996. Surveys of school and college students have shown the figures of consumers of alcohol to vary from 3.5 - 25%. The government receives nearly 3.5% of total revenues from the alcohol industry, which in 1996-97, was estimated to be 1,480 million Nepalese rupees (US \$26 million) (WHO, 1999).
- In Indonesia with a predominately Muslim community, nearly 2.7% of the population drink alcohol. The country produces and markets several types of alcoholic beverages. A community-based survey of drinking patterns in a Balinese village revealed a consumption rate of 40% of locally produced palm wine. The adult per capita consumption in 15+ age groups has increased from 0.07 litre to 0.11 litre in 1995 (WHO, 1999).
- Alcohol consumption patterns vary in Sri Lanka from region to region. A country survey of 8,257 adults in seven districts found that between 25 - 34% (depending on the region) of respondents had once drunk alcohol and between 20 - 32% were regular current alcohol users. Also, adult men from poorer families were frequently found to be experiencing alcohol related problems (WHO, 1999). A significant, and worrying, observation was that often the starting age for drinking was around 15 years of age. Alcohol usage is found to be extremely high in rural areas and in poorer families (Gunasekara and Perera, 1997). The liberalised economic policies have resulted in a massive expansion of liquor industry with the adult per capita consumption being 3.2 litres in 1988.
- In Thailand, a predominantly Buddhist country, alcohol consumption is on the increase. A national survey conducted in 1991 estimated that 31.4% of all adults drank alcohol; while a later survey in 1996 found that over 2% of the total population were drinkers, 32% of adults were drinkers, with 2% drinking alcohol every day (Saxena, 1997; Ministry of Health Thailand, 1997). In recent years several international companies have entered the Thai market resulting in increased production, distribution, advertising and availability. The total household expenditure on alcohol had increased from 1.2% in 1986 to 2.5% in 1992 while the adult (over 15 years of age) per capita consumption of alcohol has increased from 2 litres in 1970 to 7 litres by 1996 (WHO, 1999). A hospital study of 2,099 accident admissions to the emergency unit at the police hospital in Bangkok revealed that 28% of the 1,255

drivers admitted had a positive BAC. Nearly 92% of these drivers were less than 39 years of age.

- In the Maldives, the per capita alcohol consumption is estimated to be over 2 litres of pure alcohol per year per adult.

5.6 Illicit drug use in SEAR

This general information on the use of drugs is included here as it provides some of the context in which the problem of drugged (and impaired) driving exists.

Most medicinal drugs are consumed on the advice of doctors or physicians. However, many drugs (often illegal) are consumed for 'recreational' purposes in search of pleasure, thrills, excitement and experimentation. Today this drug culture is world wide, extensive and increasing. Commonly abused drugs (apart from alcohol, nicotine and caffeine which are all legal) are cannabis and its products (eg bhang, ganja and charas), tranquillisers (such as hypnotics and sedatives), barbiturates, amphetamines, hallucinogens (eg LSD), other narcotic drugs (such as opium, pethidine, morphine, heroin and cocaine) and drugs routinely available over the chemists counter – which varies considerably from country to country.

Because of the illicit nature of such activities much less is known compared to legal behaviours such as drinking alcohol. However, drug use still exists within a historical, social and life-style context. For example, in India the history of drug abuse is similar to that in some other parts of world. The earliest usage of cannabis was found in India by 800 BC and was fairly common by 1,000 AD. The use of these substances can be seen even today in some of the religious premises across the country. Some of these are grown on native soil, some are imported from other parts of the world and some are smuggled from neighbouring countries.

Epidemiological studies of the use of drugs have provided very different 'pictures'. Three percent of those suffering mental illness in Agra (Dube, 1970) were drug users; in several general population studies the rates have varied from 0.2% - 29.4% depending on location, methodology and the definitions used; while studies on student populations have shown usage rates of between 5% to 56%. Dhawan and Mohan (1999) in an extensive review of substance abuse report that 0.5 - 1% of the Indian population use cannabis regularly and 5% are heavy users. Ray (1998) reviewed 17 studies on students and observed that drug abuse was extremely common with the usage rates of tranquillisers, cannabis, opium, amphetamine, cocaine, barbiturates and LSD being 1 - 2.5%, 0.4 - 10.9%, 0.03 - 0.4%, 0.1-0.3%, 0.03 - 0.1%, 0.4 - 1.8% and 0.07 - 0.9%, respectively. A review of 6 large studies conducted in the last 10 years (Dhawan and Mohan, 1999) found that current drug use varied from 0.4 - 5.1% for cannabis, 0.2 - 1.1% for heroin and 0.3 - 2.6% for opium, respectively, in several parts of India. They also found that drug use was present in both urban and rural areas, was very variable even within the same region and, as an example, cannabis, opium and heroin and tranquillisers were the most commonly abused drugs in Kashmir (Margoob and Dutta, 1993).

Globally, 0.4% of deaths (0.2 million) and 0.8% of DALYs (11.2 million) are attributed to overall illicit drug use (WHO, 2002).

5.7 Factors influencing alcohol and drug use within the population

The problem of drinking and driving in SEAR is different in many ways from the problems faced in many developed countries. Various issues requiring examination are the social, cultural, economic and environmental context of the behaviour within SEAR.

A few of the issues are, for example:

- Many countries in SEAR have local alcohol industries and the alcoholic content of drinks varies from brand to brand, country to country and from region to region.
- Government policies of production supply and distribution
- The mega advertising practices of the alcohol industry
- Changes in social values and lifestyles
- The rapid increase in motor vehicle ownership in low and middle-income countries and the absence of strict laws
- Inadequate enforcement of existing laws
- A low level of respect for legal and enforcing agencies
- Increasing income levels in the affluent sections of society
- The emerging 'pub' culture of cities (with the expansion of time limits of selling alcohol).

At the individual level many factors are important like the type of alcohol drunk, the amount of alcohol drunk, the type of drinking patterns and the interval between drinking and driving. Also, many physiological and pathological conditions influence the effect of alcohol, apart from a genetic predisposition on an individual basis. While these are predisposing events, the type of vehicle and road conditions and the nature (eg speed) of driving are obvious determinants of road crash risk and severity. The road environment also determines the physical consequences of any accident, as does the situation with regard to getting to and being treated in a hospital following an accident (eg. the skills and competencies of doctors and paramedics) will also be important factors.

Also, at the individual level, many social, genetic, cultural and economic factors come into play, such as age, sex, place of residence, education, occupation, income and family predisposition. Another important issue is why people drink. People drink for a variety of reasons such as celebrations, to relax, hospitality, alongside eating, pleasure, habit, passing time, overcoming pressure and tension, social companionship, mood enhancement and socialisation. The family values, goals, aspirations, support systems and role modelling also influence drinking and drink-driving to a considerable extent.

The absence of scientifically designed RTI surveillance systems at both the health and policy level complicates the issue further with a non-availability of data that could help evolve policies and programmes. In addition, absence of institutions and well-trained researchers combined with lack of funding for RTI research hinders the understanding of issues related to drinking and driving or driving under the influence of drugs.

Furthermore, the traffic systems in less motorised countries are highly complex due to factors such as: the large proportion of people living in villages and towns, a high proportion of non-motorised and two-wheeler traffic, extensive use of locally available non-motorised modes of transport, high density living, inappropriate mixed of land use and severe limitation of resources (Mohan, 2002, Tiwari, 1999). In a recent review of road safety in urban areas, Downing et al (2000) report that urban crashes are a serious problem in developing countries. 36 - 69% of crashes occur in urban areas and that vulnerable road users like pedestrians, motorcyclists and bicyclists dominate the urban situation and high rate of injuries among young males are involved.

5.8 Epidemiological analyses of alcohol/drug use and RTI risk

Research into quantifying and understanding the role of impairment in RTIs has been a matter of intense investigation over decades in many developed countries. This has resulted in the development, implementation and evaluation of a wide variety of interventions, which have in turn resulted in a significant decline of road traffic injuries in many parts of the world. However, such an approach has yet to take root in a majority of developing countries due to a number of factors such as a lack of research investment, infrastructure and political will. This means that less is known about the role of impairment in road safety in developing countries. Refer to Annex 5.1 and 5.2 for a summary of literature available on impaired driving and alcohol related road traffic injuries in South East Asia.

Odero (1997) in a review of epidemiological studies in developing countries reported that between 1/3 and 1/5 of crashes occurred at night time; and that the majority of these could be attributed to alcohol consumption, along with poor visibility, varying traffic volumes and poor health services. In addition, an increase in week-end crashes was also found to be associated with excessive alcohol consumption and several countries within SEAR have been registering an increasing proportion of night-time crashes, for example Thailand, Bhutan and Sri Lanka now have 44%, 30% and 25% of crashes respectively during the night-time.

The limited information that was discovered for various SEAR countries is presented below.

5.8.1 Thailand

In a general review of traffic safety problems in Thailand (Tanaboriboon, 1993) it was observed that alcohol and drugs played a major role in the causation of accidents. This report also noted that even though the use and sale of amphetamine was banned in Thailand for 10 years, the wide availability of the drug remained a matter of great concern, and several amendments to the existing law were considered to ban the use of the drug. Truck and bus drivers found to have taken liquor or amphetamines while driving have their licenses revoked (Swaddiwudhipong et al, 1994).

More recent official Thailand statistics have attributed alcohol to be a causative factor in less than 1% of accidents, although this could underestimate the actual size of the problem.

In a study of 431 road accidents in rural Thailand in 1991, 45% of cyclists, 56% of motorcyclists and 24% of motorists were under the influence of alcohol.

In a survey of 531 trauma patients registered in emergency rooms of 3 hospitals in Thailand (in Khon Kaen, Halyai and Lampang) between the hours of 18.00 and 02.00 Lapham et al (1998) observed that 36% transport related subjects tested positive for alcohol. They found a difference in this rate over time (with 31% and 43% for being positive between 18.00 - 22.00 hrs and 22.00 - 02.00 hrs, respectively). Also, men aged between 20 and 49 years, those in employment and with higher levels of income were also more likely to be positive than other groups. They report the 'odds ratio' of sustaining a traffic injury was 2.2 (95% CI 1.45 - 3.33) among alcohol positive subjects.

In a study to evaluate the role of AUDIT as a valid instrument for identifying alcohol problems conducted at 4 regional hospitals, the sensitivity was 62% for those with alcohol and correlated significantly with blood alcohol concentration levels while the sensitivity with an appropriate medical diagnosis was 89%. Nearly 44% of traffic injury causes seeking care in public hospitals had BAC levels of 0.1% or more. (Lapham et al, 1999).

Chongsuvivatwong et al (1999) undertook a six month survey in eight provinces of Thailand measuring BAC among drivers on the road. Data was collected for samples of 20 motorcyclists, 4 wheeled vehicles and 6 or more wheeled motor vehicles. The surveys were conducted between 13 - 15 hrs, 17 - 19 hrs and 22 - 24 hrs. An alcohol breath test was administered to over 4,500 drivers. The average proportion of a high BAC level (>50mg / dl) was 12.6% (4.5 - 23.7% depending on vehicle type). No significant differences were found between suburban areas (8.7%) and highways (8.4%); and between weekdays (9.8%) and holidays (7.5%). The proportion was highest during the 22 - 24 hrs period with 19.2%, 16.0% and 11.9% of motorcyclists, 4 wheel drivers and 6 + wheel vehicle drivers, respectively, exceeding the prescribed level.

A national report in Thailand (Wattansaw, 2000) on nearly 6,000 motor vehicle deaths attributed 13.2% to alcohol consumption - although further details about actual alcohol consumption details was not available at the time this review was written.

In an extensive review of the road safety scenario in Thailand (conducted by SweRoad) it was concluded that the overall accident rate during darkness was twice the rate during the day, while fatal accidents at night (from 6am - 6pm) were three times more likely. It was concluded that night-time driving is between 2 and 8 times more dangerous than driving during the day and considered the possible linkage of this finding to the consumption of alcohol.

Tanabooriboon et al (1999) in an analysis of over 8,000 traffic injuries using hospital trauma registry records (with 4.4% being fatalities) observed that nearly 60% of the sample were the result of night-time crashes (between 6 pm and 6 am) and that the fatality rate was 12.4 for night time registrations compared with 5.04 for those admitted during the day time. With regard to alcohol, it was noticed that for every 1,000 victims, about 8.26 deaths was observed for drunk drivers, while only 1.17 deaths occurred among drivers who had not consumed alcohol. The increased severity rates among motorcyclists was 6.54 verses 1.74 for alcohol positive and negative subjects, respectively, while it was 6.82 and 1.32 among drivers and passengers. If all vehicle and road users were combined the severity rates were 8.26 and 1.17 for alcohol 'positive' and alcohol 'negative' drivers.

5.8.2 Sri Lanka

In Sri Lanka, the number of people detected to be driving under the influence of alcohol increased from 118 in 1977 to 1,494 in 1984 – more than an eleven-fold increase. During the years 2000, 2001 and 2002 the number of people detected to be under the influence of alcohol was 4,094, 3,948 and 5,667 (Personal communication Somatunga; Jayasuriya and Jayasuriya - both 1998). An analysis of police records conducted in Sri Lanka revealed that over 10% of were under the influence of alcohol (Rathnayake, 1998). However, it is not clear whether this included accident involved drivers or simply those tested while conducting normal enforcement.

The national road safety secretariat of the Ministry of Transport and highways in Sri Lanka has identified drunken driving as a priority issue and it has been included within the action plan of 1997 - 2002 (Ministry of Transport and Highways, 2002).

5.8.3 Nepal

Jha et al (1998) reported a hospital study (conducted in 2 hospitals in Sunsai and Dharari) during 1997-98 that studied a total of 870 RTI admissions. They found that the highest number of RTI's occurred during weekends and that overall 17% of 'subjects' were found to be under the influence of alcohol. These included 50% of cyclists, 28% of motorised two-wheeler drivers, 17% bullock cart drivers and 5% of truck drivers.

5.8.4 India

Mohan and Bawa (1985) analysed Delhi police records and found that 32% of pedestrian fatalities, 30% of bicyclists deaths and 40% of motorised two wheeler deaths occurred during 6 pm - 6 am. It was concluded that alcohol intoxication was likely to play a major role in traffic accidents. A study of emergency room patients attending casualty departments in a New Delhi hospital found that 6.4% of attendees with a road traffic injury were under the influence of alcohol (Adityanjee, 1989). Mishear et al (1983) reported that 29% (n=87) of two wheeler crash victims admitted to a hospital had 'positive alcohol involvement', but blood alcohol levels were not available for these patients. Similarly, Shaved et al (1993) in an autopsy study of road traffic injuries

conducted in 1991 noticed that alcohol intoxication details were inconsistently documented and therefore it was not possible to identify any association.

Batra and Bedi (2003) in an unpublished document noticed that 40% of trucks and matador drivers, 60% of car drivers, 65% of two wheeler drivers and 5% of pedestrians were under the influence of alcohol during the night. Further evidence suggests that nearly 10% of young college students and 20% of professional college students may be under the influence of alcohol at night.

In an epidemiological study of over 1,700 traumatic brain injuries caused by road accidents conducted in Bangalore in 1992 (Gururaj et al, 1993, 1993a) the presence of alcohol was investigated by means of physician certified evidence from case records along with interviews of subjects and accompanying persons. Night time crashes accounted for 39.9% of total road accidents with highest number occurring between 6pm to 12 midnight. Alcohol consumption was recorded for 15% of victims. Two wheeler drivers, two wheeler passengers, pedestrians, bicyclists and motor vehicle drivers constituted 22%, 12.6%, 31.0%, 9.7% and 3.9% of the sample respectively. Within these groups, alcohol was present in 17.5%, 6.8%, 6.1%, 8.8% and 19.1% respectively. The highest alcohol consumption was documented in 20 - 39 year old (58%) and among men. No women under the influence of alcohol were found in the study.

Amongst a sample of 160 subjects, only 68 (42.5%) attributed their road crash to alcohol consumption, even though 90% had severe levels of intoxication. The risk of mortality increased by a factor of two when alcohol had been consumed.

In an ongoing study at NIMHANS in Bangalore an evaluation of road traffic injuries is being conducted. Alcohol consumption is documented based on a 'person smelling of alcohol', and/or 'physician certified evidence' and/or self-reporting by the injured person (depending on the level of consciousness). Seventy percent of those examined who had consumed alcohol were in the 15 – 40 age group; nearly 40% of RTIs had occurred at night (between 7pm to 7am); and nearly 90% had consumed alcohol within 3 hours of the crash. Alcohol consumption was considered to be a contributory factor for 22% of the brain injuries resulting from a traffic accident among men above 16 years of age. The highest number of road accidents had occurred between 18-24 hrs (40%) and 12-18 hrs (30%). The age group from 20-30 years accounted for 40% of RTA, followed by 30-40 years (20%). Two wheeler occupants (51%) and pedestrian (19%) were the major road user groups. Skid and fall, head on collisions and colliding with a stationary object were registered to the extent of 44%, 15% and 5% respectively. Severe brain injury was more among alcoholic group (13%) compared with non-alcoholic group (9%). The extent of body injuries (based on AIS ISS) was also higher among those with alcohol consumption. The mortality rate among those with alcohol in their blood was 6.5% compared to 4.4% in the non-alcoholic group. Disabilities were more common and severe (13%) in alcohol individuals. The number of days of hospital stay was also higher in the alcoholic group (Gururaj et al 2000c, 2002a, 2002c).

Under the “Suraksha Sanchar Program” in Bangalore a major programme on reducing drinking and driving was launched in 2001. As part of the programme, initial hospital and roadside surveys were undertaken to establish the problem and patterns of drinking among road users (Gururaj and Benegal, 2002b). The hospital-based survey was undertaken in 12 major hospitals in the city for one month in 2002. All those admitted involved in RTI were included in the study and the physicians used the WHO Y 91 codes for estimating alcohol consumption; blood alcohol tests were not done.

The study (involving 1,605 road accident victims) showed that:

- 51% of the crashes had occurred during the period 7pm - 7am.
- For night time crashes involving men over the age of 15 the proportion of RTIs attributable to alcohol was 28%
- The mean age of alcohol positive persons was 33 years and 60% were aged from 20–34 years to the extent of 60% (20 to 24 years - 17%; 25 to 29 years - 25%; 30 - 34 years - 19% and 40 to 44 years - 10%).
- Of those under alcohol influence 53% were two-wheeler riders, 23% were pedestrians (22.8%), 5% were two-wheeler pillion passengers and 6% auto-rickshaw (local 3-wheeler) drivers.
- The injured alcoholic involved person had primarily collided with other two-wheelers (24%), heavy trucks (12%), matadors (10%) and cars (10%).
- The commonest patterns of injury under alcohol influence was skid and fall (28%), head on collision (18%) and hit and run accidents (16%).
- Prior to getting on the roads, people had been drinking in bars (64%), retail stores (8%) and in private parties (3%). Hard spirits (like Whisky and rum) was the common beverage (53%), followed by beer (14%), brandy (8%) and locally brewed alcohol (4%). Nearly 56% of those drunk and injured had consumed alcohol within 1 hour (40%) prior to sustaining an injury. The most common reasons for drinking were as a habit (43%), pleasure seeking (32%) and to overcome family problems (12%). Further equal number (37% each) had been drinking alone or with friends and colleagues.
- With regard to level of intoxication, it was observed that 13%, 47% and 35% were at moderate, severe and very severe levels of alcohol influence. Surprisingly, there was no subject with mild levels of intoxication.
- The death rate (in emergency rooms only) among alcohol positive persons was 2.3% compared with 1.4% of alcohol negative persons.

Unfortunately, information was not available as to how many drunken drivers had caused an accident.

The accompanying roadside surveys, conducted to estimate the prevalence of drinking among road users, were conducted at 34 randomly selected check points. For a period of 15 days drivers were initially stopped based on ‘suspicion’ of being drunk and then randomly (again for 15 days). BrAC levels were obtained using breathalysers and the severity of intoxication was classified using the Y90 codes proposed by the WHO.

Over the 30 days over 5,000 drivers were sampled. In the first round of 15 days, 3,333 riders were observed, 215 were stopped based on police suspicion (11% of total observations and 89% of those checked on suspicion: a police constable smells the breath of the rider at a very close distance) and 193 tested positive for alcohol (89%). During the second round, 1,866 drivers were observed - 491 were stopped randomly and 203 (11% of total observations and 41% of those checked on suspicion) tested positive for alcohol. Since random checks are a more scientific way of assessing alcohol intoxication, it was concluded that 30-40% of night-time drivers would be in states of intoxication.

Of the nearly 400 'intoxicated' drivers in the survey it was found that:

- The peak age of drinking and driving was 25 - 29 years (24-28%), followed by 30 - 34 years (19-25%) and 35 - 39 years (16-19%).
- There was no significant difference in education levels of alcohol positive and negative subjects.
- Nearly 70% were employed in semi-professionals (middle level and lower middle level) jobs and skilled labour categories.
- Among the various road user categories, two-wheeler drivers, pillion passengers, matador drivers, lorry drivers and car drivers constituted 54%, 21%, 6%, 3% and 0.5%, respectively. The passengers in buses were represented to a greater extent of 12% in the series.
- The levels of alcohol as measured by breathalyser revealed that 40%, 27% and 10% were in moderate, severe and very severe levels of intoxication as classified by Y-90 codes.
- Various spirits (whisky and rum) and beers were consumed by 40% and 52%, respectively. Nearly 1/4 - 1/3 had consumed higher amounts of alcohol. The place of drinking was commonly local bars (70%), in parties (16%) and 12% were home drinkers. People had consumed alcohol either alone (40%) or with friends/colleagues (45%).
- It was interesting to note that 98% of tested individuals were confident to drive after drinking, thus indicating lack of awareness and health consequences.
- 97% were aware that existing law prohibits drinking and 99% were aware that drinking and driving is dangerous. However, all 100% of surveyed population mentioned that crashes would not happen after drinking.

An in-depth study of 'Injuries and Alcohol' undertaken by NIMHANS (Benegal, Gururaj and Murthy, 2002) examining patients admitted to hospital reported that 108 of the 658 (16.4%) examined were injured in a road traffic accident after alcohol consumption. It was interesting to note that among 156 persons who registered positive for alcohol, 27% felt that they were not drunk at all, 4% reported being very severely drunk, 13% severely drunk, 28% moderately drunk and 29% mildly drunk. The reported place of drinking was home, pub/hotels, night club, restaurants, workplaces and public places in 4%, 58%, 6%, 3.2% and 1% of cases respectively. Reported drinking patterns were that 34% drank everyday, 16% nearly every day, 15% about 3-4 times per week and 18% 1-2 times per week. The majority of them were heavy drinkers with an average of 4 or more drinks per occasion.

The study, supported by TRL limited, was undertaken in 23 hospitals of Bangalore in comparison with police records during the year 1997-98. The issue of alcohol and road traffic injuries was included as a collateral issue in the study. It was observed that 11% of total RTIs and 29% of night time crashes had documented evidence of alcohol consumption (Gururaj et al, 2000a).

Narayanan (2000) conducted a small study on 50 patients registered in the ER services of Thirunelveli Hospital, during the year 1997-98, found that 12% of crashes were attributable to alcohol consumption.

Table 5.4 illustrates the proportion of accidents that take place during the night in selected countries.

Table 5.4: Percentage of accidents during night-time

Country	Year	%
Japan	1992	31.7
Korea	1991	38.2
Malaysia	1985	29.8
Philippines	1986	47.8
Hong Kong	1991	30.0
Thailand	1998	31.0
Thailand	1997	Night-time accidents 3 times higher than day
Bangalore	1993	40.0
Bangalore	2000	40.0
Bangalore	2002	51.0
Thailand	1993	44.2
Bhutan	1993	30.0
Sri Lanka	1993	25.5

5.9 Some health, economic and psychological impact issues

Although research suggests that between 30 and 50% of traffic accidents occurring in SEAR have an alcohol and drugs contributory factor no research appears to have been

done that examines the impact on health, social and economical aspects at either the individual or community levels.

However it is recognised that:

- Alcohol poses greater difficulties in diagnosis and management of patients in hospital settings.
- Because 70% of injuries occur amongst 20 – 44 year olds, most involved individuals lose their income (Gururaj, 1998). The psychological impact on individuals and families is difficult to measure due to lack of reliable methodology and culture specific instruments. The loss of an income earning family member due to a drunken driving act can force families into sudden economic crisis. This in turn causes children to stop schooling, women to take up menial jobs, forcing families to take out high interest loans, even leading to depression and suicide (Gururaj and Isaac, 2001a, 2001b, 2001c; Gururaj, 1998).
- Although the economic impact has not been measured accurately the indications are that nearly 3% of GDP is lost every year (Mohan, 2002).
- Many studies have established a positive correlation between neuro-psychological deficits and brain injuries due to a road traffic injury. Sabeshan and Natarajan (1987) in a follow up study of head injury patients found irritability and social maladjustment were high among alcohol abusers. Gururaj et al (2002c) in a study of brain injured persons observed that 60% of the injuries were due to a road traffic injury. Using instruments of Glasgow Outcome Scale, Modified Barthel's Index and WHO Quality of Life instruments, it was noticed that persons with a brain injury experienced difficulties in activities of daily living (8%), memory impairment (14%), communication problems (7%), posttraumatic headache (19%) and behavioural problems (17%). 20% of patients had problems in coping with day-to-day activities and 17% were unable to carry out activities with support. The working status revealed that 5% had shifted to part time jobs, 3% were unemployed and 14% were partially employed after the injury. Income had declined by 58% in families after an injury. The quality of life was poor and unsatisfactory in 30% of subjects one year after the injury (Gururaj, 2002c).

5.10 Driver fatigue issues

The extensive search for information from SEAR on driver fatigue issues was very disappointing. In many countries of the region, people who take up driving (of heavy vehicles/trucks) as a profession are often illiterate, from poor families, with inadequate driving skills to handle the task in a complex traffic environment. It is common for these people to drive extraordinarily long distances to transport goods and people. Often, these people are not fully qualified drivers and often get promoted from 'cleaner' to 'driver'. The complexity of this type of driving makes them drive longer hours and in poor visible conditions, and at greater speeds. The physiological reflexes are dull, slow, difficult to co-ordinate, with an inability to concentrate, under great pressure to cover long distances due to fatigue that sets in after performing repeated stressful driving. To overcome their fatigue, drivers often resort to alcohol, which adds to existing slowness due to fatigue and

tiredness. An added problem is the poor vision (which may be present to a greater extent) among these drivers, complicated by fatigue – sleepiness and alcohol.

‘Anecdotal’ evidence frequently reported in the media suggests that a majority of crashes occur between 1 and 4 am in the morning, which is typically the time of greatest fatigue as drivers would be trying to overcome the vital physiological body requirements of sleep and recovery. While this may not be strictly true in terms of accident numbers (for example, see Table 5.4) the risk factors at night – taking account of ‘exposure’ (or the number of vehicles using the road during the night) - are certainly higher with regard to drugs and fatigue. These drivers not only cause collisions with other vehicles but also hit stationary objects on the road. Such drivers also pose greater dangers to their passengers and passengers in other vehicles. No research data is available in the region and it is a matter of urgent attention.

5.11 Prevention polices in SEAR with a focus on drinking and driving

Soon after developed countries recognised the road safety problems associated with drinking and driving (together with recognising the social and economic costs involved) they formulated and implemented a number of sustainable, co-ordinated and integrated programmes based on scientific research. The problem was addressed at a variety of different levels with policies aimed at the alcohol industry; actions to control the sale, distribution and availability in society; controlling human behaviour through legal and enforcement measures; increasing public awareness to respect and adhere to laws; increasing awareness of responsible and restrictive drinking; and condemnation of such behaviour by society at large. These measures have resulted in controlling the problem to a major extent in many developed countries.

In contrast to other parts of the world the governments within SEAR have not made any sincere attempts to reduce the problem. Every country of the region has a Motor Vehicles Act with ‘an active section’ on alcohol and drugs combined with a ‘sleeping level’ of implementation. The enforcement is often non-visible, not uniform, has low penalties, low rates of enforcement and is muddled with political inadequacies and economic barriers. The lack of technology, dedicated teams, information systems, and casual ways of ‘only booking cases for economic gain’ compounds the problem further. On the other hand, people are aware of the existence of a law, but have scant respect and fear for its implementation. The majority of drivers are not aware of the contents of the law or the effect it has on their lives. Education campaigns are most often executed as a routine affair without consideration of the scientific message, creative design, or target audience, and hence effect of such programmes. While some data reveal that it has increased people’s awareness of the problem, no difference has been seen in terms of reduction in injuries and deaths.

With reference to the previous section of this report on the scenario in developed countries, the situation in transitional societies of SEAR is very different and far from satisfactory. The only ‘ornament’ in these countries is the Motor Vehicles Act, as a legislative piece and the need to enforce this law in respective countries by police

agencies. Simultaneously, the only other ongoing effort seems to be occasional campaigns on drinking and driving. It is interesting to note that both these approaches have failed to make any dent in the growing epidemic. Information on prevention policies for this review could only be retrieved for India, Thailand and Sri Lanka, and these are described below.

5.11.1 India

India had a Motor Vehicles Act as early as 1939. Amendments to the Act were made, based on the recommendations of a working group in 1984 and Supreme Court directions in 1988. A review committee was again set up in March 1990, and based on discussions with the National Transport Council, a further set of amendments was brought into effect during 2001. Thus, Motor Vehicles (Amendment) Act of 2001 is currently in place for implementation by concerned agencies. Details of the Act (relevant to impairment) are given in Annex 5.3 at the end of Section 5 to show how impairment issues can be included in legislation dealing with road safety; and the problems these are likely to cause in terms of interpretation and enforcement.

In a recent study by NIMHANS in Bangalore, it was observed from a sample of 480 road users found under the influence of alcohol, that 97% were aware that drinking and driving is not permissible under the Indian Motor Vehicles Act; 99% agreed that it was dangerous to drink and drive; but only 3% were aware of the legal consequences. This is the situation in a city which is known as the technological capital of India. Further, 50% of the surveyed population revealed that their family members were aware of their drinking and driving habits, but were not aware of their levels of drinking or the dangerous consequences (Gururaj and Benegal, 2002). The breathalyser readings were not understood by the public on a large number of occasions. They just asked 'so what', 'tell me what to do next'. One of the comments was 'governments give license for selling alcohol in such an indiscriminate manner and even extend timings. All television channels and newspapers advertise so heavily that they want people to drink more. What can be achieved by such checks once in a while'.

The perception road users have on various aspects of road safety issues in Bangalore is being examined in a study by Gururaj et al (2003b - study in progress). The study population includes a cross section of society from students to the elderly, both men and women, representing different educational and occupational backgrounds. Among the various issues examined, drinking and driving is an important one. A total of 3,792 interviews have been completed and data entry is in progress. Nearly 94% of respondents agreed that drinking and driving is a major cause of night time accidents in Bangalore (strongly agree 59% and agree 35%). Only 6% did not agree that it was a cause of accidents. However, all 100% did not know the law, the penalty and legal-health consequences. Nevertheless, 22% agreed that they had driven their vehicle in the last one week under the influence of alcohol. Interestingly, among the total respondents, 70% were two-wheeler drivers (Gururaj et al, 2003b).

The Society for Alcohol Related Social Policy Initiatives (SASPI) is a non-governmental voluntary organisation in India, involved in collaborative programmes to collect data on

the effect of alcohol abuse on driving. The agency encourages people to make informed choices by providing maximum information on the dangers of drinking and driving. The society is having a few pilot projects involving education and creating awareness of the facts about alcohol. Currently SASPI is one of the partners in the drive against drinking and driving in Bangalore. SASPI's endeavours will cover research, education and advocacy about the responsible use of alcohol.

The second measure commonly adopted in recent years and which is gaining popularity are public awareness messages such as 'Do not drink and drive', 'Drinking and driving is dangerous', 'One for the road is deadly'. The makers and distributors of such messages and campaigns believe that by providing such information to the public, their behaviours can be changed. Further, these messages are seen only once or twice a year for about a week during the annual road safety celebrations, on which huge resources are spent. This is a commonly adopted measure by government (budgets are earmarked for road safety campaigns) along with the alcohol industry and media moguls. Years of research and experience has revealed that such isolated public awareness campaigns are not very successful in altering human behaviour. It is only campaigns that are set as a prelude and accompany legal measures, product modification changes, or those which require public support, which prove to be effective, though only partially (Haddon, 1964; Berger and Mohan, 1996). Further, at present, the advertisement campaigns of the liquor and automobile industry are far more attractive to youths compared with dull and drab messages of prevention. In addition, even these campaigns are not built on a scientific basis based on local data (which is not available in many countries), drinking practices, and local laws. It is also important to keep in mind the value people attribute to information alone and the way it is delivered in situations of competing time and efforts. Finally, none of these campaigns have been evaluated scientifically to know their actual impact on driver behaviour.

5.11.2 Thailand

The situation in Thailand is not very much different from India, even though the country has made progress in health and human development issues. To reduce alcohol related deaths and injuries a law was enacted in 1994, setting a legal blood alcohol limit at 0.05%. However, until 1997, no active efforts were made to publicise the law on a national scale to raise awareness among public and to support enforcement through multimedia approaches. Efforts were made to disseminate information and in 1999 highly visible sobriety check-points were set up. An evaluation of this effort by Suriyawong Paisal et al (2002) revealed that the campaign succeeded in only raising public awareness and support for law, but the proportion of road victims with illegal BAC seeking emergency care remained similar after 17 months of the campaign and 8 months of enforcement. The authors report that law enforcement activity was limited in scope and intensity; sobriety checkpoints covered a tiny fraction of the road network; low frequency of operation (3 times weekly); only 10% of riders reported being stopped by police in the past 2 months; people perceived a very low chance of being stopped even when they were under alcohol influence; low policy commitment; lack of resources with enforcement agencies; lack of clearly defined objectives for the campaign; cumbersome prosecution

procedures; legal hurdles for making decisions about penalties; and other system related issues.

Another recent government initiative to limit locations and operating time of night-time entertainment venues was evaluated by Ackplakorn and SuriyaWong Paisal (2002) in Thailand. As compared to previous initiatives, this was also well received by the public in the fact that 88% of respondents supported the idea of prohibiting alcohol sales to <21 year old, 91% agreed to limit the operating time of alcohol selling outlets to no later than 2 am, 53% opined that medical care benefits should be restricted and 50% agreed on a law to prosecute operators of alcohol distributors. However, the majority agreed that laws were very rarely enforced. Some of the problems encountered were improper implementation, inadequate legal follow-up, non-prosecution of offenders, and other factors. Authors also conclude that these measures have not made any significant impact on the problem of drinking and driving in Thailand.

5.11.3 Sri Lanka

The revised 1980 edition of the Motor Vehicles Act of Sri Lanka under sections 151, 216 and 217 consider drinking and driving to be an offence (Ministry of Transport, Sri Lanka 1980). The details of the act are provided in Annex 5.4 at the end of Section 5.

The enforcement of this is left with police agencies in Sri Lanka. Clear information on implementation of the law and associated success and failure are not known, except that the number of people convicted in recent years has been on the increase. The law is uniformly applicable to all states and union territories within the country.

5.11.4 Summary

An examination of the implementation of the law by concerned agencies reveals a number of lacunae.

- The existing enforcement teams in developing countries are untrained and unskilled to perform the task. Their understanding of drunken driving issues is far from satisfactory, as many are unaware of the dangers, harmful effects, enforcement procedure, rules and regulations and method of performing enforcement checks
- Commonly police officials enforce the law against drunk drivers in fits and starts more as a cursory practice. This is largely to 'book cases' on a routine basis and not in its strict sense
- Enforcement agencies do not have breathalysers to check breath alcohol levels. Hence, it is commonly on the grounds of mere suspicion (by smelling the person under suspicion from a close distance)
- In hospitals across the country, blood alcohol levels are not estimated regularly in emergency rooms and is undertaken only in special cases on grounds of requirement and suspicion
- Police departments do not have adequately dedicated and trained staff to do enforcement on a scientific basis. It is often done infrequently and to book cases

- Enforcement officials also do not impose fines or impound vehicles or sentence persons to jail, as it has to be proven to legal authorities that the driver was under the influence of alcohol. Lack of co-ordination between legal and enforcement agencies delays the process. Further, many are just let away for economic / political measures
- The enforcement of even cursory checks is not uniform, visible, and is often not known to the public. The public tend not to be aware of the contents of the law and its implications and consequences thereof.
- The obvious lack of resources in enforcement agencies in terms of money, manpower, time and equipment complicate the issue further, pushing drinking and driving to the periphery.
- From a compensation perspective, the injured person's family does not receive financial support if the victim was found to be under the influence of alcohol/drugs. Hence, it is not documented in medical/police/legal records to help the family on humanitarian grounds.
- Even those convicted under the law do not pay penalties due to interference of political or economic powers, thus resulting in lax implementation of law.
- As there is no scientific investigation and analysis of road traffic crashes through computerisation across the country, information is not available to policy makers on the magnitude of the problem.

The contents of various sections of drinking and driving are not known to the public as it is not given publicity at any levels through print or visual media. Since the community at large does not make special efforts to know the legal issues, they are generally ignorant of legal issues.

Bang and Bang (1991) highlight that research and action against alcoholism using the participatory approach resulted in massive community participation and proved highly successful. Public health programmes need community participation.

Reducing impaired driving due to alcohol and drugs is indeed a challenge in developing countries, amidst complex social, economic, transportation and behavioural issues. Serious decisions of politicians and policymakers (some are likely to be unpopular) are urgently required, while promoting individual responsibilities at the same time. A re-examination of laws from a medical-legal perspective is immediately required to make laws more 'people friendly'. Strict enforcement of these laws on a visible, uniform, continuous and co-ordinated basis is required built on acceptance of laws by the public through awareness programmes in an environment of political non-interference for immediate reduction of the problem. Mandatory screening in all hospitals for alcohol and drugs along with injury surveillance systems are also required. Issues regarding the production, distribution, supply, advertising, timings of bars and pubs, location of retail outlets, taxation and values of people also need to be addressed. Finally, empowering of communities to debate and dialogue on a scientific platform will decide the direction of future policies.

5.12 Directions for future work

5.12.1 Research issues and interventions

The present review of impaired driving due to alcohol and drugs has revealed the enormity of the problem and lack of sufficient information to analyse and understand the problem in order to be able to aid formulation of policies and programmes. The following list provides a number of ideas that need to be explored and researched with any resulting intervention evaluated and monitored:

1. National information systems on road safety should be strengthened with appropriate knowledge, skills, techniques and resources to include data on driving under the influence of alcohol and drugs as an important element.
2. Focused independent studies should be promoted in selected centres within each country to study the problems using both quantitative and qualitative methods. Studies should focus upon the epidemiology of drinking and drug consumption and driving in a multi-faceted way to examine problems, patterns, causes, severity, outcomes and the impact of any interventions.
3. The feasibility of introducing health screening for alcohol and drugs in hospital emergency rooms among patients with a road traffic injury should be strongly considered by national health authorities - and international funding agencies.
4. The question of 'how much is too much' is a question frequently asked by policy makers, professionals and the public - and is also equally important in setting legal limits in different countries. Moreover, this is a question, which is still confronting researchers in developed countries. Revisions to National Motor Vehicle legislation will be required based understanding of the answer reached. This should focus upon the effects of alcohol on skills and abilities required for safe driving; the effects of alcohol on collision risk; and the likely effects of introducing legal limits at a lower level.
5. Validation studies should be conducted to find out acceptable definitions and methods for 'suspicion' checks, the need for medical officer certification, and public information campaigns about breathalyser and blood alcohol levels.
6. Participatory learning and action (PLA) research should be carried out to understand local drinking patterns, methods of consumption and the consequences at the community level. This should be conducted and developed through operational research methods in collaboration with other stakeholders in this area.
7. The health, social and economic impact of alcohol / drugs and traffic injuries has not been examined in any detail in the region. Research providing such information will be a powerful tool to both influence the public and persuade professionals and policymakers to begin interventions in a scientific way.
8. Local studies in specific institutions, such as hospitals, should be encouraged to promote pooling of data. This will need the various institutions to collect information in a uniform manner based on standard injury surveillance methods.
9. In relation to alcohol use the issues of driver fatigue and tiredness needs further research. Also, health related issues (both physiological and pathological) need to be researched to provide an understanding of the environment of the road safety problem.

10. The overall impact of alcohol and drugs on poor communities, urban-rural differences, differential traffic injury patterns, and the association with varying levels of motorization should be studied in greater detail.
11. While impaired driving due to alcohol and drugs needs immediate attention, alcohol prevention as a wider health promotion approach needs to be examined to identify its association with, for example, suicides, violence, workplace injuries, poisoning and other issues.
12. Regional training programmes on the problem of recognition of driving under the influence of alcohol and drugs should be supported and funded by national governments and other international agencies.

5.12.2 Some policy proposals

Successful interventions often depend on having a suitable policy framework. The following might be considered:

1. A rational alcohol abuse prevention policy should be developed in all countries with a primary focus on reducing drinking and driving. This requires an appreciation of a large number of issues with regard to, for example, the production, distribution, availability, location and timings of alcohol. This should be followed by a similar programme for drug abuse.
2. The existing sections of Motor Vehicles Acts dealing with drinking and driving (and impairment issues if considered) should be widely publicised. Also, information should be conveyed to citizens through multimedia publicity approaches to promote an acceptance and respect of the law.
3. It is recommended that strict enforcement policies be put in place with stiff penalties. The enforcement should not only cover drivers but the distributors and suppliers of alcohol who may operate outside the law.
4. The enforcement agencies need to be provided with additional budgets, manpower, equipment such as breathalysers and other enforcement equipment. Dedicated teams should be developed within police departments at both national and local levels to oversee the implementation of enforcement. Training in effective strategies and the use (and calibration) of equipment will need to be provided.
5. Educational programmes could be launched to 'sensitise' society to respect and adhere to the law, but these must be accompanied with strict enforcement activities.
6. Existing medical-legal issues should be addressed at all levels to overcome existing problems and bridge any existing gap (for example, to minimise delays in convictions and imposing fines). There is frequently a need, at a strategic level, for better co-ordination of activities.
7. Steps should be taken to tackle the problems on a priority basis. For example, there should be targeted high-risk intervention programmes for men in the age group of 20-45 years. Also the problems of motorcyclists and heavy vehicle drivers should be given immediate attention.
8. It is recommended that screening for alcohol and drugs become mandatory in all hospitals, with a phased introduction programme. In a country such as India this would involve a first phase to include all leading hospitals (eg medical colleges and district hospitals) to be followed by a second phase which should cover all (other)

major hospitals at all levels on a regional basis. Any necessary training for doctors, instructions to medical institutions, laboratory support systems and testing equipment must be planned and made available for this activity.

9. A compulsory hospital based surveillance system (as exists in Thailand today) should be promoted in all countries to monitor the problem of traffic injuries. Minimum and essential data for such monitoring should be collected by emergency room staff and subjected to epidemiological analysis.
10. Scientifically designed training programmes could be conducted for police department personnel, doctors in hospitals, transport department officials, drivers of heavy trucks and fleet operators, and owners of transport companies on a number of issues. These programmes should be scientifically designed with practical demonstration exercises in regional languages (since many drivers do not speak English).
11. A variety of interventions like the timing of alcohol distribution outlets, the location of outlets (perhaps a specific law that they should not be the highway), improving public transport systems at night, strict enforcement on the part of servers (eg bar staff) should be considered within SEAR countries. Other strategies, like restricting the sale to minors may not be feasible at this stage of many of these societies.
12. Awareness and orientation programmes (eg capacity building workshops) should be conducted for senior officials within the police and transport and health departments on the problem of drinking and driving. These workshops should lead to more internal activities within the departments.
13. Policies and programmes on drinking and driving should be integrated with other road safety interventions like helmet promotion, speed control, the safety of pedestrians, increased visibility of trucks, buses, motor cycles, bicycles and other vehicles as only an integrated and co-ordinated approach are likely to yield long term results (Gururaj, 1998b).

5.13 Limitations of study

The present study was undertaken within a short period of time and a comprehensive review and analysis was planned and attempted. Given the vastness of the scope of work, more time would have provided an opportunity to explore literature from many more agencies. The obvious lack of data in all countries of the region was a major impediment. All national reports do not include 'alcohol status' in accident investigation and reports. Further, many of the reports are also published in local languages (Thai, Sinhalese, Indonesian) a translation of which to English language was not possible within the project time-scale.

5.14 Summary and Conclusions

The present review of drinking and driving in SEAR highlights the current limitations of existing data and inadequacies of policies and programmes in addressing the problem. It is widely acknowledged that impaired driving due to alcohol and drugs is a major public health problem but data is not sufficient to prove this in a scientific way. Limited studies highlight that 30-50% of crashes during the night time and 1/3 to 1/2 of injured or killed

persons are under the influence of alcohol. The data also suggests that vulnerable road users - motorised two wheeler drivers, cyclists, pedestrians and drivers of heavy vehicles under the intoxicating influence of alcohol, risk injuring themselves and others on the road. There appears to be no data available indicating the involvement of drugs in SEAR, even though epidemiological studies have proved that it is a major problem.

Addressing the problem through relevant policies and programmes has not assumed importance in the region. Numerous political, social, economic, technological factors are in operation in a complex money driven environment propelled by the alcohol industry, motor vehicle industry and liberalised economic policies of governments. The numerous success stories of the developed nations cannot be implanted and implemented in these countries and requires innovative research. Some experiments tried in these countries have not been sustainable and successful. However, the lessons learnt in this process should not be forgotten and principles should be understood. Society as a whole, must recognise the hazardous effects of impaired driving due to alcohol and drugs. Enforcement measures backed by educational strategies must be implemented in all countries in a visible, uniform, penalty based, standardised, planned approach and must be co-ordinated and integrated. An enabling environment should be created to reduce impaired driving due to alcohol and drugs both through a societal/collective responsibility and an individual responsibility. Urgent action is required to save lives in the Region and it is time to accept the challenge.

5.15 Useful Internet Sites

www.bps.go.id

www.lk/national/census

www.nso.go.th

www.who.int/violence-injury-prevention/waw/prevalence-htm

Annex 5.1: Prevalence of alcohol related RTIs in South East Asia

	Place	Author	Sample Size	Remarks
1.	Rural Thailand	Swaddiwudipong et al 1994	431	45% bicyclists, 56% motorcyclists and 24% motorists were under alcohol influence
2.	3 hospitals in Thailand	Laphaur et al 1998	531 trauma patients	36% of subjects tested positive on AUDIT
3.	4 regional hospitals of Thailand	Laphaur et al 1999	-	44% traffic injury cases were positive for alcohol
4.	Khon Kaen Hospital in Thailand	Tamabooriboon et al 1999	8,233 trauma patients	Night time crashes accounted for 58% of total crashes
5.	Dharai, Nepal	Ha et al, 1998	870 RTI subjects	17% of subjects under alcohol influence
6.	New Delhi, India	Mishear et al, 1983	300 hospital subjects	29% under alcohol influence
7.	India	Batra and Bedi	-	40% of truck and matador drivers, 60% car drivers, 65% two wheeler drivers and 5% pedestrians under the influence of alcohol.
8.	Bangalore, India	Gururaj et al. 1993	1,725 brain injured persons due to a road traffic injury registered in one hospital	Night time crashes accounted for 40% of total crashes. 15% of total subjects under alcohol influence. 24% of two wheeler occupants, 6% pedestrians, 10% bicyclists and 4% of heavy motor vehicle drivers under alcohol influence.
9.	Bangalore, India	Gururaj et al, 2000	3,979 brain injured persons due to a road traffic injury registered in one hospital	40% night time crashes. 22% of subjects under alcohol influence. Two wheeler occupants (51%) and pedestrians (19%) represented in greater numbers. Deaths, disability and severity higher in alcohol positive subjects

Contd...

	Place	Author	Sample Size	Remarks
10.	Bangalore, India	Gururaj and Benegal, 2002	1,605 road traffic injury subjects registered in 12 hospitals of the city,	29% of night time crashes directly related to alcohol consumption. Two wheeler riders (53%), pedestrians (23%) and 3 wheeler drivers (6%) represented in greater numbers.
11.	Bangalore, India	Benegal and Gururaj, 2002	Injured persons registered in one public hospital	37% of injuries attributable to alcohol
12.	Bangalore, India	Gururaj, 2000	3,051 road traffic injured persons from 23 hospitals of Bangalore	11% of RTIs and 29% of night time crashes linked to alcohol
13.	Tamil Nadu, India	Narayanan, 2000	50 patients admitted in ER due to RTI	12% of crashes admitted were under the influence of alcohol.

Annex 5.2: Prevalence of impaired driving due to alcohol in South East Asia

1.	Thailand	Roadside Survey	4,675 drivers	Chongsuvivatwang et al, 1999	March-August 1995	Breath Alcohol Tests	12.6% of drivers under alcohol influence
2.	Thailand	Roadside survey	-	Suriyawang et al, 2002	1999	Knowledge Attitude Survey	37% of drivers under alcohol influence
3.	Sri Lanka	Police records	1,1370 drivers	Rathnayake, 1998	1999	Suspicious checks	10% drivers under alcohol influence
4.	New Delhi, India	Police records	-	Mohan and Bawa, 1985	1985	Suspicious checks	Significant proportion under alcohol influence but no exact figures
5.	Bangalore, India	Roadside Surveys	3,333 drivers	Gururaj and Benegal, 2002	2002	Suspicious checks confirmed by breathalyser tests	89% of those checked were positive for alcohol
6.	Bangalore, India	Roadside Surveys	1,866 drivers	Gururaj and Benegal, 2002	2002	Random stopping and breathalyser administration	41% of randomly stopped drivers positive for alcohol. Two wheeler drivers, drivers of four wheeler vehicles (10%) and bus passengers (12%) were in greater numbers
7.	India	Police records	-	Batra and Bedi	2003		40% of truck and matador drivers, 60% car drivers, 65% two wheeler drivers and 5% pedestrians under the influence of alcohol.

**Annex 5.3: Details of Indian Motor Vehicles Amendment Act 2001
(relevant to impairment)**

Section 16: Revocation of driving license on grounds of disease or disability

Notwithstanding anything contained in the foregoing sections, any licensing authority may at any time revoke a driving license or may require, as a condition of continuing to hold such driving license, the holder thereof to produce a medical certificate in the same form and in the same manner as is referred to in sub-section (3) of section 8 if the licensing authority has reasonable grounds to believe that the holder of the driving license, is, by virtue of any disease or disability, unfit to drive a motor vehicle and where the authority revoking a driving license is not the authority which issued the same, it shall intimate the fact of revocation to the authority which issued that license.

Section 19: Power of licensing authority to disqualify from holding a driving license or revoke such license

- (1) *If a licensing authority is satisfied after giving the holder of a driving license an opportunity of being heard, that he -*
- (a) *is a habitual criminal or habitual drunkard; or*
 - (b) *is a habitual addict to any narcotic drug or psychotropic substance within the meaning of the Narcotic Drugs and Psychotropic Substances Act, 1985 (61 of 1985); or*
 - (c) *is using or has used a motor vehicle in the commission of a cognizable offence; or*
 - (d) *has by his previous conduct as driver of a motor vehicle shown that his driving is likely to be attended with danger to the public.*

Section 185: Driving by a drunken person or by a person under the influence of drugs

Whoever, while driving, or attempting to drive, a motor vehicle -

- 1(a) *has, in his blood, alcohol exceeding 30 mg. per 100 ml. blood detected in a test by a breathalyzer, or*
- (b) *is under the influence of a drug to such an extent as to be incapable of exercising proper control over the vehicle, shall be punishable for the first offence with imprisonment for a term which may extend to six months, or with fine which may extend to two thousand rupees, or with both; and for a second or subsequent offence, if committed within three years of the commission of the previous similar offence, with imprisonment for a term which may extend to two years, or with fine which may extend to three thousand rupees, or with both.*

EXPLANATION: For the purposes of this section, the drug or drugs specified by the Central Government in this behalf, by notification in the Official Gazette, shall be deemed to render a person incapable of exercising proper control over a motor vehicle.

203. Breath tests

1[(1) *A police officer in uniform or an officer of the Motor Vehicles Department, as may be authorized in this behalf by that Department, may require any person driving or attempting to drive a motor vehicle in a public place to provide one or more specimens of breath for breath test there or nearby, if such police officer or officer has any reasonable cause to suspect him of having committed an offence under section 185:*

PROVIDED that requirement for breath test shall be made (unless, it is made) as soon as reasonably practicable after the commission of such offence].

(2) *If a motor vehicle is involved in an accident in a public place and a police officer in uniform has any reasonable cause to suspect that the person who was driving the motor vehicle at the time of the accident had alcohol in his blood or that he was driving under the influence of a drug referred to in section 185 he may require the person so driving the motor vehicle, to provide a specimen of his breath for a breath test -*

(a) in the case of a person who is at a hospital as an indoor patient, at the hospital,

(b) in the case of any other person, either at or near the place where the requirement is made, or, if the police officer thinks fit, at a police station specified by the police officer:

PROVIDED that a person shall not be required to provide such a specimen while at a hospital as an indoor patient if the registered medical practitioner in immediate charge of his case is not first notified of the proposal to make the requirement or objects to the provision of a specimen on the ground that its provision or the requirement to provide it would be prejudicial to the proper care or treatment of the patient.

(3) *If it appears to a police officer in uniform, in consequence of a breath test carried out by him on any person under sub-section (1) or sub-section (2) that the device by means of which the test has been carried out indicates the presence of alcohol in the person's blood, the police officer may arrest that person without warrant except while that person is at a hospital as an indoor patient.*

(4) *If a person, required by a police officer under sub-section (1) or sub-section (2) to provide a specimen of breath for a breath test, refuses or fails to do so and the police officer has reasonable cause to suspect him of having alcohol in his blood the police officer may arrest him without warrant except while he is at a hospital as an indoor patient.*

(5) *A person arrested under this section shall while at a police station, be given an opportunity to provide a specimen of breath for a breath test there.*

(6) *The result of a breath test made in pursuance of the provisions of this section shall be admissible in evidence.*

EXPLANATION: For the purposes of this section "breath test", means a test for the purpose of obtaining an indication of the presence of

alcohol in a person's blood carried out on one or more specimens of breath provided by that person, by means of a device of a type approved by the Central Government by notification in the Official Gazette, for the purpose of such a test.

Section 204: Laboratory test:

- (1) A person who has been arrested under section 203 may while at a police station be required by a police officer to provide to such registered medical practitioner as may be produced by such police officer, a specimen of his blood for a laboratory test if -
- (a) it appears to the police officer that the device, by means of which breath test was taken in relation to such person, indicates the presence of alcohol in the blood of such person, or
- (b) such person when given the opportunity to submit to a breath test, has refused, omitted or failed to do so:
- PROVIDED that a person shall not be required to provide a specimen of his blood for a laboratory test under this sub-section if the registered medical practitioner in immediate charge of his case is not first notified of the proposal to make the requirement or objects to the provision of such specimen on the ground that its provision or the requirement to provide it would be prejudicial to the proper care or treatment of the patient.
- (3) The result of a laboratory test made in pursuance of this section shall be admissible in evidence.

EXPLANATION: For the purposes of this section "laboratory test" means the analysis of a specimen of blood made at a laboratory established, maintained or recognized by the Central Government or a State Government.

Section 205: Presumption of unfitness to drive

In any proceeding for an offence punishable under section 185 if it is proved that the accused, when requested by a police officer at any time so to do, had refused, omitted or failed to consent to the taking of or providing a specimen of his breath for a breath test or a specimen of his blood for a laboratory test, his refusal, omission or failure may, unless reasonable cause therefore is shown, be presumed to be a circumstance supporting any evidence given on behalf of the prosecution, or rebutting any evidence given on behalf of the defense, with respect to his condition at that time.

**Annex 5.4: Details of Sri Lankan Motor Vehicles Act 1980
(relevant to impairment)**

Section 151

- (1) *No person shall drive a motor vehicle on a highway after he has consumed alcohol or any drug.*
- (1A) *No person shall drive any omnibus or hiring car or any other vehicle intended for a carriage of persons for fee or reward on a highway after he has consumed alcohol or any drug.*
- (1B) *Any person who drives a motor vehicle on a highway after he has consumed alcohol or any drug and thereby causes death or injury to any person, shall be guilty of an offence under this Act.*
- (1C) (a) *Where a police officer suspects that the driver of a motor vehicle on a highway has consumed alcohol he may require such person to submit himself immediately to a breath test for alcohol and that person shall comply with such requirement.*
- (b) *Where a breath test for alcohol reveals that such person has consumed alcohol or where such person refuses to submit himself to such test it shall be presumed that such person has consumed alcohol, unless evidence to the contrary has been adduced.*
- (c) *Where a police officer suspects that the driver of a motor vehicle on a highway has consumed any drug it shall be lawful for the police officer to produce such person before a Government medical officer for examination and that person shall comply with such requirements.*
- (d) *The report of a Government medical officer to the effect that the driver of a motor vehicle on a highway has consumed any drug shall be sufficient evidence of the fact that such person has consumed any drug unless evidence to the contrary has been adduced.*
- (e) *Where such person refuses to submit himself to any such examination by the Government medical officer it shall be presumed that he was driving after the consumption of drugs unless evidence to the contrary has been adduced.*
- (1D) *Regulations may be made prescribing -*
- (i) *the mode and manner in which the breath test for alcohol shall be conducted;*
 - (ii) *the concentration of alcohol in a person's blood at or above which a person shall be deemed to have consumed alcohol;*
 - (iii) *the mode and manner in which any examination may be conducted to ascertain whether a driver of a motor vehicle has consumed any drug; and*
 - (iv) *the concentration of any drug in a person's blood at or above which a person shall be deemed to have consumed any drug.*

Section 216: *Any person who is guilty of the offence of contravening the provisions of subsection (1) of section 151 shall, on conviction after summary trial before a Magistrate, be liable to a fine not less than two*

thousand rupees or to imprisonment of either description for a term not exceeding three months or to both such fine and imprisonment and to the suspension of his driving licence for a period not exceeding twelve months.

Section 216A: *Any person who is guilty of the offence of contravening the provisions of subsection (1A) of section 151 shall, on conviction after summary trial before a Magistrate, be liable to a fine not less than three thousand rupees and to imprisonment of either description for a term not exceeding six months and to the cancellation of his driving license.*

Section 216B: *Any person who is guilty of the offence of contravening the provisions of subsection (1B) of section 151 shall, on conviction after summary trial before a Magistrate, be liable -*

- (a) where he causes death to any person to imprisonment of either, description for a term not less than two years and not exceeding ten years and to the cancellation of his driving license;*
- (b) where he causes injury to any person, to a fine not less than five thousand rupees or to imprisonment of either description for a term not exceeding five years or to both such fine and imprisonment and to the cancellation of his driving license.*

Section 217:

- (1) Any person who is guilty of the offence of contravening the provision of section 151(2) shall, on conviction after summary trial before a Magistrate, be liable to a fine not exceeding five hundred rupees, and on a second or subsequent conviction, to a like fine or to rigorous imprisonment for a term not exceeding six months or to both such fine and imprisonment.*
- (2) Any person who is guilty of the offence of contravening the provisions of section 151(3) shall, on conviction after summary trial before a Magistrate, be liable to a fine not exceeding two hundred rupees.*

6 IMPAIRED DRIVING IN LATIN AMERICA AND CARIBBEAN COUNTRIES

(by M Hajar)

6.1 Introduction

In many countries the social and environmental changes brought about by the shift from rural to urban living, and the resulting growth of large cities, have direct consequences for the population's health. One example, is that in Latin American and the Caribbean countries (LAC) road traffic injuries (RTI) now rank third among the ten leading causes of death; and are the leading cause of death for young men within the population. This means that road safety represents a serious public health problem and one that has clear and profound repercussions in daily life. As well as being a major cause of death, road accidents cause numerous other problems. For example, they often result in injuries or disabilities (since in most cases the victims do not die) that mean people need to adapt to changes in their roles (perhaps becoming a burden upon a family rather than it's 'breadwinner') and activities for weeks, months, or even permanently. Road accidents can be considered within physical, emotional, economic, family or social contexts.

The LAC area, consists of a large number of low and middle-income countries - and as a consequence has a serious, and worsening, road traffic injury problem. As with many non-developed countries roads are shared by a wide variety of users (such as pedestrians, cyclists, vendors, cars, buses and lorries) who all compete for space under unequal conditions. Traditionally, as in many developing countries, road safety measures introduced in LAC countries have been imported from developed countries and have focused on the driver and passengers with little attention paid to other traffic 'actors'. Also, they do not tend to take proper account of the particular characteristics of each country.

The present review aims to address certain road safety issues within the regional, country and social contexts in LAC countries. In particular it aims to identify the current knowledge on accidents caused by impaired drivers (recognised as being a major safety problem in most countries) in the LAC region, what interventions are currently in place and to consider if (and what) research might be appropriate to identify interventions and strategies that might be successfully applied in the future within the region.

6.2 Scope of the review

The geographic scope of review (the LAC region) covered 45 individual countries: 12 in South America, 8 in Central America, 24 (50 % of which were 'small' Islands) in the Caribbean and 1 in North America.

The impairment issues to be considered include: alcohol, drugs and fatigue.

The objectives of this regional study were:

- To undertake an extensive review of relevant literature and to summarise existing knowledge and information on the causes and consequences of

impaired driving resulting from the use of alcohol and other psychoactive substances in the LAC region

- To evaluate the scope for further research which would assist in the formulation of interventions for reducing impaired driving.

To achieve this the study examined data from all possible sources that presented evidence on the following aspects of impaired driving:

- 1) The proportion of road traffic crashes, injuries and deaths due to impaired driving
- 2) The demographic and socio-economic profile of drivers and pedestrians impaired by alcohol or psychoactive drugs
- 3) Patterns of alcohol consumption and drug use, including type of beverages and drugs used, and the social contexts of drinking and driving behaviour
- 4) Travel patterns of impaired drivers and pedestrians
- 5) Interventions to counter impaired driving

As a result it was possible to identify important 'knowledge gaps' so that proposals for further research (contained within the overall Terms of Reference for this Scoping Study) be formulated.

This particular regional review (one of three) was intended to cover all Latin American and Caribbean countries. However, relevant data on alcohol and drug impairment was available from only 13 countries, located mainly in 3 sub-regions of the area (see Table 6.1). There are a number of papers that include aggregated data of the region where it was not possible to identify specific data by country.

Table 6.1: LAC countries identified with relevant studies on impaired driving

Region	Number of papers	Country
I. Latin America region	20	Unspecified
II. Central America	3	Costa Rica Nicaragua
III. South America	54	Argentina, Brazil, Chile Colombia, Peru, Uruguay Venezuela
IV. North America	19	Mexico
V. Caribbean	6	Cuba, Jamaica Puerto Rico
TOTAL	102	

6.3 Method

The method used to collect information for this review was to search bibliographic indexes and the reports of scientific meetings; and to obtain 'grey' literature via the

Internet and by personal communication with selected individuals. It was decided that the period of interest would be from 1965 to the present.

The various searches used the following key words: alcohol, drugs, fatigue, unintentional injuries, crashes, pedestrians, bicycles, children, elderly, gender, large trucks, motorcycles, passenger, vehicles, roadside hazards, teenagers, urban/rural crashes, highway, Latin American, mortality, morbidity, prevention, and interventions. The databases examined included:-

- Bibliographic indexes such as: Medline, Medlars, Artemisa (a specific index for Mexican journals), Lilacs (an index for Latin American journals in Spanish), Proquest, Sumsearch and the virtual library from the Colegio de México (a Social Sciences Index) .
- The Internet to access: press releases, ministries and other governmental institutions, NGO's, civil associations and international organisations.
- Abstracts of scientific meetings, such as: ICADTS World conferences on injury prevention in Amsterdam (1996), Melbourne (2002), and Montreal (2002); World Bank workshop on urban transport strategy, Santiago de Chile, (2000), Abstracts of the Foro nacional sobre prevención de accidentes de tráfico, México City, (2002), and III Congreso Iberoamericano de Psicología, Bogotá, Colombia (2002).
- Personal communications: people identified (or previously known) such as researchers working in traffic safety in the region; and in the Road Traffic Injuries Network (RTIN) group from the Global Forum for Health Research.

This resulted in a total of 102 studies and documents related to traffic accidents and "impaired driving". Almost a half of these were papers published in Scientific Journals, 22% were from reports of scientific meetings, while the rest were from the press, interviews with experts, NGO's and documents obtained from International Agencies.

6.4 Studies on 'size' of alcohol impairment problem in RTI

Because only one study was found relating road accident to drug use (see Section 6.5) this review of the 'size' of the impairment problem in LAC is only concerned with the use of alcohol by road users. Table 6.2 below shows that one-fifth (21%) of the 'reports' reviewed made reference to the actual size of the road safety problem.

However, most of those considering the size of the road safety problem did not refer directly to the issue of impairment, while a number presented regional (aggregated) data so that country specific information was not available. Information considered relevant to this review is reported below.

Table 6.2: Proportion of studies on RTI in LAC region for various issues considered

Issues analysed	Percentage
Size of the problem	21
Causes of behaviour	15
Current road safety environment	13
Enforcement issues	13
Legislation	13
Current Prevention Strategies	9
Possible national mitigation strategies	7
Impairment issues	6
Consequences of behaviour	2

6.4.1 Alcohol consumption patterns

Alcohol consumption is common in Latin American society, but there is considerable variability in drinking patterns between countries. This suggests that the size of the road safety impairment problem will also differ from country to country, and even within different regions in the same country. Unfortunately, no information obtained recorded the patterns of consumption (or abstinence) within the region.

6.4.2 Epidemiological studies.

Most of the relevant studies identified that explored the associations between the use of alcohol and driving (see Tables 6.3 and 6.4) were epidemiological ones. Of these seven studies examined fatally injured road accident victims, while two employed 'simple' population surveys to obtain evidence of alcohol impairment.

a) Non-fatal injury studies

Table 6.3 summarises the research results for impairment studies in a number of countries using accident victims receiving non-fatal injuries, and includes information on the design of the study.

b) Studies using accident fatality studies

Table 6.4 shows studies that investigated impairment factors in road users who were killed (fatalities) in road accidents. There are markedly more studies of this type than those using injury-only road users.

Table 6.3: Alcohol impairment in road accident injury studies

Country (1 st author, year)	Road-user	Sample size	BAC Legal Limit for drivers	Sources of data
Mexico (Híjar 1990,1996 1998 and 2000) (Borges 1994) (García 1991)	Drivers Pedestrian Drivers Pedestrians	n=73197 (young men) n=386 n=324 (177 injured and 12 death) n=274 above 15 years in emergency room vs a control group of 126 cases	0.08g/100ml	Breath test Self report Breath test
Brasil (Alves 2000) (Koizumi 1992) (Yara 2002)	Drivers Pedestrians (mostly men and young) Drivers Pedestrians Drivers Pedestrians	n=45 (injured people with traumatic cerebral lesions) Injured people in emergency room (mostly young men) Non severe Injured people	0.08g/100ml	Emergency room Emergency room Pre-hospital care
Argentina (Luchemos por la vida 2002) (Isoba 2000)	Drivers (cars, motorcyclists and cyclists) Pedestrians Drivers Pedestrians	Severe traffic infractions during 1 month N=628 drivers (first year) n=612 (second year) Systematic observation more than 30,000 vehicles in three different years	0.08g/100ml	Police registers Survey

Table 6.4: Alcohol impairment in road accident fatality studies

Country (1 st author, year)	Road-user	Sample size	BAC Legal Limit for drivers	%Impaired /above Legal Limit	Sources of data
Mexico (Celis 1991)	Drivers Pedestrians	1989 reports of medical autopsies (14.3 X 1000: cause of deaths per traffic accident)	0.08g/100ml		Breath test Self report
Colombia (Posada 2000)	Pedestrians	Death and injured registers from 1991-1995.			National registers
Brasil (Deslades 2000) (Ott 1993)	Drivers Pedestrians (men and young adults) Drivers Pedestrians	Hospital registers Injuries during 1 year (majority men and young)	0.08g/100ml		Hospital registers ER
Argentina (Luchemos por la vida 2002)	Drivers Pedestrians	Institutional death and injured registers during 2000	0.08g/100ml	500 mg per blood lt. (vehicle drivers) 200 mg per blood lt. (motorcycles and bicycles) 0 mg per blood litre, for passenger and load transport	Police registers
Chile (Moyano 1997)	Drivers	n=216			Questionnaire Survey
Cuba (Nieto 1987)	Drivers Pedestrians	Rate behaviour fatal Injuries during last year			National registers

Information about which countries have published research on impaired driving and RTI were presented earlier in Table 6.2. This means that the information presented in Tables 6.3 and 6.4 represent the situation in only 14 countries – or less than one-third (31%) of the total countries in the region.

It should also be noted that 50% of the available information is concentrated in just 3 countries: Brazil, Mexico and Colombia and that almost 20% of the reports present information on ‘aggregates’ of just a few countries in the region. Importantly, the issues addressed, research designs, road users considered and approaches are typically different so that a regional interpretation is very problematic. However, a number of findings can be concluded from these studies.

Males and young adults are the groups most likely to be involved in such types of accident. Also, these accidents are more likely to occur at night and over the weekend at night. Some studies have used the breathalyser as a research tool, while some (such as the fatality studies) rely on the analysis of blood samples.

Table 6.4 shows that some studies - especially in South America, in countries like Brazil, Chile, Argentina and Colombia – are conducted in studies examining specific interventions to reduce the role of alcohol in RTI; and thus give very important results.

Many of the reported studies include pedestrians as the road user type under investigation. Only a very few of the studies (1%) consider the social consequences and the economic ‘costs’ of these accidents.

Only around 10% of the studies reviewed included ‘impairment’ data about alcohol intake related with RTI, so that this type of information is limited to only 6 countries (Mexico, Brazil, Colombia, Costa Rica, Argentina and Chile). Also, only one study (in Venezuela) was found that reported on the consumption of drugs in road accidents and this particular study did not show any association between drug consumption and RTI.

Similarly only one study (in Mexico) examined impairment issues with regard to economic status (eg rich or poor); and this study used a qualitative methodology.

6.4.3 Qualitative studies on impaired driving

One study (reported by Hjar and Cols) uses a questionnaire survey to analyse accidents involving pedestrians. They found that most of them happened during the weekend and in the dark. Also, 60% of males involved reported having ingested alcohol prior to the accident compared to none (0%) of the females who were knocked down.

6.5 Studies on drugs and RTI

Only one study, reported by Pionero de Fuentes in Venezuela, in 1998, attempted to examine the possible role of psychotropic drugs in causing road accidents in LAC. Perhaps surprisingly, they failed to find any association between the consumption of marijuana and cocaine and the risk of being involved in a RTI.

There are a number of possible reasons why this is the only study reported. One is the need to use relatively expensive (blood) analysis techniques – although cheaper saliva analysis is now possible – that typically simply register whether the drug has been used recently rather than measuring any level of the drug being in the blood – that might infer the degree of impairment. Another reason might be that in many countries the alcohol problem is much more ‘transparent’ and higher on the list of ‘research’ questions being asked.

6.6 Studies on fatigue and RTI

None of the published sources consulted report information on the incidence of fatigue (or ‘tiredness’) in road accidents in LAC. Nevertheless there is empirical evidence from Mexico suggesting that 15% of the RTI on their highways are related with driver fatigue - especially for drivers of trucks and buses - and concluded this is one issue that needs to be included in future research.

6.7 Demographic and socio-economic profile of impaired drivers

Often successful accident countermeasures depend on having a clearly defined target group of those involved in the behaviours being tackled. This, together with DFID’s poverty focus for research, means that it is important to know what types of road user are most involved in impairment accidents. Unfortunately, very few of the studies conducted in LAC reviewed earlier provided any alcohol and drug impairment data disaggregated by age, sex and other socio-economic parameters. Those that did are reported in Tables 6.3 and 6.4 and commented on, where appropriate.

6.8 Current prevention strategies

6.8.1 Road Safety Councils

Countries such as Colombia, Argentina, Brazil, Chile, Costa Rica and Mexico all have an ‘institutional framework’ based on having a National Road Safety Council (NRSC) which are mandated to develop appropriate road safety interventions, co-ordinate and monitor their implementation. These Councils were established at different times in each country and also differ markedly in terms of their memberships, funding arrangements, programmes and commitment - and thus in their effectiveness. For example, in Mexico, the NRSC consists of representatives of various key stakeholders including government ministries (eg Education, Transport and communications, Health, Safety, and Finance), while in Costa Rica they have a local Road safety councils (COLOSEVI - from the name in Spanish) that include education establishments, industry and public institutions.

However, in many LAC countries, effective implementation of road safety measures is problematic. The main constraints are: a lack of political concern and the low priority given to road safety; inadequate feedback to decision makers on the magnitude and consequences of the road safety problem due to poor systems for collecting and recording data; a lack of human resources; inadequate funding for road

safety work; widespread corruption in law enforcement; and a lack of authority and political 'power' of the Road Safety Councils.

6.8.2 Legislation and Enforcement

The points discussed here were mainly taken from newspaper reports; reports of international organisations who typically report on the entire LAC region; and publications from a small number of countries (eg Chile and Colombia).

In 1993 Colombia introduced compulsory insurance cover for traffic accidents, plus a national budget to help reduce road traffic injuries. Reports suggest these changes have been very successful in improving road safety.

In 2001 Costa Rica introduced a national road safety programme that included a permanent campaign to improve impaired driving. They have a target to reduce the numbers of RTI by 19% by 2005.

In general terms the entire LAC region considers the alcohol (and driving) issue within the legislation related to RTI. One major problem is the lack of effective enforcement of such legislation; while a second problem is that although there is a law for impaired drivers there isn't one for impaired pedestrians. Another serious issue in some LAC countries is the high percentage of 'hit and run' accidents. This situation is encouraged in Mexico, for example, because current legislation always judges them to be the guilty party in certain accidents irrespective of the circumstances. It is also widely believed that many such accidents occur because the driver may be drunk (or under the influence of drugs) and is afraid of the consequences of stopping and reporting the accident.

6.8.3 Some possible strategies to mitigate impairment issues

A small number of reports addressed the issue of how to tackle the problems associated with impaired driving; and mostly came from Mexico, Colombia, Brazil and Venezuela. Unfortunately, it is not easily possible to compare the results of these studies because of the large differences between studies. However, Table 6.5 summarises the information on a number of countermeasure issues and prevention strategies obtained by the review conducted in the LAC region.

Table 6.5: Findings from individual LAC countries that can inform the development (and improvement) of possible remedial measures

COUNTRY	IMPAIRMENT ISSUES CONSIDERED	CAUSES OF BEHAVIOUR	SOCIAL / CULTURAL ISSUES	LEGISLATION ENFORCEMENT	CURRENT PREVENTION STRATEGIES
Argentina	83% of drivers report Alcohol Intake before driving. Self report	Low knowledge about institutional rules and penalisations in road issues. 83% reported to drive after alcohol intake and 45% at high speeds Main reasons: i) lack of road education, ii) lack of institutional control. No relation between theorists knowledge of road users and specific behaviour (Isoba, 2000)	Massive campaigns To change behaviours of perceived risk to objective-risk	Increase the law enforcement on drunk drivers Police Training	Media Spots about consequences of drink and driving Road education included in school curricula. Restructure of the license system Training of transit police. Improvement in public transport. Checking vehicular system. (Luchemos por la vida, 2000)
Brazil	Alcohol	Significant differences in alcohol consumption related to motorcycle drivers younger than 18 years (Yara Bastos, 2002)	Age and sex		
Brazil			Strict rules, change in focus toward major pedestrian protection	New Code for Traffic focused in mayor protection for the pedestrian (1998). Significant reduction in traffic accidents. (E. Daros)	
Brazil			Strict rules and higher fines (Poli de Figueiredo, 2001)	Increases in fines and drivers license withdrawal	New Traffic Code in Brazil 1998

COUNTRY	IMPAIRMENT ISSUES CONSIDERED	CAUSES OF BEHAVIOUR	SOCIAL / CULTURAL ISSUES	LEGISLATION ENFORCEMENT	CURRENT PREVENTION STRATEGIES
Brazil			Program based in observation and interviews with drivers and pedestrians (Caroadcante, 1998)		Programme for the training of military policemen and traffic accident prevention
Brazil			Educational actions and participatory actions in education sector, urban planning and communication and NGOs (Socorro, 2002)		Programme "Reduction of morbidity and mortality due to traffic accidents" developed by the Ministry of Health
Brazil	Alcohol			Enforcement of a law to reduce the blood levels of alcohol allowed from 0.80 to 0.60	
Chile	Alcohol	Young population do not perceived the alcohol intake as a risk and to RTI as an event due to the chance. Youngsters don't consider the transit rules transgression as something severe (Moyano-Díaz, 1997) Youngsters tend not to perceive road risks and consider "luck" as the factor related with RTI occurrence, they perceive an exclusive punitive role to policemen. (Moyano,	Road education in schools focused towards change in behaviour patterns, reinforcement of the importance of coexistence spaces (Aulestia, 2001)	Electronic charge in highways. Obligation to maintain current address of vehicle owner in the Register of Motorised Vehicles. (Fotoradar, 2002)	Technical Organ (Conaset) created in order to attack the problem of TA with three main lines to improve infrastructure and reduce Accidents. Allowances of more concessions for highway constructions. Use of road technology in order to improve security and quality in highways. Development of an organism for money recollection through carburetors tax: Fund for the Road Preservation. (López, 2002)

COUNTRY	IMPAIRMENT ISSUES CONSIDERED	CAUSES OF BEHAVIOUR	SOCIAL / CULTURAL ISSUES	LEGISLATION ENFORCEMENT	CURRENT PREVENTION STRATEGIES
Colombia	34% of deaths are related with alcohol in drivers and 23.3% in Motorcyclists	1998)			
Colombia	High speed and alcohol	Main causes of accidents: high speed and alcohol consumption, more deaths during nights and week ends (Posada, 2000)			
Colombia	Use of security belt and alcohol consumption	Use of seat belt and measure after and before (Espitia Victoria, 2002)	Law for the use of seat belt	Law for the use of seat belt	
Colombia				Obligatory insurance for transit accidents and creation of the National Fund for Road Prevention (1993, 1995) National Plan of Road Security and creation of the Inter-sectoral Commission of Highways Security (2000) Regulation of the New National Transit Code (Rodríguez, 2002)	Obligatory insurance for transit accidents and creation of the National Fund for Road Prevention (1993, 1995) National Plan of Road Security and creation of the Inter-sectoral Commission of Highways Security (2000) Regulation of the New National Transit Code (Rodríguez, 2002)

COUNTRY	IMPAIRMENT ISSUES CONSIDERED	CAUSES OF BEHAVIOUR	SOCIAL / CULTURAL ISSUES	LEGISLATION ENFORCEMENT	CURRENT PREVENTION STRATEGIES
Costa Rica	Inter-sectoral vision to solve traffic accidents	Social and political issues (Rojas Vargas, 2002)		Focus in having legal support and reliable and current information, as well as social participation	National Plan for the Promotion of Road Security: different phases, objectives and projections.
Costa Rica	Alcohol and RTI Deaths: In Rural Area 199 (61.4%) Urban Area: 125 (38.6%) (GRSP 2001)			Initiative with the consultant of GRSP and the Council of Road Security of Costa Rica	
Mexico	Alcohol 26.5% on death cases. Risk of severity of injuries: OR 10.8 CI 3.8-30.4 Breath sensor ER Risk of RTI Injuries and alcohol: OR 8.96; CI 2.01-39.96.	Different knowledge about vehicle security among children depending of higher socio-economic level. Higher level related to knowledge about seat belt use, helmet and smoke detectors. (Mock, 2002)	Poor Pedestrians had higher costs for health care and 80% of them had to pay out-of-pocket (p<0.05). Extended family networks as a prevention factor for traffic accidents. (Celis, 2002)		
Mexico	Cultural and social issues	lack or none knowledge of traffic signs and rules plus no experience in driving in pedestrians (Hijjar, 2003)	Knowledge in driving and of traffic signs and rules		
Mexico	Alcohol		Variables related to non use of security belt were alcohol consumption, size of vehicle, night time and specific stretch		

COUNTRY	IMPAIRMENT ISSUES CONSIDERED	CAUSES OF BEHAVIOUR	SOCIAL / CULTURAL ISSUES	LEGISLATION ENFORCEMENT	CURRENT PREVENTION STRATEGIES
			of the highway (Hijar, 1996) Alcohol as risk factor for severe injuries in traffic accidents (Hijar, 1998)		
Venezuela	Drugs : Marihuana 35% of RTI and 15% Cocaine Non association with RTI				

6.9 Discussion and suggestions for further research

- Although only a few papers were found that considered the role of impairment caused by alcohol in road accidents in the LAC region, it is very clear that alcohol plays a major role in contributing to the numbers of road accidents.
- Most of the studies and documents consulted for this particular review go beyond simply identifying the 'size' of the problem and often consider such issues as what interventions can best change behaviour and how to increase enforcement to reduce the impairment accidents.
- It was seldom possible to make comparisons between countries because most of the information reported was obtained from different sources and used different research methodologies.
- The concentration of studies in pedestrian injuries is consistent with the vehicle mix observed in motorised and developing countries where 'actors' like bicyclists, motorcyclists and pedestrians - and their risks - take on a special importance.
- It is clear that policing issues, the need for trained professionals in traffic safety, the status of traffic safety in government, the unclear role of the different sectors involved are all serious concerns for those currently working in the RTI field in the region. In particular the role of very pro-active NGO's needs to be clarified.
- The study of traffic accidents as a single item, using aggregated measurements, or making regional comparisons (as in 19% of the documents consulted in this review) is not very useful and prevents identifying the magnitude of the problem for individual traffic users, their location and particular characteristics. This limits the analysis of their determining factors, such as impairment. This is especially true in developing countries, in the Latin American and Caribbean region, where users, mainly pedestrians, street vendors and cyclists, share and struggle for road space with motor vehicles.
- Therefore, it is very important to discuss "space", as a fundamental variable in traffic injury studies. The process of simply counting accidents and using aggregated measurements (eg fatality rates) prevents the possibility of identifying the magnitude of the problem for different types of road user. It is necessary to consider a number of fundamental variables (eg location, 'local' conditions) in order to study and understand the problems.
- Approaching the accident problem through traditional epidemiological studies focus on the analysis of risk factors at the individual level, but do not allow for the identification of determining social factors over which one may define interventions based on the complexity and social context of the problem.
- It is clear that the published articles included in this study fail to identify what the situation actually is in Central America and the Caribbean countries. It will be necessary to conduct other studies, perhaps using new approaches, to know the complete situation with regard to impairment and driving in the Latin American and the Caribbean region.
- The large number of papers reporting on the size of the RTI problem in the region show there is a high level of concern about traffic accidents and their consequences.
- Obtaining reliable and accurate data about alcohol and other risk factors in RTI for different types of road user is urgently required - and is necessary in order to devise effective interventions.
- There is a lack of information in many of the region's countries. This may reflect the absence of research being conducted in these countries. The Central America

region would therefore be a suitable target area to support and conduct research: this could focus on developing appropriate and effective interventions.

6.10 Useful contacts

Programa de investigación en tránsito y transporte – pit universidad nacional de colombia
p293149@ing.unal.edu.co

Consejo Nacional de Seguridad de Tránsito (Conaset)
Santiago de Chile
Organización “Luchemos por la Vida. AC.” Buenos Aires, Argentina
www.luchemos.org.ar
Brazilian Pedestrian Association (ABRASPE)
www.iwalktoschool.org/brasil.htm
Charles Wright
Interamerican Development Bank. Expert advisor.
Alberto Concha PAHO/WHO

Personal Communications

MSc. Roy Rojas Vargas, Enfrentando los retos a través de una visión intersectorial, Foro Nacional sobre accidentes de tránsito en México, 10-11 Diciembre 2002, México, D.F. (Información sobre Costa Rica)

Rodríguez Deysi. Seguridad Road en Colombia. Foro Nacional sobre Accidentes de Tránsito en México, 10-11 de diciembre 2002. México, D.F.

‘Grey’ literature

Agrupación de Automovilistas de Chile. “Importantes cambios en la ley de tránsito. Santiago de Chile. Web page
www.fotoradar.com/adach/articulo.asp?ArticuloCat=1&ArticuloID=140

Aulestia Muñoz Danny. “Opina el presidente del Instituto de Formación Road de Uruguay Carlos Tabasso: En materia de tránsito, Chile es líder en América Latina”. Comisión Nacional de Seguridad de Tránsito. *Sólo Autos: Las Últimas Noticias*. Domingo 22 de julio de 2001. Santiago de Chile
<http://www.conaset.cl/html/noticias/2001/22072001.html>

Boyd Stephanie. “How the system makes us sick. The Peru File. Destination gridlock”. *New Internationalist* 331. January- February 2001. Web page
<http://www.newint.org/issue331/gridlock.htm>

Casado Luis. “Transporte: una política que consiste en no tener ninguna”. *Periódico Locomoción colectiva*. 25 de septiembre del 2002 Francia. Web page
www.locomocioncolectiva.cl/paginas/luiscasado.htm

Constance Paul. “The preventable plague” *Revista del Banco Interamericano de Desarrollo BIDAmérica*. Enero-Febrero 2000. Washington, EU. Web page

<http://iadb.org/iadbamerica/archive/stories/2000/eng/JAN00E/e200i.htm>

Daros E. "The Brazilian Pedestrian" Brazilian Pedestrian Association (ABRASPE). Brazil. Web page

<http://www.iwalktoschool.org/brasil.htm>

Della Porta Agostino. "Sobreviviendo en las calles. Entrevista con Charles Wright". *BIDAmérica. Revista del Banco Interamericano de Desarrollo*. 13 enero de 2003. Washington, EU. Web page

<http://iadb.org/idbamerica/Spanish/OCT01S/oct01s2.html>

Fernández Oriana. Primer estudio objetivo sobre efectos del ruido en Santiago. *El Mostrador* 13 de enero 2003. Santiago de Chile. Web page

<http://www.locomocioncolectiva.cl/paginas/rm.htm>

GRSP Annual Report. June 2001. Web page

http://www.grsproadsafety.org/activities/country_chapter_detail.asp?chapter_id=54

Industria Nacional de Autopartes A.C. Vehículos a nivel mundial: producción por área geográfica, producción por países y parque vehicular. México, D.F.

www.ina.com.mx

Isoba María Cristina. "¿El riesgo elegido?" *Revista Luchemos por la Vida*. Año 6 – No. 16. 2001. BA, Argentina. Web page

www.luchemos.org.ar

López Jaime. La Dirección General de Tráfico asesorará a los países sudamericanos interesados en educación y seguridad road. 20 noviembre 2002. *Revista El Mundo Motor*. Madrid, España. Web page

<http://elmundomotor.elmundomotor/2002/11/20/seguridad/1037818487.html>

Luchemos por la vida. Asociación Civil. "Accidentes de tránsito: tragedias cotidianas que pueden evitarse". Abril 2002. BA Argentina. Web page

www.luchemos.org.ar

Luchemos por la vida Asociación Civil. "Mujeres al volante". Abril 2002. BA. Argentina. Web page www.luchemos.org.ar

Luchemos por la vida. Asociación Civil. "Eficiencia de los controles de tránsito. Infracciones graves en la Ciudad de Buenos Aires". Mayo-junio 1997. BA Argentina. Web page

www.luchemos.org.ar

Luchemos por la Vida Revista. "Seguridad road en bicicletas" – Año 4 No. 11. 1999. BA Argentina. Web page

www.luchemos.org.ar

Luchemos por la vida. Asociación Civil. "El alcohol al volante mata. 22- Campaña de Concientización y Educación Road en TV y Radio". Octubre 2002. BA Argentina. Web page www.luchemos.org.ar

Luchemos por la vida. Asociación Civil. "Propuestas para la Ciudad de Buenos Aires convocada por el Gobierno de la ciudad de Buenos Aires". 14 de julio del 2000. BA Argentina.

Web page

www.luchemos.org.ar/espa/propuestasba.htm

Romero Elizabeth. "Importantes reformas a la ley de tránsito". *La Prensa. El Diario de los Nicaragüenses*. 4 de julio del 2002. Nicaragua. Web page

<http://www-ni.laprensa.com.ni/archivo/2002/julio/04/sucesos/>

Strategis.gc.ca. Market Assessment Canada. "Brazil- Intelligent Transportations Systems". Brasil. Web page

<http://strategis.ic.gc.ca/SSG/dd74942e.html>

Transport Research Laboratory Crowthorne, UK. "Colombia Project Sheet". Web page

<http://www.aitruk.com/Int/Colombia.html>

World Bank. "Thematic priorities. Road management, concessioning and transport enterprise reform, urban transport". Washington, EU. Web page
Wbln0018.worldbank.org/external/lac/lac.nsf *Documentos páginas WEB*

Estimating global roads fatalities, Factbook.net,

http://www.factbook.net/EGRF_Economic_costs.htm

Family characteristics and pedestrian injury risk in Mexican children, *IP Online Injury Prevention*, Future content, January 14, 2003,

<http://ip.bmjournals.com/misc/future.shtml>

GRSP News, Working together for road safety, Working together for road safety, Issue 2, July, 2000, <http://www.grsproadsafety.org/news/newsletter/actual2.html>

Involvement in accidents is traumatic in its consequences, there is no need to make it worse. <http://www.mexicoautotravel.com/articles/insimpt.asp>

Rural transport safety strategy, Rural Transport Knowledge Base, Rural Travel and Transport Program 2001, Buscador: Google

Unintentional injuries. Regional reconnaissance of policies and programs, PAHO-HCN Prevention of Unintentional Injuries. Non communicable diseases, Washington D.C. EUA, <http://165.158.1.110/english/hcn/hcnunintent.htm>

7 CONSULTATIONS WITH ROAD SAFETY ORGANISATIONS

In order to obtain more general information relevant to this study it was decided to conduct an informal consultation with research institutes, government ministries and NGOs in developing countries by means of an email survey. The objectives were to cover as many developing countries as possible, obtain information on impairment factors from the individual respondents, identify individuals and institutes with an 'interest' in impairment factors and to seek collaborators for possible future research. It was recognised at the outset that this type of survey would provide information that was neither objective nor fully representative of the situation. However, it was seen as a method of establishing contact with interested practitioners who might not already be known.

The first step involved identifying suitable e-mail contact addresses. This was done using contacts from previous e-mail surveys undertaken by TRL, identifying suitable contacts established during other research projects conducted in developing countries and targeting organisations known to have an interest in this specialist area. The second stage involved transmitting, by e-mail, a short questionnaire to all the identified individuals and organisations. The questionnaire and covering letter are given in Annex 7.1. Recipients were encouraged to pass on the questionnaire to others who they thought might be interested or better able to complete the questionnaire. Follow-up phone calls were made to clarify any problems with the returned questionnaires.

It was recognised at the outset that this type of survey was likely to produce biased and subjective information. It will, for example, be biased in favour of 'English speakers' and the results provided will be of a subjective nature and restricted to the perceptions of the individuals who have (or find) the time to complete the survey. In spite of these concerns it was decided that it would be a worthwhile exercise since it was likely to broaden the scope of the review beyond the particular areas of the regional reviews and might also identify key individuals who could be involved in future research studies. It was also considered that this type of survey would be relatively inexpensive – and as such if it proved successful could be used as a model for other research studies in developing countries.

However, it must be reported that this exercise was not very successful and that the response rate was very poor despite the mailing of a reminder e-mail sent between two and three weeks after the initial mailing. Nearly 90 questionnaires were sent out (sometimes more than one was sent to a particular country) and only 10 completed questionnaires were actually returned. It should be mentioned that a significant proportion was not delivered ('unroutable') because the address was no longer valid.

In spite of the small number of responses some useful information (and contacts) was obtained that will be briefly summarised here. It was explained that 'impairment' in this context referred to driving after consuming alcohol or drugs, or while tired.

The majority of responses (N = 6) were from Sub-Saharan Africa (where TRL has carried out a great deal of research and has built up many good contacts), two were from the Far East and two were from South America and the Caribbean. All those responding were told that their names would remain confidential.

All 10 respondents (100%) thought that there was a road safety problem caused by driving after drinking alcohol, 80% thought that there were similar problems associated with both taking drugs and driving while tired or fatigued. 'Only' 60% thought there was problem with impaired pedestrians. While these results come from a small sample of committed road safety practitioners (or medics) and are only subjective, they do suggest that the problem of impaired driving in developing countries is an important one.

When asked if there were problems with 'drugs' other than alcohol a variety of responses were provided. While one respondent mentioned 'medicinal and recreation drugs', others referred to: marijuana, cannabis, miraa (khat), bhang/bhangi, amphetamines/metamphetamines (locally called Shabu), opium, cocaine, crack and even ecstasy. Driving after using drugs is recognised as a problem around the world. Also, it is clear that many drugs (such as marijuana) are known by a wide range of names around the world – and even within a particular country.

Seven of the respondents thought that the main motive for taking drugs was 'social', four thought that it was to 'keep drivers awake' and only one thought the main motive was 'medicinal'. Note that two of the respondents 'ticked' 2 reasons although they were requested to only tick one.

Six respondents thought that 'all drivers' were the main problem, three thought that 'private drivers' were the problem and only one respondent thought that 'commercial/professional' drivers were the main problem.

Only three of those responding were aware of any statistics or research publications that presented information on the size of the (impairment) problem in their countries, while 7 were not aware of such information. While half (N = 5) were aware of either 'individuals, research institutes or government departments' who we should contact to find out more about impairment and road safety in their country (eg NRSC, Police Department, AA, Ministry of Works), 5 did not know of any suitable contact.

With regard to existing 'traffic laws (regulations)' 9 of the 10 knew a law existed about drinking alcohol and driving, 6 were aware of a law about driving after taking drugs (one said that there was no enforcement of this law), but only one was aware of any regulation about 'driving while tired (eg maximum hours each day for lorry drivers)'. It should be noted that this information was based on what the respondent thought was the situation and not necessarily what was the legal situation.

Nine of the respondents said that they would be prepared to help further with the study or possible act as partner in future research studies. This interest and commitment might be useful when identifying possible countries for conducting future studies.

A number of interesting additional comments were made. For example, different individuals stated:

"it (impaired driving) is a huge problem"

"drinking and driving is condoned in our society"

"it's mainly a problem of the poor"

"there is no enforcement of the law"

"the police have no breathalysers so cannot enforce the law – and the people know it"

"there is no equipment to measure a driver's BAC level so nothing is done"

"our drivers are very 'macho' to suggest they don't drink is an insult"

"we have a 'boys will be boys' mentality; they do what they want"

"it's mainly a young driver problem, they are ill-disciplined and feel they are invincible"

"nobody will blame anybody they know – even the police – and nearly everybody knows everyone"

"half of the minibus public drivers are drunk or drugged and so it is accepted as normal"

"alcohol and drugs are part of our lives"

"there is a problem with pedestrians"

"there is a problem with public (transport) drivers"

In summary, although the response to this survey was disappointing it did produce some useful information and contacts. However, the small number of respondents means that the finding cannot be generalised and should be interpreted as being qualitative rather than quantitative in nature. The responses clearly reveal a recognition that impaired driving is a large a problem. They also revealed that the problem is very complex – and differs greatly from country to country. Even with the limited number of responses received it was clear that the problem of drinking and drugs extend beyond road safety and is often ingrained within the society. Such qualitative information is valuable in alerting future activities about both the size and complexity of the problem being addressed, and the need to consider the social context of the behaviour.

8 IMPAIRED DRIVING AND COUNTERMEASURES IN DEVELOPED COUNTRIES

8.1 Introduction

Death and injury from road crashes and motor vehicle collisions with pedestrians constitute a major public health problem. The years of expected life lost as the result of motor vehicle crashes and collisions are at similar levels to those lost from the major modern epidemics of cardiovascular disease and cancer. Alcohol, and increasingly drug consumption, along with fatigue and sleepiness, cause a reduction in driving capability, resulting in an alarming number of road traffic accidents and associated fatalities. The following sections describe the characteristics of different impairment problems in the developed world, providing statistics from particular geographic areas of concern.

8.2 Drink Driving

As reported by the European Transport Safety Council in 'Reducing Traffic Injuries Resulting from Alcohol Impairment' (ETSC, 1995), international research indicates that the combination of drinking and driving is one of the most important factors that influence traffic safety. Five percent of the driver population under the influence of alcohol at any time can cause a significant proportion (around 20%) of fatal and severe injuries in road traffic accidents (RTA's). Hence a minor reduction of driving under the influence (DUI) of alcohol would have a large impact on accident rates. Drinking and driving is most problematic in private road transport where, unlike public transport operations, it is more difficult to control driver behaviour, and to enforce drink driving-legislation.

Alcohol is a sedative drug, which affects the central nervous system in a similar way to other anaesthetic drugs, resulting in a depression of brain mechanisms, thus affecting various behavioural and cognitive capabilities. Consequently, reaction times of an inebriated driver are reduced by 10-30%, as the brain function is affected and information to the eye and other muscles is delayed. In addition, vision can be impaired by alcohol consumption, with night vision reduced by as much as 25% (IAS, 2002). Alcohol can also cause behavioural change in a driver, giving them a sense of over-confidence and causing them to take unnecessary risks, such as driving competitively or at excessive speeds. Both laboratory and on-the-road tests have demonstrated a reduction in driver performance, even with BAC levels below 0.5 mg/ml, decreasing further with higher intoxication (ETSC, 1995).

A number of epidemiological studies have been undertaken to ascertain the correlation between road traffic accidents and blood alcohol concentration levels. Among these include a study conducted in Toronto, Canada by Lucas et al (1955), The 'Grand Rapids' study conducted in Michigan, USA by Borkenstein et al (1964) between 1962-63, and more recently a study of crash risk conducted in Long Beach, California and Fort Lauderdale, Florida (Moskowitz, 2002). The latest study, which involved sampling of 4,919 drivers from 2,871 accidents occurring between 1997 to 1999, confirmed the results of previous studies, that the accident risk rises with increased BAC, beginning at 0.4 mg/ml, and an accelerated rise at BAC's in excess of

1.0 mg/ml. Whilst Moskowitz and colleagues reveal that the earlier risk estimates were likely to be a significant underestimate of the true crash risk produced by alcohol, their study showed that relative risk estimates for BAC's below 0.4 mg/ml were not significantly different from the risk at 0.0 mg/ml. This is reflected in the blood alcohol concentration legislation of the United States, which has the highest permissible BAC level amongst all countries (a total of 53) where BAC legislation exists, with some states enforcing 1.0 mg/ml as the BAC threshold for impaired driving (ICAP, 2002).

A similar study was undertaken by the University of Adelaide in Australia, which investigated both the relationship between a driver's BAC and the risk of involvement in a crash, and the relationship between a driver's choice of travelling speed and the risk of involvement in a crash (McLean and Kloeden, 2002). The results of the former study indicated that, at a BAC of 0.5 mg/ml, the risk of crash involvement was found to be 1.83 times greater than for a sober driver, and five times as great, at a BAC of 1.0 mg/ml.

In the UK, where the current BAC legislation is 0.8 mg/ml, 90% of convicted drink-drivers are male, 10% of those convicted are aged under 21 years and 52% of convicted motorists are aged under 33 years. Drink driving accidents are found to occur most frequently between the hours of 10pm and 4am when approximately 50% of drivers involved in fatal road traffic accidents are above the legal BAC limit, rising to 60% on Fridays and Saturdays (DTLR, 2001). The number of accidents caused by alcohol impairment is highest in July and August, followed by the period over Christmas and New Year.

The number of deaths and injuries, resulting from accidents involving illegal alcohol levels in the UK, have steadily declined since the late 1970s. The total number of alcohol related RTAs reduced by over 15% between 1979 and 1983 (the year in which evidential breath testing machines were introduced) to 26,520, and accident casualties reached a record low in 1993 with only 14,980 injuries. This has since increased again to 18,030 in 2000, along with a rise in the number of drink-driving related fatalities that reached a minimum of 460 in two consecutive years (1998 and 1999), but rising to 520 deaths in 2000, predominantly in the 30-39 age group (DTLR, 2001).

The peak age for becoming a high risk offender is 27 years, in particular male manual workers or unemployed males, as well as older professional/managerial males, although high risk offenders rarely exceed the age of 45 (Home Office, 2000).

High-risk offenders are defined as recidivist offenders of drink-driving. Since 1990, in the UK, a high risk offender (HRO) is categorised by one of the following (Maycock, 1997):

1. A driver who has been disqualified once for driving with an alcohol level in excess of 2.5 times the legal limit
2. A driver who has been disqualified twice within a ten year period for any drink-drive offence
3. A driver who has been disqualified for failing to provide a sample for analysis

High-risk offenders are disqualified in order to keep recidivist offenders off the road where they pose an extreme threat to themselves and other drivers, and are required to

undertake a medical assessment before getting their licence back. In the first year of the scheme there were 39,000 HRO's convicted, but this number has been declining by 4-5% per year ever since. HRO's, also known as 'persisters' (drink-drive offenders with previous convictions) predominantly fall into the semi-skilled, unskilled and unemployed occupation group, and tend to be male, aged between 25-44 years (Research Services Ltd, 1994).

A study of 'HRO data' supplied by the Driver and Vehicle Licensing Agency (DVLA) and Home Office 'Offenders Index' (OI) in the UK found that those who had committed previous drink-drive offences were more likely to re-offend than those who had been driving with high alcohol levels (2.5 times the legal limit of 0.8 mg/ml). When re-offending behaviour of HRO's was examined, those with two drink-drive convictions within a three year period were found to form a particularly high risk group, with many more likely to drive whilst disqualified (Davies and Broughton, 2002).

Around 12% of convicted drink-drivers are convicted of a second offence within ten years (Home Office, 2000), and 40% of convicted drink-drivers have previous convictions for other offences. These astonishing statistics call into question the effectiveness of the High-Risk Offenders scheme, particularly as there is no irrefutable evidence that the HRO scheme reduces subsequent offence rates. Nevertheless, whilst its effectiveness as a deterrent from drink-driving is in dispute, its short term objective is to keep habitual drink-drivers off the roads.

The French legal limit for driving while under the influence of alcohol was reduced to 0.5 mg/ml in 1995, yet Filou (2002) suggests that the more stringent legislation has had no influence on the number of drivers involved in injury accidents with an illegal alcohol rate. He also found there to be no reduction in the mean alcohol rate of convicted drivers (2.15 mg/ml). Filou also exposes the fact that French statistics related to alcohol levels of drivers involved in injury accidents are incomplete, with data available for only 88% of RTA's, accounting for results of breath tests and not necessarily blood samples. Since 2001, it has become compulsory to record the level of alcohol and drugs in drivers involved in fatal crashes, which will provide more accurate data for future comparisons.

In countries of Central and Eastern Europe, drinking and driving legislation is strict, with BAC levels at between 0.0 mg/ml and 0.5 mg/ml. Those convicted of driving under the influence of alcohol in all Central and Eastern European countries can have their licence suspended after the first offence, and increasingly, countries are introducing enforcement measures. Bulgaria is a case in point, where traffic police are equipped with breathalysers and blood testing is becoming commonplace. Under Bulgarian legislation, the authorities may also permanently revoke an offender's driving licence after second offences (Iontchev, 1998).

In the USA, drink-driving is also a major highway safety problem with 16,653 alcohol related fatal crashes occurring in 2000 alone, comprising 40% of all RTAs – a 25% decline from RTA statistics in 1990 (NHTSA, 2001).

In a study of driver records in the State of Maryland, USA, Rauch et al (2002) estimated the probability of survival without alcohol-related recidivism among drivers

with zero or one prior alcohol-related event. They found that any alcohol related traffic incident among first offenders, significantly and substantially increases the future risk of an alcohol related event, and that alcohol impaired driving recidivism among first offenders more closely resembles that of multiple alcohol offenders.

Clearly, the seminal contributions to the field of alcohol safety related to the relative risk of a crash produced by a driver's blood alcohol concentration have done much to emphasise the need for more stringent legislation and enforcement. The Grand Rapids study, for instance, was one of the earliest and largest studies of its kind and had a strong influence on impaired driving laws in the United States and abroad. Borkenstein left an important legacy to the field of impaired driving through his demonstration that rapid breath-test measurements could be made by ordinary police officers. This led to the adoption of a breath sample as the method of choice for the enforcement of BAC limits in most countries and to the rapid development of small handheld preliminary breath sensors that provided the basis for random-testing programmes around the world. Enforcement of drink driving legislation is discussed further in Section 9.3.

8.3 Drugs and Driving

Historically there has been less 'concern' (and research) on the problems associated with drugs and driving. Partly this is a result of the more prevalent and transparent problems resulting from drinking and driving. Many developed countries can be viewed as 'alcohol societies' – rather than 'drug cultures' that can be said to exist in certain regions of the world; although often alcohol and drugs co-exist within societies and cultures. However, in developed countries at least, there has been an explosion over the last 20 to 30 years in both the numbers of people using 'drugs' and the types of drugs being consumed. This is true for both prescription drugs (eg tranquilisers) and so-called recreational drugs (eg marijuana). More recently the types of such drugs has changed dramatically with many more people 'using' drugs such as heroin, cocaine and (more recently) ecstasy – all drugs which are likely to impair driving activities. It is a daunting proposition to consider that the dramatic increase of drug use in developed countries is matched by a similar increase in the consumption of alcohol in many developing countries.

Between 1985 and 1987 the Transport Research Laboratory (TRL) carried out a study to measure the incidence of drugs in fatal road accident casualties in the UK. This showed that the incidence of medicinal drugs (5.5%) and drugs of abuse (3%) was relatively low in comparison to alcohol, which was found in 35% of cases (Everest et al, 1989).

More recent research, undertaken by TRL has shown that illicit drug taking has increased by a factor of six since the earlier study. Over the same period, the incidence of medicinal drugs and alcohol has remained very similar and overall, drug taking has increased by a factor of three (Tunbridge et al, 2001). The study, whose objectives were to monitor trends in drug use in road casualties and to relate blood alcohol levels in fatal road accident casualties with any associated drug use, found that, of the 1184 casualties sampled, 24% had traces of medicinal or illicit drugs. Cannabis was the drug most frequently found among casualties, demonstrating a rise

in the incidence of cannabis in fatal road casualties by 9.3% to 11.9%, since the previous study in the 1980s.

In a survey of illicit drug use in different European countries, de Gier (2000) notes the difficulties in making comparisons across studies because of the lack of conventions used in reporting findings. In Belgium, the Belgian Toxicology and Trauma Study, carried out between 1995-6 involved a sample of 2,143 patients admitted to six hospital emergency departments following a traffic accident. 19% of the sample were tested positive on one or more of the following: amphetamines, benzodiazepines (sedatives), barbiturates, cannabis, cocaine, opiates, methadone and propoxyphene, with 27% of these cases also found with BAC exceeding the legal limit of 0.5 mg/ml.

In comparing a Danish study undertaken in 1996 (Worm et al, 1996) and a similar investigation in Norway (Kruse et al, 1994), the drug use patterns associated with traffic violations proved to be quite different, with Cannabis being the most frequently observed drug amongst the sample of drivers in Norway, compared with Methadone in Denmark. Despite the fact that Denmark and Norway are both Scandinavian countries of similar size and population, the studies demonstrate how disparate drug use patterns are amongst European countries.

Investigations carried out in Germany have also demonstrated the prevalence of drug (and alcohol) use while driving. Of a sample of 650 drivers stopped for suspicion of driving under the influence of alcohol, 10.4% had consumed Cannabis, while 16.7% had taken benzodiazepines in addition to alcohol (Rittner, 1991). A similar study carried out by Möller (1994) using 660 blood samples of driving under the influence cases found that in 10% of cases, licit and illicit drugs were found in addition to alcohol, and in 3.3% licit and illicit drugs were found alone.

Certainly there is reason to believe that European drivers are regularly driving after consuming medication. In Germany for example, the Möller study found that over a third of cases found positive for drugs were from licit medications. In Spain, a survey carried out by the University of Roadladolid and the National Traffic Agency revealed that 5% of Spanish drivers are regularly taking medication that can impair driver performance (Del Rio and Alvarez, 1996). In summarising this collection of European case studies, de Gier notes that the most frequently detected licit drugs in all driver populations are benzodiazepines, normally observed in the older age categories above 40 years.

Driving under the influence of drugs (DUID) has been a statutory offence in Ireland since the 1961 Road Traffic Act. Yet the law does not set prohibited concentrations for drugs nor does it distinguish between legal and illegal drugs. As part of the Irish Government's Strategy for Road Safety 1998 - 2002, the Medical Bureau of Road Safety was commissioned to carry out a nation-wide survey on the current trends and epidemiology in driving under the influence of drugs in Ireland. Over 1800 specimens were analysed and the preliminary results indicate that 46% of the sample under the legal alcohol limit and 26% over the legal limit contain drugs (Cusack, 2002). The legislation with regard to drugs/driving will be reviewed in light of the findings, both analytical and epidemiological.

All too often, the potential risk of drivers causing traffic crashes under the influence of prescribed drugs is ignored by patients and also by pharmacists and physicians. In order to investigate this assertion, a questionnaire survey of 1161 drivers conducted in Poland (Florek, et al, 2002) found that the prescribed drugs most frequently taken by drivers are pain relievers (35.6% of drivers sampled) and benzodiazepines (11.1% of drivers sampled). The most popular benzodiazepine was diazepam, taken by 40% of drivers found to have consumed benzodiazepines. The study concluded that knowledge of traffic regulations among Polish drivers is low. Almost 18% of them think that the law does not forbid driving after taking drugs, and only 27% of drivers know that this kind of regulation exists.

Evidently, the medicinal drugs with the most negative effect documented for road traffic safety seem to be benzodiazepines. From several studies, increased risk factors have been documented when benzodiazepines are used both therapeutically and probably with a higher risk when misused at a higher dose. In 2001, flunitrazepam and diazepam were detected in 30% and 25% of drug positive cases, respectively, in a study comparing the prevalence of different drugs among apprehended drivers in the Nordic countries. The majority of the drivers were men (85 – 88%), aged 20 – 35 years, often with earlier convictions for drunken or drugged driving, and a higher probability to be arrested again (Christophersen, 2002).

In Norway, Benzodiazepines are commonly abused drugs, with 10-15% of drivers apprehended for suspected impaired driving, having benzodiazepines in their blood upon testing. The aim of the study, conducted by the National Institute of Forensic Toxicology and Norwegian Institute of Public Health (Bramness et al, 2002), was to see whether blood benzodiazepine concentration levels were related to a physician's conclusion of 'not impaired' or 'impaired'. Of 90,000 blood samples from cases of suspected driving under the influence from the period 1987 to 1998, approximately 9,500 samples contained benzodiazepines, and of those, 81% of suspected drivers were determined to be 'impaired'. Very limited background information about the subjects' intake of drugs was obtained, and in most instances, neither the dose nor the time of intake was known. Hence a pharmacodynamic phenomenon like acute tolerance would greatly vary depending on time since last drug intake and dose ingested.

Despite all these possible uncertainties and limitations a clear concentration effect relationship was still found, measured as benzodiazepine drug concentrations and clinically assessed impairment, even after adjustment was made for background variables. The relationship is of a similar magnitude to that found in the control group of drunken drivers, at least for mildly and moderately elevated BAC.

In most surveys reported in different European countries the prevalence of licit drug use falls in the range of 5-15%, and illicit drug use in the range of 1-5%. In the general (non-accident) driving population, cannabinoids are the most frequently detected illicit drug, with the use of opiates less frequently observed (for instance, 5% of late night weekend drivers found with cannabis, compared with 1.3% found with opiates amongst DUI cases in the Netherlands).

In Australia, research commissioned by the Road Safety Committee of the Parliament of Victoria showed that a quarter of all accident fatalities had drugs in their bodies.

Drivers who consume drugs alone or with alcohol have a higher risk of being in a fatal crash than those who are drug free, and that the incidence of drugs in drivers killed is now comparable to the incidence of alcohol. In Victoria, the presence of drugs in drivers of itself is not the issue, but rather the driver impairment caused by drugs. Boorman (2002) reports that impairment cannot be established by quantification of the drugs present because the variable characteristics of each drug coupled with the variable factors for each person make it impractical to set quantitative impairment levels.

Certainly, sources of data and the methods by which they are collected can cause methodological problems. The first source of data is official records (police, coroner, medical), which has limitations because data on illicit drug use are not routinely collected. Even when drug tests are carried out, only a select number of drugs are tested. In official records underreporting is a serious problem, because they tend to contain only the most extreme cases.

Different methods of data collection used in surveys have their own problems. The method of drug analyses in blood, sweat, saliva or urine has problems with respect to sample collection, handling and transportation as well as toxicological assays used. Interpretation of drug levels detected is difficult; for example cannabinoids can be detected in urine many days, even weeks, after use and the relevance of this to traffic safety is obscure (de Gier, 2002). Hence blood specimens are considered to be essential for surveys of illicit drugs and driving, yet blood sampling is fraught with regulatory problems that are discussed in Section 9.3.

Methodological issues compound the problem of data collection in the following ways:

- Studies that have been conducted after a crash in a hospital setting among persons with an injury are undertaken only in major trauma care centres
- It is not clear from some studies whether it was all injured persons or selected injury subjects that were included
- Some studies have been undertaken on fatally injured subjects
- A combination of alcohol and other drugs like marijuana, cocaine have been studied among crash victims and it becomes difficult to isolate the effects at an individual level
- Drug testing based on urine analysis or toxicological studies do not mention the periods between time of consumption, time of crash and time of testing (Waller et al, 1995).

A complete understanding of the problem of illicit drugs and driving will only be achieved in two complementary approaches: experimentation and epidemiology. Experimental studies focus on drug effects on psychomotor performance, in particular the types of skills affected and the dosages used. Questions on the extent or magnitude of this problem, as well as the determination of which drugs are risk factors for collision involvement, can be answered in sound epidemiological research (de Gier, 2002).

8.4 Driving Fatigue

In the literature on driver fatigue and sleep related vehicle accidents, sleepiness is distinguished from terms such as 'fatigue', defined as a disinclination to continue performing the task at hand (Brown, 1994), because it comprises inattention due to distractions and preoccupations.

Data on driver sleepiness is derived either from traffic accidents involving a driver that was evidently asleep at the time of the crash, or from public surveys. In a UK survey of 4,600 male drivers conducted in 1995, 29% admitted they had nearly fallen asleep at the wheel in the previous year (Maycock, 1995). Since then, a survey of 1,209 motorists compiled by the Lex Report on Motoring (1997) reported that 30% of those driving private cars had driven 'while very tired' in the previous year, whilst 51% of drivers with company cars admitted having driven while very tired, and 44% said they had fallen asleep at the wheel at least once in the past year.

Similarly in the United States, a poll conducted in the early 1990s found that 52% of drivers had felt sleepy while driving at least once in the past year (National Sleep Foundation, 1993; cited in Flatley and Rayner, 2000). A follow up study of 956 people found that 62% had driven a vehicle while drowsy, whilst 27% admitted having fallen asleep at the wheel in the previous twelve months (Johnson, 1999; cited in Stutts, 2000).

The incidence of fatigue whilst driving is typically captured by certain criteria that determine the state of drivers involved in road traffic accidents, where poor weather conditions, alcohol and drug use, mechanical failure and excessive speed are factored out. The Sleep Research Laboratory at Loughborough University have created the following set of seven criteria used to define a crash as a probable (when all seven criteria are accounted for) or possible (when criteria 1-6 are accounted for) sleep related vehicle accident (SRVA) (Horne and Reyner, 1995):

1. Good weather conditions and clear visibility
2. Breathalyser/blood alcohol levels were below the legal driving limit
3. Vehicle either ran off the carriageway, or ran into another vehicle that was clearly visible, implying prolonged inattention
4. No sign that the driver has applied the brakes (no skid marks visible)
5. No mechanical defects to the vehicle
6. Elimination of 'speeding' and 'driving too close to the vehicle in front' as possible causes
7. The police officer at the scene suspected 'sleepiness'

The prevalence of SRVA's varies from country to country, with driver sleepiness being the cause of between 1.5% (in the United States) to over 30% (on UK motorways) of road traffic accidents (including fatal accidents), and as much as 40% of fatal RTAs on the New York State highway (Reyner, Flatley and Horne, 1998; Flatley and Rayner, 1995). Sleep-related vehicle accidents typically result in fatalities because there tends to be no braking or attempt to avoid a collision before impact. Research has indicated that the peak times for driver drowsiness to occur are between midnight and 6am (particularly prevalent amongst male drivers under the age of thirty years), and between 2pm and 4pm (especially for older male drivers). As one might expect, drivers who are already sleepy before they set off on a journey are more prone

to SRVS's, as are those suffering from sleep disorders, including sleep apnea and narcolepsy.

Skilled manual workers and shift workers, who are often exposed to long driving hours as part of their profession, have a greater risk of being involved in an SRVA (Horne and Rayner, 2001; Rogers, et al, 1999), with 40% of SRVA's involving commercial vehicles.

Fatigue in commercial road transport is extremely commonplace, as commercial drivers are most vulnerable to the effects of fatigue. There is shown to be an increased risk of fatigue-related accidents at night (a risk factor ten times higher than daytime levels), an increased risk the greater the length of the working day, and with irregular working hours. The majority of commercial drivers are subject to these working conditions, with many working over 55 hours in a working week, which is the threshold for accident peaks (ETSC, 2001). It is not surprising then that 50% of long-haul drivers have fallen asleep at the wheel during their career (Hamelin, 2000).

In the European Union, HGV drivers engaged in transport operations for hire work the longest of all commercial driver categories (an average of 11 hours per day, 60.5 hours per week) across all countries (ETSC, 2001). However, one third of the driver's time is spent waiting, loading or unloading the vehicle. Consequently there is a major discrepancy in existing EU legislation, with the European Regulation EEC 3820/85 permitting drivers to drive up to an average of 45 hours a week, and up to 56 hours one week in two. This means that, including non-driving time, the drivers work span is legally permissible up to an average of 13 hours in one stretch. This legislation is clearly ineffective as accident risk data reveals that the risk of being involved in an accident doubles after 11 hours of work span (Hamelin, 1987).

The consequences of fatal accidents involving heavy goods vehicles (HGV) do not just impact on the truck operators, but rather, have serious implications for civic society, particularly due to the socio-economic costs of accidents associated with fatigue. An estimated 60% of the total cost of traffic accidents involving commercial cargo carrying trucks in the United States are borne by society rather than the truck operator (Morris, 1996).

Clearly, fatigue and sleepiness while driving are difficult to counteract through legislation and enforcement, except in the commercial sector, but even here the safety of truck drivers and other road users is being compromised by ineffective legislation, especially in the EU. Nonetheless, there are clearly social and cultural factors that impact on driver fatigue, such as sleep deprivation, prolonged vehicle journeys without stopping, and driving at high risk periods of the day when driving performance deteriorates. There are ways in which SRVA's can be prevented, including driver behaviour, engineering countermeasures (including hard shoulder rumble strips to alert drivers that they have drifted out of their lane), education and advice to drivers on the roadside, all of which are explored in the next section.

9 CURRENT ROAD SAFETY MEASURES

The evidence suggests that a minor reduction of driving under the influence of alcohol and drugs would have a large effect on accident occurrence (ETSC, 1995). There is wide agreement in the international scientific literature that increasing drivers' perception of the risk of being detected for excess alcohol is a very important element in any package of measures to reduce alcohol related crashes. Police powers, procedures and the type of evidentiary equipment used all play a large part in determining the extent to which this objective can be reached.

9.1 Social and Cultural Factors

Social and cultural factors refers to public awareness of driver impairment cause and effects, with an emphasis on countermeasures that use education, rehabilitation and publicity to deter people from driving while impaired, and to prevent recidivist offenders from re-offending.

In response to the moderate success of the High Risk Offenders scheme in the UK, the Department of Transport set up an experimental scheme in 1993 to provide education/rehabilitation courses for drink drive offenders in 22 areas of Britain. The courses, costing up to £200 were voluntary and aimed at first time offenders who were requested to pay for the course themselves. The scheme was criticised by some road safety groups who considered payment for the course, in return for a 25% reduction in their period of disqualification, as a pay-off for the penalty incurred on conviction (IAS, 2002).

Results of these courses have been very encouraging, with course participants shown to be better informed about the effects of alcohol on driving, and up to three times less likely to re-offend. Consequently, the scheme was expanded to 175 areas of Britain and Northern Ireland in 1999. Following Parliamentary approval, the Government made an Order (The Courses for Drink-Drive Offenders Order 1999), ending the experimental period and giving permanent effect to the legislation across the whole of Great Britain from 1 January 2000.

The ETSC (1995) recognise that the transfer of knowledge of the effects of alcohol on performance and the consequences of driving a vehicle should have an important place in the curriculum. For school aged children, the topic is often set in existing health education or traffic safety programmes. For driver training, theoretical lessons are normally limited to traffic rules and behavioural codes. More attention could be paid to alcohol and traffic, focusing on the relationship between drink driving and accidents.

Anti-drink drive publicity campaigns have been effective in reducing accident casualties. The first British Government anti-drink drive campaign was launched in 1967 to coincide with the introduction of roadside breath testing, but the campaigns really began to take effect when, in 1987, a large drop in the incidence of drink related traffic accidents took place, at the same time television advertising shifted emphasis from warnings about drivers getting caught, to the fact that 'drinking and driving wrecks lives'.

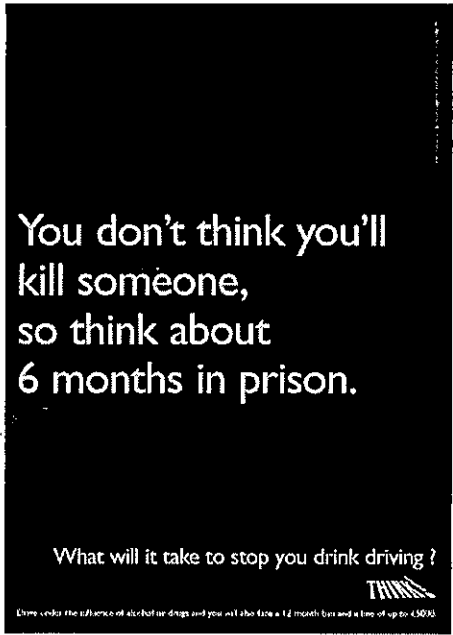
The publicity campaigns have since got increasingly graphic in relaying the stark reality of drink-drive impact statistics. The more recent Department for Transport's Think! Road Safety campaign, branded in 2000 with a series of radio and television commercials and posters at point of sale (bars and clubs) has continued the success of the drink-drive campaign, and consequently, the percentage of people failing breath tests after road injury accidents has fallen from 8.5% in 1990 to 3.7% in 2000.

The Department for Transport has joined forces with the Rugby Football League to tackle drink driving in Great Britain by signing on as the major sponsor of the Great Britain Rugby League team for New Zealand's tour to England for the 2002/2003 season. The test series is officially known as the Think! Don't Drink Drive Test Series and the Department's Think! logo will appear on the front of the Great Britain Rugby League team's jerseys. The sponsorship enables the Department to communicate their Think! Don't Drink Drive message to rugby league followers at the high profile test matches and television broadcasts to educate them about the dangers and consequences of drinking driving.

The alcohol beverage industry comprises an array of competing companies who recognise the need to encourage more responsible use of alcohol, since the cause and effects of alcohol abuse can be extremely destructive to an industry that relies heavily on reputation. Indeed, reckless drinking, irresponsible advertising and inappropriate promotional activities can have serious consequences for the industry, not only reflected in sales figures, but also in restrictive government regulation.

As far back as the 1930s, advertising campaigns for a US and Canadian distiller extolled the need for moderation when consuming alcohol (Max and Willersdorf, 2001). However, it was only in the late 1980s that major drinks companies began to review alcohol related social issues such as underage drinking and drink-driving, which culminated in the creation of social aspects organisations (SAO) to promote responsible drinking and the reduction of alcohol misuse. There are now over thirty SAO's in Europe, Australasia and North America and drinking and driving is the main topic addressed by these industry sponsored programmes, yet they have been subject to intense criticism that the programmes and policy options put forward by the SAO's are not impartial to the interests of the beverage alcohol industry. Indeed, the UK's Department for Transport have recently been condemned for changing its position on the drink driving limit in favour of the alcohol industry, rather than independent public health interests and the views of experts in road safety, law enforcement and alcohol policy (The Globe, 2002).

The effects of drugs (other than alcohol) on driving ability are not well understood by drivers. A concerted effort is being made to educate drivers and health care



**You don't think you'll
kill someone,
so think about
6 months in prison.**

What will it take to stop you drink driving ?

THINK!

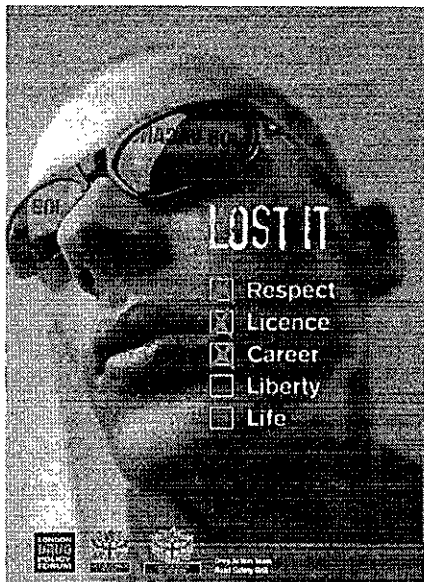
Even under the influence of alcohol or drugs and you will also face a 12 month ban and a fine of up to £5000

professionals about the impairing effects of some drugs. This will involve a wide range of organisations in the public and private sectors. In association with key professional groups, information and resource materials are being developed that are appropriate for doctors, pharmacists, dentists and pharmaceutical manufacturers.

Victoria (Australia) is developing a Drugs and Driving Code of Practice to enable health professionals to provide advice to the public about the likely effects of medications on driving (VicRoads, 2001). Peak bodies representing the medical profession, pharmacists, pharmaceutical manufacturers and relevant regulatory bodies will be urged to promote the national adoption of the Code to ensure a consistent approach to the provision of advice. Public education and awareness campaigns will be implemented to alert drivers to the effects of some medications on safe driving.

In Europe different approaches are possible for reducing the danger of driving under the influence of medicinal drugs. One of the most important is prevention. Patients must be warned of the dangers of driving under the influence of certain drugs. This should be done by the prescribing physician and by the pharmacist who dispenses the medicines. The summary of product characteristics or package insert contains a warning (if applicable) but experience has shown that it is often very vague and not informative. To draw the attention of the patient, a pictogram can be printed on the package. In Europe, eight countries (the five Nordic countries, Austria, The Netherlands and France) have a warning pictogram, and the experience has not been very good. This pictogram is a red triangle in the Nordic countries, a red triangle with a black car in France, and a sticker that can be used by the pharmacist in the Netherlands (Verstraete, 2002). Yet, countries that have a system of using pictograms on packaging are unhappy about it, and countries that don't have it, would like to introduce it.

The Prescribing and Dispensing Guidelines for Medicinal Drugs affecting Driving Performance published by an ICADTS Working Group have been available since June 2001 (ICADTS, 2001a). Yet, clearly the problem of licit drug consumption by drivers continues to prevail and is as prolific, if not more so than driving under the influence of illicit drugs.



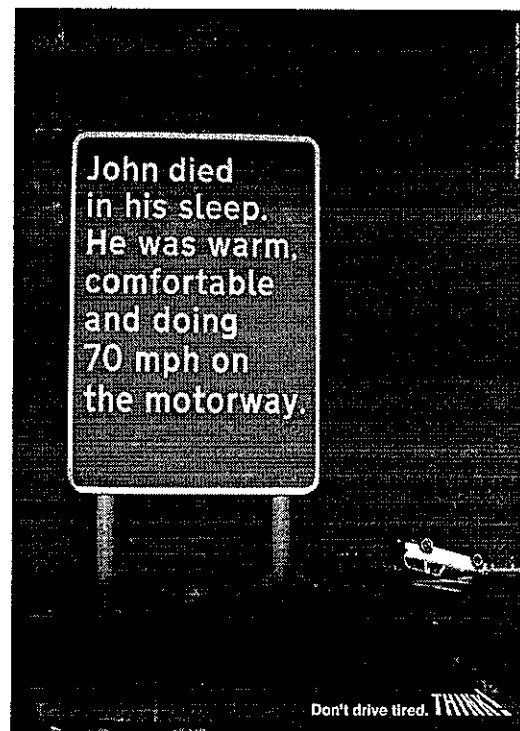
There is currently no Think! Road Safety campaign for drug driving in the UK, yet many local authorities undertake their own initiatives to publicise the risks of drug driving. Drug Action Teams are a case in point, these are local multi-agency co-ordinating groups set up under the UK Government's strategy for England, 'Tackling Drugs Together'. The City of London Drug Action Team was established in 1999 to work on the Government's ten-year strategy for tackling drug misuse. It brings together relevant key people and organisations to translate the strategy into effective local action. The Drug Action Team's Road Safety Unit, in association with the London Drug Policy Forum, City of London Police and Corporation of London has produced a series of leaflets and posters 'Drug driving. Risk it, risk

everything', highlighting the effects of different illicit drugs on drivers.

The first ever drug driving safety campaign in England and Wales was launched on 20 August 2001 by Wokingham District Council and the Wokingham Community Safety Partnership. The campaign began getting its 'don't do drugs and drive' message across by targeting revellers attending the Reading Festival. The campaign's hard-hitting leaflets were handed out at the festival, and continue to be distributed at public events and festivals.

For sleep-related vehicle accidents, research in the UK has shown that drivers are seldom aware when they become sleepy, and hence do not have time to take preventive action before actually falling asleep at the wheel (Horne and Rayner, 1995). In order to counteract the feeling of drowsiness, drivers adopt a variety of techniques while on their journey to avoid falling asleep. These include stopping to get out of the car for fresh air, listening to the radio, talking to passengers, winding down the window for cool air, drinking coffee, changing drivers, and stopping the car for a short sleep. In an international survey, the expert opinion of 1200 specialists in the field of driving, fatigue and traffic safety, agreed that the latter two methods were the only effective remedies to driver fatigue (Nguyen et al, 1998). The other measures only succeed in maintaining driver alertness for just a few minutes, until the driver has stopped for a significant rest (Reyner et al, 1998).

Driver tiredness features heavily in the Think! Road Safety campaign of the UK's Department for Transport. The 'Take a break' campaign began in earnest in 2000 with radio commercials featuring interviews with drivers who had been involved in fatigue-related accidents. This was followed by the distribution of posters at motorway service stations, and more recently (March 2002) a television commercial intended to provide shock value as a deterrent to driving while sleepy. In addition, permanent road signs featuring the words 'Tiredness can kill: take a break' (installed in 1994) appear along British motorways, typically 1-1.5 miles before a motorway service area. The 'Don't drive tired' message also appears on variable message signs (VMS) periodically along the motorway. Similar warning signs and VMS messages are used throughout Australia, Germany, and in the State of Massachusetts, USA.



Fatigue Management Programmes also exist to raise awareness and generate disapproval of driving while sleepy so that it becomes socially unacceptable. In Australia, the 'Driver Reviver' programme, co-ordinated by State Governments and police authorities, and operated by local community group volunteers, has been in operation for ten years. In Queensland, the programme involves 3,000 volunteers at

30 roadside locations where motorists are encouraged to stop, rest and have a free beverage before continuing their journey (Queensland Transport, 2000). The programme is supported by television advertising, leaflets and billboards advising drivers to take a break every two hours. The Department of Transport estimates that between 1991-1999, one hundred serious crashes were avoided in Queensland due to the Driver Reviver initiative, equivalent to an accident cost saving of A\$3 million.

In the United States, a 'social marketing' approach is used to target specific audiences with tailored messages contained in individual mailings, meetings, videos and conference presentations for groups of motorists at greatest risk of SRVA's: young men, HGV drivers and people suffering from sleep disorders (Stutts, 2000). Other effective target groups are those who can influence driver behaviour such as driving instructors and employers.

The effectiveness of public education programmes, along with other countermeasures to driver fatigue, including improved working hours regulations, rest areas and in-vehicle technology, is still in debate, and relies to a large extent on the willingness of drivers to change their behaviour in order to reduce the risk of SRVA's.

Social and cultural countermeasures have been shown to reduce the incidence of accidents caused by impairment. Yet, without effective legislation, raising awareness through publicity campaigns and education schemes remains a short-term resolution, by influencing people's driving behaviour without the control of the legal system.

9.2 Legislation Issues

Legislation for drink and drugged driving is variable from country to country. Virtually the only legislation that is consistent across countries is the setting of maximum blood alcohol concentration levels or breath alcohol content. Even then, BAC limits are not standardised across countries, with many (especially low and middle income countries) not applying BAC levels at all. The World Medical Association asserts that appropriate legal sanctions are a requisite of any national anti-drink or drug driving campaign for enforcing appropriate penalties on drivers that flout drink and drug driving laws.

At present, there is insufficient information to support policy and the development of valid and standard protocols to evaluate driver impairment. The aim of the IMMORTAL (Impaired Motorists, Methods of Roadside Testing and Assessment for Licensing) research programme is to provide evidence to propose intervention methods for driver impairment, and support the future development of European policy governing driver impairment legislation.

The IMMORTAL programme, which began in 2002 is run by a consortium of ten European partners, concerned with the accident risk associated with different forms of driver impairment. The purpose of the IMMORTAL programme is to:

- Ascertain 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; and

- Identify 'tolerance levels' applied to licensing assessment and roadside impairment testing (including drug screening).

Similarly, the ROSITA (Roadside Testing Assessment) study was developed to identify the requirements for roadside testing equipment, and to make an international comparative assessment of existing equipment or prototypes. The assessment will address roadside testing, result validity, equipment reliability, usability (practicality) and usage costs.

So far, ROSITA has:

- Investigated the drugs and medicines that are suspected to have a detrimental impact on road user performance
- Carried out an inventory of state-of-the-art road side testing equipment
- Explored operational, user and legal requirements across EU member states for roadside drug testing equipment
- Evaluated different Roadside Drug Tests

ROSITA is set to undertake an evaluation of roadside oral fluid drug tests, carried out in six countries in Europe and several centres in the USA over the next three years.

For drugs and driving in developed countries, the law is ambiguous to say the least. Road safety legislation in the United Kingdom is based on the *Road Traffic Act*. 1988. Section 4 of the Act describes driving while impaired as:

“A person who, when driving or attempting to drive a motor vehicle on a road or other public place is unfit to drive through drink or drugs is guilty of an offence.” (Taylor, 1995)

However, the law draws no distinction between a person unfit to drive through the consumption of medically prescribed drugs and the person unfit through drug misuse. The difficulty facing legislators is that drugs are available either at a pharmacy or supermarket, by prescription or by illegal means. The number and types of drugs are constantly expanding with increasing scientific and medical knowledge of the treatment of human ailments and the development of new recreational drugs.

In their inquiry into the effects of drugs (other than alcohol) on road safety, the Parliament of Victoria (1996) undertook an international overview by examining legislation in comparable overseas jurisdictions. New Zealand was found to have a comprehensive road safety action plan but it does not identify drugs as an issue to be addressed. In the United States, all state laws were found to be variants of the 'driving under the influence of alcohol' offence and there were no specific offences solely relating to drug impairment. California has misdemeanour offences for 'driving under the influence of alcohol or drugs or a combination of alcohol and drugs' and for 'a person addicted to any drug to drive'.

Norwegian legislation requires that police suspecting drugs when attending accidents or observing irregular or dangerous driving require a driver to undergo a roadside breath test and, later, give a blood sample and undergo a standard clinical examination by a doctor. Victoria considers Norway to be a useful benchmark for gauging the effectiveness of drugged driving legislation because of their high rate of drug-driving detection due to:

- An alert police force
- Systematic examination and recording of driver impairment
- The National Institute of Forensic Toxicology providing expert witness
- Advice, databases and analysis of blood samples

As far as legislating for commercial truck drivers (vulnerable to sleep-related vehicle accidents) goes, the ETSC (2001) regards EC regulations, particularly 543/69: initiatives to regulate drivers' hours, which has been in operation for over thirty years, to be wholly ineffective in reducing the impact of fatigue on driving safety. Moreover, they suggest that for implementation of regulations and code of practice to be effective, additional measures need to address:

- The professional training and career structure of drivers and operators
- The monitoring of health and safety
- The auditing of enterprises and of the contractual relationships between them

A regulatory system for working time in road transport should be based on the following specifications:

- The duties and obligations of the driver, operator, prime contractor, national authority and European authority
- A code of practice incorporating permissible hours of work and rest: a set of mandatory limits prescribing minimum rest periods and maximum periods of driving and working time
- Safety standards to be assessed and enforced: aided by careful selection of safety conscious management and professional training of drivers

The ETSC recommend three main areas of policy that need to be addressed if there is to be a chance of overcoming the limitations of current policy and successfully reducing the influence of fatigue on safety:

1. The framework of regulation and enforcement broadened to include safety management, a code of practice, auditing, monitoring and inspection, enforcement and training
2. Hours of work and rest: specifically daily and weekly rest, night work, working and driving time, and rest breaks
3. Intensification of research to address gaps in the evidence of the role of fatigue in road safety: in particular the influence of fatigue on SRVA's, the social and commercial costs associated with fatigue related accidents, and the effectiveness of regulatory interventions and other countermeasures

A recent report by the ETSC (May 2002) has criticised the European Commission's new proposal for regulating driving time in commercial road transport, which could allow drivers to work two consecutive 80 hour weeks, thus permitting daily averages of 13 hours or more, and hence potentially doubling the risk of a fatigue-related accident:

“Given that around 18% of road deaths across the EU involve commercial road transport vehicles, reducing driving fatigue will play its part in reaching the ambitious new EU target to reduce deaths by 50% by 2010. We urge the EU institutions who are currently discussing this proposal to take immediate steps to remedy this fundamental contradiction in EU policy for regulating working time and driving time in road transport.”

Clearly, legislation against driver impairment is not restricted to the prevention of illegal drink and drugged driving, but also to improve the working conditions of transport workers, and in particular the working and driving hours of commercial drivers who are at most risk from sleep related vehicle accidents.

9.3 Enforcement Issues

Without enforcement by local authorities and police forces, legislation against drink and drugged driving is virtually redundant, because unless offenders can be detected, and there is an effective deterrent, drink and drugged driving offences will continue to rise. Research indicates, that for drink driving at least, breath testing is the most effective means of both enforcing legislation and deterring potential or high-risk offenders.

9.3.1 Alcohol enforcement

In 1967 the UK's Road Safety Act established the 80mg blood alcohol limit, along with the breath test. In the first seven years the breath test saved 5,000 lives and prevented 200,000 injuries in the UK (IAS, 1997). Breath testing powers fall under two broad categories (ETSC, 1995):

- Breath testing after reasonable cause for suspicion: the power to stop and breath test if there is reasonable cause for suspicion that alcohol has been consumed
- Random breath testing: the power to stop and breath test randomly at highly visible roadside checkpoints, sometimes accompanied by publicity

The evidentiary breath test has revolutionised drink driving enforcement measures throughout the western world and have reduced the amount of time police officers have to spend in the police station to conduct blood alcohol tests, thus allowing them more time for breath tests to be conducted.

Interest in using a technological approach to preventing alcohol-impaired drivers from operating a vehicle was aroused in 1986, when the American State of California passed the first law that allowed for a pilot alcohol ignition interlock trial. Between then and 2001, alcohol interlock programmes went through a period of growth, evolution and maturation in the U.S. and Canada. Forty three American states have since passed some sort of enabling legislation, and the U.S. federal government has provided for interlock programmes as well (ICADTS, 2001b). The criminal code of Canada has been amended, and now half of the Canadian Provinces and Territories have, or are soon beginning, to institute interlock programmes.

A breath alcohol ignition interlock device is a hand-held electronic breath-testing device, wired to the ignition system of a vehicle. Interlocks can be fitted to motorcycles, cars and trucks. A vehicle fitted with an interlock will not start unless the driver passes a breath test. Interlock programmes are most often used as a form of secondary prevention to prevent impaired driving by people identified as high-risk due to prior DUI offences, and are most often paid for by DUI offenders. Interlock devices, when embedded in a comprehensive monitoring and service programme, lead to 40-95% reductions in the rate of repeat DUI offences of convicted DUI offenders.

In the United States, Canada, Sweden, and in pilot programmes in Australia, interlocks are placed on the vehicles of DUI offenders under the order of a court, or through stipulation by a motor vehicle authority as part of a reinstatement requirement or a restricted driving license. Used in this way, interlock programmes are targeted at proven high-risk operators. Yet, the system is not infallible, indeed it is very easy for a driver to circumvent the interlock by using a different vehicle without the interlock. Clearly, the alcohol interlock device must be configured as part of a comprehensive programme of monitoring, recording, and reporting in order to be considered complete. The device by itself is not sufficient.

Interlocks have also been used as a primary prevention measure for drivers who have not been convicted of DUI. Although this type of programme is still mostly unknown outside of Europe, it is one of the approaches used in Sweden and is justified by the high proportion of people who occasionally drive while alcohol impaired even though they may have never been convicted of DUI. However, the interlock is unlikely to take off as a preventative measure, simply because of its intrusive design. Each start-up attempt requires a breath test and many programmes require additional tests once the vehicle is running. With such inconvenience, it is unlikely that the alcohol interlock would be acceptable by the general public for use on all private vehicles as a primary prevention measure.

Alexander et al (1996) undertook a meta-analysis of 125 studies on drink driving control policies and enforcement efforts. These included, administrative license suspension, implied consent, preliminary breath tests, mandatory jail sentence, mandatory community service, mandatory licence suspension, limits on plea bargaining, mandatory fines, selective enforcement patrols, regular police patrols and sobriety check points. These studies revealed that all these efforts resulted in a reduction of drink driving accidents. Even though study designs were weak in some studies and required basic data for such analysis, it revealed the growing impact of these interventions. Lawrence (1996) identifies the success of such behavioural change programmes to both personal and social motivators along with internal motivators and external activators to be operational in societies.

The amendments to the Queensland liquor bill in 1994 placed greater emphasis on regulations pertaining to harm minimisation principles as well as promotion of responsible management of alcohol consumption within licensed venues. Formal and informal regulations with community links contributed to a reduction in drinking and driving in Queensland (Marge et al, 1996). Only a combination of mass media publicity with increased random breath testing using highly visible 'booze' buses resulted in a significant decline of road traffic crashes in Victoria (Stuart and Maxwell, 1996). David (1996) report that only a deterrent based random breath test in New South Wales (since 1982), characterised by a highly visible, state wide enforcement activity throughout the year, combined with extensive publicity, resulted in a significant reduction in drink driving. Oluwoye (2000) commenting on the effect of these measures, illustrated that car driver fatalities, truck deaths, passenger fatalities, motorcycle drivers decreased by 12.7%, 28.7%, 13.1% and 11.3%, respectively, after introducing them in New South Wales. A series of counter-measures resulted in a decline of driver fatalities from 44% in 1981 to 31% in 1991 in Australia (Peter, 1993). In South Australia, the legal blood alcohol limit for drivers was lowered from 0.08 to 0.05 GM per 100 ml in 1991. The impact of this change

was assessed over a 15-year period both before and after changes in law. A steady downward trend has been registered in the percentage of late night drivers with a blood alcohol level at or above 0.08. The blood alcohol levels of fatally injured drivers have also followed a similar trend (McLean, 2003).

A review of countermeasures was conducted by Assailly (2000) in several countries with programmes of server intervention. These included breathalysers, designated driver schemes, disco buses, specific legal BAC level for young drivers, road checks and media campaigns. The review concluded that process and product evaluation, methodological and societal issues need to be addressed for success of these interventions.

The United States has made substantial progress in checking the menace of drinking and driving. An extensive review by Shults et al (2001) based on 75 studies (55 from within the USA) focused on interventions, the primary goal of which was reducing alcohol impaired driving. Several states have implemented a variety of programmes and laws to deter alcohol impaired driving that are by far the most widely used strategies. The various strategies adopted are minimum legal age of drinking set to 21 years; lowering BAC limit from 0.10 to 0.08 g/dl; community based interventions including sobriety training programmes for servers; hospital screening and others. As a result, the proportion of alcohol related accidents have declined steadily from 57% in 1982 to 38% in 1999.

Ryan (2003) in a review of alcohol and road traffic crashes in the Western Pacific region, acknowledges the universal lack of data in all countries on this problem. The available data indicates that there is a large variation in the size of the problem based on the number of motor vehicles in use, availability and use of alcoholic beverages, laws regarding drinking and driving and the level of enforcement. A multidisciplinary approach on an inter-sectoral basis is important for developing successful alcohol and drink driving countermeasure programmes.

9.3.2 Drug enforcement

In cases of drugs impairment, enforcement is linked closely to legislation, for example in Canada where there is no law requiring a driver to submit to any physical test of co-ordination. Here, any person arrested for alcohol or other impaired driving offences has the right to consult a lawyer prior to submitting to a breathalyser test.

The apparent lack of roadside testing has been redressed in Victoria, with the Roadside Impairment Assessment (RIA) and Standard Impairment Assessment (SIA), along with the collection of body samples for drug analysis, a progressive evidence gathering process to determine the presence of impairment and the cause of that impairment (Boorman, 2002). The RIA enables an investigator to form an opinion as to whether a driver's behaviour or appearance indicates impairment for a reason other than alcohol alone. The SIA involves the conduct of validated impairment tests and interview of the suspect. Where impairment is identified, the next step is to obtain body samples, which are chemically analysed for the presence of drugs.

In the UK, there is an increasing demand from politicians and the general public for a roadside screening device for the detection of drug drivers. Here, a subset of field

impairment testing techniques using Surface Enhanced Raman Spectroscopy (SERS) that test oral fluid taken from mouth swabs, has been developed from the American Drug Recognition Expert Program (Lamping et al, 2002). Training in these techniques is available to police officers who express an interest in recognising drug impairment. However, this to date has not been incorporated into their routine training. If these tests were to be used in conjunction with a quick and simple roadside screening test it would have an added deterrent effect as well as enabling drug detection.

Securetec was founded in 1995 to develop, manufacture and market devices for the rapid on-site detection and identification of illegal narcotics. Drugwipe®, a pen-size detector for invisible traces of drugs on surfaces, was initially developed for Customs and Law Enforcement Officers to detect smuggling and dealing with illegal narcotics. Since 1998 Drugwipe® has been in use by German Traffic Police Forces to identify Drivers under the Influence of Drugs, and is now in use in Baden-Württemberg, Saxonia, Berlin, Thuringia and Lower Saxonia (Aberl and Zimmermann, 2002). Since it was tested under the ROSITA study, a second generation Drugwipe has been developed specifically for traffic control applications, taking into consideration the comments and experiences of the traffic police in Germany and other European Countries.

The Cozart RapiScan claims to be the world's first fully integrated, onsite, oral fluid based drugs of abuse diagnostic system (Cooper, et al, 2002). This system has been used successfully for a number of different applications including workplace drug testing, monitoring compliance at drug treatment centres, assessing prevalence of drug use in prisons and police custody suites, and determining impairment through roadside testing.

Screening devices are crucial in order to gain a suspicion for further methods, particularly for blood sampling, however, alcohol and drug-screening methods are not directly comparable because alcohol testing is broadly accepted among the population and does not impose any meaningful physical or moral burden on the driver. Yet, current drug-screening methods impose a much higher burden on the driver, especially sweat and urine testing that requires a complicated testing procedure that invokes a personal feeling of shame, particularly for an illegal activity that is socially unacceptable. Whilst blood sampling is considered to be the most effective means of testing for drug induced impairment, it is an inconvenient screening method because blood samples can never be taken on a random basis. Rather, there must be suspicion, or, as in the UK, accident involvement before a blood sample is taken, and unlike roadside breathalyser tests, blood samples can only be used for prosecution purposes. Furthermore, European countries appreciate that physical integrity is a basic constitutional right, and hence there tend to be stricter restrictions for testing procedures with physical infringements such as blood sampling, hence in most countries blood testing is dependent on the driver's co-operation and the driver can refuse to be tested (Mettke, 2000).

The UK Government is targeting motorists suspected of driving whilst under the influence of drugs as part of its Road Safety Strategy and its Campaign Against Drugs. In response, the police service has adapted Standardised Field Sobriety Tests and Drug Recognition Examinations for use in the UK and introduced Field Impairment Testing (FIT), introduced in 2000 (Kitchen et al, 2002). Much of the

development work that was required for the FIT was concerned with adapting these sampling techniques for the analysis of blood samples using automated equipment. This new service was developed to enable modern automated analytical methods to be used on blood samples. The objective was to reduce both the cost of the service and the time taken to provide the police with results. The analytical results are reported in two stages. As a report setting out the results of the screening tests and confirmation of the presence of one or more drugs; and a second report that describes the effect of the relevant drug in general terms with specific reference to the effect that it might have on driving. Since drug induced impairment is an ingredient of the offence, this is necessary to demonstrate that there is a link between the impairment observed by the arresting officer and the drugs found.

9.3.3 Fatigue enforcement

For commercial truck drivers suffering from fatigue, there is an alleged lack of enforcement of regulations, where drivers hours regulations have been continually ignored, with 84% of a sample of 650 international truck drivers from Europe in violation of such regulations (van Ouwerkerk, 1989). The scale of the problem is exacerbated because there is no consistent enforcement strategy across the European Union, and equally the level of sanctions also varies considerably between member states. Furthermore, there is a question of accountability, largely because Council Regulations that are in place, such as 3820/85 on the harmonisation of certain social legislation relating to road transport, are misinterpreted. The ETSC (2001) concur that European regulation manifestly fails to meet the criteria for enforcement that is a high probability of detection, and adequate penalties.

9.4 Effects of urbanisation and traffic density

For identifying the effects of urbanisation and traffic density on the propensity of DWI cases, there is little to be gleaned from accident data where driver impairment, either through alcohol, drug consumption or fatigue, are a contributory factor. For developed countries there is little or no relational data correlating accident rates caused by driver impairment with traffic density, and the evidence is even less so in developing countries where underreporting of accidents is rife. There are instances where level of urbanisation and therefore traffic density can be inferred from regional statistics. For example, the percentage of accident casualties by single and multiple drug use has been calculated by region in the UK (Tunbridge et al, 2001). Here, the regional classification shows substantial variations in drug and alcohol use ranging from 12.5% in Scotland, to 30.7% in Wales (both of which are considered to be predominantly 'rural' and with less traffic density than much of England). For regions with statistically reliable data, those with the highest drug use amongst casualties are the East Midlands (27.3%) and the North-West (26.9%). These regions are densely populated with Birmingham, Manchester and Liverpool being heavily trafficked and significant growth points.

Harrison (1996) reports that differences can exist between rural and urban areas in the prevention, detection and intervention of drink driving, and highlights that drink driving research conducted within urban or metropolitan jurisdictions may not be applicable to the rural case. There are many environmental and geographical factors, which ensure that the experience of drink driving is different between rural and urban

areas. Some of these factors include (Elliott and Shanahan, 1983; Harrison, 1996; Travelsafe, 1999):

- The probability of detection in rural areas is low
- Rural communities tend to be smaller, close knit communities (ie they have high social cohesion)
- Rural regions tend to have fewer enforcement staff and environmental supports available
- Traffic law enforcement can be expensive on low traffic volume roads
- Available alternatives to drink driving (eg. public transport) are limited in rural areas
- Rural drivers tend to travel greater distances to drinking establishments and have limited available routes on which to travel.

Drink-drive crash statistics reported by the New Zealand Land Transport Safety Authority (2001), show that:

- There are around 300 rural drink-driving crashes each year in which 95 people are killed and 300 seriously injured. By comparison there are 150 such crashes in cities
- The number of young male (15-24) rural drink drivers has halved since 1995 but 25-34 year olds have not shown such an improvement, falling by 24%
- Country people die on country roads. Most people who are killed or injured in rural drink-driving crashes are locals from nearby areas and rural towns.

The difference in rural-urban accident statistics can be demarcated in countries where jurisdictions are clearly defined, and hence where road safety policy is tailored to an urban or rural context, for instance in Australia. Yet the relationship between driver impairment and accidents between rural and urban areas will be less distinct in countries of Europe, where the rural-urban boundaries are blurred, and even more so in the developing world where accident and impairment data is scant and unrelated to geographic space.

In spite of this lack of information in developing countries it is clear that urbanisation and traffic density are growing very rapidly in many low income countries and this will have implications for road safety in general as well as for particular impairment issues.

As people seeking employment move from the countryside to the city they contribute to the numbers of pedestrians and the need for low cost public transport. The public's increasing wealth and exposure to urban customs – such as drinking in bars and consuming recreation drugs – have road safety implications; as does the need to provide more public transport when the current system is already stretched. Traffic congestion (and cost) also means that motorcycles are often the preferred means of private transport so that the consequences of impairment factors tend to be more serious, especially if helmets are not worn and roads are poorly maintained.

This report concludes with some proposals for further research - some of which address the urbanisation and traffic density issues.

10 LESSONS LEARNED AND 'GOOD PRACTICE' IN DEVELOPED COUNTRIES

The long-standing experience of more developed countries in tackling impaired driving has produced a number of 'lessons learned' that include:

10.1 Alcohol impairment

- The public should be made aware of (and understand) the laws on drink driving, expect them to be enforced to an extent that will influence their behaviour and also support them to a significant extent. The laws need to be understood and respected by the general public (which is not the same as the driving population) or they will not be effective. To this end, a package of measures is required combining:
 - Reliable data and reporting
 - Political will and government resources to directly address the problem
 - A mixture of public education, effective legislation, enforcement and appropriate penalties
- Little progress will be made in combating drink driving, unless there is a strong political will to promote the road safety issue further up the political agenda.
- It is necessary to have appropriate - and workable - legislation in place. If a 'legal limit' is to be set it needs to take account of local circumstances. It may be better to have a higher limit that has strong public support than a lower limit that is not respected and considered to be unreasonable.
- In practice the minimum enforceable limit is around 20mg/100ml (as used in Sweden) because:
 - the human body can generate a small level of natural alcohol during its normal metabolism, and
 - unless evidential equipment is provided at the roadside, low levels of consumption can 'disappear' in the time taken to transport them the evidential machine and conduct a second test.
- The police, or those involved in enforcement activity, have to actively support the law and their role in enforcing the law - whether related to promoting safety or for other reasons - and need to be given the training and equipment to carry out their job. The police must not be above the law, such that 'off-duty' police driving under the influence must receive the same (or harsher) treatment than other drivers.
- Any enforcement activity should be high profile. The intention should not be to catch as many offenders as possible but to increase the general public perception of such activities. People should expect that if they break the law there is a good chance that they will be detected and punished. This means that enforcement activity should be both transparent and widely publicised. Properly conducted 'random' breath checks that fail to find any drivers, or only a few, over the limit demonstrate success rather than failure.

- Targeted enforcement – rather than ‘random’ testing – is more cost effective. It is generally the case that the police know where and when offending is likely to occur. Police experience is also valuable in identifying the types of driver and car – and the number and types of occupant – who are likely to be impaired. There is evidence that some police are very skilled in detecting impaired driving by simply observing the driving ‘style’ adopted by drivers.
- Targeting enforcement to accident involvement both promotes public support and often maximises the success rate of enforcement activity. Many countries adopt a policy of breath-testing all accident involved drivers (irrespective of the time of day) and some also breath-test drivers who are caught speeding or driving dangerously.
- Research reveals that less experienced (typically younger) drivers are more susceptible to impairment factors than more experienced drivers. In part this is due to a lack of driving skills, but life-style also plays a major role. Some countries adopt a stricter regime for such novice drivers (such as a ‘lower’ or ‘zero limit’ for the first two years after passing). This strategy is intended to remove the ‘learning to drink’ factor (when people learn from experience how alcohol affects them) from the ‘learning to drive’ experience.
- Drivers (and riders) found to be driving while impaired should be offered a course of ‘rehabilitation’ as well as being punished. Some drivers may have a drink problem that they need help with and some would benefit from education courses that improve their attitudes and knowledge in relation to alcohol and the decision to drive.
- While there is (usually) affordable and reliable breathalyser equipment available (for breath alcohol concentration - BrAC) conducting an analysis of a blood sample (BAC) is more complicated. In addition to requiring a qualified person to take the sample and use the equipment, the equipment required is more expensive and not readily mobile. This means that using BrAC rather than BAC for enforcement is easier and cheaper.
- The concept of the ‘hard core’ drink driver is widely used in developed countries. In practice such a driver is one who offends repeatedly rather than at high level. (The average drink driver in the UK is around 150mg/100ml anyway). Early intervention with individual drink drivers is very important to deter them from becoming repeat offenders.
- The concept of the ‘Designated’ driver is a valuable one, where one person opts to consume no alcohol so that passengers can drink ‘safely’.
- More ‘high-tech’ solutions that can be considered in developed countries (such as ignition lock devices) are probably not suited for use in developing countries at the present time.
- Public and community involvement and participation should be encouraged whenever possible. The involvement of organisations such as MADD (Mothers Against Drinking and Driving) in America and CADD (Campaigns Against

Drinking and Driving) in the UK have helped to raise the profile of drunk-driving and supported other measures that have been influential in changing political and public attitudes.

- The size of the penalty for offending drivers is very important. It should be severe but not too severe. If too severe it may encourage offenders to continue driving without a license or insurance, although some particularly irresponsible drivers will do this whatever the penalty. People who cause the death of others while impaired need a sufficiently large punishment to persuade others from taking the risk (eg. a custodial sentence).
- Public knowledge (and attitudes) are important and should be an important element of the countermeasure programme, for example information could be included in the school curriculum, as well being communicated via mass media channels. Early intervention at pre driving age 13-15 and peer pressure to behave well can be very important.
- Good practice should involve conducting alcohol and drug tests on blood samples taken automatically from traffic fatalities. Such information allows very valuable comparisons between countries. These can be compared with non-accident involved populations only if they are available.
- Safety practitioners need to recognise that progress with respect to impaired driving will not be fast or easy. The culture change that was engineered in the UK (from having 'one for the road' to 'drinking and driving is socially unacceptable') took many years and is still being developed. In the UK the message still needs to be taken on board by many young drink drivers.

10.2 Drug impairment

- Enforcing drug impairment (resulting from substances other than alcohol) is a problem even in developed countries since there is no 'legal limit', even for common drugs like cannabis, and no equivalent to the breathalyser for detecting such drugs. Hence, a package of measures, such as those available to combat drink driving are not yet in place. Clearly, efforts need to be made to research the effects of licit and illicit drug taking on driver behaviour, and used to formulate appropriate enforcement measures that feed into the legal system.
- Current methods of drug testing – such as saliva tests – only detect a limited number of substances and confirm consumption of a given drug group e.g. opiates, rather than individual drugs. It is therefore not possible using these tests to distinguish between illicit opiate use (eg. heroin) and medicinal use (eg. codeine). Furthermore any given drug level does not relate directly to impairment across individuals. It is therefore necessary to use behavioural methods such as Drug Recognition Training (DRT) and Field Impairment Testing (FIT) to determine drug impairment. Such techniques have been very successful in the US where the police can assess impairment at the road-side and are now being evaluated in the UK, Europe and parts of Australia.

- The relative impairment resulting from taking a single drug – or mixing them – needs to be assessed. Results from simulator trials in developed countries allows comparisons between ‘safe’ and ‘unsafe’ versions of drugs from the point of view of driving and the information should be made available to the public. For example, readily available ‘hay fever’ medication can cause drowsiness; a fact not readily made available on the packaging in all countries. Also some anti-depressants and sleeping pills are ‘safer’ than others. Improved labelling and information on drugs capable of causing driving impairment needs to be a legal requirement.
- Medical practitioners, pharmacists (and medical associations) should advise patients on the effects of driving while using prescribed drugs, including their interaction with alcohol.
- The alcohol and drugs industry should be encouraged to become involved in promoting road safety programmes. For example, The Portman Group (Drinks industry association in the UK) offer free travel in London on New Years Eve. Even a tiny percentage of their profits would represent a very sizeable budget for promoting road safety.
- The role of the criminal justice system should be given special attention. It needs to be fast, fair and unbiased and the public should recognise it as such.
- All countries need to recognise that they are a special case and conduct research to help develop measures suited to their particular circumstances. This is particularly true of alcohol and drug use, where the situation in different countries will differ widely depending on cultural, social and economic considerations.
- All countries need to collect road safety information so that they can monitor the situation, learn from and compare their road safety progress with others, and further develop strategies and evaluated intervention programmes.
- Road safety will be improved by supporting more general media and education campaigns concerning the dangers of drugs and alcohol, which interact with society at all levels.

10.3 Fatigue

- Legislation that restricts commercial drivers’ hours is important in reducing impairment due to driver fatigue, particularly on long journeys.
- In many developed countries HGVs are fitted with tachographs that can be used to monitor (and enforce) the need of drivers to take adequate rest breaks.
- Drivers need to be educated about how to recognise the onset of fatigue and the measures they should take (eg drink a coffee and then take a short ‘nap’). Similarly, they need to be aware that opening the window or (perhaps more so in developing countries) or drinking alcohol will not help to overcome tiredness.

- Fleet operators need to be involved in getting their drivers to behave sensibly – and not to pressurise them into driving for overlong periods, taking inadequate breaks between trips and shifting from one shift rota to another without giving them time to adjust their diurnal ‘body clocks’.

10.4 Summary

- There is no quick ‘fix’ for reducing the numbers of road accidents caused by impairment factors. The problems are often part of accepted social and life-style activities that will need long-term public education programmes to counter.
- Prevention and improvement programmes will need to compete against powerful commercial factors that are encouraging people to drink more alcohol and consume more drugs; while the managers of commercial drivers will recognise the financial advantages to be gained by requiring their staff to drive for longer periods, with less opportunities provided for resting.
- The main lesson that can be transferred from the developed to developing world is that doing nothing is NOT an option. Delaying an intervention programme will simply make it more difficult to impose in the future.

11 DISCUSSION

It should be noted that each of the individual regional reviews conducted for this scoping study contain information very relevant to this section, which can be considered as an 'overview' of the findings reported in each of the reviews.

The reviews do highlight a series of common issues. The current research that exists on impairment and road traffic safety is limited, particularly in developing countries. There are shortcomings in many of the research studies identified (eg absence of 'exposure' information, lack of consistency and experimental control, inadequate sample size). A lack of equipment and funding (and 'political' support) is also a common problem. In addition to a dearth of reliable statistics (especially in developing countries) there is serious lack of information on the context of the problems, for example, the social patterns of alcohol and drug use and differences between urban and rural and rich and poor communities. However, even in developed countries, there are sizeable problems with researching (eg quantifying and understanding) the use of illicit drugs. The lack of information, or concern about, fatigue was especially disappointing.

However, a number of epidemiological studies were identified that examined alcohol and drug use in populations such as: those killed in road accidents, those entering hospital A&E departments following a road accident, those involved in accidents and those 'randomly' driving along the road. All these studies identified a very significant problem; except, for example, in countries or regions where the culture (eg the Islamic faith) influenced behaviour. The fact that numerous individuals in a majority of countries and cultures commonly use mind altering drugs (such as alcohol) indicate the extent of the problems that will need to be overcome to segregate such behaviours from the risk of being exposed to traffic.

This scoping study had a number of objectives. The first was to obtain information on the 'size' of the problem – although it can be considered as 3 (or even more) separate problems. The second objective was to provide preliminary information to 'understand' the health, social, political and economic context – as well as other dimensions - surrounding the road safety impairment problem in developing countries. Finally, it was intended to identify 'knowledge gaps' that could be tackled by means of further research. The over-riding purpose of the review was not to simply describe what was known (or not known) but to consider what (and how) future strategies could (and should) be adopted to try and stabilise and overcome the problem.

It is clear from the 3 regional reviews that a majority of developing (low-income) countries have a rapidly worsening road safety problem and that impairment issues contribute significantly to many of the accidents. However, it should also be recognised that many developed (high-income) countries also have similar problems – even if their roads are inherently safer in terms of the numbers of accidents that occur and the severity of the injuries resulting from these crashes.

The term 'impairment' can refer to a sizeable number of factors, however this study limited its interest to impairment caused by consuming alcohol, taking drugs (both medicinal and 'recreational' - which often translates to legal and illegal) and the

problem of fatigue, or driving when tired. Although limited to 'only' three factors the issue is very complex. There are many types of alcohol, many different types of drugs and numerous reasons while drivers might be tired. Also, many drivers will consume both alcohol and drugs, and often drugs (eg amphetamines or 'speed') are taken to overcome fatigue – especially by commercial drivers.

It should be noted that relatively little is known in general about the consequences of mixing drugs, including alcohol. The large number of drugs in common usage (both illicit drugs and legally prescribed medication) means that little is known about the driving impairment resulting from drug 'cocktails'. Of special concern might be those circumstances when the driver is driving legally, within the law, although being seriously impaired (eg being under the legal limit for alcohol after having taken a prescription drug) because of the combination of drugs being consumed.

The reviews find more is known about the role of alcohol than other drugs. There are a number of reasons for this, eg. the legal/illegal distinction in some countries and the problems of measuring consumption (and impairment) caused by drugs. With regard to developing countermeasures it is important to deal with alcohol and other drugs in different ways since they are likely to involve separate populations and require very different interventions.

Drinking alcohol and (perhaps to a lesser extent) drug use are often part of a society's fabric of normal behaviour and many individuals 'use' alcohol and drugs so regularly that they become part of their normal lifestyle. Importantly, the consumption of alcohol (and sometimes in large quantities) are integral parts of many social and cultural activities (such as weddings and funerals). When such normally accepted patterns of behaviour are mixed with rapidly increasing motorization it is not surprising that problems occur.

It is also clear that the consumption (and manufacture) of alcohol around the world is on the increase. It is now a very major industry and one that employs very sophisticated marketing techniques to increase profits (and consumption). It is possible to speculate that the increasing commercialisation of the alcohol industry and, importantly, the recognition by various governments of the amounts of money that can be raised by taxing alcohol consumption is encouraging the shift from legal to illegal consumption of alcohol and drugs. However, the lack of information available on the illicit use of drugs and the growth of traditional brewing (both for personal use and selling) makes it impossible to confirm such hypotheses. The illicit nature of such activities also means that important information (such as trends in drug taking) are not available.

The regional reviews also revealed that often governments in low-income countries do not view transport (and therefore road safety) as being a high priority area, emphasising the extent of underreporting by the police, of traffic injuries caused by alcohol impairment. In many cases the responsibility for road safety is delegated to National Road Safety Committees, or Councils (eg NRSCs) which are often (according to the various reviews) not given the resources (in terms of skills, staff and funding) to properly carry out the job for which they were constituted.

Also, the situation is often made worse because existing traffic regulations and legislation are inadequate to tackle the problem. This together with either an absence or low levels of enforcement will not change road user behaviour to any great extent. In many developing countries the perception of drivers (often, based on what actually happens) is that the payment of an instant road-side 'bribe' will prevent the police from taking further action. It goes without saying that the traffic police will find it difficult (or impossible) to enforce drinking 'legal limits' if they do not have breathalysers (to measure BrAC) or easy access to blood testing equipment (to measure BAC) - or even petrol for their patrol cars. Often the pay of the traffic police is insufficient to feed their family and their superiors expect (or demand) a share of the 'profit' so that enforcement practices do not contribute to safety as they should.

12 SOME WIDER ISSUES, PROPOSALS FOR RESEARCH AND INTERVENTIONS

It should be noted that each of the three developing countries regional reviews concludes with ideas about what is required in terms of research, legislation and a possible change of political 'will' to promote road safety by reducing impaired driving. These 'regional' proposals should be considered in conjunction with the ideas raised in this section.

The problem of impaired driving in developing countries is very sizeable – even though the actual size of the problem may not be accurately quantifiable. In addition the situation is quickly getting worse in many countries. If the problem is to be faced (and ignoring it should not be an option), urgent action is required. The problems of where (and how) to start this process when faced with a problem of such magnitude is not clear – but experience suggests that 'action' should follow on from properly designed, conducted and targeted research. Where the impetus (and funding) of this research will come from is also unclear. While developed countries have much to offer in terms of their experience it is not sensible to think that their 'solutions' (if such things exist) can simply be applied in developing countries without taking account of local circumstances. Each country is unique – and indeed some countries consist of different regions and ethnic populations that are very different from each other.

Although this scoping study has considered the road safety problems caused by impairment, it is clear that this (single) factor consists of a number of very different issues: namely impairment resulting from alcohol, drugs and fatigue. Both the size of the problems and the steps that will be needed to overcome the problem are very different for each of these impairment factors. This means that different research will be required to provide an understanding of the problem – and the solutions – for these different impairment factors. Similarly tailored research will be required for individual countries – and perhaps even regions.

Any long-term effective strategy to reduce impaired driving accidents in developing countries will need the support and encouragement of the government. In order to make politicians and policy makers support such activities it is necessary to persuade them about the 'true' size of the problem and provide convincing evidence about the social and economic cost of impairment issues. This type of information – together with objective assessments of what a variety of interventions would be likely to achieve could provide a very strong case in many developing countries for implementing countermeasures.

There is much to be learnt about the background (or framework) of the impaired driving problem. Initial studies are needed to see if it mainly an urban or rural problem, whether the rich or poor are primarily involved, whether it is mainly a problem for private or professional drivers, and the types of road user (eg drivers or pedestrians) primarily involved. A number of such studies have already been conducted (and are reported on the regional reviews) but typically a lack of 'exposure' information means that many of the questions remain unresolved.

It was thought that this review would be able to clearly identify individual countries where impairment (whether caused by alcohol, drugs or fatigue – or two of these in combination, or even all three together) was clearly identified as being a serious problem. In fact it proved difficult to compare countries (and thus identify those having ‘good’ and ‘bad’ practice) because of the very sizeable number of methodologies used. For example, there were different ways of assessing alcohol impairment (from ‘smelling of alcohol’, information from police report forms, self reported behaviour, clinical assessment – using ICD–10 codes, using breath test or blood testing method – and analysing whether these readings were simply alcohol positive or actually over the (variable) legal limit). There were also considerable differences between the populations being analysed. Some were obtained by random sampling at different times of the day, other methods looked at accident involved drivers, those attending hospital as the result of being involved in a traffic accident – and some studies trying to assess which persons were responsible for the accident – as well as studies who took a blood sample from traffic accident casualties.

Another important variable was the type of road use being studied. Some studies examined pedestrians, some riders, some car drivers and some lorry/bus drivers. It is clear that if comparisons are to be made in the future it will be necessary to develop and use a standardised approach so that proper comparisons can be made. This standardised approach would also allow particular countermeasures to be properly evaluated and monitored over time – something that is not usually possible given the lack of both a standardised approach and long-term programmes. However, in the short term it will be necessary to work within the constraints (eg poor data) available; and hope that standardisation will follow.

Although a considerable amount of information is available from a large number of individual studies that provide details about the circumstances of impaired accidents (eg. when they occur, who is involved, and even sometimes where they occur) there is typically insufficient information to provide a detailed ‘understanding’ of the social, cultural and psychological (eg. lifestyle) factors that are important. In particular, it would be valuable to have information on what people know (and understand) of any drinking and driving laws, what attitudes they have about impairment legislation, what perceptions they have about how the police enforce the law, what risk factors they associate with such behaviours and what social, cultural and peer group pressures there are to engage in driving while possibly impaired. Such research could develop potential ‘standard’ methods, transferable across regions, for data gathering.

The regional reviews show that the three impairment issues considered are not distinct. Those who drink and drive are often those who also take recreational drugs and drive (or take a mix of alcohol and drugs). Similarly, there is information that some long distance drivers take alcohol or drugs (eg. amphetamines) to stay awake. This behaviour will often depend on the working practices forced upon them by their employers. It would be very valuable, for example, to conduct a survey of lorry drivers to obtain information about what is expected of them by their employers (eg the number of hours they are expected to drive at a stretch, over the day or in a 24 hour period. It is likely that many bus and lorry drivers take stimulants to keep awake because that is the only way they can achieve what their trips require.

The reviews revealed that relatively little was known about the demographics of drivers likely to be impaired. Such information is important for developing countermeasures (eg developing educational materials or publicity and enforcement campaigns). It is generally the case that impaired driving is more of a problem with male drivers and the young although less is known about other demographic factors such as socio-economic group (social class), employment status and marital status. Directed research is needed to obtain such information so that interventions can target the main problem groups – which are likely to differ markedly for the different impairment factors. In this context it should be noted that other sources of information are available that were not picked up directly by the literature ‘searches’ reported here (typically focussed on ‘road safety’, and ‘impairment’). For example, ICAP have published information on the characteristics of abstainers in different countries around the world, as well as other information that is indirectly relevant to the road safety problem.

The review has also shown that having legislation and actually enforcing the law are two very different things. While many countries have legal limits the police may not conduct any enforcement activity – possibly because they do not consider it to be worthwhile, or they do not have the appropriate equipment or training, or may see it as an informal way of making money rather than arresting and prosecuting people through the normal channels. A first stage should be to conduct road-side surveys in a number of countries to identify the attitudes and perceptions of ‘ordinary’ drivers and to find out how the police actually enforce the law if they actually do. It has been suggested (often by local drivers) that in some countries the traffic police adopt an informal ‘half price instant fine’ rather than arresting people and passing them over to the courts for fining. A lack of enforcement leads to gross underreporting by the police, and hence there should be greater affiliation between the police and hospital medics who have a greater propensity to record the circumstances surrounding road crashes.

An additional possible research need with regard to the role of the police is the actual attitude of the police themselves to the enforcement issue. For example, some police may see it as an important and key part of their role, but that perhaps they are not given sufficient support by their superiors in terms of support and the equipment necessary to do the job. Others may see enforcement as a way of providing themselves (and their families) with a living wage. Surveys of both high ranking and lower ranking traffic police may provide important information on the various stages (such as training and providing equipment) that need to be considered in the long-term provision of proper enforcement.

Details of traffic accidents in developing countries are normally collected by the police who typically complete an accident report form. This information is sometimes stored on a computer and sometime is left as paper files. Sometimes the information is analysed and reported on and sometimes not. It would be a valuable exercise to carry out a comprehensive review of police accident report forms in developing countries with the aim of determining what impairment information (eg use of alcohol, use of drugs, falling asleep at wheel) is recorded and what use is made of the information. Any such review should consider what training the police receive with respect to completing the forms. Many developing countries (and cities) use computer based

accident systems (eg MAAP) and such a survey would provide valuable information about the value of such systems and the use that was being made of them.

Police enforcement activity in developing countries typically suffers from having a lack of resources in terms of both manpower and equipment. This results in having only limited numbers of enforcement equipment such as radar speed 'guns' and breathalysers (although breathalysers cannot detect impairment caused by drugs). While this limits the amount and type of impairment activity (eg detecting drivers over the legal drinking and driving limit) a number of methods are available to check drivers for alcohol and drugs impairment without using equipment. This approach should be evaluated in a small number of developing countries.

In many developing countries there is a National Road Safety Council (NRSC) that is given responsibility for road safety. While some of these are well funded and are successful in promoting road safety some may be less effective. Valuable information would be provided if a survey of NRSC activities was conducted— with a focus on impairment issues. This would identify examples of 'good practice' that could be shared.

It is very clear that the 'social dimension' plays a very important role in alcohol, drugs and fatigue issues. Research is needed to identify and understand the role of factors such as cultural, driver psychology and lifestyle. A considerable amount of this type of research has been conducted in developing countries to help develop effective countermeasures – although hardly any such research has been carried out in developing countries. Understanding the social dimension is likely to involve the use of both quantitative and qualitative research techniques. The use of participatory learning and action (PLA) methods will be especially important in understanding the issues and developing successful interventions.

With regard to conducting research in developing countries it needs to be accepted that each country has unique circumstances and characteristics. The findings of research carried out in one country are not usually directly applicable to other countries. However, information and experiences need to be shared. At present there is no recognised process, or channel, for individual countries to share their problems and support each other. If there is to be a 'forum' or similar mechanism to support and advise developing countries in how they should at least make a start in tackling this growing problem, it needs to be centred within the context of a motivated international body – such as the Global Road Safety Partnership (GRSP).

13 REFERENCES

-
- Aberl, F. and Zimmermann, R. (2002). Screening for drivers under the influence of drugs: the new Drugwipe® for sweat and saliva testing. Proceedings of the 16th International Conference on Alcohol, Drugs and Traffic Safety. 4-9 August 2002, Montreal, Canada
-
- Achwan, N. and Ruditjo, D. (1999). Accident characteristics on low volume roads in Indonesia. Transportation research record, 1652
- Acuda, S. W. (1985). International review series: Alcohol and alcohol problems research. British Journal of Addiction, 80; 121-126
- Acuda, S. W. (1990). Alcohol research in developing countries: possibilities and limitations. In: Maula et al. (Editors). Alcohol in developing countries. Proceedings from a meeting. Nordic Council for Alcohol Research (NAD): NAD-Publication No. 18, Helsinki; p15-27
- Adityanjee, M. D. and Wig, N. N. (1989). Alcohol related problems in the emergency room of an Indian general hospital. Australian and New Zealand Journal of Psychiatry. 23: 274-8.
- Aeron Thomas, A (2000). Underreporting of road traffic casualties in low income countries. TRL unpublished Project Report PR/INT/199/00 R6883. Crowthorne: TRL Limited.
- Aganga, A. O. Umoh, J. U. and Abechi, S. A. (1983). Epidemiology of motor vehicle accidents in Zaria, Nigeria. Journal of the Royal Society on Health, 103;123-126
- Aguwa, C.N. Anosike, E. O. and Akubue, P. I. (1982). Road accidents in Nigeria: level of alcohol in the blood of automobile drivers. Central African Journal of Medicine, 28; 171-174
- Aidria-Ezati, I. (1996). Medical issues arising from RTAs in Uganda. The British Council Uganda in-country training programme: road safety Phase II: Road Safety Training Seminar, TRL Ltd, Unpublished Project Report, Crowthorne
- Alexander, C. W. Terry, Z. S. Gerald, D. W. and Ralph, H. (1996) Drink Driving Control Efforts: A Meta Analysis of the Literature from 1960-1991. Proceedings of the 3rd World Conference on Injury Prevention and Control, Melbourne, Australia
- Alvarez, C. A. et al, (1977) Traffic accidents: a growing public health problem. Bull Pan Am Health Organ., 11 (3): 224-31, Medline
- Alves Lemos Maria Do Socorro et al. (2002) Morbidity and mortality traffic accident reduction: a Brazilian mark on the health promotion. 6th World Conference Injury Prevention and Control. May 12-15,. Montreal, Canada.
- Alves, D. et al (2000) What do patients with head injuries remember about their time of hospitalization?, Rev Lat Am Enfermagem, , Apr, 8 (2):91-8, Medline.
-

Anderson, T. E. (1986). Effects of acute alcohol intoxication on spinal cord vascular injury. *Journal of Neurotrauma*, 3(3): 183-92

Andrade, S. M. et al, (2001) Road accidents in a city in southern Brazil. *Rev Saude Publica*, Jun, 35 (3): 318-20, Brasil, Medline

Andrews, C. N. Kobusingye, O. C. and Lett, R. (1999). Road traffic accident injuries in Kampala. *East African Medical Journal*, 76(4); 189-194

ARA – A positive force in South African society. Website, <http://www.ara.co.za/> Accessed on January 22, 2003

Asiamah, G. Mock, C. and Blantari, J. (2002). Understanding the knowledge and attitudes of commercial drivers in Ghana regarding alcohol impaired driving. *Injury Prevention*, 8(1); 53-56

Asogwa, S. E. (1980). Some characteristics of drivers and riders in road accidents in Nigeria. *East African Medical Journal*, 57; 399-404

Assum, T. (1997). Road Safety in Africa: Appraisal of road safety initiatives in five countries. Institute of Transport Economics, Norwegian Center for Transport Research, Oslo

Baker, S.P. O'Neill, B. Ginsburg, M. and Li, G. (1992). *The injury fact book*. 2nd Edition, Oxford University Press, New York, p251-257

Bang, A. T. and Bang, R. A. (1991). Community participation in research and action against alcoholism. *World Health Forum*. 72, 104-109

Bangalore City Police: Personal Communication.

Bangdiwala, S. I. et al, (1987) Traffic accidents as a serious health problem in selected developing countries of the Americas. *Bull Pan Am Health rgan*, 21 (1): 38-47, Medline

Bastos, Y. Andrade, S. et al. (2002) Traffic accidents and the new Brazilian traffic code in a southern city of Brazil. 6th World Conference Injury Prevention and Control. May 12-15, Montreal, Canada

Bastos, Y. Maffei, S. (2002) Risk behaviour in traffic: a study of the pre-hospital attendances, 1997-2000. 6th World Conference Injury Prevention and Control. May 12-15, Montreal, Canada.

Batra, V. S. and Bedi, R. B. Effect of drunken driving on traffic safety. <http://www.druglibrary.org>

Becker, K. (1994). The consequences of drunken driving in South Africa. *Medicine & Law*, 13(1-2); 11-17

Benegal, C. Murthy, P. Shanthala, A. and Janakiramaiah, N. (2000). Alcohol related problems: a manual for medical officers. National Institute of Mental Health and Neuro Sciences: Deaddiction Centre, Bangalore

Benegal, V. Gururaj, G. and Murthy, P. (2002). Injuries and alcohol. WHO Project: Unpublished document, March 2002.

Benegal, V. Shanthala, A. Murthy, P. and Janakiramaiah, N. (2001). Alcohol use and abuse in Karnataka. A Status Paper, unpublished document

Benegal, V. Velayudhan, A. and Jain, S. (2000). The social cost of alcoholism (Karnataka). NIMHANS Journal, January and April 2000; 18(1and2): 67-76

Berger, L. R. and Mohan, D. (1996). Injury control: a global view. Oxford University Press

Bittah, O. Owola, J. and Oduor, P. (1979). A study of alcoholism in a rural setting in Kenya. East African Medical Journal, 56; 665-670

Boorman, M. C. (2002). Detection of drug impaired drivers – standard field sobriety tests. Proceedings of the 16th International Conference on Alcohol, Drugs and Traffic Safety. 4-9 August 2002, Montreal, Canada

Borges, G. García, G. Gil, A. Vandale, S.(1994) Casualties in Acapulco: Results of a study on alcohol use and emergency room care. Drug Alcohol Depend Aug;36(1)1-7

Borkenstein, R.F. Crowther, R.F. Shumate, R.P. Ziel, W. B. and Zylman, R. (1964). The role of the drinking driver in traffic accidents. Department of Police Administration, Indiana University, Bloomington

Borkenstein, R.F. et al (1964). The role of drinking drivers in traffic accidents. Bloomington: Department of Police Administration, Indiana University

Bouramia, A. A. (1993). Analyse des facteurs d'accidents de la circulation routines dans les départements de L'Oueme et de L'Atlantique (Benin). Institut Regional De Sante Publique, Cotonou

Bramness, J. G. et al. (2002). Clinical impairment of Benzodiazepines – relation between Benzodiazepine concentrations and impairment in apprehended drivers. Proceedings of the 16th International Conference on Alcohol, Drugs and Traffic Safety. 4-9 August 2002, Montreal, Canada

Brown, I. D. (1994). Driver fatigue. Human Factors, 36.

Bryceson, D. F. (2003) (ed). Alcohol in Africa. Hartford, Connecticut: Heinemann.

Caetano, R. (1984) Manifestations of alcohol-related problems in Latin America: a review. Bull Pan Am Health Organ, 18 (3): 258-80, Medline

Calderón Herrera, G. García Peña, B. (2002) Infraestructura y comportamiento en la accidentalidad peatonal de la Avenida Boyacá III Congreso Iberoamericano de Psicología. Bogotá, Colombia. 21-27 julio
<http://www.abacolombia.org/3cip/programa/transito/resumenestrafico/sesionestematicas/sesi...>

Cape Town City Traffic Department. (1993). Motor vehicle accident data – Municipal area of Cape Town. Traffic Department Statistics 1993. Traffic Department, Cape Town.

Caroadcante, T.T. Freire, (1998) A.S.A. “Programa de entrenamiento de policías militares y prevención de accidentes de tránsito” Congreso Iberoamericano de Psicología. Madrid, España. 12-16 julio
<http://copsa.cop.es/congresoiberoa/base/trafico/t2.htm>

Celis, A. Gómez, Z. et al. (2002) Family structure and risk for pedestrian injury in Mexican children. 6th World Conference Injury Prevention and Control. May 12-15, Montreal, Canada

Celis, A. Rivas-Souza, M. Roadencia, N. Salazar-Estrada, J. (1994) Alcohol y muerte traumática en Jalisco. *Salud pública de México*;36(3):269-274

Celis, A. Roadencia, N. (1991) Traumatism and poisoning in Jalisco. An autopsy based study in mortality. *Salud Pública de México*, , 33 (1): 77-87, Medline

Chakravarthy, C. (1990). Community workers estimate of drinking and alcohol related problems in rural areas. *Indian Journal of Psychological Medicine*, 13: 49-56

Chandra, V. (1999). Non communicable disease control in South East Asia. WHO Project ICP NCD 001

Channabasavanna, S. M. (1989). Epidemiology of drug abuse in India: an overview. NIMHANS: Bangalore, India and Alcohol, Drug Abuse and Mental Health Administration: USA

Channabasavanna, S. M. Gururaj, G. Das, B. S. (1993). Prevention of head injuries: educational approaches. *Health Education in South East Asia*, 8(4): 5-18

Channabasavanna, S. M. Ray, R. and Kaliaperumal, V. G. (1990). Patterns and problems of non-alcoholic drug dependence in Karnataka. Department of Health and Family Welfare, Government of Karnataka

Chengappa, R. (1986). Alcoholism, the growing malaise. *India Today*, April 30; 72-80

Cherpitel, C. J. (1993). Alcohol and injuries: a review of international emergency room studies. *Addiction*, 88: 923-37

Chongsuvivatwong, V. Ritsmithai, S. Suriyawongpaisal, P. et al. (1999). High prevalence of drink driving in Thailand. *Drug and Alcohol Review*, 18: 293-8

Christophersen, A. S. (2002). The role of medicines in traffic countries in the European countries. Proceedings of the 16th International Conference on Alcohol, Drugs and Traffic Safety. 4-9 August 2002, Montreal, Canada

Colli, B. O. Et al, (1997) Characteristics of the patients with head injury assisted at the Hospital das Clinicas of the Ribeira Preto Medical School, Arq Neuropsiquiatr, Mar, 55 (1): 91-100, Medline

Cooper, G. et al. (2002). Cozart rapiscan oral fluid drug test system. Proceedings of the 16th International Conference on Alcohol, Drugs and Traffic Safety. 4-9 August 2002, Montreal, Canada.

Cusack, D. A. (2002). Driving under the influence of drugs in Ireland: a growing and significant danger. Proceedings of the 16th International Conference on Alcohol, Drugs and Traffic Safety. 4-9 August 2002, Montreal, Canada

David, S. (1996) The Long-term Effectiveness of a Deterance Based Random Breath Testing Program in New South Wales. Proceedings of the 3rd World Conference on Injury Prevention and Control, Melbourne, Australia

Davies, G.P. and Broughton, J. (2002). Criminal and motoring convictions of high risk drink/drivers. Proceedings of the 16th International Conference on Alcohol, Drugs and Traffic Safety. 4-9 August 2002, Montreal, Canada.

De Figueiredo Poli, Rasslan S, Bruscin V y cols. (2001) Increases in fines and driver license withdrawal have effectively reduced immediate deaths from trauma on Brazilian roads: first-year report on the new traffic code. Injury Mar; 32(2):91-4. Medline

de Gier, J. J. (2000). Review of investigations of prevalence of illicit drugs in road traffic in different European countries. Proceedings of the Seminar on Road Traffic and Drugs, Strasbourg, 19-21 April 1999. Pompidou Group

De Jager, J. P. D. (1988). Alkohol: Die Monitoring van die algehele drinkkoers vir die RSA gedurende 1987. CSIR, National Institute for Transport and Road Research. Technical Report NVVR/30, Pretoria

De Sousa, R. M. et al, (1999) Traumatic brain injury: differences among pedestrians and motor vehicle occupants. Rev Saude publica, , Feb., 33 (1):85-94, Medline

Del Rio, M. C. and Alvarez, F. J. (1996). Illegal drug taking and driving: patterns of drug taking among Spanish drivers. Drug and Alcohol Dependence, 37:83-6

Department of Road Transport Safety (1997). 1996 Road Traffic Safety Annual Report, Ministry of Works, Transport and Communications, Gabarone.

Deslades, S.F. Passos da Silva, C. (2000) Analysis of hospital morbidity by motor vehicle accidents in public hospitals in Rio de Janerio, Brasil. Rev Saude Publica, 34 (4): 367-72, Medline

Deslandes, S. F. et al, (1998) Emergency care costs for victims of violence treated at two hospitals in Rio de Janeiro. *Cad Saude Publica*, Abril, 14 (2) 287-99, Brasil, Medline

DETR (2000). Tiredness kills: how to avoid driver fatigue. Leaflet for the THINK! Road Safety Campaign. London: Department for the Environment, Transport and Regions

Dhawan, A. and Mohan, D. (1999). Epidemiology of alcohol and substance abuse. *NIMHANS Journal*, 17(4): 367-76

Dhliwayo, M. E. (1997). A review of road safety situation in Africa. Lead paper presented at the Third African Road Safety Congress, Pretoria, South Africa. (Unpublished)

Downing, A. Jacobs, G. Aeron Thomas, A. (2000) Review of road safety in urban areas. TRL Limited. PR/INT/200

DTLR (2001). Road accidents in Great Britain: 2000 the casualty report. London: Department of Transport, Local Government and the Regions

Dube, K. C. and Handa, S. K. (1971). Drug use in health and mental illness in an Indian population. *British Journal of Psychiatry*, 118, 345-349

Ebie, J. C. (1990). The use of different alcoholic beverages in two urban areas of Nigeria. In: Maula et al. (Editors). Alcohol in developing countries. Proceedings from a meeting. Nordic Council for Alcohol Research (NAD), NAD-Publication No. 18, Helsinki, p168-184

Elliott, B. and Shanahan, P. (1983). The NSW motorist and random breath testing. Research report prepared for Bureau of Crime Statistics and Research, Department of the Attorney General and of Justice, New South Wales Government. Sydney, Australia.

Elnager, M. N. Maitra, P. and Rao, M. N. (1971). Mental health in a rural community. *British Journal of Psychiatry*, 118: 499-503

Espitia, V. Concha-Eastman, A. et al. (2002) Characteristics of motorcycle drivers deaths after the implementation of a compulsory law for helmet use. 6th World Conference Injury Prevention and Control. May 12-15, Montreal, Canada

ETSC (1995). Reducing traffic injuries resulting from alcohol impairment. Brussels: European Transport Safety Council

ETSC (2001). The role of driver fatigue in commercial road transport crashes. Brussels: European Transport Safety Council

Everest, J. T. Davies, C. H. and Coffey, M. G. (1990). Roadside surveys of drinking and driving; Wiltshire 1989. TRL Research Report 285. Crowthorne: TRL Limited

Everest, J. Tunbridge, R. and Widdop, B. (1989). The incidence of drugs in road accident fatalities. Research Report RR202. Crowthorne: TRL Limited

Fell, J. C. (1995). What is new in alcohol, drugs and traffic safety? 39th Annual Conference of Association for the Advancement of Automotive Medicine, 579

Filou, C. (2002). Drunk driving in injury and fatal accidents in France in 2000: interaction between alcohol and other offences. Proceedings of the 16th International Conference on Alcohol, Drugs and Traffic Safety. 4-9 August 2002, Montreal, Canada.

Finlay, J. and Jones, R. K. (1984). Alcohol consumption and the nature of alcohol-related problems in Botswana: a preliminary report. Mimeograph, cited In: Giesbrecht N, Gonzalez R. et al (Editors) Drinking and Casualties; accidents, poisonings and violence in an international perspective. Tavistock/Routledge, London, p88-89

Flatley, D. and Rayner, L. A. (2000). A survey of public education literature regarding driver sleepiness. London: Department for the Environment, Transport and the Regions

Flisher, A. J. Ziervogel, C. F. Chalton, D. O. Leger, P. H. Robertson, B. A. (1993). Risk-taking behaviour of Cape Peninsula high-school students. Part VI. Road-related behaviour. South African Medical Journal, 83(7); 486-490

Florek, E. et al. (2002). Driving under the influence of prescribed drugs in Poland: questionnaire studies. Proceedings of the 16th International Conference on Alcohol, Drugs and Traffic Safety. 4-9 August 2002, Montreal, Canada

Folle, J. A. et al, (1971) Cerebro-cranial-thoracic injuries. Cases of the last 15 years in the Hospital de Clinicas de Montevideo. Torax, Sept., 20 (3): 133-8, Medline

Fosseus, C. G. (1983). Motorcycle accidents and alcohol. A survey of fatalities in the Cape Peninsula. South African Medical Journal, 64; 159-160

Francisco, J. (1992) The frequency, causes and mortality due to accidents in Latin America. An Esp Pediatr, Jun, 36, Suppl, 48:153-6, Medline

Fromm, S. H. et al (1973) Emergency medical care and traffic fatalities in Puerto Rico. Bol Asoc Med P R, May, 65 (5): 108-10, Medline

Gangrade, K. D. and Gupta, K. (1978). A study of drug use among industrial workers. A project report of Delhi School of Social Work. New Delhi: University of Delhi

García, B. Calderón, G. y Carrillo, S. (2002) Caracterización de los conductores implicados en atropellos a infantes III Congreso Iberoamericano de Psicología. Bogotá, Colombia. 21-27 juli
<http://www.abacolombia.org/3cip/programa/transito/resumenestrafico/resumenesconfere.n.o>

García, G. Borges, G. (1991) Alcohol and the risk of injuries in 3 emergency services in Acapulco, México. Bol Oficina Sanit Panam Sep; 111(3):231-9

García, G. y Borges, G. (1991) Alcohol and the risk of injuries in 3 emergency services in Acapulco, Mexico. *Bol Oficina Saint Panam*, Sept., 111 (3): 231-, Medline

García, R. G. Hernández, M. et al. (2002) Characterization of the mortality for accidents of bicycles in Cuba, 1987-2000. 6th World Conference Injury Prevention and Control. May 12-15, Montreal, Canada

Ghaffar, A. et al (2002) Interventions for Control Road Traffic Injuries: a review of effectiveness. *JPMA*, vol. 52, no. 2, Buscador: Google

Ghee, C. Astrop, A. Silcock, D. and Jacobs, G. (1997). Socio-economic aspects of road accidents in developing countries. *TRL Report 247*

Ghee, C. et al. (1997). Socio-economic aspects of road accidents in developing countries. *TRL Report TRL 247*. Crowthorne: TRL Limited

The Globe (2002). The beverage alcohol industry's social aspects organizations: A public health warning. *The Globe New Series Issue 3*. The Global Alcohol Policy Alliance's international magazine on Alcohol

Goonawardena, A. C. R. (1998). Mobility and safety in Sri Lanka. Paper presented at the International Course on Prevention and Control of Traffic Injuries: WHO collaborating center, New Delhi

Gopinath, P. S. (1968). Epidemiology of mental illness in an Indian village. *Transactions of All India Institute of Mental Health*, 8: 68-73

Government of Karnataka (1993). Note on excise policy for the year 1993-1994

Guerrero, R. et al, (1993) An epidemiological approach for the prevention of urban violence: the case of Cali, Colombia. Buscador: Google

Guptill, et al (1991) American travel deaths in Mexico. Causes and prevention strategies. *West J Med*, Feb., 154 (2): 169-171, Medline

Gururaj, G. (2002a). Alcohol consumption, road traffic injuries and brain damage. *Proceedings of the 6th World Conference on Injury Prevention and Control*, Montreal

Gururaj, et al. (2001). Suicide prevention: emerging from darkness. *World Health Organization*

Gururaj, G. (1995). An epidemiological approach to prevention: pre-hospital care and rehabilitation in Neurotrauma. *Neurology India*; 43: 95-106

Gururaj, G. (1998a). Health consequences and socioeconomic impact of traumatic brain injury. *Proceedings of the International conference on measuring the burden of injury*, Fremantle; 141-145

Gururaj, G. (2000d). Behaviour and road safety: a multidimensional issue. In *Transportation, Traffic Safety and Health: Human Behaviour* (Eds), Nygren, A. Holst, H. V. Springer publications, New York

Gururaj, G. (2001). Background paper for the report of the working group on prevention of road traffic injuries in India. Planning Commission, Government of India

Gururaj, G. (2003c). An analysis of road traffic injuries in Bangalore. NIMHANS, Bangalore (study in progress).

Gururaj, G. Aeron-Thomas, A. and Reddi, M. N. (2000a). Underreporting of road traffic injuries in Bangalore: implication for road safety policies and programmes. Proceedings of the 5th World Conference on Injury Prevention and Control, New Delhi, 1-3-I-04

Gururaj, G. and Benegal, V. (2002b). Project Report 'Drinking under the Influence of Alcohol and Road Traffic Injuries in Bangalore' (unpublished document)

Gururaj, G. and Isaac, M. K. (2001b). Epidemiology of suicides in Bangalore. NIMHANS Publication No.43

Gururaj, G. and Isaac, M. K. (2001c). Suicides: beyond numbers. NIMHANS Publication, No.44

Gururaj, G. and Tekur, S. P. (1998b). Road traffic injuries: an emerging public health problem in Bangalore: need for an intersectoral approach and people's participation. Proceedings of the Seminar on Road Safety and Traffic Scenario: Meeting the New Challenges, 8-13 July

Gururaj, G. Channabasavanna, S. M. Das, B. S. and Kaliaperumal, V. G. (1993b). Road accidents and head injuries: need for prevention in developing countries. Conference on Asian Road Safety. Kuala Lumpur: Malaysia

Gururaj, G. Channabasavanna, S. M. Das, B. S. et al. (1993a). Epidemiology of head injuries in Bangalore. NIMHANS, PR/3/93.

Gururaj, G. Channabasavanna, S. M. Das, B. S. Kaliaperumal, V. G. (1993c). Epidemiology of traumatic brain injuries in Bangalore. Proceedings of the 3rd World Conference on Injury Prevention and Control, Atlanta, USA; 225

Gururaj, G. Girish, N. and Benegal, V. (2003) Health care utilization of alcoholic and non-alcoholic families in Bangalore. Study in Progress

Gururaj, G. Girish, N. and Suryanarayana, S. P. (2003b). Public perceptions on road safety in Bangalore. NIMHANS, Bangalore (study in progress)

Gururaj, G. Kolluri, S. Chandramouli, B. A. and Subbakrishna, D. K. (2002c). Disabilities and impact after traumatic brain injury: results of a one year outcome study from Bangalore, India. Proceedings of the 7th European Multidisciplinary Neurologica Meeting, Newcastle-upon-Tyne, UK

Gururaj, G. Reddi, M. N. and Thomas, A. A. (2000b). Epidemiology of road traffic injuries in Bangalore. 5th World Conference on Injury Prevention and Control, New Delhi

Gururaj, G. Sastry, K. V. R. Chandramouli, B. A. and Subbakrishna, D. K. (2000c). Neurotrauma registry in NIMHANS. A Collaborative Project of National Institute of Mental Health and Neuro Sciences and Southern California Injury Prevention Research Centre, UCLA School of Public Health, Los Angeles, USA

Gururaj, G. Sastry, K. V. R. Chandramouli, B. A. and Subbakrishna, D. K. (1999a). Bangalore agenda road safety. NIMHANS, Bangalore

Gururaj, G. The effect of alcohol on incidence, pattern, severity and outcome from traumatic brain injury. In press - Journal of Indian Medical Association

Gutiérrez, G. Celis, G.A. Pineda, J. (2002) Peatones y uso de las ciclorutas en Bogotá. III Congreso Iberoamericano de Psicología. Bogotá, Colombia. 21-27 julio
<http://www.abacolombia.org/3cip/programa/transito/resumenestrafico/sesionestematicas/>

Haddon, W. Suchman, E. A. and Klein, D. (1964). Accident research: methods and approaches. New York, USA

Hamelin, P. (1987). Lorry drivers' time habits in work and their involvement in traffic accidents. Ergonomics, Vol.30

Hamelin, P. (2000). The working time of professional drivers as a factor of flexibility and competitiveness in road haulage and passenger transport. Proceedings of the TUTB-SALTSA conference 'Working with limits? Re-organising work and reconsidering workers health.' Brussels, 25-27 September 2000

Harrison, W.A. (1996). An exploratory investigation of aspects of drink-driving and enforcement in rural areas of Victoria. Report No. 93. Melbourne, Australia: Monash University Accident Research Centre

Harworth, A. (1989). Alcohol-related casualties in Africa. In Drinking and Casualties; accidents, poisonings and violence in an international perspective. Giesbrecht N, Gonzalez R. et al (Editors). Tavistock/Routledge, London, p83-111

Hedden, F. J. Wannenburg, P. J. D. (1994). Results of Survey on Marijuana and alcohol amongst accident victims attended at Addington Hospital Accident and Emergency Unit. Trauma & Emergency Medicine, 11(4): 1074-1078

Hernandez-Avita, M. Coldiz, G. A. Stampfer, M. J. et al. (1991). Caffeine, moderate alcohol intake and risk of fractures of the hip and forearm in middle aged women. American Journal of Clinical Nutrition; 54: 157-63

Hettige, S. T. Sri Lanka. In: T. Kottteinen (ed.), State monopolies and alcohol prevention: report and working papers of a collaborative international study. Helsinki: Social Research Institute of Alcohol Studies

Híjar, M. (1990) Mortality as a result of accidental and intentional injuries in the Federal District from 1970-1986. Salud Pública de México, Jul-Agosto, 32 (4): 395-404, Medline

Híjar, M. et al (1997) Methodological aspects of measuring injuries from traffic accidents at the site of occurrence. *Rev Saude Publica*, 31 (1): 100-4, Brasil, Medline

Híjar, M. et al (1998) Alcohol intake and severity of injuries on highways in Mexico: a comparative analysis. *Addiction*, Oct, 93 (10): 1543-51, Medline

Híjar, M. et al (2000) Cross-national comparison of injury mortality: Los Angeles County and Mexico City, Mexico. *Int J Epidemiol* Aug, 29 (4): 715-21, Medline

Híjar, M. et al, (1996) Safety belt use and severity of injuries in traffic accidents. *Salud Pública de México*, 38 (2), 118-27, México, Medline

Híjar, M. et al, (1999) Risk factors for injuries caused by traffic accidents and the impact of an intervention on the road. *Rev Saude Publica*, , 33 (5): 505-12, Medline

Híjar, M. et al, (2000) Usefulness of geographic analysis in the study of deaths caused by motor vehicles injuries. *Salud Pública de México*, 42 (3): 188-93, México, Medline

Híjar, M. et al, (2001) Analysis of fatal pedestrian injuries in Mexico City, 1994-1997. *Injury* May, 32 (4): 279-84, Medline

Híjar, M. et al. (2003) RTI and epidemiological and costs analysis. *Accident Analysis and prevention*. In Press

Híjar, M. Trostle, J. Bronfman, M. (2003) Pedestrian injuries. A multi-method approach. *Social Science and Medicine*. In press.

Home Office (2000). The criminal histories of series traffic offenders. Home Office Briefing Note 5/00, October 2000

Hoque, M. F. (1986). Incidence and clinical pattern of acute poisoning in a district hospital. *Bangladesh Medical Journal*

Horne, J. and Reyner, L. (1995). Driver sleepiness. *Journal of Sleep Research*, 4, Suppl. 2.

IAS (1997). 30 years of the breath test: time for a lower limit. St Ives: Institute of Alcohol Studies

IAS (2002). Drinking and driving. IAS Factsheet. St Ives: Institute of Alcohol Studies

ICADTS (2001a). Working group on prescribing and dispensing guidelines for medicinal drugs affecting driving performance. Oosterhout, The Netherlands

ICADTS (2001b). Alcohol ignition interlock devices: position paper. Oosterhout, The Netherlands

ICAP (2002). Blood alcohol concentration limits worldwide. ICAP Reports 11, May 2002. Washington D.C.: International Center for Alcohol Policies.

Iontchev, A. (1998). Central and Eastern Europe. In Grant, M. (ed.) *Alcohol and emerging markets: patterns, problems and responses*. Washington D.C.: Taylor and Francis

Isaac, M. K. (1990). A proposal for starting specialized alcohol and drug abuse services at NIMHANS. Bangalore: NIMHANS (unpublished)

Isaac, M. K. (1998). Contemporary trends: India. In Alcohol and Emergency Markets. Patterns, Problems and Responses (Eds.) Grant, M. International Centre for Alcohol Policies, USA, 1998

Isoba, M. C. (2000) Relación entre el conocimiento teórico y el comportamiento en el tránsito. 17º Congreso Internacional de la Asociación Internacional de Medicina de Tránsito y Transportes. Mayo Estocolmo, Suecia.

Jacobs, G. Aeron-Thomas, A. and Astrop, A. (2000). Estimating global road fatalities. TRL Report 445. Crowthorne: TRL Limited

Jacobs, G. and Aeron-Thomas, A. (2000). Africa road safety review. Final Report. Project Report PR/INT/659/2000;TRL Limited

Jacobs, G. and Baguley, C. J. (1995). Towards a strategy for improving road safety in developing countries. Crowthorne: TRL Limited

Jayasuriya, S. and Jayasuriya, D. C. (1998). Contemporary trends in drinking: Sri Lanka. In: Alcohol and Emerging Markets; Patterns, Problems and Resources (Eds.), Grant, M. International Centre for Alcohol Policies, USA

Jenirgan, D. H. (1999). Country profile on alcohol in Zimbabwe. In: Riley, L. Marshall, M. (eds). Alcohol and public health in eight developing countries. Geneva, Substance Abuse Department, World Health Organization; WHO/HSC/SAB/99.9

Jha, N. (1997). Road traffic accident cases at BPKHS, Dharan, Nepal: one year in retrospect. Journal of Nepal Medical Association; 35: 241-244

Jiloha. R. C. (1991). A decade of deaddiction clinics in India. British Journal of Addiction; 86: 103-104

Kapila, S. Manundu, M. Lamba, D. (1982). The matatu mode of Public Transport in Metropolitan Nairobi. The Mazingira Institute Report. Nairobi: Mazingira Institute

Khan, A. Q. (1997). Current health problems in Bangladesh. Paper presented at the Seminar on "The Impact of structural adjustment programmes in South Asia", New Delhi

Kilonzo, P. G. (1990). Production of alcohol in Tanzania, and alcohol-related accidents. In: Maula et al. (Eds) Alcohol in developing countries. Proceedings from a meeting, Oslo, August 10-12. Nordic Council for Alcohol Research (NAD), 1990: NAD-Publication No. 18, Helsinki, 185-192

Kitchen, S. et al. (2002). An improved drug driving analytical service. Proceedings of the 16th International Conference on Alcohol, Drugs and Traffic Safety. 4-9 August 2002, Montreal, Canada

Koizumi, M. S. (1992) Injury patterns in motorcycle accident victims. Rev Saude Publica, Oct, 26 (5): 306-15, Medline

Lucas, G.H. et al (1955). Quantitative studies of the relationship between alcohol levels and motor vehicle accidents. Proceedings of the Second International Conference on Alcohol and Road Traffic. Toronto: Garden City Press Co-operative

Maheswari, J. and Mohan, D. (1989). Road traffic injuries in Delhi. A Hospital Based Study. *Journal of Traffic Medicine*; 7(3-4): 23-27

Mann, R. E. (2002). Choosing a rational threshold for the definition of drunk driving: what research recommends. *Addiction*; 97: 1237-8

Marge, H. Richard, W. Gillian, M. (1996). An Australian Approach to the Prevention of Alcohol Related Violence in and around Licensed Premises: The Impact Local Government Safety Action Project. Proceedings of the 3rd World Conference on Injury Prevention and Control, Melbourne, Australia

Margoob, M. A. and Dutta, K. S. (1993). Drug abuse in Kashmir. *Indian Journal of Psychiatry*; 163-5

Mathrubootham, N. (1989). Epidemiological study of drinking behaviour in a rural population. Ph.D. Thesis. Department of Psychiatry, Madras Medical College, University of Madras

Matsumura, T. (1993). Present status and organization of road traffic safety in Japan. *Conference on Asian Road Safety*; 2.41-2.61

Maula, J. (1990). Research in the production and consumption of alcohol in Tanzania. In: Maula et al. (Eds). *Alcohol in developing countries. Proceedings from a meeting, Oslo, August 10-12 1988.* Nordic Council for Alcohol Research (NAD), NAD-Publication No. 18, Helsinki, p193-205.

Maula, J. Lindblad, M. and Tigerstedt, C. (Eds), (1990). *Alcohol in developing countries. Proceedings from a meeting, Oslo, August 10-12.* Nordic Council for Alcohol Research (NAD), NAD-Publication No. 18, Helsinki

Max, G. and Willersdorf, G. (2001). The beverage alcohol industry and learning about drinking. In Houghton, E. and Roche, A. (eds.) *Learning about drinking.* Washington D.C.: Taylor and Francis

Maycock, G. (1995). Driver sleepiness as a factor in car and HGV accidents. *Transport Research Laboratory Report 169.* Crowthorne: TRL Limited

Maycock, G. (1997). *Drinking and driving in Great Britain – a review.* TRL Report 232. Crowthorne: TRL Limited

Maycock, G. et al (1991). *The accident liability of car drivers.* Research Report RR315. Crowthorne: TRL Limited

Mbaruku, G. M. D. (1980). Motor traffic accidents in Dar-es-Salaam, their effect on mortality. *Dar-es-Salaam Medical Journal*, 8; 16-20

McLean, A. J. Kloeden, C. N. Mcroll, R. A. and Laslett, R. (2003). Reduction in the legal blood alcohol limit from 0.08 to 0.05. Effect on drink driving and alcohol related crashers in Adelaide: <http://www.druglibrary.org>

McLean, J. and Kloeden, C. (2002). Alcohol, travelling speed and the risk of crash involvement. Proceedings of the 16th International Conference on Alcohol, Drugs and Traffic Safety. 4-9 August 2002, Montreal, Canada.

Metzke, M. (2000). The legal framework for efficient roadside testing. Proceedings of the Seminar on Road Traffic and Drugs, Strasbourg, 19-21 April 1999. Pompidou Group

Ministry of Surface Transport. (2000). Statistics of road accidents in India (1991-1998). Government of India: Ministry of Surface Transport

Ministry of Transport and Highways. Sri Lanka Action Plan 1997-2002. Unpublished Document

Ministry of Transport. (1980). Legislative enactments of the Democratic Socialist Republic of Sri Lanka, Vol. XVI, chapter 520-536, revised edition, Sri Lanka

Mishra, B. K. Banerjee, A. K. and Mohan, D. (1984). Two-wheeler injuries in Delhi, India: a study of crash victims admitted in a neurosurgery ward. *Accident Analysis and Prevention*; 16(5/6): 407-16

Miura, F. K. et al (1995) Depressed skull fractures in children under 2 years of age. Retrospective study of 43 cases. *Arq Neuropsiquiatr*, Sept, 53 (3-B): 644-8, Medline

Mock, C. Amegashie, J. and Darteh, K. (1999). Role of commercial drivers in motor vehicle related injuries in Ghana. *Injury Prevention*; 5(4):268-277

Mock, C. et al, (2002) Childhood injury prevention practices by parents in Mexico, *Inj Prev*, Dec, 8 (4): 303-5, Medline

Mohan, D. (1981). Alcohol use among college students. In D. Mohan, H. S. Sethi, and E. Tongue (Eds.), *Current Research in Drug Abuse in India*. New Delhi: Japya Brothers

Mohan, D. (1981). Current research in drug abuse in India. In Mohan D, Sethi HS and Tongue E. (Eds.) *All India Institute of Medical Sciences*, New Delhi; 18

Mohan, D. (1984). Accidental death and disability in India: a stock talking. *Accident Analysis and Prevention*; 16(4): 279-288

Mohan, D. (1991). Safety of the vulnerable road users. Proceedings of the International conference on vulnerable road users, New Delhi

Mohan, D. (1992). Safety of the vulnerable road users. *Indian Highways*; 29-36

Mohan, D. (2002). Road safety in less motorized environments: future concerns. *International Journal of Epidemiology*; 31: 527-32

Mohan, D. (2002). Social cost of road traffic crashes in India. Study done for the Working Group of Planning Commission, Government of India by Transportation Research and Injury Prevention Programme, IIT, New Delhi.

Mohan, D. and Bawa, P. S. (1985). An analysis of road traffic fatalities in Delhi, India. *Accident Analysis and Prevention*; 17(1): 33-45

Mohan, D. Chopra, A. and Sethi, H. (2001). A rapid assessment study on prevalence of substance abuse disorders in Metropolis Delhi. *Indian Journal of Medical Research*; 114: 107-14

Mohan, D. Desai, N. G. Chopra, A. and Sethi, H. (1992). Rapid survey on substance abuse disorders in the urban slums of New Delhi. *Indian Journal of Medical Research*; 96(B): 122-7

Möller, M. R. (1994). Drogen und medikamentennachweis bei verkehrsauffälligen kraftfahrern. *Berichte der Bundesanstalt für Strassenwesen*. Heft M29

Morris, J. R. (1996). External accident costs and freight transport efficiency. In Saccomanno, F. and Shortreed, J. (eds.) *Truck safety: perceptions and reality*. Waterloo, Ontario: Institute for Risk Research

Moskowitz, H. et al (2002). Methodological issues in epidemiological studies of alcohol crash risk. *Proceedings of the 16th International Conference on Alcohol, Drugs and Traffic Safety*. 4-9 August 2002, Montreal, Canada.

The Motor Vehicles Act (1988). As Amended by the Motor Vehicle (Amendment) Act, 2001. Commercial Law Publishers (India), Pvt. Ltd., 2002

Moyano, D. E. Guajardo, A. y Vargas, P. (1998) Exploración del discurso acerca de la seguridad de tránsito en usuarios de vías en Santiago de Chile. *Congreso Iberoamericano de Psicología*. Madrid, España. 12-16 julio
<http://copsa.cop.es/congresoiberoa/base/trafico/t4.htm>

Moyano-Díaz, E. (1997) Evaluation of traffic violation behaviors and the causal attribution of accidents in Chile *Traffic in Chile*. *Environment and Behavior*, Vol. 29, No. 2, March, Sage Publications, Proquest

Murray, C. J. L. and Lopez, A. L. (1996b). Quantifying the burden of disease and injury attributable to 10 major risk factors. In: *The Global Burden of Disease: A Comprehensive Assessment of Mortality and Disability from Diseases, Injuries and Risk Factors in 1990 and projected to 2020*. Cambridge, Massachusetts, Harvard school of public health; 295-314

Murray, C. P. L. and Lopez. (1996a). The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990 and projected to 2020. *World Health Organization and World Bank*

Murthy, P. Srikumar, R. Auradkar, K. M. and Singh, G. M. (1999). A case study. Workplace Prevention of Alcohol and Drug Abuse in Karnataka State Road Transport Corporation, unpublished document

Murthy, R. S. (1994). The laws relating to narcotic drugs and psychotropic substances and alcohol: Indian situation. Bangalore: NIMHANS (unpublished)

Mushanga, T. M. (1976). Crime and deviance. East African Literature Bureau, Nairobi

Mwaniki, B. W. (1990). Production and sale of alcohol and tobacco products in Kenya. Mimeograph; cited in Maula et al. (Eds). Alcohol in developing countries. Proceedings from a meeting, Oslo, August 10-12, 1988. Nordic Council for Alcohol Research (NAD), NAD-Publication No. 18, Helsinki

Myers, R. A. Taljaard, J. J. and Penman, K. M. (1977). Alcohol and road traffic injury. South African Medical Journal, 52: 328-330

Nantulya, V. M. and Muli-Musime, F. (2001). Kenya: Uncovering the social determinants of road traffic accidents. In Challenging inequities in health. (Evans T et al., Eds). Oxford University Press, 2001, New York; pp.211-225

Narayanan, L. M. (2002). Association of alcohol intoxication and traffic crashes in Tamil Nadu. Proceedings of the 6th World Conference on Injury Prevention and Control, 2-I-E-02

National Road Safety Committee (1984). Review of road safety in Botswana. In: Economic Commission for Africa. First National Road Safety Conference, Nairobi, 27-30 August 1984; Compendium of Papers. Norwegian Institute of Transport Economics, Oslo, p2.83-2.101

National Safety Council, Thailand, 1997

National Trauma Research Programme (1990). The Cape Metropolitan Study 1990. Unpublished Report.

National Trauma Research Programme. The Cape Metropolitan Study 1990. Unpublished data

Nedel, F. B. et al, (1999) Years of life lost by mortality: a component of the burden of disease. Rev Saude Publica, Oct, 33 (5) 461-9, Medline

Nguyen, L. T. et al. (1998). Changing behaviours to prevent drowsy driving and promote traffic safety: review of proven, promising and unproven techniques. University of Pennsylvania/American Automobile Association Foundation for Traffic Safety

NHTSA (2001). Traffic safety facts 2000: alcohol. National Highway Traffic Safety Administration. DOT HS 809 323. Washington D.C.: US Department of Transportation

Nielsen, F. J. Resnick, C. and Acuda, S. W. (1989). Alcoholism among outpatients of a rural District Hospital in Kenya. *British Journal of Addiction*, 84(11), 1343-1351

Nieto Lluís, M. et al, (1987) Accident death rate. Some data on its behavior in Cuba, *Rev Cubana Adm Salud*, Oct-Dec, 13 (4): 479-87, Medline

Njelekela, L. C. K. (1978). Drinking patterns in selected communities in Ludewa District, Iringa Region. Dissertation in partial fulfilment of the award of the Diploma in Public Health of the University of Dar-es-Salaam, Dar-es-Salaam

Odenije, A. O. and Olatawura, M. (1977). Alcohol use in a Nigerian rural community. *African Journal of Psychiatry*, 1; 69-74

Odero, W. (1997). Road traffic injuries and alcohol in Eldoret, Kenya: epidemiology and policy analysis. PhD thesis, London School of Hygiene and Tropical Medicine, University of London

Odero, W. (1998). Alcohol-related road traffic injuries in Eldoret, Kenya. *East African Medical Journal*, 75(12); 708-711

Odero, W. and Zwi, A. B. (1997). Drinking and driving in an urban setting in Kenya. *East African Medical Journal*, 74(11); 675-679

Odero, W. and Zwi, A. B. (1999). An evaluation of sensitivity and specificity of blood alcohol concentrations obtained by a breathalyser survey in a casualty department in Kenya. *Accident Analysis and Prevention*, 31; 341-345

Odero, W. Garner, P. and Zwi, A. (1997). Road traffic injuries in developing countries: a comprehensive review of epidemiological studies. *Tropical Medicine and International Health*, 2(5); 445-460

Odero, W. Garner, P. and Zwi, A. (1997). Road traffic injuries in developing countries: a comprehensive review of epidemiological studies. *Tropical Medicine and International Health*; 2(5): 445-60

Odero, W. Zwi, A. B. Alcohol-related traffic injuries and fatalities in developing countries: a critical review of literature. Health Policy Unit, Department of Public Health, London School of Hygiene and Tropical Medicine, UK
www.druglibrary.org/scahffer/misc/driving/s26p1.htm

Olivares Urbina, C. (1981) Mortality from traffic accidents among motorcyclists or caused by them. Federal District México, *Salud Publica de México*, 23 (3): 219-44, Medline

Olivos Jara Pablo. (1999) Control Percibido y atribución causal de accidentes de tránsito según rol de usuario de la vías, experiencia de accidentalidad, sexo y edad. Congreso Iberoamericano de Psicología. Madrid, España. 12-16 julio
<http://copsa.cop.es/congresoiberoa/base/trafico/r3.htm>

Oluwasanmi, A. J. (1993). Road accident trends in Nigeria. *Accident Analysis and Prevention*, 25; 485-487

Oluwoye, J. O. (2002). Alcohol Involvement in NSW Driver Fatalities: Random Breath Testing Reducing Transport Injuries. Proceedings of the 5th World Conference on Injury Prevention and Control, New Delhi

Ott, E. A. et al, (1993) Traffic accidents in a metropolitan area of southern Brazil, victim and lesion characterization. *Rev Saude publica*, Oct, 27 (5): 350-6, Brasil, Medline

Palaniappun, V. and Soundararajan, M. (1994). A glimpse of deaddiction centre at the institute of mental health, Madras. In V. P. Bashyam (Ed.), *Souvenir of ANCIPS* (117-119). Madras: Indian Psychiatric Society

Pan, L. (1975). Alcohol in Colonial Africa. The Scandinavian Institute of African Studies. Uppsala. Cited by Acuda, S. W. (1985) in *International review series: Alcohol and alcohol problems research*. *British Journal of Addiction*, 80; 121-126

Panichaphongse, V. et al (1995). Effects of law promulgation for compulsory use of protective helmets on death following motorcycle accidents. *Journal Medical Association of Thailand*, 521-525

Parry, C. D. H. Bhana, A. Myers, B. Pluddeman, A. Flisher, A. J. Peden, M. and Morojele, N. K. (2002). Alcohol use in South Africa: findings from the South African Community Epidemiology Network on Drug Use (SACENDU) Project. *Journal Studies on Alcohol*, 63(4); 430-435

Partanen, J. (1990). Abstinence in Africa. In: Maula, et al. (Eds). *Alcohol in developing countries*. Proceedings from a meeting, Oslo, August 10-12. Nordic Council for Alcohol Research (NAD), 1990: NAD-Publication No. 18, Helsinki, p70-85

Patel, N. S. and Bhagwatt, P. P. (1977). Road traffic accidents in Lusaka and blood alcohol. *Medical Journal of Zambia*, 11; 46-69

Peden, M. M. et al (2001). The sentinel surveillance of substance abuse and trauma, 1999-2000; Final Report. Medical Research Council, Tygerberg

Peden, M. M. et al, (1996). Injured pedestrians in Cape Town – the role of alcohol. *South African Medical Journal*, 86(9); 1103-1105

Peden, M. M. Van der Spuy, J. W. (1996). Pedestrian injuries – some of the facts. *Trauma and Emergency Medicine*, 13(1); 40-42

Peden, M. McGee, K. and Sharma, G. (2002). *The injury chart book: a graphical overview of the global burden of injuries*. World Health Organization

Pefñuelas, J. E. et al, (1989) Effectiveness of seatbelts in automobiles. *Salud Pública de México*, 31 (4): 469-72, México, Medline

Peter, M. (1993) Random Breath Testing and other Drink Driving Counter-measures in Australia. Proceedings of the Asian Conference on Road Safety

Philip, M. and Richard, J. (1998). Road accidents in North Arcot and Thiruvannamalai districts in 2000. NADHI; 15(4)

Pinero de Fuentes, S. et al (1998) Prevalence of drug abuse in patients receiving care in adult emergency. *Salud Pública de México*, 40 (3): 234-40, Medline

Pittella, J. E. et al (1999) Intracranial hypertension in victims of fatal traffic accidents, *Arq Neuropsiquiatr.* Sept, 57 (3B): 843-7, Medline

Ponnudrai, R. Jayakar, J. Raju, B. and Pattamuthu, R. (1991). An epidemiological study of alcoholism. *Indian Journal of Psychiatry*; 33: 176-9

Portugal, W. (2002) Multi-sectoral intervention from road injuries in Callao (Peru) 2001. 6th World Conference Injury Prevention and Control. May 12-15, 2002. Montreal, Canada.

Posada, J. et al, (2000) Death and injury from motor vehicle crashes in Colombia. *Rev Panam salud publica*, Feb, 7 (2): 88-91, Medline

PoV (1996). Inquiry into the effects of drugs (other than alcohol) on road safety in Victoria. Parliament of Victoria, Road Safety Committee

Prasad, R. J. R. (1992). A spirited battle, anti-liquor awakening. In A.R Frontline, 1992; 51-3 (unpublished)

Premarajan, K. C. Danabalan, M. Chandrasekar, R. and Srinivasa, D. K. (1993) Prevalence of psychiatric morbidity in an urban community of Pondicherry. *Indian Journal of Psychiatry*; 35: 99-102

Queensland DoT (2000). Driver reviver and driving tired. Brisbane: Queensland Department of Transport

Ranganathan, S. (1994a). The most sensible thing is not to drink. *World Health Forum*; 15: 226-7

Rathnayake, G. S. (1998). Road accidents and vehicle population in Sri Lanka. Unpublished data

Rauch, W. J. et al (2002). Any first alcohol-impaired driving event is a significant and substantial predictor of future recidivism. Proceedings of the 16th International Conference on Alcohol, Drugs and Traffic Safety. 4-9 August 2002, Montreal, Canada.

Ray, R. (1998). Earlier era. In: South Asia Drug Demand Reduction Report, New Delhi, UNDCP ROSA; 38-48

The Readers' Digest Association of South Africa Ltd (2003)., Alcohol and driving. Cape Town: Website, <http://www.legalcity.co.za>. –accessed on January 7, 2003

Research Services Ltd (1994). Drink driving: a survey of male offenders. London: The Portman Group

Reyner, L. A., Flatley, D. and Horne, J. A. (1998). Driver sleepiness as a cause of road traffic accidents on the Warwickshire section of the M40 during 1995 and 1996. London: Department for the Environment, Transport and Regions

Rigau-Perez, J. G. et al, (1986) Prevention of accidents and control of injuries in Puerto Rico: progress toward the National Health Objectives for 1990. *Col asoc Med P R*, 78 (12): 523-34, Puerto Rico, Medline

Rittner, C. H. and Becker, J. (1991). Untersuchungen zum Benzodiazepingebruch auffälliger Verkehrsteilnehmer in Rheinland-Pfalz. Universität Mainz

Rizzi, R.G. et al, (1988) Maternal Mortality due to violence. *Int J Gynaecol Obstet*, Dec, 63, Suppl 1: S19-24, Medline

Road Sector Investment Programme (1998). Zambia Road Safety Study. Final Report and Action Plan. Lusaka, Zambia

Rodriguez, G. et al, (1992) Attitudes and knowledge toward bicycle helmet by school age children. *Bol Asoc Med P R*, 84 (11): 305-8, Medline

Rogers, A. S. et al (1999). The impact of tiredness as a cause of road accidents for specific groups of 'at risk' drivers: a review. Crowthorne: TRL Limited

Rojas, R. A. et al, (2002) Mandibular fractures. Experience in a trauma hospital. *Rev Med Chil*, May, 130 (5): 537-43, Medline

Room, R. Jernighan, D. Carlini-Marlatt, B. et al (2002). Alcohol in developing societies: a public health approach. Finish Foundation for Alcohol Studies and World Health Organization, Helsinki

Ross, A. (1998). Road safety in developing countries. Highways and Transportation

Ross, A. Baguley, C. Hills, B. McDonald, M. and Silcock, D. (1991). Towards safer roads in developing countries – a guide for planners and engineers. Crowthorne, TRL Limited

Ryan, G. A. Alcohol and road traffic crashes in the western pacific region. <http://www.druglibrary.org>

Sabey, B. E. Everest, J.T. and Forsyth, E. (1988). Roadside surveys of drinking and driving. TRL Research Report 175, Crowthorne, TRL Limited

Sahdev, P. Lacqua, M. J. Sing, B. et al (1994). Road traffic fatalities in Delhi: causes, injury patterns and incidence of preventable deaths. *Accident Analysis and prevention*, 26, 3, 377-384

Sarin, S. M. Bajpai, R. K. and Mittal, N. (2000). Note on road traffic accidents in India. Central Road Research Institute, New Delhi

Saxena, S. (1999). Country profile of Alcohol in India. In: Alcohol and Public Health in 8 developing Countries (Eds.), Riley, L. and Marshall, M. World Health Organization; 37-60

Sethi, B. B. and Trivedi, J. K. (1979). Drug abuse in rural population. Indian Journal of Psychiatry; 27: 211-6

Sexton, B. et al (2002). Report on scoping study for research into the effectiveness of 'Tiredness can Kill' signs. Unpublished Project Report PR/SE/500/02. Crowthorne: TRL Limited

Shults, R. A. Elder, R. W. Sleet, D. A. (2001). Reviews of Evidence Regarding Intervention to Reduce Alcohol Impaired. 21(45): 66-88.

Shults, R. A. Elder, R. W. Sleet, D. et al (2002). Reviews of evidence regarding interventions to reduce alcohol-impaired driving. American Journal of Preventive Medicine, 21(4S); 66-84

Silberschmidt, M. (1990). The interaction between changing male and female roles and alcohol problems in rural Kenya. In: Maula et al. (Eds). Alcohol in developing countries. Proceedings from a meeting, Oslo, August 10-12, 1988. Nordic Council for Alcohol Research (NAD), NAD-Publication No. 18, Helsinki, p134-150

Simon, D. (1996). Transport and Development in the Third World. Routledge, London

Singh, G. (1989). Epidemiology of alcohol abuse in India. In: Proceedings of the Indo-US Symposium on Alcohol and Drug Abuse (Eds.) Ray, R. and Pickens, R. W. NIMHANS, Bangalore, India and Alcohol, Drug Abuse and Mental Health Administration, USA; 3-11

Singh, G. and Jindal, K. C. (1980). Drugs on a medical campus, II: drug use among faculty members. Drug and Alcohol Dependence; 6: 123-130

Single, E. and Leino, V. (1998). The levels, patterns, and consequences of drinking. In Grant, M. and Litvak, J. (eds.) Drinking patterns and their consequences. Washington D.C.: Taylor and Francis

Sloan, E. P. Zalenski, R. J. Smith, R. F. et al. (1989). Toxicology screening in urban trauma patients: drug prevalence and its relationship to trauma severity and management. Journal of Trauma; 29(12): 1647-53

Soderlund, N. and Zwi, A. B. (1995). Traffic related mortality in industrialized and less developed countries. Bulletin of World Health Organization; 73(2): 175-182

Soderstrom, C. A. Dischinger, P. C. Kerns, T. J. et al. (1993). Marijuana and other drug use among automobile and motorcycle drivers treated at Level 1 Trauma Care Centre. 37th Annual Proceedings of the American Association for Automotive Medicine; 279-86

Somatunga, L. Ministry of Health, Sri Lanka, Personal Communication.

Spagnhol, J. M. y Saruby do Nascietno, A.(1998) "Actuación de la policía de tránsito: evaluación, planificación y acciones educativas integradas" Congreso Iberoamericano de Psicología. Madrid, España. 12-16 julio
<http://copsa.cop.es/congresoiberoa/base/trafico/tar52.htm>

Sri Wi Wat, S. Homjoo, S. Kulleao, S. and Chad bunchachai, W. (1999). Trauma registry, Khon Kaen hospital. ISBN 974-293-465-7

Starmer, G. A, and Mascord, D. J. (1994). Drugs and Traffic Safety. Report CR 140, Federal Office of Road Safety

Stuart, N. S. and Maxwell, C. H. (1996) Mass Media Publicity as Support for Police Enforcement in Victoria. Proceedings of the 3rd World Conference on Injury Prevention and Control, Melbourne, Australia

Stutts, J. C. (2000). Sleep deprivation countermeasures for motorist safety: a synthesis of highway practice. NCHRP Synthesis 287. Washington D. C.: Transportation Research Board, National Research Council

Suriyawongpaisal, P. Plitapolkarnpim, A. and Tawonwanchai, A. (2002). Application of 0.05% legal blood alcohol limits to traffic injury control in Bangkok. Journal of Medical Association of Thailand

Surya, N. C. (1964). Mental morbidity in Pondicherry. Transactions of All India Institute of Mental Health; 5: 50-61

Swaddiwudhipong, W. et al. (1994). Epidemiological characteristic of drivers, vehicles, pedestrians and road environments involved in road traffic injuries in rural Thailand. Southeast Asian Journal of Tropical Medicine and Public Health; 25: 37-44

Sweedler, B. M. The worldwide decline in drinking and driving:
<http://www.druglibrary.org>

SweRoad. Road safety situation in Thailand, 1997

Tanaboriboon, Y. Ruengsor, D. Chadbunchachai, W. et al. (1999). Analysis of road traffic accidents through hospital trauma records: case study of Khon Kaen, Thailand. IATSS Research; 23(1): 115-24

Tapia Granados, J. A. (1998) Reducing automobile traffic: an urgent policy for health promotion. Rev Panam Salud Publica, 3 (4): 227-41, Medline

Taylor, J. F. (ed.) (1995). Medical Aspects of Fitness to Drive - A Guide for Medical Practitioners. United Kingdom: Medical Commission on Accident Prevention

Terhuine, K. W. and Fell, J. C. (1981). The role of alcohol, marijuana and other drugs in accidents of injured drivers. 25th Annual Proceedings of the American Association for Automotive Medicine; 117-32

Tiwari, G. (1999). Planning for non-motorized traffic: a prerequisite for sustainable transport system. IATSS Research; 23: 70-7

Touhami, M. (1990). A study on attitudes among Moroccan medical students towards the use of alcohol: preliminary results. In: Maula, et al. (Eds). Alcohol in developing countries. Proceedings from a meeting. Nordic Council for Alcohol Research (NAD), NAD-Publication No. 18, Helsinki, 162-167

Trauma center bulletin. Khon Khen hospital, 2, 1996

Trauma center bulletin. Khon Khen hospital, 6, 1997

Travelsafe. (1999). Rural road safety in Queensland. Issues Paper No. 4. Brisbane, Australia: Parliamentary Travelsafe Committee

Treat, J. R. (1980). A study of pre-crash factors involved in traffic accidents. Research Review 10 (6) and 11 (1). University of Michigan: Highway Safety Research Institute

Tunbridge, R.J., Keigan, M. and James, F.J. (2001). The incidence of drugs and alcohol in road accident fatalities. TRL Report 495. Crowthorne: TRL Ltd

UN World population prospects, 1996 revision, New York, 1997.

UN World urbanization prospects, 1996 revision, New York, 1996a.

UNESCO, World education report, Paris, 1998

United Nations. (1999). Economic and Social Commission for Asia and the Pacific: Review of the road safety in Asia and the Pacific, 1999.

Vaaje, T. (1987). Drunken driving in Southern Africa – problems and countermeasures. Institute of Transport Economics, Norwegian Center for Transport Research, 1987, Oslo

Van de Spuy, J. W. (1989). Trauma, alcohol and other substances. South African Medical Journal, 90 (3); 244-246

Van Heerden, I. V. Parry, C. D. H. (2001). If you drink alcohol, drink sensibly. South African J Community Nursing, 14; S71-S77

Van Kralingen, W.N. Whittaker, S. Van der Spuy, J.W. et al (1991). Alcohol and the injured driver. The PODDER Project Conducted at the Groote Schuur Hospital Trauma Unit. Pretoria: CSIR Roads and Transport Technology. Technical Report DPVT/170

Van Ouwerkerk, F. (1989). La duree du travail des conducteurs routiers a longue distance: une question toujours d'actualité. Paris: Colloque Professions et Réglementations des Transport dans le Perpectiive Européene 1993

Varma, V. K. and Dang, R. (1979). Non-medical use of drugs amongst school and college students in India. Indian Journal of Psychiatry; 21: 228-234

Varma, V. K. Singh, A. Singh, S. and Malhotra, A. (1980). Extent and pattern of alcohol use and alcohol related problems in North India. *Indian Journal of Psychiatry*; 22: 331-7

Vasconcellos, E. (1999) Urban development and traffic accidents in Brazil. *Accid Anal Prev*, Jul, 31 (4): 319-28, Medline

Vasconcellos, E. (2000) "Strategies to improve traffic safety in Latin America". World Bank Workshop on Urban Transport Strategy, Santiago, Chile, 6-9 November

Vergheese, A. Beig, A. Senseman, L. A. Rao, S. S. and Benjamin, V. (1973). A social and psychiatric study of a representative group of families in Vellore town. *Indian Journal of Medical Research*; 67: 618-626

Verstraete, A. G. (2002). Progress in the European Union on the application of lists of medicinal drugs that impair driving. Proceedings of the 16th International Conference on Alcohol, Drugs and Traffic Safety. 4-9 August 2002, Montreal, Canada

VicRoads (2001). Arrive alive! Victoria's Road Safety Strategy

Vilchis Licon, H. et al, (1986) Traffic Accidents, a current problem. *Salud Pública de México*, 28 (5): 537-42, México, Medline

Viviescas, F. (2002) Urbanism and Accident Prevention in Cities of Developing Nations: The case of Bogotá, Colombia. 6th World Conference Injury Prevention and Control. May 12-15, Montreal, Canada.

Voas, R. B. and Lacey, J. H. (1990). Drunk driving enforcement, adjudication and sanction in the United States. In: *Drinking and Driving: Advances in Research and Prevention* (Eds.) Wilson, R. J. and Mann, R. E. Guilford Press, New York; 116-58

Waller, P. F. Blow, F. C. Maio, R. F. et al. (1995). Crash characteristic and injuries of victims impaired by alcohol versus illicit drugs. 39th Annual Proceedings of the Association for the Advancement of Automotive Medicine, USA; 89-104

Walter, P. F. Stewart, J.R. Hansen, A. R. et al. (1986). The potentiating effects of alcohol on driver injury. *Journal of the American Medical Association*; 256: 1461-6

Ward, E. et al. (2002) The Jamaican Injury Surveillance System (JISS). A key step towards bridging the gap between surveillance and intervention. 6th World Conference Injury Prevention and Control. May 12-15, Montreal, Canada

Wattansaw, S. (2002). Study of non-communicable disease surveillance in Thailand. Unpublished document

WHO (1996). The global burden of disease. World Health Organization, World Bank and Harvard University

WHO. Adolescent Health and Development, Overview of Child and Adolescent Health and Development, Buscador: Google
www.who.int/child-adolescent-health/OVERVIEW/AHD/adh_sheer.htm

Wig, N. N. (1994). Live sensibly, the rest will follow. *World Health Forum*; 15: 229-231

World Development Report (2000). *Entering the 21st century*. New York: Oxford University Press

World Health Organization (1992). *International classification of diseases, 10th Edition*

World Health Organization (1998). *Life in the 21st Century: a vision for all*. The World Health Report 1998

World Health Organization (1999). *Making a difference*. The World Health Report 1999

World Health Organization (1999a). *Health situation in the South-East Asia Region 1994-1997*

World Health Organization. (1999). *Global status report for alcohol*. Substance Abuse Department. Division of Social Change and Mental Health. WHO/HSC/SAB/99.11

World Health Organization. (2000). *Health systems: improving performance*. The World Health Report 2000

World Health Organization. (2002). *Reducing risks: promoting health life*. World Health Report 2002

Worm, K. et al. (1996). Drugs and narcotics in Danish drivers. *J Traffic Med*, 24: 39-42

Yangon General Hospital (1998). *Statistical report, 1998*

Yguel, J. et al (1990). Consumption of alcoholic drinks in three different parts of Cameroon. In: Maula, J. et al (Eds). *Alcohol in developing countries*. Proceedings from a meeting, Nordic Council for Alcohol and Drug Research (NAD); NAD-Publication No. 18, Helsinki

Zwi, A.B. Gilson, L. Fox-Rushby, J. (1993). *Injury surveillance in Zimbabwe; a situation analysis*. London School of Hygiene and Tropical Medicine, and Ministry of Health and Child Welfare, Zimbabwe; Harare and London

Useful Internet Sites

European Transport Safety Council: www.etsc.be

UK Department for Transport, Think! Road Safety Campaign:
www.thinkroadsafety.gov.uk

Drink Driving:

Arrive Alive: www.arrivealive.com

Victoria's road safety strategy: www.arrivealive.vic.gov.au

Drugged Driving:

Roadside Testing Assessment: www.rosita.org

Impaired Motorists, Methods of Roadside Testing and Assessment for Licensing:
www.immortal.or.at

Fatigue and Driving:

Driver Reviver Programme, Australia: www.roadsafety.net/DriverReviver

Annex 7.1: Consultation Questionnaire



Reducing impaired driving in developing countries

Preliminary e-mail survey

The Global Road Safety Partnership (GRSP) supported by the UK's Department for International Development (DFID) have commissioned the Transport Research Laboratory (TRL) to research the road safety problems associated with 'impaired driving in developing countries'.

The initial objective is to providing information on driving:

- while under the influence of alcohol
- after consuming other (psychoactive) drugs
- when tired (fatigued).

For the purposes of this study 'drugs' should be taken to include both medicinal-types (eg. stimulants to keep people awake) as well as the so-called 'recreational drugs'; and also include natural forms such as smoking marijuana or chewing coca leaves.

The research plans to identify safety problems and develop - and evaluate - possible solutions in a wide range of countries.

As a first step we are conducting a short e-mail survey of selected road safety practitioners around the world. We would be very grateful if you could spend a few minutes completing the attached survey form (in Microsoft Word format). Also, please pass this on to any colleagues who you think may be able to provide us with information and inform us of their e-mail address so that we can contact them directly. If you have any questions please do not hesitate to contact us.

In the follow-up to this questionnaire we may re-contact practitioners who have specific information that would strengthen the survey, and would therefore be grateful if you could indicate your willingness to contribute to this process.

We hope this initial survey will lead to further research being conducted in a number of countries; and the form invites you (or your organisation or institute) to express an initial interest in being our partner in such studies.

We would appreciate your response by

Reducing impaired driving in developing countries

E-mail questionnaire

Please note that any information provided will be treated in the strictest confidence.

Your name:.....

Your tel. no:.....

Your e-mail address:.....

Your organisation:.....

Your country:.....

1. In your country, do you think any of the following cause a road safety problem – (please tick/mark 'yes' or 'no' - or leave blank if you 'don't know').

	Yes	No
Driving after drinking alcohol	<input type="checkbox"/>	<input type="checkbox"/>
Driving after taking other drugs	<input type="checkbox"/>	<input type="checkbox"/>
Driver fatigue/tiredness	<input type="checkbox"/>	<input type="checkbox"/>
Pedestrians impaired by alcohol or drugs	<input type="checkbox"/>	<input type="checkbox"/>

2. If you think 'drugs' (other than alcohol) are a problem please write in what drug, or drugs, are mainly involved.

3. What do you believe is the main motive for taking this drug? – (please tick one box):

Social	<input type="checkbox"/>
To keep awake for driving	<input type="checkbox"/>
Medicinal purposes	<input type="checkbox"/>
Other reason (please state)	<input style="width: 400px; height: 40px;" type="text"/>

4. What types of driver (eg. 'private' or 'professional') do you think are the main safety problem owing to impairment? (please tick one box – or leave all blank if impairment is not a problem):

Private drivers are the main problem	<input type="checkbox"/>
Commercial/professional drivers are the main problem	<input type="checkbox"/>
All drivers are a problem	<input type="checkbox"/>

5. Are you aware of any statistics or research publications that give information on the actual size of the problem in your country?

No
Yes - if 'yes' please provide information below

6. Are you aware of any individual, research institute or government department, etc, who we should contact to find out more about impairment and road safety in your country

No
Yes - if 'yes' please provide details (including contact details if possible) below:

Contact name:.....

Contact tel. no:.....

e-mail address:.....

Contact organisation:.....

7. Are there any traffic laws (regulations) about drink-driving in your country?

None that I know of
Yes - please provide brief details of what the law states below:

8. Are there any traffic laws (regulations) about consuming drugs and driving in your country?

None that I know of
Yes - please provide brief details of what the law states below:

9. Are there any traffic laws (regulations) related to driving while tired (for example, maximum hours that lorry drivers can drive each day) in your country?

None that I know of

Yes

- please provide brief details of what the law states below.

10. If you are prepared to help further with this study - either by providing additional information or possibly being a 'local partner' in the future to carry out research in your country - please indicate below:

Yes, I am prepared to help further with this study

No, sorry I am unable to provide further help with this research

11. Please can you write a few words on what you think are the main impairment problems affecting road safety.

We are especially interested in:

- national and regional problems
- whether/how problems are being tackled
- what types of alcohol (eg. beer, wine, spirits, etc) and drugs (eg. cannabis, cocaine, amphetamines ('speed')) do you think present the biggest problem,
- which groups (eg. men, women, rich, poor, drivers, pedestrians) present the biggest problems,
- issues concerning the traffic law and police enforcement

Please provide any additional information on driver impairment in developing countries you think might be useful to the study.

Thank you very much for your assistance in completing this questionnaire. Please return it to the following email/postal address at your earliest convenience: